E4473

DIRECTORATE GENERAL
AGRICULTURE ENGINEERING &
WATER MANAGEMENT SINDH
HYDERABAD

ENVIRONMENTAL ASSESSMENT/ ENVIRONMENTAL MANAGEMENT PLAN
FOR
SINDH IRRIGATED AGRICULTURE PRODUCTIVITY ENHANCEMENT PROJECT
(SIAPEP)

ENVIRONMENTAL IMPACT ASSESSMENT REPORT

Submitted By:

M/S COUNTRY SURVEY & MAPPING SERVICES
&
FINCON SERVICES INC.

Joint Venture Address
691, Karim Block, Allama Iqbal Town, Lahore, Punjab, Pakistan
Tel: + 92 (42) 35426927, Fax: +92 (42) 35426928
Web: www.csms.com.pk Email: info@csms.com

TABLE OF CONTENTS

LIST OF TABLES:

LIST OF ABBREVIATIONS

ADG	Additional Director General
AD	Assistant Director
ADB	Asian Development Bank
AWB	Area Water Board
A/E	Agriculture Engineer
AE&WM	Agriculture Engineering & Water Management
APTA	Agriculture Pesticide Technical Advisory Committee
BCR	Benefit Cost Ratio
BOQ	Bill of Quantity
BP	Bank Procedure
BP	Banned Pesticides
CC	Cement Concrete
CCA	Culture able Command Area
CCB	Citizen Community Board
CIF	Cost Insurance & Freight
CIG	Common Interest Group
CITES	Convention On International Trade in Dangered Species
CMR	Complaints Management Register
CNIC	Computerized National Identity Card
CSR	Cost on Schedule Rates
DBG	Drainage Beneficiary Group
DD	Deputy Director
DDT	Diphenyl Trichloroe Thane
DG	Director General
DO	District Officer
EA	Environmental Assessment
EIA	Environmental Impact Assessment
ES	Environment and Social Specialist
EF	Extension Facilitator
EIRR	Economic Internal Rate of Return
EMMP	Environmental Management and Monitoring Plan
ESMP	Environmental/Social Management Plan
ESMF	Environment and Social Management Frame Work
ESC	Environment and Social Consultant
ESA	Environment and Social Assessment
EDO	Executive District Officer
EHS	Environmental Health Safety
EPA	Environmental Protection Agency
FAO	Food and Agriculture Organization
FAQs	Frequently Asked Questions
FFS	Farmer Field School
FO	Farmer Organization
FOB	Free On Board
FS	Feasibility Study
FTI	Field Team In-charge
GAP	Good Agriculture Practices
GCA	Gross Command Area
GDP	Gross Domestic Product
GIS	Geographical Information System
GoS	Government of Sindh
GM	Genetically Modified
GOP	Government of Pakistan

GP	Good Practices
GPS	Global Positioning System
GRC	Grievance Redress Committee
GRM	Grievance Redressal Mechanism
GVP	Gross Value of Product
GW	Ground Water
HEIS	High Efficiency Irrigation System
HDI	Human Development Index
ha	Hector Area
I & D	Irrigation & Drainage
IBIS	Indus Basin Irrigation System
ICB	International Competitive Bidding
IDA	International Development Association
IDMT	Irrigation and Drainage Management Transfer
IF	Inter-Farm
IUCN	International Union for Conservation of Nature
IPM	Integrated Pest Management
IR	Inception Report
IRR	Internal Rate of Return
IPSNM	Integrated Plant and Soil Nutrient Management
ISEA	Integrated Social and Environmental Assessment
ISC	Implementation Supervision Consultant
IEE	Initial Environmental Examination
LBOD	Left Bank Outfall Drain
LF	Lead Farmer
LOS	Laws of Seas
MAF	Million Acre feet
MR	Market Rates
MTR	Mid Term Report
MT	Metric Ton
MT	Master Trainer
MEA	Multilateral Environmental Agreements
M&E	Monitoring and Evaluation
MRL	Maximum Residue Limit
NAT-IPM	National Integrated Pest Management Project
NCB	National Competitive Bidding
NCS	National Conservation Strategy
NGO	Non Governmental Organization
NPIW	National Program for the Improvement of Watercourses
NEFR	Natural Enemies Form Reservoirs
NEQS	National Environmental Quality Standards
NPV	Net Present Value
NVP	Net Value of Production
O & M	Operation and Maintenance
OF	On-Farm
OFWM	On Farm Water Management
OP	Operational Policies
PAD	Project Appraisal Document
PAP	Project Affected People
PCCL	Precast Concrete Lining
PD	Project Director
PDO	Project Development Objective
POP	Persistent Organic Pollutants
PEC	Pakistan Engineering Council

PEPA	Pakistan Environmental Protection Act
PEPC	Pakistan Environmental Protection Council
PIS	Pakistan Irrigation System
PISC	Project Implementation Supervision Consultant
PIC	Project Implementation Committee
PIC	Prior Informed Consent
PIAPIP	Punjab Irrigated Agriculture Productivity Improvement Project
PPC	Project Policy Committee
PSC	Project Steering Committee
PIU	Project Implementation Unit
PMO	Producer Marketing Organizations
PHL	Post Harvest Losses
PTD	Participatory Technology Development
PTDC	Pakistan Tourism Development Corporation
PLL	Precision Land Leveling
QPR	Quarterly Progress Report
RAP	Resettlement Action Plan
RBOD	Right Bank Out Fall Drain
RPF	Resettlement Policy Framework
RS	Remote Sensing
SAGP	Sindh Agriculture Growth Project
SCF	Standard Conversion Factor
SIDA	Sindh Irrigation and Drainage Authority
SIMF	Social Impact Management Framework
SOWAPEP	Sindh On-Farm Water and Agriculture Productivity Enhancement Program
SIAPEP	Sindh Irrigated Agriculture Productivity Enhancement Project
SS	Scoping Session
SFD	Sindh Forest Department
SWMO	Sindh Water Management Ordinance
STDC	Sindh Tourism Development Corporation
TDS	Total Dissolved Solids
TOR	Terms of Reference
TOF	Training of Farmers
TPV	Third Party Validation
TS	Technical Sanction
TA	Technical Assistance
TATC	Technical Assistance and Training Consultant
USAID	United States Assistance for International Development
UNFCCC	United Nation Frame Work Convention On Climate Change
VO	Variation Order
WAA	Water Apportionment Accord
WAPDA	Water & Power Development Authority
WC	Watercourse
WCA	Watercourse Association
WST	Water Storage Tanks
WMO	Water Management Officer
WWF	World Wildlife Federation

EXECUTIVE SUMMARY

Introduction

Irrigated agriculture is central to Pakistan's economy; because of its arid climate, the annual evaporation far exceeds the rainfall, making irrigation essential for growing crops. Pakistan relies on the largest contiguous irrigation system in the world, namely the Indus Basin Irrigation System (IBIS) to provide basic food security (90 percent of food production and 25 percent of the Gross Domestic Product). Agriculture is the single most important source of employment and exports (two thirds of employment and 80 percent of exports) and irrigation represents more than 95 percent of the total consumptive use of water.

1.1 Sindh is the Pakistan's second largest province occupying land area of 14.091 million ha which is equivalent to 17.7% of the country. Sind is the south-eastern province of Pakistan, bounded on the east by the Indian border of Rajasthan, in the south by the Runn of Kutch and the Arabian Sea, in the west by the arid rocky mountains of Balochistan and in the north by the irrigated plains of Punjab. The province contains 23% Pakistan's population and plays an important role in the national economic and development agenda.

1.2 The construction of three barrages on Sindh during twentieth century, starting with Lloyd Barrage at Sukkur in 1932, followed by Ghulam Muhammad Barrage at Kotri and Guddu Barrage in upper Sindh region in subsequent years, gave boost to agriculture in the region. These barrages became hubs of an extensive irrigation system, which is considered as one of the largest such system in the world. This helped in still enhancing the fertility and agriculture productivity of the lower Indus valley.

1.3 The major field crops sown in Sindh consist of wheat, cotton, rice, and sugarcane which utilize 68% of the total cropped area. Sindh also produces horticulture crops of mango, banana, and chillies are the primary crops grown in this area. Sindh produces 35% of rice, 28% of sugarcane, 20% of cotton, and 12% of wheat in the country. Among the horticultural crops, 73% bananas, 34% mangoes, and 88% of chillies are produced in Sindh.

2. Key Agriculture and Irrigation Issues in Sindh are i) Water logging and salinity ii) In adequate water availability, equity, reliability, and efficiency resulting in cropping intensity and pattern iii) low surface water delivery efficiency iv) water distribution inequities v) lack of storage capacity and control structures vi) wasteful on-farm water use vii) poor operation and maintenance viii) low cost recovery ix) constrained investment climate x) inadequate awareness and xi) in appropriate use of insecticides and pesticides.

2.1 Pesticide use is also widely practiced in Sindh, intended to assist farmers in getting rid of pests, extended and indiscriminate has resulted in pest outbreaks as well as negative effects on people working in the agricultural fields and the surrounding environments. It has also disturbed the agro-ecosystem and killed non-target bio-control agents and environment friendly organisms including birds. Such a disturbance in agro-ecosystem has induced pest

resurgence and increased the resistance in resident pest populations. Natural enemies of persistent common pests have been decreasing due to widespread and unchecked pesticide use. Some of other side effects of increased pesticide use have included the contamination of soil and water and chemical residues in the food chain.

Due to the fact that almost 20-25% of crop output is lost due to attacks by pests and insects, it is necessary to provide technical training to farmers to adopt integrated pest management techniques which focus on the use of bio-agents and natural predators to minimize the use of chemical pesticides.

3. Previous OFWM Projects in Sindh

A number of OFWM Projects have been implemented in Sindh since 1977 Government of Sindh, through its Agriculture Department and Agricultural Engineering and Water Management Wing, financed by USAID, WB, IDA, ADB and OECF. In early eighties On-Farm Water Management Project was launched mainly focusing on small-scale farms of less than 5 ha that relied on irrigation. It was revealed that poor watercourse maintenance was affecting efficiency of irrigation systems, thus the objective was to increase agricultural production by improving water management practices. Since 1981-85 to 2012-13 other projects were launched with the objectives of watercourses improvement, precision land leveling, and productivity enhancement in which out of 46,699 watercourses 29,480 were improved and still 17,276 projects are still to be improved.

4. Present Project and its description

The Government of Sindh is planning to up-scale its earlier OFWM projects and undertake a 6-year project titled, ***"Sindh Irrigated Agriculture Productivity Enhancement Project" (SIAPEP)*** in 24 districts of the Province by seeking the World Bank assistance for this purpose. The Project has the following components;

Component A: Community Water Infrastructure Improvement. This component is further divided into two parts A1 (Community Watercourse Improvement) & A2 (Mitigating Flood Risk for the Poor).

Component B: Promotion of High Efficiency Irrigation Systems. This component is further divided into two parts B1 (Small and medium-sized HEISs for 2 ha (5 acres), 4 ha (10 Acres) and 10 ha (25 Acres) farms) & B2 (Small HEIS kits for schools and individual households).

Component C: Improved Agriculture Practices. This component is further divided into two parts C1 (Laser Land Leveling and Deep Ripping) & C2 (Improved Agriculture Production Technology).

Component D: Project Management, Technical Assistance (TA), Training, Studies, Monitoring and Evaluation. This component is further divided into four parts D1 (Detailed Design and Construction Supervision Support Consultants), D2 (Monitoring and Evaluation

(M&E) of Project Impact Assessment Consultants including Training), D3 (Studies and Training) & D4 (Project Management & Incremental Operation Costs)

The Project objectives include the following:

- Improvement of watercourses,
- Improved field irrigation practices,
- Introduction and promotion of a High Efficiency Irrigation Systems (HEIS),
- Promotion of laser land leveling,
- Introduction of deep plowing, provision of emergency community flood shelters,
- Improving agronomic practices through Integrated Pest Management (IPM),
- Crop diversification, and other measures

Administratively the project area is located on left bank and right bank of Indus. Districts located on left side include Ghotki, Sukkur, Khairpur, Naushahro Feroze, Shaheed Benazirabad (Nawabshah), Sanghar, Hyderabad, Matiari, Tando Allahyar, Mirpurkhas, Umerkot, Tharparkar, Tando Muhammad Khan, Badin and newly created Sujawal (previously eastern part of Thatta) and on right side of Indus and districts Kashmore/Kandhkot, Jacobabad, Shikarpur, Qambar/Shahdadkot, Larkana, Dadu, Jamshoro, Thatta and Karachi East.

Project Implementation

The proposed project will be implemented by the Agriculture Department, Government of Sindh through its Agriculture Engineering and Water Management Wing headed by the Director General. The mission of the Agriculture Department is to maintain "a system aiming to sustain food security and support to national economy, making agriculture cost effective and knowledge based, with emphasis on farmer's welfare and maintenance of the yield potentials. The Department's objectives comprise: i) ensuring food security; ii) enhancing productivity through better varieties and improved management practices; iii) promoting high value crops, fruits and vegetables; iv) promoting export of high value agricultural products; v) promoting efficient use of water and other inputs; vi) improving soil health; vii) development of culturable waste lands; and viii) ensuring fair returns for the growers in marketing of their produce.

5. Environmental Impact Assessment (EIA) Study

In line with the prevailing legislation in the Country and World Bank Safeguard Policies an environmental assessment (EA) of the Project has been carried out.

Based upon the Pakistan Environmental Protection Act, 1997 (PEPA 1997) every development project in the country needs to submit either an Initial Environmental Examination (IEE) or Environmental Impact Assessment (EIA). The list of the projects requiring IEE/EIA Regulations 2000 issued under the PEPA 1997 in enclosed in Annexure # D.

The World Bank Operational Policy 4.01 (OP 4.01) states that "The Bank requires environmental assessment (EA) of projects proposed for Bank financing to help ensure that they are environmentally sound and sustainable" and application of Integrated Pest Management Policy OP-4.09.

OP 4.01 Policy Categories the projects in three categories;

- Category A: Environmental Impacts of severe nature and significance
- Category B: Potentially less adverse environmental impacts but site specific and minor in significance
- Category C: No adverse environmental impacts

As per the schedule I & II, our project does not fall in any of the category specified so no IEE or EIA is required, but as per Environmental Assessment Operational Policy (OP 4.01) and Integrated Pest Management Policies, OP-4.09 of the World Bank the project requires an Environmental Assessment Study. In order to comply with the environmental requirements of World Bank, the Environmental Assessment is required. This study highlights the negative and positive impacts of the interventions. The impact may be high negative (-2), low negative impact (-1), negligible impact (0), low positive impact (+1), high positive impact (+2) and no impact (N).

The Environmental Assessment team of experts comprising of environmental expert, ecologist, pest management specialist, water resource engineer and other support staff computer operator, social mobilize and translator.

Environmental & Social Management Framework (ESMF)

A management framework was also developed in the form of an Environmental & Social Management Plan (ESMP) containing all required aspects for the implementation of the mitigation measures identified during the study.

Inception Report

Taking into account the guidelines in the Environmental & Social Management Framework (ESMF) an Inception Report was prepared for the Environmental Assessment (EA) assignment. This document provided all details of EA and was submitted to the Government/Client who forwarded to the World Bank. The comments of the World Bank were both appreciative and suggestive with respect to the EA. The compliance was submitted to the Bank in the form of revised Inception Report.

Scoping

During this phase, key information on the project were collected and reviewed. A 'long list' of the potential Environmental as well as Social issues likely to arise as a result of the project development were documented. The stakeholder analysis was also carried out.

In order to determine the policy, legal and institutional environment for the project, the consultants reviewed the applicable Policies, Guidelines and Legislation of Government of Sindh and World Bank concerning the project.

Applicability of Operational and Safeguard Policies of World Bank

The operational policies of the World Bank applicable to the projects are triggered below;

Operational Policy	Triggered
Environmental Assessment (OP 4.01)	Yes
Involuntary Resettlement (OP 4.12)	No
Forestry (OP 4.36)	No
Natural Habitat (OP 4.04)	No
Pest Management (OP 4.09)	Yes
Safety of Dams (OP 4.37)	No
Projects in International Waters (OP 7.50)	No
Cultural Property (OP 4.11)	No
Indigenous People (OP 4.10)	No
Projects in Disputed Area (7.60)	No

Stakeholder Consultations

Stakeholder consultations were carried out during the Environmental & Social Assessment (ESA) study. Meetings were held with the institutional stakeholders and key environmental and social issues discussed. Extensive consultations with the grass root stakeholders were carried out during visits to the agricultural farms and fields in various parts of the Province.

Eight Stakeholder consultations workshops in 24 districts of Sindh to access the Environmental & Social Assessment (ESA) were conducted. Meetings were held with the institutional stakeholders and key environmental and social issues were discussed.

Extensive consultations at the grass root stakeholders were carried out during visits to the agricultural farms and fields in various parts of the Province. All the grievance comments and apprehend were documented. Some of the views of the stakeholders are summarized below;

- The capacity building and awareness program of farmers will be conducted.
- The tree cutting caused by the water course improvement will be compensated through plantation with ratio 1:4.
- Noise and Air Pollution generated by the Agriculture activities will be monitor.
- The lining of the water courses should be carried out by 30 percent.
- Laser land leveling will help the farmers for saving the water with enhancement of yield.
- The soil and water pollution caused by the left over plastic tubing and other parts for the drip/sprinkler irrigation system needs to be addressed.
- Washing of clothes on lined water courses resulting in pollution of irrigation water should be monitored.
- Heritage sites in the respective districts should be saved
- Protected areas in the respective districts should be saved
- Wild life in the respected areas should be saved
- Emergency Community Flood Shelters will help the farmers during any disaster
- Pesticide Residue in Food Chain must be monitored and verified through registered laboratories.
- Toxic solid waste generated due to pesticide empty container must be incinerated and verified.

Data Collection/Compilation

During this phase, data was collected and compiled to develop a baseline of the project area's Physical, Biological and Human Environment. For this purpose, both review of secondary sources and field data collection were carried out.

The secondary resources that were consulted included reports of the studies carried out earlier, published books and data, and relevant websites. With the help of these resources a generic profile of the entire project area was developed.

Check List for the Interventions & Mitigation

A check list has been designed for the following interventions;

- Water Courses
- High Efficiency Irrigation System
- Emergency Community Flood Shelter
- Ecology
- Field Irrigation Practices
- Hazards

Check List for the Interventions of Integrated Pest Management & Mitigation Assessments has also been designed.

The main parts of EA study

Following were the main parts under Environmental Assessment Study.

- Baseline studies on physical resources, biological resources, social and historical aspects and other relevant information and data
- Identification, screening and description of positive and negative impacts and their mitigation measures
- Environmental Management Plan
- Integrated Pest Management Plan (OP-4.09)
- Other relevant documents

Current Pest and Pesticide Management Approaches

The pest problems first emerged with the introduction of high yielding and fertilizer responsive crop varieties in the country in the decade of 60s and 70s. The introduction of delta pine cotton, IRRI – 6 rice, and Mexican wheat varieties brought in their wake pests which caused colossal damage to crops. In the late 50s, plans were conceived to spot spray the diseased crops. Various crop rotations are in vogue in different parts of Sindh; rotation mostly practiced is wheat-cotton in upper Sindh on the left bank of the Indus river canal command area, while in the southern parts, it is rice-wheat and sugarcane. Considerable area around large towns is planted with vegetables while fruit orchards (mainly mango and banana) are scattered all over. Floriculture is also getting popular to meet the demands of the Karachi city.

Interventions & Mitigation Assessments

Intervention and Mitigation Assessment (-2: High negative impact; -1: Low negative impact; 0: insignificant/negligible impact; +1: low positive impact; +2: High positive impact, N: no impact) has been established in the form of Matrix. Reference Table No. 8.1

Environmental and Social Management Plan

The following points have been considered while establishing the Environmental and Social Management Plan;

- To provide a mechanism to implement the mitigation and control measures identified during the present ESA.
- To propose institutional arrangements to implement the above-mentioned mitigation and control measures
- To define environmental monitoring requirements to ensure effective implementation of the mitigation and control measures.
- To identify capacity building needs with respect to the environmental and social aspects of the project.

- To specify the documentation requirements with respect to the ESMP implementation.

Institutional Arrangement

The following committees have been formulated for the smooth functioning of the project. The detail of the committees has been described in Chapter 9

- Project Policy Committee (PPC)
- Project Steering Committee (PSC)
- Project Implementation Committee (PIC).
- Project Implementation UInit (PIU)
- Institutional Setup and Responsibilities Regarding Environmental and Social Activates

Report compilation was the last step of the study. The report includes a brief description of the proposed project, a review of environmental legislation and policy framework relevant to the project, a description of baseline environmental and socioeconomic conditions in the project area, and potential project impacts and mitigation measures, check lists and conclusions.

Environmental Assessment

- In line with the prevailing operation and safeguard policies of World Bank an environmental assessment (EA) of the Project was carried out. The Assessment will help the ways of environmentally improving the project by preventing, minimizing, mitigating or compensating any adverse impacts.

- The training on IPM will help the stakeholder to adopt the relevant biological and environmental control methods.

- Pesticides residue will be prescribed once a year for 10% of the farmers who have received training in IPM. Control sample will also be taken where farmers did not receive any training.

Since our project does not fall under the schedule I and schedule-II so no IEE or EIA was required but as per the operation policies of the World Bank the Environmental Assessment of the project must be done. Based upon the Environmental Assessment Study and as per the table 8.1 it is observed that most of our interventions fall under category -1 (Low negative impact), 0 (insignificant/ negligible impact) or having no impact (N). So it is concluded that neither IEE nor EIA is required for this project but the mitigation requirement is still required for some of the interventions.

Conclusions

The following points have been summarized regarding the Environmental Impact Assessment

- With the implementation of this project, water courses will be improved, high efficiency irrigation systems (HIES) typically will reduce input costs, increase yields, lower irrigation labor, diversify cropping patterns, and will save water.

- Under the Component A, community water infrastructure improvement will be made. This will help community watercourse improvement and mitigating flood risk for the poors. Component B will promote high efficiency irrigation systems for small and medium-sized HEISs including 2 ha (5 acres), 4 ha (10 Acres) and 10 ha (25 Acres) farms. Small HEIS kits provided for schools and individual households will improve the irrigation systems. Component C will help community improved agriculture practices with laser land leveling, deep ripping and improved agriculture production technology. Component D will help project management, technical assistance (TA), training, studies, monitoring and evaluation with detailed design and construction supervision support consultants, monitoring and evaluation (M&E) of project impact assessment consultants including training, studies and training project management & incremental operation costs.

- Soil testing should be carried out for soil build up prior to start of use of High Efficiency Irrigation System and should be conducted at a biennial basis.

- Since the project does not fall under the schedule I and schedule-II of PEPA, 1997 so no IEE or EIA was required but as per the operation policies of the World Bank the Environmental Assessment of the project was done. Based upon the Environmental Assessment Study and as per the table 8.1 it is observed that most of our interventions fall under category-1 (Low negative impact), 0 (insignificant/ negligible impact) or having no impact (N). So it is concluded that neither IEE nor EIA is required for this project but the mitigation requirement of the interventions like linning of water courses, High Efficiency Irrigation System, flood shelters and integrated pest management etc were required. The mitigations has been suggested in Chapter 8.

Chapter 1

Introduction & Background

1.0 Introduction

Sindh is the Pakistan's second largest province occupying land area of 14.091 million ha which is equivalent to 17.7% of the country. Sind is the south-eastern province of Pakistan, bounded on the east by the Indian border of Rajasthan, in the south by the Runn of Kutch and the Arabian Sea, in the west by the arid rocky mountains of Balochistan and in the north by the irrigated plains of Punjab. The province contains 23% Pakistan's population and plays an important role in the national economic and development agenda.

1.1 Background of the Agriculture in Sindh/ historical perspective

The agriculture in Sindh has been dependent on the waters of river Indus. About five centuries ago, the people of Sindh experimented to broaden the cultivation area, by developing 'inundation canals' which received the excess flow of Indus water during rising seasons to farther lands. By the middle of 19th century there were about hundred such canals irrigating about half a million acres. The subsequent years saw expansion of these canals. The subsequent years saw expansions of these canals and by 1921 about two million acres were irrigated through this type of canals.

The construction of three barrages on Sindh during twentieth century, starting with Lloyd Barrage at Sukkur in 1932, followed by Ghulam Muhammad Barrage at Kotri and Guddu Barrage in upper Sindh region in subsequent years, gave boost to agriculture in the region. These barrages became hubs of an extensive irrigation system, which is considered as one of the largest such system in the world. This helped in still enhancing the fertility and agriculture productivity of the lower Indus valley.

Table.1.1. Sindh Irrigation Infrastructure

Main Canal	14
Branch Canals	109
Distributes	509
Minors	902
Total Length of Channels	13,234 miles
Total number of outlets/WCs	46,699

Source: Irrigation Department Govt. of the Sindh

The Government of Sindh, through its Agriculture Department and Agricultural Engineering and Water Management Wing is planning to up-scale its earlier OFWM projects and undertake the "Sindh Irrigated Agriculture Productivity Enhancement Project" (SIAPEP) in 24 districts of the Province by seeking the World Bank assistance for this purpose. In line with the prevailing legislation in the Country and World Bank Safeguard Policies an environmental assessment (EA) of the Project has been carried out. This document presents the report of this assessment.

1.2 Background

The backbone of economy of Sindh, agriculture is a multifaceted sector with far-reaching implications on issues ranging from rural poverty, food security, water resource management, infrastructure development, employment opportunities and export earnings. The policies of this sector thus have a great influence on those of other related sectors in Sindh.

Irrigated agriculture is central to Pakistan's economy; because of its arid climate, the annual evaporation far exceeds the rainfall, making irrigation essential for growing crops. Pakistan relies on the largest contiguous irrigation system in the world, namely the Indus Basin Irrigation System (IBIS) to provide basic food security (90 percent of food production and 25 percent of the Gross Domestic Product). Agriculture is the single most important source of employment and exports (two thirds of employment and 80 percent of exports) and irrigation represents more than 95 percent of the total consumptive use of water. However, this massive infrastructure is deteriorating and in need of modernization along with reforms to improve the allocation of water as well as the efficiency of its use. Moreover, competition for water is growing among the provinces and across the increasing needs for irrigation, industrial and domestic use, and the environment. Yet there remains a need for significant new investment, not only in irrigation but in other uses of water as well, including power generation and urban-industrial and domestic supplies (50 percent of the population is not served by a formal supply system and sanitation and water treatment reaches less than ten

percent of the population). At the same time, there is uncontrolled pollution of surface and groundwater from agriculture, industry and rapidly growing cities.

The major field crops sown in Sindh consist of wheat, cotton, rice, and sugarcane which utilize 68% of the total cropped area. Sindh also produces horticulture crops of mango, banana, and chillies are the primary crops grown in this area. Sindh produces 35% of rice, 28% of sugarcane, 20% of cotton, and 12% of wheat in the country. Among the horticultural crops, 73% bananas, 34% mangoes, and 88% of chillies are produced in Sindh.

1.2.1 Issues in agriculture and water management

Following key irrigation sector management and environmental issues are experienced and are listed:

- Water logging and salinity
- In adequate water availability, equity, reliability, and efficiency resulting in cropping intensity and pattern
- Low surface water delivery efficiency
- Water distribution inequities
- Lack of storage capacity and control structures
- Wasteful on-farm water use
- Poor operation and maintenance (O&M)
- Low cost recovery
- Constrained investment climate
- Inadequate awareness
- In appropriate use of insecticides and pesticides

These issues are a manifestation of institutional weaknesses due to near exclusive control by the public sector entities characterized by the usual inefficiencies of centralized bureaucracies, lack of corporate skills and poor client (farmer) focus and accountability.

1.2.2 Chemical use in Agriculture:

The use of Nitrogen and Phosphorus based fertilizers, has increased significantly in Sindh in past decades and also the highest in all provinces of Pakistan. The increase in fertilizer use is directly related to the increase in land productivity in agriculture. Unfortunately, the impact of this on soil is negative in that it decreases soil quality through changes in the organic matter. But, this increase has significant environmental repercussions which are not being addressed due to insufficient research on appropriate varieties, effect on land in the surrounding areas, effects on agricultural workers and the effects of intensified fertilizer use

on the ecological components, including insects and wildlife of the surrounding environment.

Pesticide use is also widely practiced in Sindh, intended to assist farmers in getting rid of pests, extended and indiscriminate has resulted in pest outbreaks as well as negative effects on people working in the agricultural fields and the surrounding environments. It has also disturbed the agro-ecosystem and killed non-target bio-control agents and environment friendly organisms including birds. Such a disturbance in agro-ecosystem has induced pest resurgence and increased the resistance in resident pest populations. Natural enemies of persistent common pests have been decreasing due to widespread and unchecked pesticide use. Some of other side effects of increased pesticide use have included the contamination of soil and water and chemical residues in the food chain.

Due to the fact that almost 20-25% of crop output is lost due to attacks by pests and insects, it is necessary to provide technical training to farmers to adopt integrated pest management techniques which focus on the use of bio-agents and natural predators to minimize the use of chemical pesticides.

Watercourse improvements have repeatedly shown to yield an economic rate of return of more than 25 percent, and benefits to laser land leveling and drip irrigation are even higher. These high efficiency irrigation systems typically reduce input costs by 20-35 percent, increase yields by 20-100 percent, lower irrigation labor up to 30 percent, diversify cropping patterns, and save up to 75 percent water.

Sindh Province has 3.8 million ha cropped area of Pakistan's 22.4 million ha cropped area, representing 17 percent of country's total cropped area. About 30-35 percent of Sindh's population lives below poverty line, and a majority of the poor are rural. Landholding patterns in Sindh are highly skewed from national norms, with a median farm size of around 11.33 hectares, as compared with 2.83 hectares in Punjab. According to one estimate in 2005, wealthy landlords in Sindh, who held farms in excess of 100 acres and who accounted for less than 1 percent of all farmers in the province, owned 150 percent more land than the combined holdings of 62 percent of small farmers with landholding less than 5 acres. Large landowners dominate production of the four major crops in Sindh—rice, wheat, sugar cane, and cotton.

1.3 The previous OFWM Projects in Sindh

In late seventies and early eighties On-Farm Water Management Project was launched mainly focusing on small-scale farms of less than 5 ha that relied on irrigation. It was revealed that poor watercourse maintenance was affecting efficiency of irrigation systems, thus the objective was to increase agricultural production by improving water management practices.

In early eighties On-Farm Water Management Project was launched mainly focusing on small-scale farms of less than 5 ha that relied on irrigation. It was revealed that poor watercourse maintenance was affecting efficiency of irrigation systems, thus the objective was to increase agricultural production by improving water management practices.

A number of OFWM Projects have been implemented in Sindh since 1977, financed by USAID, IDA, ADB & OECF. A brief description of the World Bank and other donor agencies assisted OFWM Projects are given below.

The first pilot OFWM project funded by the USAID in Rohri Canal command area was launched. A total of 231 water courses were improved. This project paved a way for other projects with a wider scope.

OFWMP-I: The first phase of World Bank assisted OFWMP was implemented in Rohri Canal command area during 1981-85. A total of 358 watercourses were renovated. The other components included Precision Land Leveling (PLL) & establishment of demonstration plots. PLL was done through locally manufactured tractor driven scrapers and land planers.

Under the cost sharing arrangements, the farmers were required to arrange unskilled labor. The cost of material and mason was initially borne by the project, 25% of which was later on recovered from the farmers in 10 six monthly installments. The OFWM field staff, who improved the watercourses was given the responsibility of cost recovery.

OFWMP –II: The second OFWM Project, financed by World Bank was implemented during 1985- 91, and a total of 925 watercourses were improved. The project area covered the entire province except the areas covered by similar projects during this period. PLL and demonstration plots were implemented under this project on the pattern of Phase

The farmers were required to arrange all the unskilled labor and cost of material & mason was initially borne by the project as in Phase-I-.However the recovery was increased from 25% to 30%, recoverable in 10 six monthly installments. A grace period was allowed for increasing the recovery period to seven years.

OFWMP – III: The third phase of World Bank assisted OFWMP was implemented during 1991-97 in the whole province except the areas covered by LBOD and OECF projects. A total number of 1706 watercourses were improved. For PLL, 24 laser units of equipments were procured. However these were not fully utilized or want of trained manpower and 0 & M funds.

As per original plan, the farmers were required to arrange unskilled labour and share 30% material cost, (10% in advance and 20% in 10 six monthly 'installments). However in view of declining rate of recovery, the government introduced a new recovery policy from July 1995. Under the changed policy, the farmers were required to share 25% of material cost instead of 30% as upfront payment instead of the earlier approach based on cost recovery.

Other projects of similar nature implemented by foreign donors and ADP and their achievement is as under:

Table.1.2 Summary of Watercourses Improved Under Different OFWM Projects.

S.no	Name of District	Number of W/C According to Inventory	Number of Complete Watercourses Under Previous Scheme	Watercourses Improved Under SOFWMP (Original)	Watercourses Improved Under SOFWM-AF	Watercourses Improved NPIW (upto 30-06-2013)	Total Improved Watercourses (4+5+6+7)	Balance (3-8)
1	2	3	4	5	6	7	8	9
1.	Badin	5307	242	450	252	1378	2322	2985
2.	Dadu	1364	196	213	0	909	1318	46
3.	Ghotki	2884	468	399	343	840	2050	834
4.	Hyderabad	420	115	52	0	161	328	92
5.	Jacobabad	2089	107	90	0	506	703	1386
6.	Jamshoro	835	120	121	0	501	742	93
7.	Kamber-Shahdad Kot	3005	224	182	0	796	1202	1803
8.	Karachi	1228	97	107	0	736	940	288
9.	Kashmore	2259	98	100	0	573	771	1488
10.	Khairpur	3413	460	449	205	1855	2969	444
11.	Larkana	1702	132	108	0	679	919	783
12.	Mirpurkhas	1742	458	207	151	383	1199	542
13.	Nawab Shah	1445	781	138	0	282	1201	244
14.	Naushero Feroze	1338	706	87	0	251	1044	294
15.	Sanghar	2103	1191	175	120	488	1974	129
16.	Shikarpur	2082	270	160	0	1036	1466	616
17.	Sukkur	1552	299	143	41	667	1150	402
18.	Tando Allah Yar	479	124	45	0	224	393	86
19.	Tando M. Khan	2059	535	240	224	922	1921	138
20.	Tharparkar	1759	0	162	0	688	850	909
21.	Thatta	5742	411	504	0	1898	2813	2929
22.	Umerkot	1246	360	139	73	322	894	352
23.	Matiari	702	182	84	0	45	311	391
Grand Total		**46,699**	**7,576**	**4,355**	**1409**	**16,140**	**29,480**	**17,276**

Ref: Feasibility Report Sindh Irrigated Agriculture Productivity Enhancement Project 2013

After transferring the responsibility of management and development of water resources to provinces they started their own On Farm Water Management Projects. In 2003-04 NPIW was started and continued till June 30, 2012. Government of Sindh started Sindh On Farm Water Management Project and continues with Additional Financing from the World Bank. The project includes; lining of conveyance system in order to reduce water courses losses, precision land leveling for improved application efficiency, and demonstration plots for farmers training.

Irrigation channels were rebuilt, improved and cleaned, demonstration plots laid out to show farmers benefits of good irrigation maintenance/practices and land leveling equipment was also provided, along with fertilizer and seed inputs. The project served as a role model for future water management projects to be replicated in other parts of Pakistan. Under above projects 29,480 water courses WCs have been improved and the remaining 17,276 are yet to be improved.

The ultimate aim of these projects was to improve water productivity in irrigated agriculture resulting in increased agricultural output per unit of water used. Government of Sindh realizing the scarcity of water available for agriculture productivity is planning to improve remaining 17,276 watercourses in the province in next 20 to 25 years. The lining of 5500 watercourses is proposed under the Phase - 1 of the proposed program namely Sindh On Farm Water and Agriculture Productivity Enhancement Program (SOWAPEP-I).

Other Agriculture/Water related Projects

Following projects are being implemented in agriculture and water sectors in Sindh and Punjab provinces, respectively.

Sindh Agriculture Growth Project (SAGP):

The "Sindh Agriculture Growth Project" (SAGP) has focused on horticulture—particularly chilies (92 percent of national production), onions (33 percent), dates (about 50 percent), and milk production because these commodities have a small farmer focus, have significant involvement of women in production and processing. Horticulture is largely unregulated, includes more private sector actors than the major crops, and has received little donor attention in the past, albeit with the exception of mangos and bananas—the two most profitable horticulture crops, which are often grown by large landowners. The SAGP has also have some intervention in the rice value chain, which will target a cluster of small and medium sized producers to help them reduce the post-harvest damage and loss from poor practices.

In horticulture, farmers may link with either traders or processors. In these three major value chains, several private sector traders and processors operate who actively seek high-quality products for domestic and international markets. Despite their presence, 25 percent of Pakistan's fruits and vegetables produced annually go to waste between the farm and the consumer. Only four percent of Pakistan's total fruit and vegetables are exported and at far lower prices due to poor quality and the reliance on traditional low end markets. In milk production, losses climb to about 30 percent in the summer due to lack of infrastructure and equipment.

The introduction of good agricultural practices (GAP) and modest investments in relatively simple technology could substantially increase the quality of production and the potential for increased trade and higher incomes.

An integrated social and environment assessment (ISEA) for the project as prepared in greater details. As the overall impacts of the project on the environment were expected to be positive and accordingly project was classified it as a category B project under its operational policies (OP 4.01), the same category is proposed to be retained for the SAGP.As also, the preparation of an Environmental Management Plan (EMP) was mandated (OP 4.01) and the EMP recommended measures to mitigate possible adverse impacts on the environment, including the potential induced impacts of increased pesticide use, a Pest Management Plan (PMP) was prepared in compliance of the Bank's procedures (BP 4.01) and had formed a part of the EMP; this PMP is being used as a basic document from which a shorter but updated version of the PMP has been prepared for the SAGP. It is mentioned at the outset that the PMP does not recommend procurement of any pest control products or methods nor does the project envisage any such procurement.

Punjab Irrigated Agriculture Productivity Improvement Project (PIAPIP)

The Government of the Punjab, Pakistan, through its Directorate General Agriculture (Water Management), Agriculture Department, has undertaken the Punjab Irrigated-Agriculture Productivity Improvement Project (PIPIP) in various parts of the Province, and seeked the World Bank assistance for this purpose. In line with the prevailing legislation in the Country, and WB safeguard policies, an environmental and social assessment (ESA) of the Project has been carried out.

In line with one of the Agriculture Department's key objectives the Project aims to improve the productivity of the irrigation activities in the Province. Improved water productivity will translate into greater agricultural output per.unit of water used, and will be achieved through improved physical delivery efficiency, irrigation practices, crop diversification and effective application of inputs. The project's objectives would contribute to increased agricultural production, employment and incomes, higher living standards and positive environmental outcomes. The direct beneficiaries of Project would be about 650,000 farm families or about 4.5 million people all over the Punjab Province.

The key components of the Project include: i) installation of high efficiency irrigation systems; ii) strengthening of laser land leveling in private sector; iii) improvement of water courses in canal command and non-canal command areas; and iv) adoption and promotion of modern irrigation technologies. Details of these components are further discussed later in the document.

1.4 Project Executing Agency

The proposed project will be implemented by the Agriculture Department, Government of Sindh through its Agriculture Engineering and Water Management Wing headed by the Director General. The mission of the Agriculture Department is to maintain "a system aiming to sustain food security and support to national economy, making agriculture cost effective and knowledge based, with emphasis on farmer's welfare and maintenance of the

yield potentials. The Department's objectives comprise: i) ensuring food security; ii) enhancing productivity through better varieties and improved management practices; iii) promoting high value crops, fruits and vegetables; iv) promoting export of high value agricultural products; v) promoting efficient use of water and other inputs; vi) improving soil health; vii) development of culturable waste lands; and viii) ensuring fair returns for the growers in marketing of their produce.

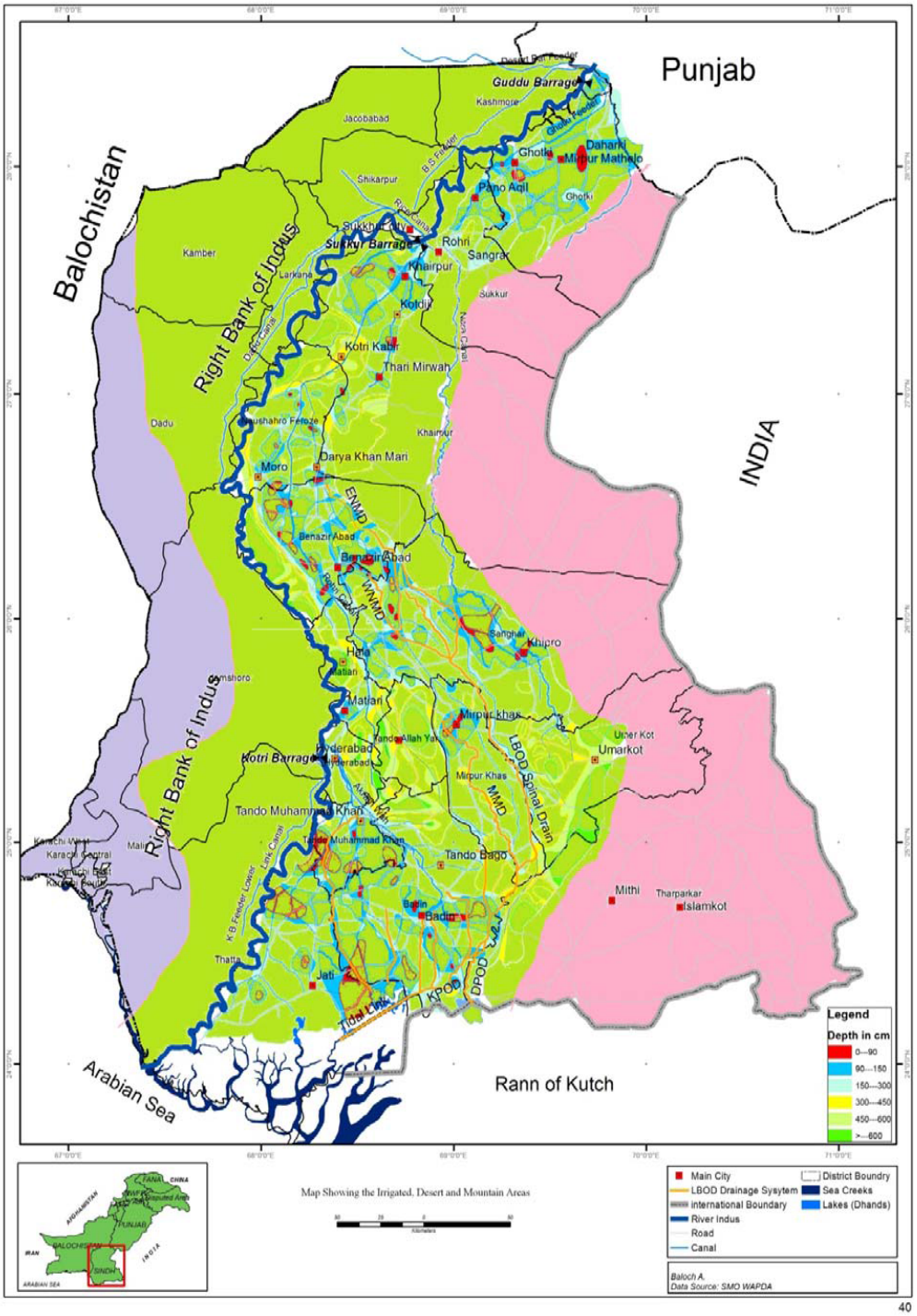
1.5 Project Overview

1.5.1 Project Location and Boundaries:

Administratively the project area is located on left bank and right bank of Indus. Districts located on left side include Ghotki, Sukkur, Khairpur, Naushahro Feroze, Shaheed Benazirabad (Nawabshah), Sanghar, Hyderabad, Matiari, Tando Allahyar, Mirpurkhas, Umerkot, Tharparkar, Tando Muhammad Khan, Badin and newly created Sujawal (previously eastern part of Thatta) and on right side of Indus and districts Kashmore/Kandhkot, Jacobabad, Shikarpur, Qambar/Shahdadkot, Larkana, Dadu, Jamshoro, Thatta and Karachi East.

The project namely "Sindh Irrigated Agriculture Productivity Enhancement Project" (SIAPEP) will be executed in the irrigated areas located in above districts of Sindh province on either sides of Indus where no improvement of watercourses has taken place in any on-farm improvement program. These districts are located in the command area of Guddu, Sukkur and Kotri barrages and main canals and their distributaries.

Fig. 1.1: The Project Area



Ref: Feasibility Report Sindh Irrigated Agriculture Productivity Enhancement Phase-I Project 2013

1.5.2 Project Objectives and Approach:

The main development objective of the project is to improve water productivity in irrigated Agriculture, resulting in increased agricultural output per unit of water used.

A detailed project feasibility study of the proposed project titled, "Sindh Irrigated Agriculture Productivity Enhancement Project" (SIAPEP) in Sindh has been prepared. The proposed project is continuation of ongoing long-term efforts of the Government of Sindh in scaling-up the watercourse improvement and agricultural productivity enhancement program in irrigated agriculture.

The proposed program and the associated first phase project include:

- Improvement of watercourses,
- Improved field irrigation practices,
- Introduction and promotion of a High Efficiency Irrigation Systems (HEIS),
- Promotion of laser land leveling,
- Introduction of deep plowing, provision of emergency community flood shelters,
- Improving agronomic practices through Integrated Pest Management (IPM),
- Crop diversification, and other measures

The Government of Sindh in its continuation of ongoing long term efforts desires to scale up the watercourse improvement and agricultural productivity enhancement program in irrigated agriculture in entire province of Sindh. The existing watercourses are earthen and unlined subjected to heavy seepage and leakages. It has been experienced that at present, many irrigation systems in Sindh province suffer from:

- Low water delivery efficiency
- Water distribution inequities;
- Wasteful on-farm water use;
- Water logging and salinity; and
- Poor operation and maintenance (O&M) and low cost recovery.

1.6 Environmental Impact Assessment (EIA) Study

The various aspects of the present study, including its need and objectives, its scope, the methodology employed while conducting it are described in the following sections.

Need for EA study

Based upon the Pakistan Environmental Protection Act, 1997 (PEPA 1997) every development project in the country needs to submit either an Initial Environmental Examination (IEE) or Environmental Impact Assessment (EIA). The list of the projects requiring IEE/EIA Regulations 2000 issued under the PEPA 1997 in enclosed in Annexure # D.

The World Bank Operational Policy 4.01 (OP 4.01) states that "The Bank requires environmental assessment (EA) of projects proposed for Bank financing to help ensure that they are environmentally sound and sustainable" and application of Integrated Pest Management Policy OP-4.09.

The present study has been conducted in response to the above requirements.

1.6.1 EA Study Objectives

As per the schedule I & II, our project does not fall in any of the category specified so no IEE or EIA is required, but as per Environmental Assessment Operational Policy (OP 4.01) and Integrated Pest Management Policies, OP-4.09 of the World Bank the project requires an Enviromental Assessment Study. In order to comply with the environmental requirements of World Bank, the Environmental Assessment is required. This study will highlight the negative and positive impacts of the interventions. The impact may be high negative (-2), low negative impact (-1), negligible impact (0), low positive impact (+1), high positive impact (+2) and no impact (N).

The objectives of the EA were to:

- Review the state of the environment in the project area as an input to the decision-making process;
- Ensure that environmental concerns are recognized at an early stage and are taken into account in the identification and consideration of project alternatives, selection, detailed project planning and design; and
- Identifing ways of environmentally improving the project by preventing, minimizing, mitigating or compensating any adverse impacts.

The consultant consider that the proposed project would improve management of water resources used for irrigation purposes in the Indus River Basin and hence would have an overall positive environmental impact. In fact, the proposed project will include an environmental management plan to ensure minimization/mitigation of any adverse

environmental impacts and maximization of the environmental benefits of the proposed project.

In order to screen all potential impacts and identify the main environmental issues, a methodology was developed during the initial stage of the EA for the project.

1.6.2 EA Study Scope

The present EA study covers the following key components of the proposed "Sindh "Irrigated Agriculture Productivity Enhancement Project" (SIAPEP):

- Improvement of water courses;
- Improved irrigation technologies and practices;
- Promotion of high efficiency irrigation system including Small Water Storage Tanks;
- Promotion of laser land leveling;
- Introduction of deep plowing;
- Provision of emergency flood shelters;
- Provision of integrated Pest Management (IPM) (OP-4.09)
- Crop diversification.

The study addresses the potential environmental and social impacts that may be encountered during the construction and operational phases of the proposed project.

1.6.3 Scope for Integrated Pest Management (IPM)

The scope of IPM work includes the following;

- Identification of all project activities that may lead to usage of pesticides.
- Developing a negative list of activities to ensure that pesticide usage intensity does not increase because of project activity,
- Providing the list of pesticides not be used in agriculture activities to be financed by World Bank as described by OP 4.09 (WHO Class IA and IB pesticides)
- Studying existing literature including any IPMP that may already be in practice in the province.
- Identification of biological and environmental control methods that can be used to minimize pesticide usage

- To train stakeholders to adopt the relevant biological and environmental control methods.
- Identification of measures to ensure that this IPM Plan acts in concert with implementation of other IPMP in the province.
- Design of any institutional measures that may be needed to be implemented to ensure implementation of the IPMP.
- Pesticide residue testing will be prescribed one a year for 10% of the farmers who have received training in IPM. Control sample will also be taken for crops where farmers did not receive any training.

Harmful effects of pesticides

Chemical pesticides are the main reason for all the health problems in humans. Now proceed to all important point whether we should consider money or ourselves first. Prolonged exposure to pesticides in humans can lead to severe disorders in our reproductive, nervous and immune system plus in some cases can even lead to cancer. Exposure to some pesticides can be 'hell' for a pregnant lady as it can easily lead to death of baby and even if the baby is produced will have lots of disorders or even loss of limbs.

However, pesticides are not like poisons where a very small amount can be deadly but we need to always, if possible, protect ourselves from exposure to pesticides. Farmers can use mouth masks or other accessories to keep them away from intake of pesticides.

Environmental and Social Management Framework (ESMF) has also been completed and made part of the feasibility study of the project and gives the framework for assessment and management of environmental and social safeguards for proposed development project in line with the environmental safeguards of the World Bank's E and S safeguard policies (OP 4.01), Integrated Pest Management (IPM), OP-4.09 and the Government's EIA policies and regulations.

1.6.4 Environmental Assessment (EA) Study Methodology

The key steps that were followed while conducting the EA are briefly described below.

1.6.4.1 Scoping:

During this phase, key information on the project was collected and reviewed. A 'long list' of the potential Environmental as well as Social issues likely to arise as a result of the project development. The stakeholder analysis was also carried out for the consultation to be carried out subsequently.

1.6.4.2 Review of Policies, Guidelines and Legislation of GoS, GoP and World Bank:

In order to determine the policy, legal and institutional environment for the project, the consultants reviewed the applicable Policies, Guidelines and Legislation of GoS, GoP and World Bank concerning the project. As the project is to be funded by the Government of Sindh and the World Bank, two sets of policies and legislation were reviewed.

1.6.4.3 Stakeholder Consultations:

Stakeholder consultations were carried out during the Environmental & Social Assessment (ESA) study. Meetings were held with the institutional stakeholders and key environmental and social issues discussed. Extensive consultations with the grass root stakeholders were carried out during visits to the agricultural farms and fields in various parts of the Province.

1.6.4.4 Data Collection/Compilation:

During this phase, data was collected and compiled to develop a baseline of the project area's Physical, Biological and Human Environment. For this purpose, both review of secondary sources and field data collection were carried out.

The secondary resources that were consulted included reports of the studies carried out earlier, published books and data, and relevant websites. With the help of these resources a generic profile of the entire project area was developed.

1.6.4.5 Impact Assessment:

During the impact assessment, the environmental, socioeconomic, and project information collected in previous steps was used to determine the potential impacts of the proposed project. Subsequent to this, the potential impacts were characterized Component wise to determine their significances. Mitigation measures were identified where required to minimize the significant environmental impacts.

1.6.4.6 Management Framework:

For conducting detailed Environmental Assessment (EA) following Framework and documentations were carried out/prepared. The strategy for EA study was to work from general to specific task.

1.6.4.7 Environmental & Social Management Framework (ESMF):

A management framework was also developed in the form of an Environmental & Social Management Plan (ESMP) containing all required aspects for the implementation of the mitigation measures identified during the study.

1.6.4.8 Inception Report:

Taking into account the guidelines in the Environmental & Social Management Framework (ESMF) an Inception Report was prepared for the Environmental Assessment (EA) assignment. This document provided all details of EA and was submitted to the Government/Client who forwarded to the World Bank. The comments of the World Bank were both appreciative and suggestive with respect to the EA. The compliance was submitted to the Bank in the form of revised Inception Report.

1.6.4.9 Report Compilation:

Report compilation was the last step of the study. The report includes a brief description of the proposed project, a review of environmental legislation and policy framework relevant to the project, a description of baseline environmental and socioeconomic conditions in the project area, and potential project impacts and mitigation measures.

1.6.5 The main parts of EA study are as under:

- Baseline studies on physical resources, biological resources, social and historical aspects and other relevant information and data
- Identification, screening and description of positive and negative impacts and their mitigation measures
- Environmental Management Plan
- Integrated Pest Management Plan (OP-4.09)
- Other relevant documents

1.6.6 EA Study Team

The Environmental Assessment team consisted of environmental and socioeconomic experts.

- Dr. Junaid Habib-Ullah (Environmental Specialist/ Team Leader- CSMS)
- Dr. Khalid Mehmood Qamar (Ecologist)
- Dr. Rab Dino Khuhro (Pest Management Specialist)
- Engr. Sulman Mukhtar (Water Recourse Engineer)
- Technical Support Staff
    - o Computer Operator
    - o Social Mobilizer
    - o Translator

1.6.7 EIA Document Structure

Chapter 2 Discusses the legislative, regulatory, and institutional setup that exists in the Country, as well as the World Bank's safeguard policies relevant to the environmental and social assessment. The Chapter also outlines the international environmental agreements to which the country is a party.

Chapter 3 Description of Institutional Arrangements

Chapter 4 Provides a simplified description of the Project and its components.

Chapter 5 Describes the project alternatives and their evaluation

Chapter 6 The environmental and social baseline conditions

Chapter 7 The stakeholder consultations process and outcome

Chapters 8 The assessment of environmental as well as socioeconomic impacts, their mitigation measures are presented in this chapter.

Chapter 9 Environmental and Social Management Plan

Annexures

Annexure A: Integrated Pest Management Plan

Annexure B: List of Participants of Workshops

Annexure C: Detailed baeline studies on flora, fauna and archaeology and heritage sites

Chapter 2

Legislative, Regulatory, And Policy Framework

2.0 Introduction

a) This Chapter discusses the policy, legal and administrative framework as well as institutional set-up relevant to the environmental and social assessment of the proposed Project. Also included in the Chapter are the environmental and social guidelines from the national agencies as well as international donors and other organizations. Covered here are legal instruments for Land, Water (Irrigation and Drainage), Wildlife, Fisheries, Forests, Environment and others. With the passage of time there have been amendments, revisions and rules under the purview of these Policies, Acts, Ordinances and Rules.

Thus two sets of environmental safeguard policies and legislation have been reviewed and described in this chapter as under:

- Government of Pakistan and Sindh Policies and Legislation
- The World Bank Safeguard Policies, Guidelines and Directives

b) Legal Implications of the 18th Amendment Relating to Environment

Legal implications of the 18th Amendment for each of these Rules / Regulations are as follows:

(i) PEPA (Review of IEE and EIA) Regulations, 2000.

Powers under section 12 of PEPA 1997 relating to review of Initial Environmental Examination (IEE) and Environmental Impact Assessment (EIA) have been delegated to the Provinces, subject to the condition that these shall not be exercised in respect of projects of the Armed Forces of Pakistan or projects having transitional and inter-provincial adverse environmental effects. Again, the delegated powers may continue to be exercised till modified by the Provincial EPAs after enactment of Provincial laws.

(ii) National Environmental Quality Standards (Certification of Environmental Laboratories) Regulations, 2000.

Powers under section 6(1)(k) of PEPA 1997 for certification of environmental laboratories have been delegated to the Provinces, which can continue to exercise the same. As mentioned above, any change in these Regulations can only be made after

Provincial EPAs have been duly authorized in this behalf by Acts of the Provincial Assemblies. Pak EPA will continue to exercise these powers for laboratories situated within the ICT.

(iii) Environmental Tribunal Rules, 1999 (notified on 18th March, 2000).

Terms and conditions of the Chairperson and Members of the Environmental Tribunals and other provisions of these Rules remain unaffected by the 18th Amendment.

(iv) Provincial Sustainable Development Fund Board (Procedure) Rules, 2001.

Management of the Fund established under section 9 of PEPA 1997 has been entrusted to a Board constituted under section 10, comprising of officers and non-official nominees of the Provincial Government. The Rules relate to functioning of the said Board, and remain unaffected.

(v) Environmental Samples Rules, 2001.

Powers under clauses (f), (g), (h), (i) and (j) of section 7 relating to supply of information, search, taking and testing of samples, and confiscation etc have been delegated to the Provinces and may continue to be exercised till amended after enactment of Provincial laws.

(vi) National Environmental Quality Standards (Self-Monitoring and Reporting by Industry) Rules, 2001.

These Rules relate to submission of Environmental Monitoring Reports to the Federal Agency, i.e. Pak EPA. Although powers under clauses (e) and (f) of section 6 relating to preparation, revision and enforcement of the National Environmental Quality Standards (NEQS) stand delegated to the Provinces, the Rules require modification to permit filing of the Reports with the Provincial EPAs also. This can be done after necessary amendment in section 33, as mentioned above.

(vii) Pollution Charge for Industry (Calculation and Collection) Rules, 2001

These Rules provide Guidelines for calculation and collection of the pollution charge payable by an industrial unit under section 11 for discharges or emissions at levels in excess of the NEQS /established standards. While section 11 needs to be amended to empower Provincial Governments to levy the charge, the Rules refer to, and require action by, the Provincial EPAs, and therefore can be applied without any immediate modification.

Legal Implications of the 18th Amendment relating to Environment

(viii) Provincial Sustainable Development Fund (Utilization) Rules, 2003.

These Rules prescribe procedure for filing, appraisal and sanction of project proposals for utilization of financial assistance from the Fund. As action is to be taken by the Provincial EPAs/ government departments, no immediate amendment is required.

(ix) Pakistan Biosafety Rules, 2005.

These Rules provide for establishment of National Biosafety Committee, Technical Advisory Committee and Institutional Biosafety Committee and grant of licenses by Pak EPA for dealing with living modified organisms etc. Appropriate amendments are required to adapt the provisions in the light of devolution, including empowering of the Provincial EPAs.

(x) Hospital Waste Management Rules, 2005.

These Rules lay down detailed procedures to be followed by every hospital / health care and biomedical facility for disposal of waste. Separate Hospital Waste Management Advisory Committees have been constituted for the ICT and the Provinces. Minimal amendment is required: Rule 25 has to be modified to allow the Provincial Government to exempt any class of hospitals in the Province and the Federal Government to exempt any class of hospitals in the ICT.

2.1 National Laws and Regulations

Pakistan's statute books contain a number of laws concerned with the regulation and control of the environmental and social aspects. However, the enactment of comprehensive legislation on the environment, in the form of an act of parliament, is a relatively new phenomenon. Most of the existing laws on environmental and social issues have been enforced over an extended period of time, and are context-specific. The laws relevant to the developmental projects are briefly reviewed below.

2.1.1 Pakistan Environmental Protection Act, 1997

The Pakistan Environmental Protection Act, 1997 (the Act) is the basic legislative tool empowering the government to frame regulations for the protection of the environment (the 'environment' has been defined in the Act as: (a) air, water and land; (b) all layers of the atmosphere; (c) all organic and inorganic matter and living organisms; (d) the ecosystem and ecological relationships; (e) buildings, structures, roads, facilities and works; (f) all social and economic conditions affecting community life; and (g) the inter-relationships between any of the factors specified in sub-clauses 'a' to 'f'). The Act is applicable to a broad range of issues and extends to socioeconomic aspects, land acquisition, air, water, soil, marine and noise pollution, as well as the handling of hazardous waste. The discharge or emission of any effluent, waste, air pollutant or noise in an amount, concentration or level in excess of the National Environmental Quality Standards (NEQS) specified by the Pakistan

Environmental Protection Agency (Pak-EPA) has been prohibited under the Act, and penalties have been prescribed for those contravening the provisions of the Act. The powers of the federal and provincial Environmental Protection Agencies (EPAs), established under the Pakistan Environmental Protection Ordinance 1983,have also been considerably enhanced under this legislation and they have been given the power to conduct inquiries into possible breaches of environmental law either of their own accord, or upon the registration of a complaint.

The requirement for environmental assessment is laid out in Section 12 (1) of the Act. Under this section, no project involving construction activities or any change in the physical environment can be undertaken unless an initial environmental examination (IEE) or an environmental impact assessment (EIA) is conducted, and approval is received from the federal or relevant provincial EPA. Section 12 (6) of the Act states that the provision is applicable only to such categories of projects that may be prescribed. The categories are defined in the Pakistan Environmental Protection Agency Review of IEE and EIA Regulations, 2000.

2.1.2 Pakistan Environmental Protection Agency Review of Initial Environmental Examination (IEE) and Environmental Impact Assessment (EIA) Regulations, 2000

The Pakistan Environmental Protection Agency Review of IEE and EIA Regulations, 2000 (the 'Regulations'), developed by the Pak-EPA under the powers conferred upon it by the Act, provide the necessary details on preparation, submission and review of the initial environmental examination (IEE) and the EIA. Categorization of projects for IEE and EIA is one of the main components of the Regulations. Projects have been classified on the basis of expected degree of adverse environmental impacts. Project types listed in Schedule I are designated as potentially less damaging to the environment, and those listed in Schedule II as having potentially serious adverse effects. Schedule I projects require an IEE to be conducted, provided they are not located in environmentally sensitive areas. For the Schedule II projects, conducting an EIA is necessary.

The proposed project does not falls under the Schedule-I or Schedule-II of the Regulations. Hence an IEE/ EIA is not required, but as per the safeguard policies of the World Bank (OP-401 & OP-4.09) Environmental Assessment along with the mitigation measures and EMP is required.

2.1.3 National Environmental Quality Standards

The National Environmental Quality Standards (NEQS), promulgated under the PEPA 1997, specify the following standards:

- Maximum allowable concentration of pollutants in gaseous emissions from industrial sources,

- Maximum allowable concentration of pollutants in municipal and liquid industrial effluents discharged to inland waters, sewage treatment and sea (three separate set of numbers).
- Maximum allowable emissions from motor vehicle
- Ambient air quality standards.
- Drinking water Standards
- Noise Standards.

Only a few of these standards will be applicable to the gaseous emissions and liquid effluents discharged to the environment from the activities under the proposed project.

2.1.4 Land Acquisition Act, 1894

This law regulates the acquisition of land to public purposes. The Act does not define the "public purposes" except stating that it "includes the provision of village sites" but a broader interpretation has not been excluded. Land may also be acquired by a "Company which is engaged or is taking steps for engaging itself in any industry or work which is for the public purpose". In addition the law allows for the "temporary occupation and use" of waste or arable land for a maximum period of three years. Compensation is to be provided in cash, in the form of an alternative land allocation, or through other equitable arrangements.

Detailed procedures to be followed prior to and during acquisition, and in the determination of compensation, are specified. The government may, however, bypass normal procedures to take possession of land required for a company in case of "urgency". The law provides for a preliminary enquiry to survey land and assess its suitability, allowing government officers to bore into the sub-soil, dig trenches, and cut down or clear standing crops and "jungle" areas. Powers under this Act, including the power to make rules, lie with the provincial government while specified acquisition procedures are administered by local government officials.

Following Acts are also on record with respect to Land Resource:

- Land Reforms Act, 1977
- Land Reforms Regulations, 1972
- Land Improvement Loans Acts, 1883
- Transfer of Property Act, 1882

2.1.5 Sindh Wildlife Protection Ordinance, 1972

This ordinance enables the provincial government to establish protected areas and specifies activities that are prohibited in such areas. The exploitation of forests within a wildlife sanctuary is prohibited, except for the purpose of "reducing the hazards (dic), epidemic or insect attacks or other natural calamities". In national parks felling, trapping, collecting, burning, damaging or destroying any plant or tree is prohibited. At the same time, the ordinance requires that forests inside a national park are "so managed and forest produce obtained as not to impair the object of the establishment of the national park", suggesting that the extraction and use of forest products is permitted. The protections afforded by this ordinance are subject to broad exemptions since the provincial government may authorize any of these activities for scientific purposes, for example aesthetic enjoyment or betterment of scenery in a sanctuary or for the betterment of a national park.

In 2001, the protection clauses of the 1972 ordinance were further limited through the promulgation of two amendment ordinances. New provisos were added to sections 14(3) and 15(4), allowing the government to permit the laying of underground pipelies "using construction techniques other than blasting" in a wildlife sanctuary or national park, and exempting from the provisions of sections 14 and 15 "any activity" in sanctuaries or national parks that is connected with the "exploration or production of oil and gas". Such operations must not "permanently disturb" wildlife or the environment and must be undertaken in accordance with an environmental impact assessment (EIA), as defined in PEPA, 1997. No mention is made of hoe the impact of such activities on wildlife is to be mitigated.

The law requires that the government establish a Wildlife Management Board (section 4), which operates a fund (section 5). Specific functions are responsibilities for the board are not specified, nor does the law state where money in the fund come from or on what they are to be spent. These matters may be addressed by means of rules framed by the provincial government (section 41).

Wildlife, forest and other officials are awarded powers to arrest suspected offenders without a warrant (section 27), search without a warrant premises or persons (section 21), seize wild animals as well as equipment involved in a suspected offence (section 22), release suspects on bond (section 28) and "compound" offences to the tune of PKR. 15,000 (section 33). The government may delegate to wildlife officials additional powers to hold an inquiry, call witnesses, issue search warrants and prosecute a case (section 34).

Originally, maximum penalties under the 1972 Ordinance amounted to two years' imprisonment and/or a fine of PKR. 1,000 (sections 17(1), 17(2) and 17(3) These penalties were increased significantly in 1998, by means of an amendment Ordinance, but only with respect to the hunting of specified species. Penalties in 1998 amendment, added by means of a new section 17(1-A), are as follows: three months' imprisonment or a fine of PKR. 100,000 for hunting rabbit; six months in prison or a fine of PKR. 150,000 for hunting deer, "hooder"

or "para"; and nine month sentence or a fine of PKR. 300,000 for hunting ibex (section 17(1-A)). The maximum penalties for other offences under this law remained unchanged until 2001, when an Amendment Ordinance issued in that year brought about a tenfold increase in the fines that could be imposed under sections 17(1), 17(2) and 17(3). This amount now stands at PKR. 10,000. In addition to amendment acts and ordinance, many notifications have been issued over the years to amend the 1972 Ordinance or its Schedules.

Other Wildlife Protection Ordinance and Rules are as under:

- Sindh Wildlife Protection Ordinance, 1977
- Sindh Wild Birds and Wild Animals Protection Rules, 1953.

2.1.6 Forest Act, 1927

The Forest Act enacted more than 80 years ago remains the basic charter for forest management. Since independence, the Forest Act, 1927 has been in force throughout most parts the country. It was only recently as 2002 that the NWFP government adopted a new forest legislation. In Sindh, Punjab and other provinces forests continue to be governed by Forest Act, 1927 except few amendments. Existing laws governing the forestry sector are designed to regulate the exploitation of forests and plant resources, and contain no clear provisions regarding sustainable use or conservation.

The Act is designed to protect forest areas and regulate forest produce. Forest Act provides for the creation of various classes of forests and allow governments to reserve state owned forest land, assume control privately owned forest land, and declare any government owned forest land to be protected area. The law prohibits grazing, hunting, quarrying, clearing, for the purpose of cultivation, removing forest produce, and felling or lopping trees and branches in reserved and protected areas.

Standing forests and wastelands on government or over which the government has proprietary rights may be declared reserved by the government through notification in the official gazette. Land clearing, felling trees, cultivation, grazing livestock, trespassing, mining and collecting forest produce are prohibited in reserved forests, along with hunting, shooting, fishing, setting traps or snares and poisoning of the water. These offences are punishable with a fine or imprisonment which has been revised from time to time by the government and notified.

The government may assign rights over a reserved forest to a village community. Such forests are known as village forests and government has power to regulate the management of these forests. The government may declare trees or class of trees to be reserved, close entire forests or parts of a forest, and prohibit mining, clearing and removal of forest produce.

The courts may impose penalties for trespassing and other offences on the basis of value of forest produce with the confiscation of equipment and illegally taken produce. There is provision of grant of reward to the persons providing information including forest staff.

The law allows forest officials and police officers a wide range of powers including the authority to arrest suspected offenders without a warrant, release detainees on bond and act to prevent forest offence from being committed. The provincial government also controls the transit of forest produce within and outside the province. Offences in this aspect are also penalized.

The government may make rules and delegate its powers to forest officers who carryout the tasks of policing and enforcement in addition to the responsibility for surveying, mapping, and implementing rules issued under the law.

Following Ordinance and Act are also enacted to manage and control trees, parks, firewood and charcoal:

- Sindh Plantation Maintenance of Trees and Public Parks Ordinance, 2002
- Sindh Firewood and Charcoal (Restriction) Act, 1964

2.1.7 Canal and Drainage Act, 1873

The Canal and Drainage Act (1873) prohibits corruption or fouling of water in canals (defined to include channels, tube wells, reservoirs and watercourses), or obstruction of drainage. This Act will be applicable to the construction and O&M works to be carried out during the proposed project.

2.1.8 Sindh On-farm Water Management and Water Users' Associations Ordinance

This ordinance establishes a framework for executing and managing schemes for irrigation, drainage and flood management. Water is defined broadly in section 2(r) as "any water standing or flowing on surface or found in the soil at any place in the province". Water controls all underground water resources.

The law reconstitutes the Sindh Irrigation and Drainage Authority (section 3) and provides details regarding its composition and operational procedures (sections 5-9). The Authority was established under section 3 of the Sindh Irrigation and Drainage Act, 1997, which is replaced by the 2002 Ordinance.

Functions of the Authority include operating and maintaining irrigation and drainage systems and carrying out flood protection (section 10). The Authority advises the provincial government on these matters, along with issues such as drought management and sea water intrusion.

The ordinance also assigns specific tasks to the Authority, including the distribution of irrigation from barrages within the province and from inter-provincial links canals (11 c). The Authority is empowered to levy and collect service fees and surcharges (section 11 e).

Area Water Boards, which may be established or re-constituted by the provincial government (section 28) and farmers Organizations (section 40) established under section 26 A (1) of the repealed 1997 Act, perform within their respective territorial jurisdiction many of the same functions. One notable additional responsibility of the area water boards is to monitor the disposal of "toxic or noxious effluent safely and with minimum pollution of water resources" (section 38(1). Area water boards are empowered to charge fees for monitoring services provided 9section 28(2), and to notify the Regulatory Authority of offences related to the discharge of toxic effluent within its jurisdiction (section 28(3).

The government is required to establish a Regulatory Authority of Drainage and Flood Protection (section 67), the main purpose of which is to ensure compliance with the provisions of this Ordinance (section 74(1)). It performs mostly supervisory functions but is awarded specific powers to enforce compliance (section 81). It is also empowered to determine fees and charges (section 77), institute measures for drought control (section 78), and sanction measures to prevent the "waste, undue consumption and misuse" of water (section 29).

The Ordinance empowers both the Authority and the provincial government to establish various user level boards, committees and associations, and deals almost exclusively with the powers and functions of these bodies. Offences under the law are covered in a single section, and include obstructing a watercourse, allowing cattle or animals to bathe in or near a water source, and permitting the "steeping" of "dangerous material" near or in a water source (section 103).

Maximum penalties specified under the law extend to six months' imprisonment and or a fine of PKR. 100,000. It should be noted that these prohibitions apply only to water resources that "belong" to the Authority, area water boards or farmers' organizations. Rules are to be framed by the provincial government but regulations may be framed by the various bodies established under this Ordinance (section 104).

2.1.9 Provincial Local Government Ordinance, 2001

These ordinances were issued under the devolution process and define the roles of the district governments. These ordinances also address the land use, conservation of natural vegetation, air, water and land pollution, disposal of solid waste and wastewater effluents, as well as matters relating to public health – aspects that are relevant to the proposed project.

2.1.10 Antiquity Act, 1975

The Antiquities Act of 1975 ensures the protection of cultural resources in Pakistan. The Act is designed to protect 'antiquities' from destruction, theft, negligence, unlawful excavation, trade and export. Antiquities have been defined in the Act as ancient products of human activity, historical sites, or sites of anthropological or cultural interest, and national monuments. The law prohibits new construction in the proximity of a protected antiquity and empowers the Government of Pakistan to prohibit excavation in any area that may contain articles of archeological significance.

Under this Act, the project proponents are obligated to:

Ensure that no activity is undertaken in the proximity of a protected antiquity, and

If during the course of the project an archeological discovery is made, it should be protected and reported to the Department of Archeology, Government of Pakistan, for further action.

This Act will be applicable to the construction and O&M works to be carried out during the proposed project.

2.1.11 Mines, Oil Fields and Mineral Development Act, 1948

This legislation provides procedures for quarrying and mining of construction material from state-owned as well as private land. These procedures will have to be followed during the proposed project.

2.1.12 Factories Act, 1934

The clauses relevant to the proposed project are those that address the health, safety and welfare of the workers, disposal of solid waste and effluents, and damage to private and public property. The Act also provides regulations for handling and disposing toxic and hazardous substances. The Pakistan Environmental Protection Act of 1997 (discussed above), supersedes parts of this Act pertaining to environment and environmental degradation.

2.1.13 Employment of Child Act, 1991

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

The project proponent, participating farmers and their contractors will be bound by the ECA to disallow any child labor at the project sites.

2.1.14 Pakistan Penal Code, 1860

The Code deals with the offences where public or private property or human lives are affected due to intentional or accidental misconduct of an individual or organization. The Code also addresses control of noise, noxious emissions and disposal of effluents. Most of the environmental aspects of the Code have been superseded by the Pakistan Environmental Protection Act, 1997.

2.2. Policy, Regulatory Framework, and Institutional Capacity for Pest Management

At present the Ministry of National Food Security and Research is controlling agency for the import and production of pesticides, while the department of Plant Protection (Karachi) is responsible for the registration and regulation of Pesticides. The rules and regulations for Pesticides manufacturing, import and usage are stated in the Agriculture Pesticide Ordinance Government of Pakistan 1971 and the Agriculture Pesticides Rules Government of Pakistan 1973. These rules and regulations are based on guidelines from Food and Agriculture Organization (FAO). The Ordinance was amended later with respect to import of Pesticides and punishment for defaulters. To assist and advise the Federal Government on the technical aspects of the Pesticide Ordinance, the Agricultural Pesticide Technical Advisory Committee (APTA) was established. It comprises representatives from Universities, Government Departments, Pakistan Agriculture Research Council and Central Cotton Committee.

2.2.1 Laws, Rules and Regulations

The first law called The Agricultural Pesticide Ordinance, 1971 was promulgated. The Agricultural Pesticide Rules under the law were framed in 1973. The 1971 Ordinance is a comprehensive law for regulating imports, formulation, sale, distribution, and use, and establishing of institutions, ensuring quality control, and prescribing penalties for offences. It was amended in 1979 to let pesticide business transition from public sector to private sector, thereafter in 1992 to allow pesticide imports under generic names, and lastly in 1992 to strengthen the punishment provisions for adulteration.

2.2.2 Institutional Framework

Under the Act and Rules, an Agricultural Pesticide Technical Advisory Committee (APTAC) was established to advise the Federal Government on all matters relating to agricultural pesticide use and approve the registration of pesticides on the recommendations of the APTA Sub-Committee. The former is headed by the Secretary, Ministry of Food, Agriculture and Livestock, and the latter by the Plant Protection Adviser and Director General, Department of Plant Protection, Karachi. At the federal level, the Department of

Plant Protection is responsible for the registration of pesticides, monitoring of import, and assuring quality control, while at the provincial level, the Provincial Agricultural Extension Departments are responsible for standardization of doses, registration of distributors and dealers, and quality control through its inspectors and pesticide laboratories.

2.2.3 Registration of Pesticides.

Registration is carried out in three categories: (i) under trade name for which efficacy trials are done in the field for 2 years and registration takes place over a period of 2-3 years; (ii) under generic name for which government analyst's report is considered sufficient; and (iii) importation of pesticides registered in countries of manufacture on the basis satisfactory documentary proof. By 2000, a total of 2,116 pesticides were registered: 498 products trade names, 792 under generic names, and 826 on the basis of registration in the country of manufacture.

No person shall import, manufacture, formulate, sell offer for sale, hold any stock for sale or in any manner advertise any pesticide which has not been registered in the manner provided by this Act or the rules framed there under: provided that the Government may, by notification in the official gazette directed that the pesticide specified in the notification and not having a trade name will be imported only by a class or classes of importer as specified; except a pesticide having a trade name and registered in the country of manufacture which may be imported without undergoing the registration process but subject to the conditions notified from time to time by the Government.

(1) Any person intending to import, manufacture, formulate, sell, offer for sale, hold in stock for sale or advertise any pesticide may apply to the Government for the registration of the (pesticide) under such name as he may indicate in the application. (2) An application under sub-section (I) shall be in such form, be accompanied by such fee and contain such statements and information as may be prescribed. (3) Where the person making an application under sub-section (1) is not domiciled in Pakistan, the application shall, besides such person, be signed by his agent or representative in Pakistan. (4) Upon the receipt of an application under sub-section (1) the Government may register a pesticide by the name indicated in the application, if it is satisfied that: (a) the name of the pesticide is not such as would tend to deceive or mislead the purchaser with respect to the guarantee relating to the pesticide or its ingredients or the method of its preparation; or (b) the guarantee relating to the pesticide or its ingredients is not the same as that of another registered pesticide by the same manufacturer or is not so similar thereto as be likely to deceive; or. (c) it is effective for the purpose for which it is sold or represented to be effective; or (d) it is not generally detrimental or injurious to vegetation, except weeds, or to human or animal health even when applied according to directions. (5) When it registers a pesticide on the application of any person, the Government shall grant to him a certificate of registration in such form as may be prescribed.

2.2.3.1 Storage and use of Pesticides

No person shall store or use any pesticide save in accordance with rules made under this Ordinance.

2.2.3.2 Pesticide Laboratory

(1). As soon as may be after the commencement of this Ordinance, the Government shall set up a Pesticides Laboratory or, in consultation with the provincial government, declare a provincial laboratory as pesticide laboratory which may be suitably equipped to carry out the functions entrusted to it by or under this ordinance.

(2) The functions of the Pesticides Laboratory and the mode of submission of samples for analysis or test to the Laboratory shall be such as may be prescribed.

(3) The secrecy of the formula of pesticides, samples of which are submitted to the pesticides Laboratory for analysis or test, shall be duly safeguarded in the manner prescribed.

2.2.3.3 Offences and Penalties

(1)Any person who imports, manufactures, formulates, sells, offers or exposes for sale, holds in stock for sale or advertises for sale an adulterated or sub-standard pesticide shall be guilty of an offence.

(2) The person guilty of an offence under sub-section shall be punished:-

(a) In the case of an adulterated pesticides, in relation to a first offence with imprisonment for a term which shall not be less than one year or more than three years and with fine amounting to five hundred thousand rupees and for every, subsequent offence with imprisonment for a term which shall not be less than two years or more than three years and with fine which shall not be Less than five hundred thousand rupees or more than one million rupees; and

(b) In the case of a sub-standard pesticide, in relation to a first offence with imprisonment for a term which shall not be less than six months or more than two years and with fine which may extend to five hundred thousand rupees and for every subsequent offence with imprisonment which may extend to three years and with fine but shall not be less than the punishment given for the first offence.

2.2.4 Banned Pesticides.

In 1994, twenty three (23) pesticides were deregistered and their use banned in the country Four products have been recommended for de-registration on the basis of WHO hazard classes Ia (extremely hazardous) and Ib (highly hazardous). Pakistan also subscribes to FAO/UNEP code of conduct and has placed 17 products on FAO/UNEP Prior Informed

Consent (PIC) list. However, despite the restrictions, banned pesticides are still in use on a limited scale as these are smuggled from the neighboring countries.

Banned Pesticides (Active Ingredients)

1. BHC
2. Binacryl
3. Bromophos ethyl
4. captafol
5. Chlordimeform
6. Chlorobenzilate
7. Chlorthiophos
8. Cyhexatin
9. Dalapon
10. DDT
11. Dibromochloropropane + Dibromochloropropene
12. Dicrotophos
13. Dieldrin
14. Disulfoton
15. Endrin
16. Ethylene dichloride + Carbontenachloride
17. Leptophos
18. Mercury Compound
19. Mevinphos
20. Toxaphene
21. Zineb
22. Heptachlor
23. Methyl Parathion

2.2.5 Enforcement Experience.

Implementation of the laws is generally poor. Although an adulterator can be given a punishment of 7 year imprisonment and a fine of Rs. one million, no such punishments have ever been awarded. Fines, at maximum, have been of the order of a few thousand rupees. Inspectors draw samples and have them tested in laboratories. Data show that a very small percentage of samples are sub-standard or adulterated whereas the fact is that the proportion is much higher. The problem of adulteration and use of spurious pesticides generally is due to import of sub-standard products, formulation of pesticides using less active ingredient, adulteration by distributors during re-packing, adulteration by pesticide dealers, and preparation of totally spurious material and labeling them as pesticides.

2.3. The World Bank Operational Policies

The WB Operating Policies (OPs) relevant to the proposed project are discussed in the following sections. The list of OPs and their short description is as under:

- OP 4.01 Environmental Assessment, 1999
- OP 4.04 Natural Habitats, 2002
- OP 4.36 Forests, 2002
- OP 4.09 Pest Management, 1998
- OP 4.11 Cultural Property, 1999
- OP 4.20 Indigenous People, 1991
- OP 4.12 Involuntary Resettlement, 2001
- OP 4.37 Safety of Dams, 2001
- OP 7.50 International Waters, 2001
- OP 7.60 Projects in Disputed Areas, 2001

2.3.1 Environmental Assessment (OP 4.01)

The World Bank requires environmental assessment (EA) of projects proposed for Bank financing to help ensure that they are environmentally sound and sustainable, and thus to improve decision making. The OP defines the EA process and various types of the EA instruments.

The proposed project consists of activities which can potentially have environmental and social consequences, including:

Changes in land use, Damage crops, Deterioration of air quality, Water contamination and consumption, Damage to top soil, land erosion, cutting of trees Safety hazard.

Since none of the potential impacts of the project are likely to be large scale, unprecedented and/or irreversible, the project has been classified as Category B, in accordance with OP 4.01. Furthermore, the present ESA is being carried out in accordance with this OP, to identify the extent and consequences of these impacts, and to develop an EMP for their mitigation.

OP 4.01 Policy Categories the projects in three categories as under:

- Category A: Environmental Impacts of severe nature and significance
- Category B: Potentially less adverse environmental impacts but site specific and minor in significance
- Category C: No adverse environmental impacts

SOFWM project is categorized as Category B but most of its interventions have no negative impacts.

2.3.2 Involuntary Resettlement (OP 4.12)

The WB's experience indicates that involuntary resettlement under development projects, if unmitigated, often gives rise to severe economic, social, and environmental risks: production systems are dismantled; people face impoverishment when their productive assets or income sources are lost; people are relocated to environments where their productive skills may be less applicable and the competition for resources greater; community institutions and social networks are weakened; kin groups are dispersed; and cultural identity, traditional authority, and the potential for mutual help are diminished or lost. This policy includes safeguards to address and mitigate this impoverishment risks.12

The overall objectives of the Policy are given below.

Involuntary resettlement should be avoided where feasible, or minimized, exploring all viable alternative project designs.

Where it is not feasible to avoid resettlement, resettlement activities should be conceived and executed as sustainable development programs, providing sufficient investment resources to enable the persons displaced by the project to share in project benefits. Displaced persons should be meaningfully consulted and should have opportunities to participate in planning and implementing resettlement programs.

Displaced persons should be assisted in their efforts to improve their livelihoods and standards of living or at least to restore them, in real terms, to pre-displacement levels or to levels prevailing prior to the beginning of project implementation, whichever is higher.

No land will need to be acquired and no resettlement will need to be carried out for the proposed project, hence this OP is not triggered. Small tracts of land may be needed for the watercourse improvement works, however this land will be voluntarily donated by the beneficiaries.

2.3.3 Forestry (OP 4.36)

The objective of this Policy is to assist the WB's borrowers to harness the potential of forests to reduce poverty in a sustainable manner, integrate forests effectively into sustainable economic development, and protect the vital local and global environmental services and values of forests.

None of the project components would be located inside any forested areas. Hence the OP 4.36 is not triggered.

2.3.4 Natural Habitat (OP 4.04)

The conservation of natural habitats, like other measures that protect and enhance the environment, is essential for long-term sustainable development. The Bank therefore supports the protection, maintenance, and rehabilitation of natural habitats and their functions.

All of the proposed project components would be located in areas where the natural habitat has already been significantly modified, as a result of cultivation and associated activities. Therefore the OP 4.04 is not triggered for the proposed project.

2.3.5 Pest Management (OP 4.09)

Through this OP, the WB supports a strategy that promotes the use of biological or environmental control methods and reduces reliance on synthetic chemical pesticides.

The high efficiency irrigation methods such as drip system generally results in reduction in the usage of pesticides and fertilizers. Other project components such as water course improvement and laser land leveling though related to cultivation, do not have any bearing on the need or quantity of chemical inputs for cultivation. The capacity building component of the proposed project will nonetheless include aspects such as integrated pest management, judicious use of pesticides, herbicides, and fertilizers, and minimizing the chemical inputs.

2.3.6 Safety of Dams (OP 4.37)

The Policy seeks to ensure that appropriate measures are taken and sufficient resources provided for the safety of dams the WB finances. However this OP is not relevant since the proposed project does not involve construction of dams.

2.3.7 Projects on International Waterways (OP 7.50)

This OP defines the procedure to be followed for projects the WB finances that are located on any water body that forms a boundary between, or flows through two or more states. Since river Indus is an international water way the policy is triggered and the Bank has prepared appropriate disclaimers to clarify that the project activity does not infringe upon the water rights of any of the upper or lower riparians..

2.3.8 Cultural Property (OP 4.11)

The World Bank's general policy regarding cultural properties is to assist in their preservation, and to seek to avoid their elimination. The specific aspects of the Policy are given below.

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

The Bank will assist in the protection and enhancement of cultural properties encountered in Bank-financed projects, rather than leaving that protection to chance. In some cases, the project is best relocated in order that sites and structures can be preserved, studied, and restored intact in situ. In other cases, structures can be relocated, preserved, studied, and restored on alternate sites. Often, scientific study, selective salvage, and museum preservation before destruction is all that is necessary. Most such projects should include the training and strengthening of institutions entrusted with safeguarding a nation's cultural patrimony. Such activities should be directly included in the scope of the project, rather than being postponed for some possible future action, and the costs are to be internalized in computing overall project costs.

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

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

Since the project activities will be carried out in the cultivated fields, it is unlikely that any sites of cultural, archeological, historical, or religious significance will be affected. However, in case of discovery of any such sites or artifacts during the project implementation, the work will be stopped at that site and the provisions of this Policy will be followed. Additionally, the provincial and federal archeological departments will be notified

immediately, and their advice sought before resumption of the construction activities at such sites.

2.3.9 Indigenous People (OP 4.10)

For purposes of this policy, the term "Indigenous Peoples" is used in a generic sense to refer to a distinct, vulnerable, social and cultural group possessing the following characteristics in varying degrees self-identification as members of a distinct indigenous cultural group and recognition of this identity by others collective attachment to geographically distinct habitats or ancestral territories in the project area and to the natural resources in these habitats and territories customary cultural, economic, social, or political institutions that are separate from those of the dominant society and culture; and an indigenous language, often different from the official language of the country or region.

The OP defines the process to be followed if the project affects the indigenous people.

No indigenous people - with a social and cultural identity distinct from the dominant society that makes them vulnerable to being disadvantaged in the development process – are known to exist in the Province. Therefore this OP is not triggered.

However if such groups are identified during the project implementation, the proponents will develop an Indigenous People Development Plan, in compliance with the OP and get it approved by the Bank.

2.3.10 Projects in Disputed Areas (OP 7.60)

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

The Bank may proceed with a project in a disputed area if the governments concerned agree that, pending the settlement of the dispute, the project proposed for country A should go forward without prejudice to the claims of country. This OP is not triggered since no part of the Punjab Province is located in any disputed territory.

2.3.11 Applicability of Safeguard Policies

Operational Policy	Triggered
Environmental Assessment (OP 4.01)	Yes
Involuntary Resettlement (OP 4.12)	No
Forestry (OP 4.36)	No

Natural Habitat (OP 4.04)	No
Pest Management (OP 4.09)	Yes
Safety of Dams (OP 4.37)	No
Projects in International Waters (OP 7.50)	Yes
Cultural Property (OP 4.11)	No
Indigenous People (OP 4.10)	No
Projects in Disputed Area (7.60)	No

2.4. Obligations under International Treaties

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

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

These MEAs impose requirements and restrictions of varying degrees upon the member countries, 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 nonexistent.

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

2.5. Current Pest and Pesticide Management Approaches

The pest problems first emerged with the introduction of high yielding and fertilizer responsive crop varieties in the country in the decade of 60s and 70s. For example, the introduction of delta pine cotton, IRRI – 6 rice, and Mexican wheat varieties brought in their wake pests which caused colossal damage to crops. In the late 50s, plans were conceived to spot spray the diseased crops. Various crop rotations are in vogue in different parts of Sindh; rotation mostly practiced is wheat-cotton in upper Sindh on the left bank of the Indus river canal command area, while in the southern parts, it is rice-wheat and sugarcane. Considerable area around large towns is planted with vegetables while fruit orchards (mainly mango and banana) are scattered all over. Floriculture is also getting popular to meet the demands of the Karachi city.

2.5.1 Main Agricultural Pests/Diseases by Crop

Major Field Cops. In Sindh, ground plant protection measures (mostly pesticide sprays) are employed on 24% of the cropped area of all field crops including vegetables and orchards as compared to 21% on the national basis. However, plant protection on cotton and sugarcane account for 69% and 15% respectively of their cropped area in the province. Pests/diseases on these crops are amply mentioned in the comprehensive PMP for SOFWM. In the case of rice, 28% of the cropped area in Sindh is sprayed with pesticides. Stem borers and white backed plant hopper (Sogatellafurcifera) are the main pests of the rice crop. The diseases caused include: leaf blight, brown leaf spot, stem rot, and smuts.

Crop Losses

Reliable data on crop losses due to insect pests and diseases is generally not available. Various reports in the public sector archives put losses in crop production due to insects at 20-30%. The first incidence of white backed plant hopper as a major pest in 1976 caused losses of up to 60% paddy yield in Sindh.

Post-harvest losses (PHL) are significant in the case of grain cereals: for example, wheat and rice which are stored for long durations, the national average storage loss is estimated at 3.5% over a period of 5 months and could be as high as 15% if stored for 2-3 years. However in the case of horticultural and vegetable crops of the SAGP, post harvest losses area huge, both in terms of quantity and quality of production affected. According to some informal estimates, PHL in Sindh could be as high as 35%in the case of dates, 15% in the case of onions and chilies. Alflatoxin contamination is reported to affect80% of the chili crop.

Pesticide Use

The use of pesticides has steadily increased in the country from about 250 metric tons (MT) in the mid 1950s, to about 670 MT in 1980 when pesticide business was transferred to the private sector. Pesticides consumption was 3,672 MT in 1981, 20,213 MT in 1991, and 47,592

MT in 2001. It kept on increasing until the middle of first decade of the 21st century (129,598 MT in 2004), but started declining persistently (105,164 MT in 2005), albeit with fluctuating consumption thereafter. In 2008, the consumption of pesticides was reported at 39,186 MT; in 2009 it was 40,643 MT but jumped to 73,632 MT in 2010.

On the basis of three-years moving averages of the pesticide use in the country, the decline in the use of pesticides from 2005 to 2010 has been considerable; from 104,298 MT to 51,557 MT respectively at an annual decline rate of 12.9%. Prior to this period, the pesticide use had increased at an annual rate of 14.5% from 1992 to 2005. Cotton is the singular largest crop whereupon pesticide use is the highest; 51% of the entire cropped area for all crops in 2000, 64% in 2005, 55% in 20102 and 47% in 2011. In Sindh also, cotton accounted for about 50% but dropped to 32% in 2000, increased to 83% in 2005 and steadily came down to 60% in the years of 2010 and 2011. The latest figures of these recent Years show that fruits and vegetables account for 21-22% of all cropped areas in Sindh (more or less similar to the national average usage of 15-22% on fruits and vegetables). However, a striking difference is that in 2000, Sindh's fruits and vegetable sector has accounted for 49% of pesticides use as compared to 20% at the national level.

The reductions could be attributed to the various reasons, including the introduction and adoption of IPM practices and genetically modified (GM) crops, as for example Bt-cotton in particular, diminishing return to the costly pesticides, and to lesser extent on the awareness of the externalities of pesticides.

The excessive use of pesticides has disturbed the agro-ecosystems in the region. Pesticides have been instrumental in the killing of non-targeted and friendly organisms, including birds, and have also induced pest resurgences. In some cases, resistance to pesticides has developed and outbreaks of secondary pests have been witnessed. There have also been deleterious effects of pesticide use on human health, natural resources and the environment.

2.5.2 Externalities of Pesticide Use

The cost of pesticide use is much more than the cost of the pesticide itself. The social cost is enormous which is generally disregarded while determining the economic gains in terms of higher crop yields. These costs include: occupational poisoning, food residues, drinking water contamination, pest resistance, loss of biodiversity, cost of prevention and abatement measures and the cost of awareness campaigns. Further, there are health related issues; such as (a) ***Sickness Incidence of Pesticide Applicators***, pesticide-related sickness is very common in the cotton zone as about 63% of households report sickness during the spraying season, mortalities are about 1 per 400 households while main reported ailments were vomiting, dizziness, and breathing problems; (b) ***Sickness in Women Cotton Pickers***, about 87% women pickers complain of a variety of symptoms like headache, nausea, vomiting, skin irritation, general weakness, fever, dizziness, stomach pain, and blisters; (c) ***Industrial Worker Poisoning***, about half of the labor force, working in the pesticide plants report

sickness by inhaling pesticide emissions; and (d) ***Pesticide Residue in Food Chain***, fruits and vegetables are contaminated with pesticide residues to the extent of 40% and 63%-70% of these are above the Maximum Residue Limit (MRL)

Other externalities Pesticide residues also found in irrigation and drinking water, cotton seed, oil, lint and cattle feed, cottonseed cake, animal milk, and soil. Increased pesticide resistance is resulting in additional applications of pesticides to maintain expected crop yields. The consequences are lower yields and higher production costs. Pesticide use is affecting biodiversity too but it is little understood and appreciated. Some examples are: pollinator damage (honey bee poisoning), soil fauna, wildlife and birds.

Monetization of Pesticide Externalities Clearly there are substantial costs that the society has to bear on account of harmful effects of pesticides. Periodic research needs to be carried out on the economic costs of pesticide-related externalities. An assessment made in 2000 shows that the external costs of pesticide use in Pakistan amounts to about Rs. 11.7 billion annually.

The National pesticide survey was conducted by NFDC in 2002. The results of these are shown in the following two tables:

Table 2.1: Environmental Problems on National Basis

	Freq (Number)	Percentage	Cumulative
Soil Pollution	245	5	5
Water Pollution	253	6	11
Environmental Pollution	1,276	28	39
Health Hazard	1,102	24	63
Fish Pond	92	2	65
Animal Health	429	10	75
Habitual Change	1,100	24	99
Others	10	0	100

Source: NFDC National Pesticide Survey 2002

Table 2.2: Different Types of Sickness Symptoms Reported

Symptoms	Freq (Number)	Percentage	Cumulative
Headache	456	15	15
Dizziness	621	21	36
Irritation of skin, eyes, nose. Throat	706	24	60
Vomiting	435	15	75
Blurred vision	138	5	80
Heart trouble	187	6	86
Cancer	158	5	91
Fatality	15	1	92
Other	247	8	100

Source: NFDC National Pesticide Survey 2002

Monitoring Pesticide Residues in Blood Samples of Pickers from IPM vs Non-IPM Trials conducted under World Bank Assisted IPM Productivity Enhancement Component of SOFWM (2012) by Prof. Dr. Shafi Muhammad Nizamani, Professor & Principal Investigator National Center of Excellence in Analytical Chemistry, University of Sindh, and Jamshoro-Pakistan describes that;

Pesticide residues were monitored in blood samples of pickers of IPM and Non-IPM field trials of cotton, chilies and okra at the time of crop harvest peak activity. Blood samples were collected through the courtesy of FFS Facilitators. Blood samples were collected from two

groups of volunteers (10 IPM pickers and 10 Non-IPM Pickers for comparison) for each crop and a total of sixty blood samples analyzed in this study.

According to results of survey, all the Non-IPM pickers complained for various ailments. Among those were headache, dizziness, eye irritation, general weakness and fatigue, itching, digestive system (indigestion/vomiting/diarrhea), and respiratory system (coughing/ breathing problems) reported as the major symptoms. On the other hand all the IPM pickers interviewed did not complain the aforementioned ailments except few elderly pickers complained general weakness.

Further investigation has indicated the presence high level residues of Endosulfan, DDT, Bifenthrin, Lambda cyhalothrin, and Chlorpyrifosin the blood samples of Non-IPM farm pickers. Higher endosulfan residues in Non-IPM pickers could be due to occupational exposure plus dietary intake; whereas low level endosulfan residue in IPM pickers may be due to dietary intake only. Moreover, low level DDT residues were detected in elderly pickers of Non-IPM as well as IPM trials. Chlorpyrifos, Bifenthrin and Lambda cyhalothrin residues were found in Non-IPM pickers only which could be due to occupational exposure.

2.6. Institutional Setup for Environmental Management

The apex environmental body in the country is the Pakistan Environmental Protection Council (PEPC), which is presided by the Chief Executive of the Country. Other bodies include the Pakistan Environmental Protection Agency (Pak-EPA), provincial EPAs.

The EPAs were first established under the 1983 Environmental Protection Ordinance; the PEPA 1997 further strengthened their powers. The EPAs have been empowered to receive and review the environmental assessment reports (IEEs and EIAs) of the proposed projects, and provide their approval (or otherwise).

The proposed project would be located in the Sindh Province. Hence this ESA report will be sent to the SINDH EPA for review.

2.7 Environmental and Social Guidelines

Two sets of guidelines, the Pak-EPA's guidelines and the World Bank Environmental Guidelines are reviewed here. These guidelines address the environmental as well as social aspects.

2.7.1 Environmental Protection Agency's Environmental and Social Guidelines

The Federal EPA has prepared a set of guidelines for conducting environmental assessments. The guidelines derive from much of the existing work done by international donor agencies and NGOs. The package of regulations, of which the guidelines form a part, includes the PEPA 1997 and the NEQS. These guidelines are listed below;

- Guidelines for the Preparation and Review of Environmental Reports,

- Guidelines for Public Consultation,
- Guidelines for Sensitive & Critical Areas,
- Sectoral Guidelines.

It is stated in the Pakistan Environmental Protection Agency Review of IEE and EIA Regulations, 2000 that the EIA or IEE must be prepared, to the extent practicable, in accordance with the Pakistan Environmental Protection Agency Environmental Guidelines.

2.7.2 World Bank Environmental and Social Guidelines

The principal World Bank publications that contain environmental and social guidelines are listed below.

- Environmental, Health, and Safety (EHS) Guidelines prepared by International Finance Corporation and The World Bank in 1997.
- Pollution Prevention and Abatement Handbook 1998: Towards Cleaner Production
- Environmental Assessment Sourcebook, Volume I: Policies, Procedures, and Cross-Sectoral Issues.
- Social Analysis Sourcebook.
- All environmental and social safeguard operational policies.

Chapter 3

Current Institutional Issues of Relevance to Project

This part of chapter presents traditional water sharing system and impact of recent institutional reforms in the water sector, discussing issues specific to SOFWM Project.

3.1 Water sharing systems and Institutional Reforms

3.1.1 Water Distribution System

Given the shortage of canal water supplies in relation to its demand in agriculture, irrigation water has historically been rationed in the Indus Basin. 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. In native language it also refers to "*Warahbundi*" as well as rotation system. Accordingly, at each watercourse the total delivery of water is established and size of the outlet is determined. The water is supplied round the clock in each season. Each farm receives its share after certain time period.

In most areas, this period is defined as one week or 10 days. So the warabundi is based on a weekly or 10 days basis and the water is rationed out to all farmers within the command area.

3.1.2 Impact of Drought

Historically, whereas this system of warahbundi has been followed all across with certain degree of inefficiency and mismanagement, the persistent drought in Sindh during the last 4 years has disturbed the warahbundi system. Currently, the distributaries/minors do not receive water supplies as per historical sanctions from the system as a result of general shortage of water in rivers. So another layer of rationing has been imposed on distributaries/minors, thereby extending the farm level warabandi to uncertain limits.

3.1.3 Water Course Level Institutions

Traditionally the operations on a watercourse used to be carried out by the farmers themselves on an informal basis as the watercourse had always been a junior property of the landowners on that particular watercourse. The intuitional reforms making the joint operations and management of the watercourse a formal one and making it an integral and functional part of overall irrigation water management system:

3.1.4 Water Course Association (WCA)

WCAs are to be formed at grassroots levels of a watercourse and include at-least two-thirds of the landowners and leaseholders on that particular watercourse. The WCA is to be registered in the revelant Farmers Organization (FO) and the board would consist of three to five elected members from amongst the member of WCA and one or more appointed officials without voting rights.

The management of the WCA will consist of Chairman, Secretary and a Treasure. The WCA would be responsible for the operation and maintenance of the watercourse as well as equitable distribution of water within the command area of the Watercourse. There are already about 7000 WCAs.

3.2 Crop production & institutional reforms

Though the crop water demand was not given any significant attention in the water policies, the levels of crop production were determined more on political ground, as compared to the economic merits, with the introduction of output pricing policies for four major crops. These policies were ad hoc in nature and were not strongly linked with the potentials reposed in the soil climate and the labour force. The issues of price and technical efficiency were seldom viewed in conjunction with each other. As a consequence, greater emphasis was paced on area expansion rather than vertical shifts in production through gains in crop yield levels. This caused higher cost of production and reduced competitive edge in the international markets. Concurrently, the instrument input subsides continued and weekend the prospects for grain in efficiency.

Though the other subsides (e.g. those on credit and fertilizer) have by now been abolished, the states subsidy on irrigation water still continue. In return, water use efficiency levels currently stands around 30 to 35% (National conservation strategy, NCS Report page 37) in the Indus basin which is quite alarming as this implies a loss of 60 to 65%.

The root causes of poor water use efficiency appear to be at two levels. First, at the system level the efficiency is determined by the effectiveness of the institutional formwork designed to provide water to farms. Here the lack of water users participation the functioning of the system above their watercourses levels and transparency of the functioning of the system are consider vital factors in improving water delivery efficiency. Second, the perpetuation of recurrent subsidy on irrigation water has not helped in improving water use efficiency at the farm and watercourse levels. Historically, the collection through water charges (Abiana) have not accounted for more than 40%of the annual repairs and maintenance cost of the system.

It appears clearly that if the goals of institutional charges and community mobilization are to be achieved then transparency in the implementation of the reforms is absolutely essential. With greater proportion of farmers on various comities and bodies, the system will become more transparent. in addition, greater participation of farmers will help in creating a demand orientation in the water management system. Whereas this will increase the confidence of water user on the system, it will also promote production levels and water conservation.

3.3 Decentralization, devolution and local government

Decentralization represents the ceding of power from the center and/or provinces to subsequently lower tier to government. Devolution is a more permanent and complex form of decentralization, currently being implemented in Pakistan under the local government ordinance of 2001. although the proposed SOFWMP will not come under the purview of the developed departmental structures, since foreign-aided water projects are to remain with provisional governments, there will be certain implications for the smooth working of the project during implementation.

It may also noted that the institutional reforms under NDP (which are the back bones of the output based system for improving watercourses under OFWM), are themselves part of the larger decentralization and devolution efforts within the irrigation and drainage sectors.

The local government ordinance 2001 provides clears demarcation of the expenditure and taxation responsibilities to the three-tier system of local government in Pakistan (district, tehsil. taulka and union council). The planning, development and delivery of most of the public services are now the responsibility of the local governments, citizens and civil society organizations will together identify priorities, develop. Manage and monitor public services.

Technically the emerging WCAs and the FOs can be seen as local civil society organizations taking over some of the roles that provincial government once played. In the emerging local scenario, many farmers and members of the WCAs and FOs are also elected members of the local councils and some are nazims and naibnazims. These roles have often added to the power that the big landowners wield in their local areas.

Under the local government ordinance there is also the provisions of sitting up citizens community board (CCBs) is very local area for energizing the community towards development and improvement in service delivery through voluntary, proactive and self-help initiatives. CCBs may be organized for and around infrastructure (such as hospitals, schools) or for services such as irrigation etc. they will be required to registered for official recognition and if they mobilize local resources for development projects, they may also receive cost sharing support from the government. Technically the FOs also fit into this proposed local structure.

While the Sindh government is fully committed to the devolution process, the foreign donor-funded projects will continue to be managed by the provincial government. However, there is a need co-ordinate with the devolved structure & to bring in both hairs&women reinforcing the example of local government.

However, problems are present in the way provincial departments are being developed to districts. Districts level government is to have several Executive District Officers (EDOs) including EDO agriculture, with four specialized officers under each. One of these is the Community Development EDO, who will oversee social development, gender mainstreaming community participation and related areas. Staff of OFWM directorate in the provisional department of Agriculture (that previously managed the implementation of OFWM 1,2& 3) is also required to place its staff in the districts under EDO agriculture.

Under the developed government setup agriculture development activities, including on-farm water management, are the responsibility of District Governments. However, according to the current GOS policy implementation of externally aided projects is the responsibility of the Provincial Government. The Agriculture department through DG,AEWM, Director OFWM and WCAs Would be responsible for project components including social mobilization capacity building, water course improvement, productivity enhancement, Training and M&E. On-farm water management staff posted in the district governments will be put under the technical and administrative control of the DG,AEWM for smooth implementation of project activities.

One of the most outstanding features of the local government is the induction of women on 33 percent of the local council seats, through fixed quotas. Given that over 95 percent of the reserved seats have been filled (including those in the rural areas), the contention that the rural women of Pakistan are passive and will not come forward, has been proved wrong once and for all. While there are many problems in this system, and the paternalists are trying their best to show that women and politics do not go together, the monster of 'culture and tradition' –at least in politics- has been subdued. There is no reason why similar reform measures cannot change the situation of women under the SOFWMP. Taking action to induct women now in SOFWM would introduce complementary with the local government actions and consolidate the position of women.

In the background of the current legal, policy and institutional environments (where some measures seem to overlap, while others duplicate or counter each other), there are a number of issues that are likely to impact on the implementation of OFWM. These need to be considered in the fine-tuning of SOFWM and be addressed in the Implementation Framework.

These issues can be summarized are as follows:-

3.4 Lack of knowledge and awareness issues

- A vast majority of farmers are not fully aware with the formation as well as the autonomy of FOs
- The irrigation authorities also do not posses full and complete awareness with regard to transfer of distributaries/minors to FOs
- There is a lack of understanding between SIDA (Sindh Irrigation & Drainage Authority) and AWB (Area Water Board) on the demarcation of their respective responsibilities.
- It is not clear as to who is responsible for the repairs and maintenance of regulators installed at the beginning of a distributary (or minor) i.e. AWB or FOs.
- There is a complete lack of clarity on the allocation of water across canals.

Conclusions

- The FOs and farmers in general are not regularly updated on the allocation vis-à-vis. warabandi system and the associated changes made along with the rational for doing so. In order that the water management in the system is based on demand rather than supply of water as an outcome of the institutional changes, the level of awareness to be created among all stakeholders must be considered as a pre-condition.

3.5 Apprehensions

Issues

- Detailed discussions with FO members reveal that an FO does not carry full autonomy in the collection of Abiana (water rates) from the users. In the event some users do not pay Abiana, the FO should have the requisite legal status to ensure complete collection. On the contrary, persistent losses in recovery may give rise to problems, which may completely negate the spirit of self-help and organization efforts.

Conclusions

- The technical training has not been provided to the FOs with regard to the rehabilitation work that are to be undertaken under its framework.
- As part of the autonomy as envisaged in the institutional changes for water sector, the FO should also be imparted training in Abiana collection. Currently, AABDARS (canal patwari) who are employees of SIDA are also involved in Abiana assessment that negates the empowerment of FOs.

- The FOs need to have magisterial powers in the collection of Abiana. Currently, neither the staff of SIDA nor AWB carries such powers. This power primarily rests with the Revenue Department.

The farmers have shown their apprehension with regard to the perceived biases and inequities in imposing warabandi at distributary/minor level. This change also caused greater discretionary powers to irrigation administrators.

What primarily appears from discussion with various stakeholders is that the system of irrigation at present has become less transparent. The reform package in the water sector being introduced by the government has rightfully established Water Allocation Committees (WACs) at four different tiers of the system with adequate representation af farmers. However, effectively in letter and spirit, the apprehensions of farmers caused by the current lack of transparency will continue to haunt the effectiveness of the system and pose a serious threat to its long term sustainability.

3.6 Representation

- The representation of farmers at the AWB is considered inadequate.
- Similarly at SIDA, there are only 5 FO representatives in the body, which has membership of 16. It means that SIDA can hold meeting even if FOs for any reason decide not to attend the meeting. Similarly the other 11 members can use SIDA for suc actions that are opposed by farmer's representatives.
- Farmer's selection for FO membership is based on nomination/selection and not on t basis of election as per requirement of institutional reforms.
- There is currently no arrangements to ensure the representation of haris and women the WCAs and FOs

Conclusions

- Measures are needed to ensure the participation of haris & womens (at WCA & FO leve in particular) as well as more farmer representatives at AWB & SIDA levels.

3.7 Role & effectiveness of FOs

Issues

- The pace of the institutional changes in the water sector is also slow. As a result, the formation of Farmer Organization (FO) is currently effective only in the Nara canal command area, where there is a larger proportion of medium size farmers.
- Whereas it is considered essential to empower FOs for community participation and higher efficiency attainment, it is equally important that the FO's performance be evaluated if the goal of transparency is to be achieved.

- It also filtered through discussions that women representation at WCA and FO would not have cultural barriers as it is generally argued.

- Currently, the effective FOs have shown success in Abiana collection. However, it was observed that they only collected 60 percent of the revenue target that was passed on to AWB as per S1DA Ordinance of 2002. The remaining 40 percent which was also to be collected by FOs to be controlled by them for the O&M of the distributary and watercourse was not shown as collection. Since the Ordinance is not clear in making it mandatory for the FOs to collect and control the 40 percent, it may well have happened that the farmers paid only 60percent of their Abiana and pocketed the rest assuming that it is to be spent /controlled by them anyway. Another serious implication could be that the farmers may have deflated the Abiana rate by 40 percent to reduce their cost of Abiana by taking the shelter of FOs.

Conclusions

- What needs to be done in this regard is to improve FOs capacity and monitoring procedure to avoid a situation where there may not be any fund at FO level to upkeep the O&M of distributary and watercourse.

- At the beginning, a quota for women and sharecroppers at WCA and FO would ensure balanced representation. The FOs can then be better endowed to carryout the task of social mobilization. It would add complimentarily to this effect if the FO Council is empowered. The role of effective NGO s in this respect can hardly be overemphasized.

3.8 Relationship between land owners & tenants

Issues

- The representation of various stakeholders, particularly of tenants, at WCA and FO is a major issue. The process of social mobilization is slow and needs to be accelerated particularly in the context of small farmers.

Conclusions

- There is a clear need for capacity building in order that the core aspect of water sector reforms (i.e. community participation) becomes effective. Unless the larger participation of farmers is ensured, the system will not become transparent. Unless the relationship between landowners and tenants improves, the productivity potential reposed in the reform package cannot be fully extracted.

Chapter 4

Project Description

This Chapter describes various aspects of the proposed project including its background, objectives, its components, and activities under each component.

4.1 Project Background

Sindh is one of the major beneficiaries of the Indus Basin Irrigation System (IBIS) but due to arid and desert climate, the irrigated agriculture is facing acute shortage of water, surface water is even more important in Sindh as most of its lands are underlain by saline ground water. Thus irrigated agriculture is the single most important source of economy, employment and livelihood.

The introduction of large-scale irrigation infrastructure had a significant impact on the human and physical environment of the Indus Basin. The progressive development of irrigated agriculture enabled the country to support its growing population because of the impressive achievements made in turning dry arid lands into intensively cultivated and settled areas. Work on improving and modernizing the irrigation delivery system in Pakistan has been going on for decades.

In 1981, an On-Farm Water Management Project was launched. The project mainly focused on small-scale farms of less than 5 ha that relied on irrigation. It was revealed that poor watercourse maintenance was affecting efficiency of irrigation systems, thus the objective was to increase agricultural production by improving water management practices. Irrigation channels were rebuilt, improved and cleaned, and demonstration plots laid out to show farmers benefits of good irrigation maintenance/practices. Land leveling equipment was also provided, along with fertilizer and seed inputs. The project served as a role model for future water management projects to be replicated in other parts of Pakistan. Water Course Associations (WCA) was constituted at the watercourse level, to rehabilitate and manage watercourses. By 1991, there were some 17,000 WCAs, representing about 16% of all watercourses, with a membership of 85,000 farmers.

After transferring the responsibility of management and development of water resources to provinces they started their own On Farm Water Management Projects. In 2003-04 NPIW was started and continued till June 30, 2012. Government of Sindh started Sindh On Farm Water Management Project and continues with Additional Financing from the World Bank. The project includes; lining of conveyance system in order to reduce water courses losses,

precision land leveling for improved application efficiency, and demonstration plots for farmers training.

The ultimate aim of these projects was to improve water productivity in irrigated agriculture resulting in increased agricultural output per unit of water used. Government of Sindh realizing the scarcity of water available for agriculture productivity is planning to improve remaining 17,276 watercourses in the province in next 20 to 25 years. The lining of 5500 watercourses is proposed under the Phase - 1 of the proposed program namely Sindh Irrigated Agriculture Productivity Enhancement Project (SIAPEP).

4.2 Project Objectives

4.2.1 Project Development Objectives

The project development objective is to improve water and agriculture productivity for small and medium size farmers in Sindh. This will be achieved through improved water delivery mechanism and irrigation and agronomic practices.

Progress towards achieving the development objectives will be measured through the following key performance indicators:

- Increase in watercourse conveyance efficiency by 10%,
- Increase in cropping intensity by 20% (water courses) and 60% (high-efficiency irrigation systems); and
- Increase in crop yields by 10% (water courses) and 20% (high-efficiency irrigation systems)

4.2.2. Project Rationale, Coverage and Size

The proposed project is an important element of the Bank's strategy in the water and agriculture sector for Sindh, supporting a systemic infrastructure rehabilitation/modernization, improved service delivery in a socially and environmentally sustainable manner to support the long-term goal of food security and sustainable economic growth. The project supports efficient management of scarce water resources and is designed to augment adaptation under different climate change scenarios. Most of the project interventions are well tested and demand driven, with reasonable co-financing from beneficiary farmers. They are low risk, low cost, and yield high economic and financial returns. The project will also generate substantial social as well as economic benefits. These include enhanced equity in water distribution between tail and head users in watercourse command area, increased participation by farmers, and cooperation that leads to improved O&M of the system. It generates jobs, provides flood shelters/community centers for mitigating flood risk, and strengthens social cohesion.

The project is the first phase of a long-term (15-18 year) program for improvement of on-farm water management and agricultural practices in Sindh to be implemented over the entire agriculture areas of Sindh. The project interventions will leverage substantial investments from the beneficiaries and entail substantial risks due to participation by the farmers in the design and implementation of all activities.

4.2.3 Brief Description of the Proposed Project

On-farm water management has a long history in Pakistan and in Sindh. Based on the results of studies conducted since the late 1960s and investments in on-farm water management, together with the introduction of a participatory management system dating back to the early 1980s, interventions financed by the Bank and other donors have shown good results. The interventions also promoted participatory irrigation management, and investment cost sharing. The design of the proposed program is based on the lessons learnt from the on-going and past operations, and most of its activities have been tested under the ongoing additional and mother project. The proposed project interventions are expected to encompass: improvement of watercourses, improved field irrigation practices, introduction and promotion of a High Efficiency Irrigation Systems (HEIS), promotion of laser land leveling, introduction of deep plowing, provision of emergency community flood shelters, and assistance in improving agronomic practices through Integrated Pest Management (IPM), crop diversification, and other measures.

4.3 Project Components

The proposed project will have the following components:

Component A: Community Water Infrastructure Improvement

Component A is further divided into two parts A1 & A2:

Sub-Component A1: Community Watercourse Improvement

This component will cover improvement of water courses (WC), which constitutes the tertiary level water distribution system where water losses are the highest. In Sindh, there are 46,699 water courses out of which 28,856 have been improved by various program including the World Bank financing. Of the remaining 17,843, about 5,500 WC will be improved through the provision of lining (corresponding to 30% of all WC). Lining of water courses in general and in Sindh in particular has three advantages: (i) it decreases conveyance losses and prevents seepage to groundwater aquifers; (ii) it helps to deliver water faster to farmers' fields, so they can take advantage of the full duration of an irrigation cycle under the warabandi system; and (iii) it ensures equity in water distribution. Activities under this component will include development of selection criteria, farmer mobilization, and establishment of Water Course Associations (WCAs) and their registration, survey and

design, and construction. The activities will be undertaken by the Field Teams formed with technical, agronomical, and social staff under the DG, AEWM based in all districts. The project through its TA consultants will offer guidance on using variety of lining materials to be selected by the farmers. Construction will be administered by the farmers and supervised by the design and supervision implementation support consultants (ISC), who would also facilitate farmers in efficient and economic sourcing of the material. As indicated above, this activity is well tested and has been successfully implemented throughout Pakistan and in Sindh under previous and ongoing projects. The DG, AEWM with its branch offices at the district level will implement this component in all 24 districts. The ISC will assume Engineer's role and provide supervision to construction and quality control of works. An independent M&E consultants will be hired for independent reporting on impacts of the activity, and perform environmental and social audit. Estimated beneficiary farm families are about 137,000.

Fig 4.1: Different models of water courses already exists in Sindh Province.

Sub-Component A2: Mitigating Flood Risk for the Poor

During the two successive 2010 and 2011 floods, farmers in lower areas of Sindh experienced prolonged flooding by long periods of stagnated water that destroyed crops, irrigation systems, food and seed stock, livestock, and homesteads. These floods have disproportionately affected the very poor, small farmers and landless in rural Sindh, as the loss of livelihood was much greater given their limited assets. Poor communities, especially those who could not afford to improve their homestead on their own in these areas, have been requesting flood/raised shelters to avoid total loss of livelihood in events of such disaster in future. To extend the secured benefits of the project to rural poor, this component will provide support for socially and culturally appropriate community flood

shelters/centers to be built in areas subject to frequent flooding and on an on-demand basis with beneficiary communities/public sector providing lands to facilitate construction of flood shelters. Under the project about 432 shelters in 7 vulnerable districts will be built. These facilities will provide shelters to the communities during floods, where they can also store their seed grain, food stock, and livestock. These shelters are especially important for the landless and very poor, particularly women, children, elderly and disabled among them, where their life savings include animals they own and food stock they consume. Current design provides shelter for 121,000 people and about 129,000 cattle in the most affected seven districts in Sindh. The design is such that some shelters can also be used for community activities where local population can exchange ideas on farming, animal husbandry, health, nutrition, and education - and where women can share their many talents in crafts for which Sindh is famous. As such, it is envisaged that these centers will change the current social dynamics in the rural areas and improve social cohesion which is an urgently needed item. Strong community participation and willingness to contribute in kind with strict norms will be used for wider community participation. Common village lands, government owned lands or lands donated by beneficiary communities will be used for construction of these shelters. Other options including public sector involvement in the use and maintenance of these facilities are being explored. Links are being built with UNICEF Mother and Child Program, the World Bank financed Nutrition and Education Projects and others to utilize these facilities for promotion of women's interests and to prevent potential capturing of these facilities by powerful Growers in these areas. Water Course Associations will also be encouraged to use these shelters as their meeting points/small offices. Upon completion with community participation, these flood shelters will be handed over to NDMA or similar public organization for operation and maintenance.

Component B: Promotion of High Efficiency Irrigation Systems

Component B is further divided into two parts B1 & B2:

Sub-component B1: Small and medium-sized HEISs for 2 ha (5 acres), 4 ha (10 Acres) and 10 ha (25 Acres) farms.

This sub-component would assist small and medium sized farmers to install and operate H EISs of different size but mainly with the same irrigation technology, namely drippers and bubblers. It would also include 46 demonstration sites of 2 ha (5 acres) each, two in each district, and finance the associated training of department staff and farmers including women in the installation, operation and maintenance of the HEISs. The latter will be installed on about 20,000 ha (50,000 acres) of irrigated and irrigable land. Potential beneficiaries of this sub-component would be growers of vegetable/cash crops, newly established orchards and other high value and row crops such as pulses and cotton, in

presently rain-fed areas that are not served by the existing irrigation network. Focus would be given on small farms situated in the outskirts of large metropolitan areas for peri-urban agriculture. Here farmers have easy access to the cities and markets where the demand for cash crops is high.

HEISs would be installed by Service Providers and given on a shared cost basis. The Project would cover 60% of the equipment and installation cost and the farmers the remaining 40%. In Sindh, there are numerous capable service providers that can render the necessary services. A technical assistance package would be provided by the vendors to the farmers to promote adoption of the new water saving irrigation technology. In addition, technical assistance and training will be provided to farmers through Component C and D of the project. Given the novelty of this technology in Sindh, a social awareness campaign and farmer mobilization would be initiated and carried out by consultants supported by 155 Field Teams. In each Field Team responsible for the installation of the HEISs, one person would be trained in operation and maintenance (O&M) as well as in the promotion of HEISs to individual farmers, farmers' groups and Water Course Associations (WCAs).

Sub-component B2: Small HEIS kits for schools and individual households

This sub-component would address the poorest layer of the rural society: 10,000 female headed households and 80,000 landless farmers. And it would support the promotion of HEIS technology through education and demonstration in some 10,000 primary schools and 100 demonstration sites, at least four in each district. At the demonstration sites, the Project would finance training of Government staff and farmers including women in the installation, operation and maintenance of the small HEISs. At the primary schools, the Project would finance educational material and training of teachers to promote the application of water saving irrigation technology as an important element of the curricula in rural primary schools.

The HEIS kit consists of drip irrigation equipment for a plot of 10m x 10m = 0.01 ha (0.025 acre) including a small water storage of 160 liter (40 gallon) with a conveyance pipe for the daily provision of water. It is expected that on such a plot three crops or 3 x 100 kg = 300 kg of vegetables could be produced annually. This would be a significant asset for a poor family and thus contribute to an increased income at increased water productivity.

Whereas the HEIS kits for demonstration purposes and the primary schools would be provided free of charge, individual households would need to contribute 10% to the investment cost of US$ 50. Although only an area of 1,000 ha (2,500 acres) would be brought under irrigation through this sub-component, the expected promotional impact on spreading water saving irrigation technology throughout Sindh is considered to be significant.

Component C: Improved Agriculture Practices

Component C is further divided into two parts C1 & C2

Sub-Component C1: Laser Land Leveling and Deep Ripping

Under this sub-component, the project will provide for precision land leveling and associated deep ripping equipment which will result in higher efficiency and productivity of water use. Laser land leveling saves up to 30% of irrigation water, results in uniform seed germination, and increases fertilizer uptake, which enhances crop yields by up to 20%, especially in crops irrigated by flooding system. Given the location of Sindh in the delta area, where there are sandy loam soils and hard pans, deep ripping is important for loosening the soil for easier relocation by the laser leveler and for enabling access to water and nutrients and therefore high yields for deep rooted crops like cotton and sugarcane. The equipment for deep ripping and the laser leveling will be provided to service providers on a shared cost basis in the ratio of 45% by project and 55% by applicants. These service providers could be individual farmers, entrepreneurs or groups of farmers. It is estimated that a total number of 1100 laser leveling and 1100 deep ripping units will be provided preferably to members of the watercourse associations in the project areas. The service providers will carry out services to interested farmers on an existing market rates besides using it for his/her own farm. With provision of these equipment efforts will be made to encourage establishment of local supply market and after sale services than dependence on Punjab. Support to farmers in procurement and training in operation of the equipment will be carried out by the engineering wing of the Sindh OFWM Department.

Fig 4.2: Leser land leveling

Sub-Component C2: Improved Agriculture Production Technology

This sub-component will support improvement in crop and irrigation agronomy practices in the form of demonstration and assistance in improved and modern technologies to increase the benefits of enhanced water availability from watercourse lining and introduction of high efficiency irrigation systems. The interventions will include: (a) farmers field schools (FSS) on 30% (1500) of the project watercourses with the members of the watercourse association and the HEIS recipients. This training will focus on proper land preparation; nutrition management; improved irrigation techniques; integrated pest management and safe handling of pesticides; and post-harvest loss management, (b) training of 500 trainers to conduct training of the farmers in the 1500 FFS established. These trainers will be selected from the agriculture extension department, local NGOs and lead educated farmers; (c) training and technical assistance in alternative field irrigation practices including promotion of HEIS and associated crop diversification; (d) exposure visits for 1000 farmers, selected out of the FFS participants based on the active participation and contribution to the success of the FFS program. These visits will be within the country to best practice areas and exhibitions; and (e) promotion of rearing of natural pest enemy insects on-farm with establishing 200 demonstration centers for cotton, okra, mango and guava crops with farmer of the FFS and development and testing this technology for few other important crop pests. To implement this sub-component, the project will finance technical assistance and training consultants with experience in crop production technologies and operation, irrigation techniques and irrigation agronomy, integrated pest management under the FFS methodology, biological control of pests, crop production and post-harvest management technologies, particularly for the high value crops. The training of crop production of HEIS would be performed by the field teams with assistance from service provider. Under the ongoing project, the agency recruited to help in provision of such services proved very successful and will be replicated with further refinement in its mandate. Continuing with this approach will certainly improve the services. Besides this an ICT based M & E system will be established to improve monitoring of project outputs delivery, enhance transparency and gather feedback of the project beneficiaries. This system will be managed by an independent third party supervisory consultants team hired from the market. While delivering the project outputs it will be made sure that these also reach to woman farmers where possible. An estimated target of 20% share is set for woman farmer beneficiaries.

Component D: Project Management, Technical Assistance (TA), Training, Studies, Monitoring and Evaluation

This component would support project management, Technical Assistance for design and construction supervision, M&E, studies, audits and staff training.

Component D is further divided into four parts D1, D2, D3 & D4

Sub-Component D1: Detailed Design and Construction Supervision Support Consultants

Under this sub-component, the project would finance design and construction consultants to supervise construction of the water courses improvements, flood shelters, and HEIS components. In their design and supervision management of the construction and supply & installation contracts, they will assume the "Engineer's Role". They will work closely with the Project Implementation Unit, other TA consultants, and M&E consultants. They will also carry out various studies to be prepared under the project.

Sub-Component D2: Monitoring and Evaluation (M&E) of Project Impact Assessment Consultants including Training

This sub-component will cover M&E of the project impact assessment by the third party independent Consultants, who will directly report to the Project Steering Committee. The M&E activities will provide continuous feedback to the Government of Sindh on the project's performance and impact of its various components. To implement this sub-component, independent consultants will be recruited to monitor and evaluate periodically but not less than before and after each construction seasons to review: (a) implementation progress, including spot checking of works and quality of construction, and targeting of works as compared to agreed criteria; (b) project intermediate impacts; and (c) environmental and social impacts particularly on small and marginalized farmers and female farmers. The DG, AEWM will also have dedicated staff working in M&E activities and act as counterparts for these consultants. The consultants will also be responsible for establishing continued M&E indicators during and post implementation period until project impact attained to full developed level, and to provide training to the counterpart department staff to be able to carry out on their own after demobilization of the consultants upon completion of the project.

Sub-Component D3: Studies and Training

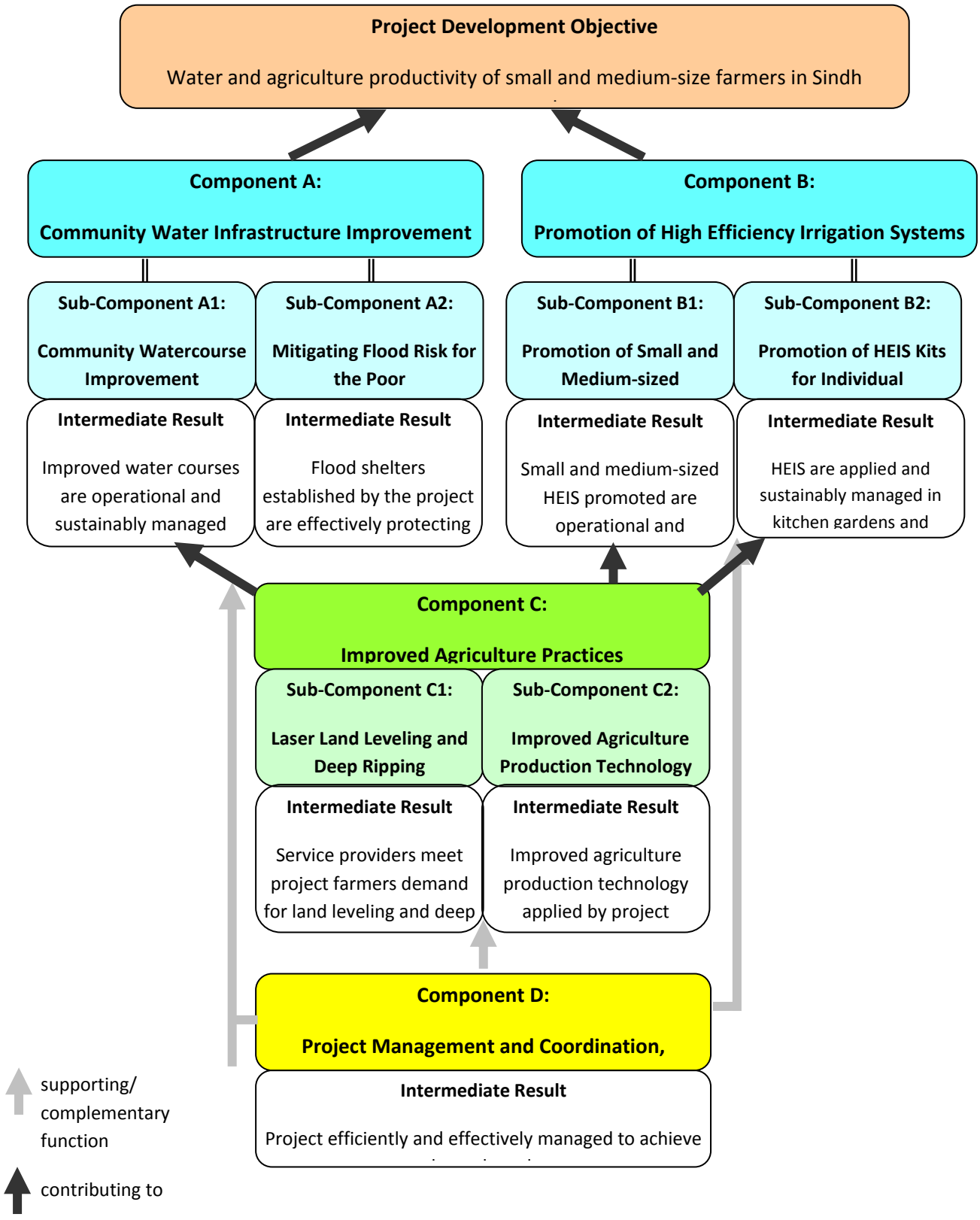
This sub-component will support strategic studies and feasibility for pilot projects that will be identified during project implementation. It will also support training, particular training for project staff, training for water management officers (WMOs) for monitoring environmental and social impacts & mitigation including integrated pest management, and the provision of (Technical Assistance) TA when and where needed.

Sub-Component D4: Project Management & Incremental Operation Costs

This sub-component will finance incremental staffs (contract) which are to be recruited to fill up or to enhance the implementing capacity of the project director's office, project district offices and field team, and incremental operation costs for running project district offices

and field offices to supplement their office and other logistic supports. The incremental salary support is only for the contract staff who will be hired during implementation period as when and needed and not for any other project allowances of the permanent government staff at all offices.

Fig 4.3: Sindh Irrigated Agriculture Productivity Enhancement Phase-I Project Component Overview



4.4 Integrated Pest Management (IPM)

Improvements of watercourses would result in the availability of additional water leading to expansion in agriculture area and higher crop yields and corresponding higher sue of pesticides, Inappropriate use of pesticides has been instrumental in the killing on non-targeted and friendly organisms, including birds, and has also induced pest resurgences. The social costs pesticides use have been high. These include: occupational poisoning, pesticides residues on food, drinking water contamination, pest resistance, loss of biodiversity, cost of prevention and abatement measure, and the cost of awareness campaigns. The main mitigating measure is the promotion of integrated Pest Management (IPM) practices in the project area.

Under this project, following supplementary IPM activities in the project area were performed.

1) launching awareness raising programs and dissemination of information of IPM;
2) Training of farmers through Farmers Field School (FFS) and farmers training program in safe use of pesticides and training of trainers;
3) Monitoring / testing of pesticides residue on agriculture crops.

Launching awareness programs

Under this all modes of campaigning like as media would be used to disseminate awareness program by producing print material on IPM approach, holding seminars, workshops and field demonstration, etc. these activities will cover like pesticides handing usage, storage and disposal, type of pesticide application equipment, protective measure and ecological friendly methods, promotion of bio-pesticides.

Training of Farmers by establishing ToF Training if Facilitator and farmer field school in the project under IPM approach.

Research and development on IPM approach has been initiated in our country since two to three decades ago. This has resulted to ask governments and international agencies to allocate more funds for adopting IPM Practices in agriculture and a study to test the suitability of Training of Trainers (ToT) / Farmers Field Schools (FFS) approach to IPM implementation on different crops.

Indigenously, biological control based IPM technologies for cotton, sugarcane, maize, fruits and vegetables have been developed but are not generally practiced. Different international

organizations are applying IPM techniques on field crops through Training of Trainers (ToT) and farm field School (FFS)."

The concept of dissemination of IPM knowledge stands since 1980 to address insecticides overuse, particularly the excessive use of board-spectrum insecticides in irrigated field crops which was disrupting the ecosystem and hurting farmers' yields and profits. The international forums related to agriculture has promoted the concept through IPM programs for vegetables and field crops, and consider it as one of the most promising and successful approaches to promote participatory IPM. Normally, a ToF consists of participants (mostly agriculture officers, but also include representative from research, NGOs and others, including women) who are trained by experts of various disciplines over a cropping seasons.

ToF participants observe a selected field to carry out an agro-ecosystem analysis (AESA) and then discuss what they had observed in the field: soils, crop health, water requirements, incest pests and their natural enemies etc.

On the basis of observation made, decisions are taken by consensus as to what is needed to be done next (including whether and spray of chemical pesticides is needed or not). As a next step, the participants are dividing into groups and each group reproduces to a group of farmers, i.e. called the FFS. This training continues throughout the crop season.

The main emphasis of this sub component is to promote IPM practices in the project area to integrate the all available technological options to control pest population to have sustainable production without affecting human beings, animals, and environment in general. Traditionally our agriculture extension and research system are not properly equipped to coup the increasingly complexity emerging in crop management. Therefore, there is earnest need to innovate integrated mechanism of crop management by involving farmers and officials to transform them as facilitators. Under this ToF / FFs training system is design to achieve the very objective of the sub component through establishment of farmer field schools and training of facilitators is described in the relevant component.

The fertility of the land and the prospects of plentiful food have attracted the people from many regions throughout the recorded history, who have been setting here for good. with the passage of centuries, the region has gone through immense demographic and climatic changes. But, still the soil of Sindh has produced enough to feed all its inhabitants throughout the course of centuries.

Progress of IPM Activities in OFWM Project Additional Financing

(A) Integrated Pest Management (as per original project)

Sr. No	Activity	Units	Projects Target	Progress
1	IPM trainings imparted to farmers through FFS	Persons	4,650	4,650
2	Training imparted to farmers in safe use of pesticides	Persons	300	300
3	Testing of pesticide residue sample	Nr.	150	150
4	Refresher courses for facilitators	Nr.	150	150

Source: SOFWM Project Additional Financing 2013

(b) Integrated Pest Management (for extended period of the project) by Agri. Extension.

Sr. No	Activity	Target of FFS to be Established	Achievement	Target of Farmers to be Trained	Achievement
1.	FFS on Okra Crop at Mirpurkhas	20	20	500	500
2.	FFS on Chilies Crop at Umerkot	23	23	575	575
3.	FFS on Cotton Crop at Sanghar & Ghotki	30	30 (in progress)	750	750
4.	FFS on Onion at T. Muhammad Khan	15	15 (in progress)	375	375
5.	FFS on Rice at Badin	20	20	500	500
6.	FFS on Tomato at Mirpurkhas	15	15 (in progress)	375	375
Total		123	123	3075	307

Source: SOFWM Project Additional Financing 2013

4.5. Project Beneficiaries

The direct beneficiaries of the Project would be the small and medium-size farmers in Sindh engaged in irrigated agriculture, including (i) around 137,000 farm households cultivating land in the command areas of the water courses to be improved by the project, and (ii) around 4,000 farm households supported by the project in high-efficiency irrigation (corresponding to a total of about 800,000 people). These farmers would also benefit from land improvements (laser leveling and deep plowing) and training in improved agronomic practices. In addition, 10,000

female-headed households and 80,000 landless farmers would benefit from high-efficiency irrigation kits for kitchen gardening, as well as some 10,000 primary schools. Considering that some households would benefit from several of the above interventions, it is estimated that the total number of farm households that will increase their agricultural production as result of the project will be at least 220,000, benefitting around 1.3 million people.

In addition, about 121,000 poor and vulnerable people and about 129,000 head of farm animals would be safe in case of prolonged flooding like in 2011 by having flood shelters in the most vulnerable areas. In addition to the direct beneficiaries, a large population would also benefit indirectly from the project, such as landless farm labors for agricultural operations, and temporary and permanent labors engaged in construction and manufacturing sectors.

The primary economic benefits from the project would come from increased agricultural productivity and production (resulting from increased area under irrigation, cropping intensity and yields). This would lead to increased incomes, employment opportunities, and food security of the primarily poor farm households targeted by the project. It is expected that increased output, income, and employment will result in increased demand for goods and services, which is expected to generate additional income and employment effects, and increase government tax revenues. The increased agricultural output from the project farmers will increase national production, and thereby contribute to growth in overall GDP and national food security. In addition, increased exports and/or reduced imports will result in foreign exchange earnings/savings.

Major institutional benefits expected from the project are: (a) Water Course Associations are sustainably managing the irrigation structures supported by the project; (b) public service providers (e.g. DG, AEWM district offices and field teams) and private sector operators (e.g. service providers for land improvements and consultants for design, supervision and implementation support) in all districts of Sindh are providing quality services to the small and medium-size farmers. The main social benefits expected from the project result from the inclusion of female-headed and landless households as the income opportunities will greatly reduce their vulnerability.

An economic and financial analysis will be prepared in due course on the basis of representative crop models for the different irrigation systems promoted by the project and the expected project outreach and farmers' adoption rate.

Chapter 5

Project Alternatives

This chapter considers various project alternatives, and the associated environmental as well as social concerns.

5.1 No-project Alternative

The 'no-project' alternative is not acceptable since in that scenario, a considerable amount of irrigation water will continue to be wasted. As described earlier, the irrigation sector suffers from among other factors low surface water delivery efficiency as well as wasteful on-farm water use, and only 35-40 percent of the irrigation water reaches from the canal head to the crop root zone. Pakistan relies upon its irrigation network for 90 percent of its food production and 25 percent of its GDP. In addition, the Country's agriculture sector provides two-third of employment and 80 percent of exports. With rising population and the associated increasing pressure on food and other commodities, and decreasing water availability in the rivers, improving the water delivery efficiency is vitally important to enhance the irrigation productivity that will in turn increase the productivity of agriculture sector.

5.2 Alternative Irrigation Methods

Flood irrigation has been the traditional method in the Country for ages. In this method, the entire cultivation field is flooded with the irrigation water. This method is time consuming and hence labor intensive, highly inefficient in terms of water usage, and also results in other problems such as increased vulnerability to pest attacks and proliferation of weeds, in turn resulting in the increased need of pesticides and weedicides. The high efficiency irrigation methods proposed under the Project address all of these problems, in addition to achieving enhanced yields and productivity of the farms. As already mentioned in Section 1.1, these high efficiency irrigation systems typically reduce input costs by 20-35 percent, increase yields by 20-100 percent, lower irrigation labor up to 30 percent, diversify cropping patterns, and save up to 75 percent water.

It is clear from the above comparison that the high efficiency irrigation methods are the preferred option for irrigating the cultivation fields in the Country.

Environmental and Social Aspects

The high efficiency irrigation methods generally result in the reduced need of farm inputs such as fertilizers, pesticides, fungicides, and herbicides, as mentioned above. The controlled irrigation generally results in reduced vulnerability of the crops to the pest attacks and reduced proliferation of weeds, in turn resulting in reduced need of pesticides and herbicides. In addition, fertigation (i.e., application of fertilizers or other soil additives through the irrigation system) is possible for the high efficiency irrigation systems, such as drip and sprinkler, resulting in enhanced effectiveness of the fertilizers and hence their reduced quantities needed. Similarly, for these high efficiency irrigation systems, chemigation (i.e., application of pesticides, fungicides, and herbicides through the irrigation system) is possible, resulting in enhanced effectiveness of these chemicals and hence their reduced quantities needed. The overall result of the high efficiency irrigation system is therefore a much reduced usage of chemical inputs.

The above mentioned reduced usage of chemical inputs affects the environment and communities in a positive manner. The excessive usage of these chemicals causes contamination of soil and water that may pose health hazards for the nearby communities and may also harm the natural flora and fauna including beneficial insects that are important for functions such as pollination. With the adoption of high efficiency irrigation methods, contamination of soil and water and the associated negative impacts on communities and natural flora/fauna are likely to be reduced.

5.3 Alternative Land Leveling Methods

The conventional leveling with the help of tractors or graders is the major alternate to the laser land leveling, which is included in the proposed project. Through the conventional methods, land cannot be leveled with precision, hence the advantages of leveling cannot be fully achieved. Unleveled fields result in improper irrigation, wastage of irrigation water and also require additional farm labor.

On the basis of the above, it is evident that the precision land leveling through laser leveling is a preferred mode of farm leveling.

Environmental and Social Aspects

No major environmental and social aspects are associated directly with the leveling activity. The indirect aspects of the conventional leveling methods include increased water consumption, increased need of pesticides, weedicides, and other chemical inputs. This excessive usage of

chemical inputs can potentially contaminate soil and water, which may pose health hazards for the nearby communities and may also harm the natural flora and fauna, as described above as well. It can therefore be concluded that with the help of laser leveling, contamination of soil and water and the associated negative impacts on communities and natural flora/fauna is likely to be reduced.

5.4 Alternative Methods of On-farm Water Conservation

The alternatives available for the on-farm water conservation include i) piped conveyance system; re-alignment and brick-lining the entire length of the water course; and re-aligning and improving the water course, but keeping it earthen (ie, without brick-lining). The cost of the first alternative would be prohibitive with marginal benefits compared to the second alternative, and the reduction of water losses will not be substantial in case of the third option. Therefore, the benefit-cost ratio is best for the second alternative, which has been selected for the proposed project.

Environmental and Social Aspects

No major difference exists among the above options in terms of the environmental and social consequences, except that the third option would not fully achieve the objective of water conservation and associated benefits.

5.5 Alternative Methods of Implementing the Proposed Initiatives

The beneficiaries of the high efficiency irrigation/laser land leveling/water course improvement schemes under the proposed project would be required to share the cost of establishing the schemes. Once established, these schemes will be operated and maintained by the beneficiaries themselves. This arrangement will ensure 'ownership' of these schemes by the beneficiaries, and thus the sustainability of the initiative.

Other options include i) full cost of the scheme to be covered by the Project; ii) full cost of the scheme to be covered by the beneficiary. The disadvantages of these alternatives are quite obvious; the first option would result in lack of ownership of the schemes by the beneficiaries, while the second option may fail to attract the farmers to adopt the new initiatives included under the proposed project.

No major difference exists among the above options in terms of the environmental and social consequences, except that the selected option will ensure beneficiary and community participation.

Chapter 6

Environmental and Social Baseline Conditions

6.1 Rationale

With the past success in enhancing agriculture and water savings in irrigation as a result of improvements to irrigation infrastructure and service delivery, the GoSindh has expressed its desire to scale-up infrastructure improvements in a larger program. The GoSindh intends the larger area improvement program to be taken up in the entire province. Irrigation Department of Sindh Province annually diverts approximately 55.5 to 59.25 billion cubic meters of water from the Indus River through three major barrages to 14 main canal' commands. These canal systems serve a gross command area of 14.391 million acres (5.82 million ha). Sindh, being the lowest province in the country and facing the Arabian Sea, is on comparatively flatter terrain and is thus subject to repository from upper drains and semidiurnal tides from the seaside. Around 78% of the area in the province is underlain by saline groundwater, a result both of proximity to the sea and of poor drainage. The average groundwater table is also very shallow, around 2.5 m from surface. This groundwater is not suitable for irrigation and further addition of seepages and leakages can aggravate the situation by raising the groundwater table toward root zone of crops. Close to the edges of the irrigated lands, localized fresh groundwater can be found. However, indiscriminate pumping has resulted in contamination of the aquifer in many places where the salinity of tube well water is being increased.

6.2. Environmental issues

Major environmental issues in Sindh province are identified as Degradation of fresh water bodies, Marine pollution, Urban & Indoor Air Pollution, Higher Noise levels in Urban Centers, Industrial and Municipal Solid Waste, Industrial Toxic Waste, Destruction of ecosystems, Deforestation & Desertification, Contamination in Ground water excessive use of pesticide and fertiliser, Destruction of Mangrove forest, Improper disposal of Infectious Hospital waste.

The major industries of Karachi are Textiles, Pharmaceuticals, Steel and Automobiles. Apart from these, Karachi is also called as software outsourcing hub of Pakistan. Manghopir site is the biggest industrial area of Pakistan with more than 4000 factories. Others are Landhi, Korangi,

FB Area, North Karachi and Port Qasim. Karachi has five major industrial estates with over 6,000 industrial units.

The Sindh Industrial and Trading Estate alone has 3,200 industrial units in more than 65 categories. Sukkur is hub of many small and large scale industries. Among important are cotton, textiles, cement, leather, tobacco, paint & varnish, pharmaceuticals, Agriculture. It is also a distribution centre, which fulfils the requirement of whole of the upper Sindh, part of lower Punjab and Balochistan.

There are two industrial estates in Sukkur ie Sindh industrial trading estate (SITE) and small industries estate (SIE). Hyderabad Industrial Estate is playing and important role in the development of the Province of Sindh and more then 250 industries are working. Industries include textiles, cement, glass and soap, pottery, tanneries, and film; handicraft industries.

Hyderabad is a major commercial centre for the agricultural produce of the surrounding area, including millet, rice, wheat, cotton, and fruit. Noise, vibrations, green house effect, radiation, chemicals, electromagnetic radiation and microbiological and social problems like stress and fatigue.

In Karachi, Sindh Industrial Trading Estate (SITE) and Korangi Industrial and Trading Estate (KITE), two of the largest industrial estates in Pakistan, there is no effluent treatment plant and the waste containing hazardous materials, heavy metals, oil etc is ultimately discharged into coastal waters through Malir and Lyari rivers and their tributaries.

In Hyderabad, the sugarcane based industry, is a major cause of industrial water pollution due to discharge of wastewater containing high pollutant. Since the pollutants contained in the industrial effluents are invariably toxic and most of them are difficult to be biologically degraded, the environmental contamination has been increasing steadily and spreading into the aquifer system and contaminating the groundwater.

The wastewater discharged without treatment into drainage canals, ultimately finds its way into the food chain. Untreated pollutants from industrial, agricultural and urban sources are released directly into water bodes intended for human consumption, with little regards for assimilative capacity of eco-systems. The result is heavily polluted water around towns and cities and high incidence of disease, especially among the urban poor.

The links between water quality and health risks are well established. Inadequate quantity and quality of potable water, poor sanitation facilities and practices are associated with a host of illnesses such as diarrhoea, typhoid, intestinal worms and hepatitis.

Diarrheal and typhoid mortality in children accounts for the bulk of the losses, reflecting the vulnerability of children to these diseases. Striking are the high proportion of costs due to premature child deaths, followed by the mortality impacts of typhoid in the older population.

The water quality of Indus River was assessed at six locations from Guddu barrage to Sajawal Bridge in Thatta district where concentration of certain pollutants was observed {HARZA, NESPAK & ACE, 2004}. This study was conducted for the purpose of assessing release of minimum discharge down stream Kotri to counter the impact of Sea intrusion. According to international classification the river is seriously polluted, due to the discharge of industrial and municipal wastewater from almost major cities & town into the river. Microbiological contamination in the water quality was also observed at every location which renders the water unfit for human consumption. Presence of heavy metals indicated that industrial effluent is being dumped into river.

There is an urgent need to address the health and environment effects associated with urban air pollution in Sindh Province and to promote more effective frameworks to address urban sources of air pollution. In those Pakistani cities where air quality monitoring has been performed, levels of air pollution exceed World Health Organization (WHO) recommended guidelines (WHO, 2000; 2005). National estimates of the burden of disease for Pakistan indicate that approximately 28,700 people die annually due to exposure to outdoor urban air pollution, and 70,700 people are assumed to die annually due to exposure to smoke from solid fuel use.

Air Pollution is an emerging environmental issue in major cities of Sindh. In metropolitan industrial areas such as Karachi pollution-related diseases are now realities of life. Increasing air pollution by industrial plants is already serious threats to public health in Sindh. Hundreds of tones of pollutant are emitted by factories and vehicles in thickly populated cities. Karachi, the largest industrial centre in Pakistan, alone has thousands of industrial units and about half million vehicles on its roads. Studies conducted by the University of Karachi have shown that a high concentration of lead is being excreted in the urine of people residing in Denso Hall Area. Excessive lead concentrations can pose serious kidney problem.

In Sindh, the major pollutant is dust, but people may also be exposed to acidic/caustic vapors, hydrocarbons fluorides, metals or other pollutants specific to individual processes Almost 80 per cent of the vehicles emit black smoke due to improper burning of fuel. This black smoke is loaded with chemicals like un burnt hydrocarbons oxides of nitrogen ,sulphur, paraffin's, olefing polymer aromatics and aldehydes all of which are dangerous to health he high concentration o f lead in petrol (1.5-2g / liter, being more than the maximum permissible limit of 0.5 g/ liter), is contaminating t he atmosphere w with toxic lead.

There has been evidence showing that **Particulate Matter (PM)** exposure is linked to a variety of adverse effects on mortality (non-accidental all-cause mortality, cardiovascular and respiratory mortality) and morbidity (hospital admissions, out-patient and emergency visits, asthma attacks and acute respiratory infections).

Particulate Matter (PM) is so small that they can get deep into the lungs and cause serious health problems. Numerous scientific studies have linked particle pollution exposure to a variety of problems, including increased respiratory symptoms, such as irritation of the airways, coughing, or difficulty breathing, decreased lung function, aggravated asthma, development of chronic bronchitis, irregular heartbeat, nonfatal heart attacks and premature death in people with heart or lung disease. People with heart or lung diseases, children and older adults are the most likely to be affected by particle pollution (PM) exposure. Various health impacts of heavy metal on human body due to absorption / adsorption have been found as well.

Noise Pollution is another harsh type pollution which has direct impacts on health and human behaviour. Various studies reflects that communities live in highly dense, industrial, vehicular and commercial areas have number of health related issues like hypertension, listening loss and abdominal issues.

Similarly generation and disposal under devolution plan the work of solid waste collection and disposal has become highly fragmented. In addition various round meeting with stakeholders including top industrialists have resulted that there is not central agency to collect and disposal of industrial waste which fall into hazardous and non-hazardous categories.

Waste Management is the discipline associated with control of generation, storage, collection, transfer transport and disposal of waste in a manner that is in accordance with the best principles of conservation aesthetics and other environmental considerations and that also is responsive to public attitudes. It includes all administrative, financial legal, planning and engineering functions involved in the whole spectrum of solutions to problems of wastes thrust upon the community by its inhabitants. The aim of waste management is to ensure that the waste is collected, handled and disposed as efficiently, economically and with as little environmental impact as practically possible. Usually industrial waste consists of chemicals, paints, metal scraps, fly ash, effluents, sludge, garbage and rubbish. In current situation the disposal of industrial and domestic of solid waste is being done in very unscientific manner by dumping into the depressions, water bodies or burnt in open atmosphere causing sever threat to environment.

To the address the environmental issues in Sindh province the provincial government as establish Environmental Protection Agency for implementation and enforcement of Pakistan Environment Protection Act, rules and regulations that provide stern action against the violators of Environmental Law.

However, the enforcement requires building Institution Capacity for Environmental Management, strong political will, availability of adequate infrastructure for wastewater collection and treatment, investment for effective disposal of solid and industrial waste.

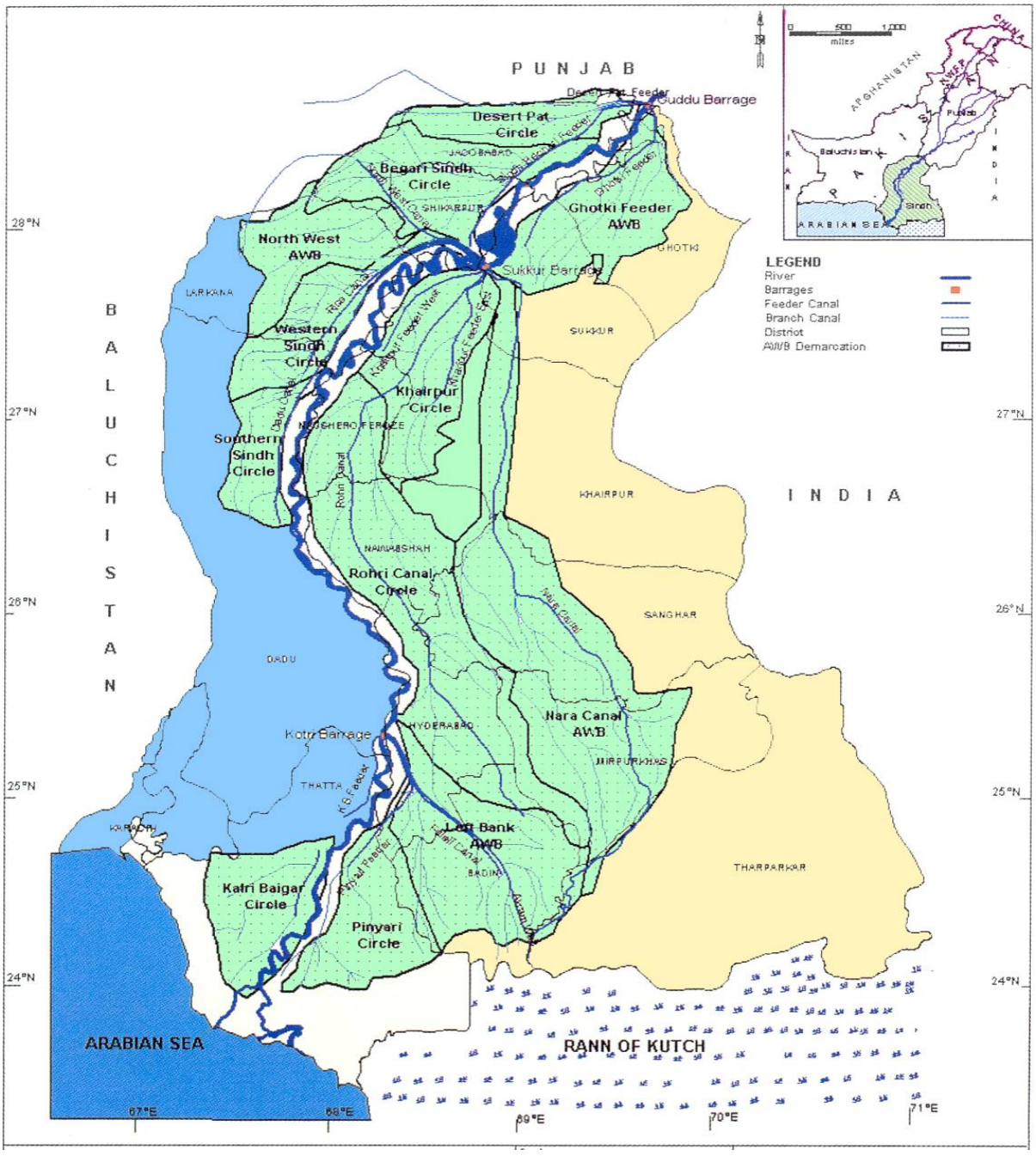
Environmental Management in the province needs to be assigned one of the top priorities to enhance quality of life and health of general public. Responsibilities and role of public & private organizations, civil society and general public can never be over looked for better environment management by addressing the challenges in the interest of every person of our society. Consideration of Environment must be integrated with socio-economic development for an approach of sustainable development so that we can preserve and maintain our natural resources for future generations.

6.3 Environmental Trends in Sindh

6.3.1 Physical Environment

Sindh is the land of contrasts like, deserts, hilly area, irrigated lands, riverine flood plain, deltaicregion and coastal/marine zone. The province is divided in three distinct ecological regions i.e. Thar Desert, Kohistan zone and the canal irrigated zone. The irrigated zone is located in the centre of the province which is bisected by river Indus dividing it into left bank and right bank areas.

This irrigated zone is flanked by two arid ecological zones i.e. Thar and Nara deserts on it sea stand rocky Kohistan on its western side (Fig.6.1).



Source: Sindh Irrigation and Drainage Authority (SIDA)-Master Plan for Left Bank of Indus Sindh 2013

Fig.6.1: Ecological distribution of Sindh

It is divided into four distinct topographical parts; the Khirthar range on the west, a central alluvial plain in the middle through which runs the Indus river, a desert belt in the east and the Indus delta in the south.

6.3.2 Soils

The soil is an important parameter for assessing the biophysical environment of the study/project area. The data required for the EA will mainly be collected from the secondary data sources and review of different published documents/studies.

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

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

The Soil Survey of Pakistan has grouped approximately 80 percent Sindh soils into eight land capability classes according to their agriculture potential and the relative suitability for sustained agriculture use. Soils placed in Class I are generally very responsive to high inputs of water, improved seed, fertilizers, labor and also to improved management techniques, while lower classes have correspondingly decreasing response to inputs and management. Approximately 10 percent of classified land in Sindh falls under Class I and 20 percent under Class II and 15 percent under Class III. Arable area constitutes approximately 50 percent of the classified area in Sindh.

Salinity is one of the major soil problems confronting agriculture in Sindh. The problem is generally considered to be the result of the canal irrigation system, but countrywide soil surveys have established that most of the existing saline/saline sodic soils are not related to the present irrigation system, and their formation is the consequence of the gradual redistribution of salts already present in the soil. However, the canal irrigation system has certainly aggravated the situation. This kind of salinity, identified as secondary salinity, is relatively temporary and can be easily eliminated by adopting appropriate measures. Major factors responsible for the development of secondary salinity include lateral seepage of water from the canal system and its evaporation from the surface of adjoining soils, the rising of water table due to excessive

percolation from the canal system and over-irrigation practices, inadequate availability of water, and accumulation of salts in low lying areas through runoff from surrounding saline soils.

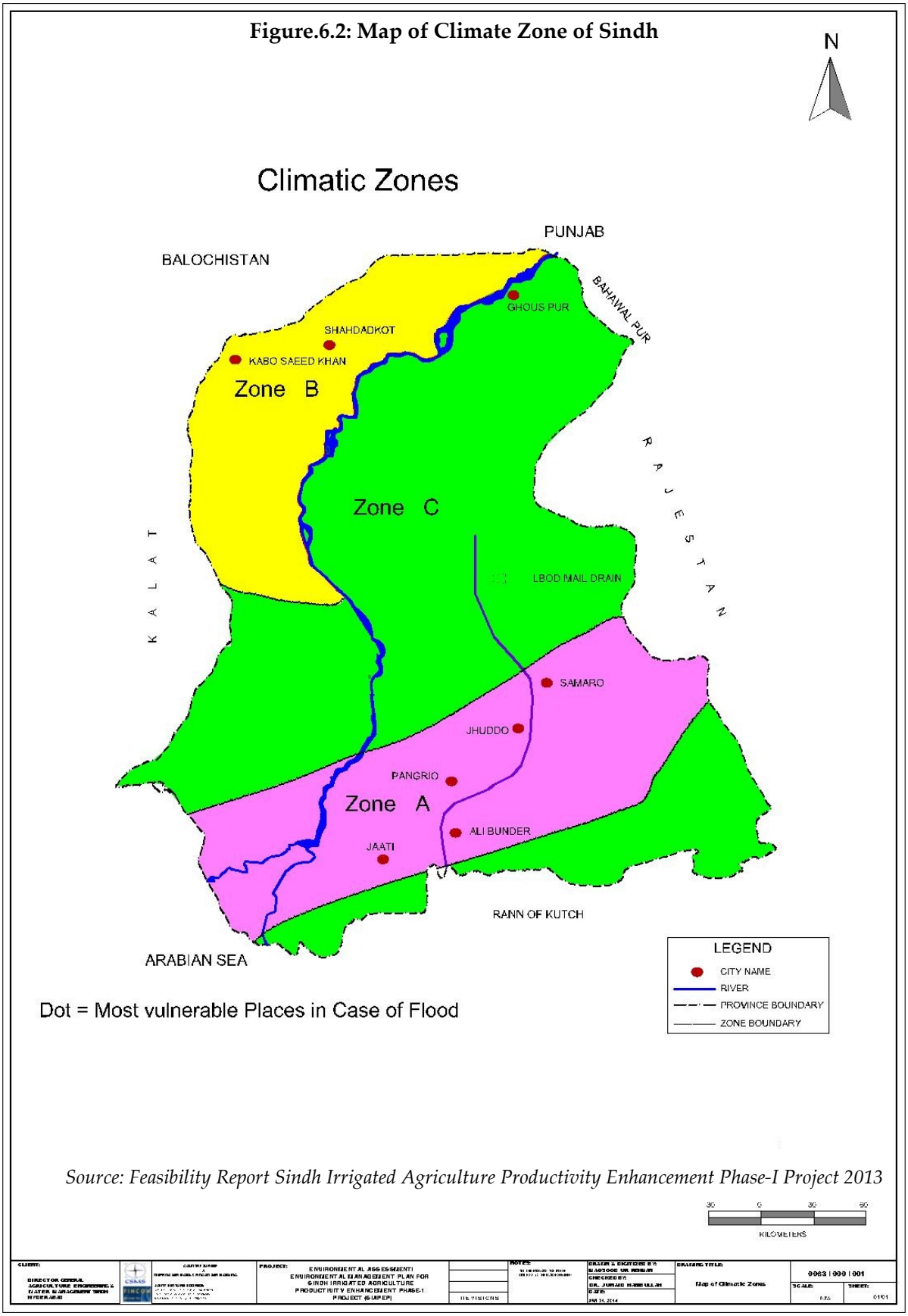
6.3.3 Topography and Geology:

The project area is distinctly divided into three zones as follows:

- Lar or Southern Sindh comprising the areas south of Hyderabad constituting districts of Hyderabad, TM Khan, T. A. Yar, Mirpurkhas, Umerkot, Thatparkar, Badin, Thatta and Malir.
- Wichalo or Central Sindh, the area lying immediately around Hyderabad constituting Matiari, Sanghar, Jamshoro, Dadu, Nawabshah and Naushahro Feroze.
- Siro, or Northern Sindh, comprising the area beyond Naushahero Feroze and Sehwan constituting of Khairpur, Sukkur, Ghotki, Shikarpur, Kandhkot/Kashmore, Larkana, Qamber/Shahdadlot and Jacobabad.

The required information about topography and geology of the above zones will be collected from the available secondary sources while conducting the EIA.

Figure.6.2: Map of Climate Zone of Sindh



Source: Feasibility Report Sindh Irrigated Agriculture Productivity Enhancement Phase-I Project 2013

6.3.4 Land Use

Land use surveys have been carried out in the past by a number of Government and semi Government agencies. The data produced is of high value and still serves as a base line for the forthcoming surveys, but it lacks both uniformity and adequacy, hence in order to have a comprehensive soil survey of the Indus region a major program for fresh and updating the data was highlighted in Drainage Sector Environmental Assessment (DSEA) report for launching a National Drainage Program. In perspective of that, a country wide survey was initiated for evaluating different aspects of physical resources by using the latest technology, and Land use studies were one of them.

The above Studies were conducted on Canal command basis, and covered 14 canals of Right and Left bank of Guddu, Sukkur and Kotri barrages. For this study, only the data of left bank command of eight (8) Canals off taking from three (3) barrages have been collected. It is pertinent to note that it is fortune to have this data for mapping and presenting the Land use of the left bank, otherwise for mapping the different classes' latest imagery is required for showing the present status of land under different use within the Study area. However, due to non-availability of latest Imagery we have to depend upon the available recent past data which is very useful and authentic.

i. Land Use Classification

The main objective of this survey was to map the different categories of land use, mainly depending upon the availability of irrigation Water, nature of relief/ topography, types of soils, climate and management. Besides the socio-economic factors have also great influence on the land use. For conducting Survey/ investigation SPOT images of 1:50,000 scale and Ground Topo sheets at the scale of 1:50,000 were used for appraisal and delineation of different categories and determination of overall status of the prevailing land use. The main classes of land use are as under:

ii. Cultivated Lands

Over all 6,767,289 acres (69.7%) of canal commands of Indus left bank study area are cultivated mostly by canal irrigation supplies supplemented by Tube well irrigation.

iii. Irrigated Lands

Perennially Canal Irrigated: This covers an area of about 3299362 acres (34%). Mostly within this category, all type of Kharif and Rabi crops are sown, however majorcash crops are cotton, wheat, Rice and Sugar Cane.

Non- Perennially canal Irrigated Lands: On Left bank area out of Eight Canals, the three major canals Ghotki feeder, Pinyari and Fuleli offtaking from Guddu and Kotri barrages respectively are non-perennial and are opened during the Kharif (summer season). Overall acreage under these Canal commands is almost 1593684 (16.4%) acres.

Canal Irrigated supplemented with Tube Wells: The overall area under this category is about 1874243 acres (19.3%). As the area within this category has no shortage of Irrigation water, therefore, lands are capable to grow all suitable crops including orchard, vegetables under the required climate conditions.

iv. Forest Lands

This category covers a very small area about 41531 acres (0.42%) of the study area this is because of the deforestation trend in the area and no further plantation is being carried out.

v. Unproductive Lands

This category includes the sand dunes, highly saline lands, water logged and high topographic soils which are not under the reach of irrigation system. These lands overall occupy about 2210780 acres (22.88%) within the left bank command area. Such type of land only supports natural vegetation for grazing animals.

vi. Miscellaneous Land Type

A sizeable area is covered by this class which includes the villages, Towns, Cities, grave yards, industries and the linear features like road, railways, canal, drains etc. The total area under this category is about 689125 acres (7%) of the Indus left bank Study area

6.3.5 Climate and Meteorology

Sindh province is a subtropical region; hot in the summer and cold in winter. The climate of the province is generally semi-arid to arid. The climate of the project area is determined from the rainfall data and pattern, temperature, air humidity and other climatic factors. From Climatic perspective the Sindh is also divided in upper Sindh and lower Sindh. The general climate of

the study area is arid sub-tropical-monsoonal. Dusty winds arising from Arabian sea blow from south-west direction in the months of May to July.

The overall climate of the area is arid influenced by the rainfall pattern and adjoining Khirthar Hills and That desert and the coastal area. The area has extremely arid climate receiving about 100-150 mm rainfall mostly in monsoon season whereas the rest of months of the year are almost dry. There are also periods without rains resulting in severe droughts in the area. The temperature ranges between 40 – 50 degrees C in summer and 20-30 degrees C in winter seasons. Humidity on an average ranges between 30-50%.

Rainfall varies from north to south. Poor rains are encountered after every three to four years and a complete drought occurs once in every eight to ten years. The amount of rainfall varies from year to year and the annual average for some areas is as low as 100 mm. Most of the rain falls between July and September over a period of two to three days.

The air humidity is influenced by the coastal belt of Sindh especially in the lower part of the province. During monsoon season the air humidity ranges from 60% to 80% which sharply drops to 20-30% during winter.

During the months of May and June, violent winds blow with a velocity of more than 40 km per

hour in lower Sindh and cause severe wind erosion, especially in cultivated areas and in areas that are subject to heavy grazing. At the end of April or in May, and sometimes in June, the wind velocity reaches 60 km per hour.

Thar and lower Kohistan fall in the wind belt winds blowing with a velocity of more than 40 km per hour and cause severe wind erosion, especially in cultivated areas and in areas that are subject to heavy grazing. The atmosphere is charged with dust and fines and which becomes difficult for the inhabitants of the area to live.

Table 6.1 provides the average rainfall data at different meteorological stations received during the monsoon months for the period from 1980 to 2011 in Sindh.

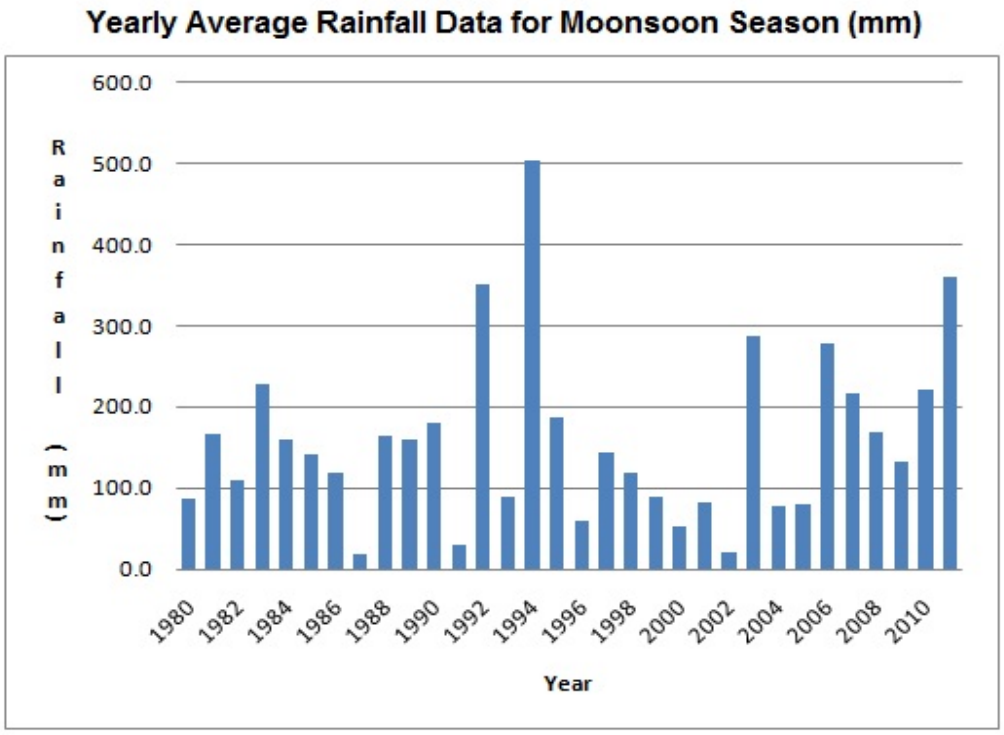
Table.6.1. Average Rainfall Data mainly during Monsoom Period (mm)

YEAR	BADIN	CHHOR	HYDER ABAD	JACOB ABAD	KARACHI	MOENJO DARO	NAWAB SHAH	PADIDAN	ROHRI	Average Rainfall
1980	101.5	61.4	118.5	13.9	193.8	25.2	112.4	101.9	59.0	**87.5**
1981	350.5	231.2	117.0	163.0	185.6	-	242.3	119.6	93.6	**167.0**
1982	158.7	202.9	80.8	97.6	161.2	11.8	120.2	92.0	59.0	**109.4**
1983	354.3	386.3	300.4	76.5	281.5	186.6	161.9	191.7	105.1	**227.1**
1984	352.6	279.7	206.4	58.8	270.0	51.4	134.3	50.5	28.5	**159.1**
1985	178.0	194.8	116.4	184.3	154.6	99.0	105.4	169.3	69.6	**141.3**
1986	143.7	86.3	178.1	83.5	91.6	62.0	149.3	30.1	238.0	**118.1**
1987	0.0	53.5	15.8	38.2	0.0	10.0	-	4.7	39.0	**17.9**
1988	226.0	309.8	265.3	335.2	160.0	-	-	56.9	122.3	**163.9**
1989	318.3	238.3	200.7	187.7	185.2	-	130.6	67.6	110.1	**159.8**
1990	351.7	478.6	170.9	116.4	137.4	30.6	175.4	81.3	75.9	**179.8**
1991	40.5	24.6	8.5	21.2	24.5	31.2	53.4	56.3	5.8	**29.6**
1992	352.1	395.2	427.2	250.8	273.0	233.8	393.4	546.9	291.0	**351.5**
1993	196.5	210.3	60.9	37.9	35.5	42.5	50.1	103.6	65.4	**89.2**
1994	913.9	499.1	487.1	366.3	481.5	413.1	551.7	370.4	452.3	**503.9**
1995	266.5	190.6	95.7	94.7	259.8	190.3	212.6	202.3	175.9	**187.6**
1996	28.0	185.1	16.4	95.5	99.0	21.8	5.2	64.0	22.4	**59.7**
1997	154.7	198.0	57.0	272.1	150.1	94.4	107.3	76.1	188.8	**144.3**
1998	168.3	547.1	49.3	39.3	82.4	21.1	60.9	36.3	54.1	**117.6**
1999	208.2	189.3	79.4	89.3	14.5	40.1	20.5	35.6	116.7	**88.2**
2000	89.8	89.7	55.0	19.0	46.9	102.2	46.0	8.5	7.5	**51.6**

YEAR	BADIN	CHHOR	HYDER ABAD	JACOB ABAD	KARACHI	MOENJO DARO	NAWAB SHAH	PADIDAN	ROHRI	Average Rainfall
2001	66.8	174.8	171.3	17.8	100.4	50.3	56.5	21.0	81.3	**82.2**
2002	36.6	4.6	9.0	17.1	55.8	33.3	4.0	9.0	7.7	**19.7**
2003	392.0	542.3	405.6	210.0	324.9	155.2	339.9	111.5	97.3	**286.5**
2004	149.4	171.9	129.5	49.6	65.9	28.5	30.0	40.0	31.8	**77.4**
2005	56.9	90.8	52.4	61.8	97.2	105.7	57.9	84.7	117.9	**80.6**
2006	390.4	535.2	524.9	94.2	301.1	105.2	293.6	174.1	76.3	**277.2**
2007	177.0	158.8	241.9	183.0	465.6	114.8	243.4	235.5	126.1	**216.2**
2008	168.8	126.1	156.6	187.7	121.6	298.0	109.1	187.2	172.4	**169.7**
2009	217.7	239.9	202.2	42.8	279.9	15.2	106.8	13.8	75.4	**132.6**
2010	348.3	355.8	214.1	-	372.9	73.1	342.6	200.4	88.0	**221.7**
2011	615.0	541.0	407.0	212.0	273.0	105.0	628.0	381.0	89.2	**361.2**

Ref. Metrological Department, Government of Pakistan, 2011

The average rainfall data is presented in Fig. 6.3 shows that the rain fall has remained erratic during the last 31years.Thereare only 6yearswhen the average annual rain fall has been exceeded than 200 mm during above period and in 25 years the average rainfall has been less than 200 mm of which 11 years were drought years having rainfall less than 100 mm.



Source: Meteorological Department, Government of Pakistan, 2011

Fig.6.3: Annual average rainfall during last 31 years

The impact of rainfall results in increase in average range carrying capacity upto 30 kg/ha but immediately after the rains or during periods of low rainfall it drastically reduces to about 5-10 kg/ha. Although the rain occurs in the form of heavy showers, it creates no run off. All the rain fall is absorbed by the dehydrated sandy soil. After the rain fall, the pastures are generated and sub- soil aquifers get replenished. After February, when the dry period starts, the lands get completely grazed and the sub soil water depletes and becomes saline.

During the monsoon season of 2011 the lower part of Sindh including the Thar and part of Nara areas received heavy rain fall. There corded evidence shows that in the history of 150 years no such quantum of rain fall was in the area. Although this quantum of rain fall had lot of storm water drainage problems and damages to the habitations, crops, existing drainage infra-structure, loss of properties, breaches to existing irrigation and communication infra-structure

and loss of life associated problems but it was a significant blessing for the dry lands as these areas were recharged with underground and surface water and ultimately the rangelands and other biotic life was highly benefited. The range lands were full of plant life, grasses, mushrooms, crops and species diversity and ultimate beneficiary was the people, livestock, wild life and biotic life of other forms. Although no any study was carried out to assess the increase in the biomass in range areas after the rains but as explained above and confirmed by the people of the area the rangelands were more productive after the rains than without the rains.

6.4 Water Resourses in Sindh

Sindh is entirely dependent on the River Indus for its survival and development. About 95 percent of the farmland in Sindh obtains its water from the irrigation system, while the rest is cultivated with the help of tube wells. The limited groundwater (less than 5 million acre feet or MAF – about 6.17 billion cubic meters or BCM) in the province is available in only 28 percent of the entire area. Rainfall is only in the range of 100 to200 mm per annum, while the evaporation rates about 1000 to 2000 mm, depending on climatic conditions. Thus the whole of Sindh is arid, with the River Indus being the primary freshwater source that gives life to the province. With population growth, the average amount of renewable freshwater available to each person has been declining. A country is considered to be under serious water stress if it falls below 2000 cubic meters. It is classified as water deficient if the per capita water availability falls under 1000cubic meters. In such a situation the socioeconomic and environmental development of the country is seriously hampered.

6.4.1 Surface Water Resources

Indus River: The Indus River is the main source of surface water in the project area (and in the country). The Indus rises in Tibet, at an altitude of about 18,000 feet (5,486 m) above mean sea level (amsl), and has a total catchment area of 654,329 km2. Length of the Indus River in the country is about 2,750 km. Five main rivers that join the Indus from the eastern side are Jhelum, Chenab, Ravi, Beas and Sutlej. Besides these, two minor rivers - Soan and Harrow also drain into the Indus. On the western side, a number of small rivers join Indus, the biggest of which is River Kabul with its main tributaries i.e. Swat, Panjkora and Kunar. Several small streams such as Kurram, Gomal, Kohat, Tai and Tank, also join the Indus on the right side.

Irrigated agriculture was, still is, and will remain in future the backbone of Pakistan's economy. Nature has blessed Pakistan with abundant surface and subsurface water resources. These resources had been exploited and utilized for agricultural, domestic, and industrial purposes in the past and will continue to be explored in future. The river Indus and its tributaries provide

the surface water. At the time of independence, we had about 67 MAF water available for diversion, this amount increased to about 85 MAF by the year 1960. At this juncture, the right of three eastern rivers (Beas, Sutlej, and Ravi) was given to India under Irrigation Water Treaty 1960, during this period, Indus Basin Project (IBP) was implemented with international assistance of the World Bank. IBP enabled Pakistan to acquire significant capability of river flow regulation through integrated system. By the dint of river regulation-cum-storage facilities of IBP and other irrigation developments on the river Indus, canal diversions progressively increased and peaked to about 108 MAF. The recent statistical data shows that the River Indus and its tributaries provide about 147 MAF during flood season. Out of which nearly 106 MAF is diverted into canals and is available for agriculture, while, about 32 MAF outflows into sea, whereas, over 8.6 MAF is considered as evaporation and seepage losses in the river system. It is worth mention here that during last 3-5 years hardly 2-5 MAF water has flown into sea, whereas, at least 12 MAF must be left to sea in order to control intrusion of brackish water

6.4.2 Groundwater Sources

Regular surveys have not been carried out to assess the availability of groundwater in the province. Various sources estimate that its volume is between 3 to 5 MAF (3.7 to 6.2 BCM) scattered in 28 percent of the geographical area of Sindh. However, some experts suggest it to be less than these estimates. This water is found mainly along the Indus water channels and in the few natural underground streams. In recent years, drought has caused excessive extraction of groundwater to make up for the lack of irrigation water. This, in turn, has resulted in rapid depletion of the groundwater and filling up of the underground freshwater channels and reservoirs with brackish water.

6.4.3 Groundwater Potential

Useable groundwater in the Province is mainly found in the Indus Plain, which is recharged from the meandering river and from the irrigation network that has been developed in the area. The other source of recharge is rainfall which is quite scanty and its contribution to the resource is limited. Rainfall recharge was 1.96 MAF (2% of 265 mm per year) as worked out by ACE and Halcrow (2001). The recharge from return flows (22.5% of 38.2 MAF), irrigation returns (22.5% of 3.5 MAF) was assessed 8.58 MAF and 0.79 MAF respectively. In the Sindh, canal water losses have been taken as 15 % of the total average canal supply of 45 MAF for the period 1988-2000. The recharges from these canals was estimated 6.76 MAF. The recharge from the river was assessed 0.3 MAF. The total available resource of the Sindh Province was assessed to be 18 MAF.

Groundwater quality: One of the impeding factors for the irrigated agriculture in Sindh is the brackish groundwater. More than 80% of the irrigated land in Sindh is underlain with brackish water unfit for agriculture. The shortage of irrigation water coupled with drought conditions in Sindh has increased the importance of groundwater exploitation wherever fresh water is available. Fresh groundwater is found mostly in a strip parallel to the left bank of Indus River and some pockets in other areas. More than 30,000 tube wells in private and public sector are installed for' agriculture purpose. Rapid development of groundwater by private sector is endangering groundwater sustainability by further lowering the water table and inviting intrusion of saline water into fresh water aquifer. The alluvium, which predominantly consists of sand of various grades constitute an extensive groundwater reservoir in Pakistan. The aquifer found at shallow depths is extensive and well assorted.

6.5 Biological Environment

Generally there are two distinct zones in the study area namely upper Sindh and Lower Sindh.

There is distinct variation in the climatic conditions between in these zones but is not reflected in the flora of the two zones. These regions have diverse habitats which support a large variety of flora and fauna. These habitats support the peculiar species according to their requirements.

The following broad categories have been identified for this report focusing on the project area:

The study area comprising of 24 districts located on both sides of Indus is rich in natural resources, having diverse and productive habitats, ecosystems and faunal and floral resources.

They protected areas, reserved and protected forests, wetlands, variety of fish both marine and inland, wildlife, agriculture and livestock and wetland resources. Some of wetlands of the study area are internationally recognized Ramsar sites. The wildlife in the study area consists of marine and terrestrial species and migratory birds visiting the area every year.

6.5.1 Important Flora in Irrigated Zone (Project Area)

This is an irrigated zone commanded under Guddu Barrage, Sukkur Barrage and Kotri Barrage with its network of canals distributaries and water courses. Where there is sweet water available in sub-soil, the agriculture is raised by installation of tubewells also. The agricultural zone is conspicuous of tree growth in various forms. Trees are grown not only with agricultural crop in the form of agro forestry but also as solitary or as in groves for shade, firewood and forage for cattle.

The main crops grown in Kharif and Rabi season are Cotton, Wheat, Sugar cane, Rice, Oilseeds of Rape, and Sunflower. Besides various vegetables like Cabbage, Chilies, Radish, Tomato, Onion, Coriander, Brinjal, Citrus, Lady finger, Mint, Bitter gourd and fruits like Date palm, Papita, Grewia, Mango, Jaman, Guava, Banana, Mulberry and, Berry, is grown.

The area is also marked with irrigated plantations raised by Sindh Forest Department to cater the needs of timber, fireweed and forage. In Ghotki, Sukkur and Khairpur the main species being the Talhee (Dalbergia sissoo) where as in rest of the irrigated plantation, Babul (Acacia nilotica) constitutes the predominant species. In addition to this various fast growing species like Mulberry, (Morus alba) Neem (Melia azadirech), Cono (Conocarpus lanrceofolius), Simal (Salmalia malabaricum) are also raised for various economic and environmental returns.

In the agricultural fields, the trees are raised along field boundaries, water courses, in linear fashion as shelterbelts or wind breaks and individual scattered trees. The main species growing as shelterbelts or wind breaks are Eucalyptus, Conocarpus, Neem and Agata grandiflora (Manjadri). The raising of Acacia nilotica (Babul) on close spacing in a block plantation for shorter rotation is a common practice of agro forestry in lower region, particularly in Sanghar, Matiari, Hyderabad and Mirpur Khas districts. The main objective is to improve the fertility of soil on one hand and getting economic return in the form of small timber for mines. In addition to the hurries, area is utilized to get fodder for animals.

There are various trees growing along roads, opens spaces, and open spaces for shade and aesthetic purpose. They include, Eucalyptus camaldulensis (Sufeda), Conocorpus lencefolius (Hybrid Cono) Poinciana pulcherima (Gold Mohar), Albizzia procera (Siris), Melia azedarach (Bakain), Tamarindus Indica (Tamarind) and Pithecolobium dulce, (Jungle Jalebee) and Cassia istula (chimkani).

This information will be updated/ revised during the EIA process either by engaging an Ecologist or a Forester to conduct baseline investigation about the flora of the project. He will also determine the level of any negative impact on vegetation by implementing the project activities.

6.5.2 Reserved Forests in the study Area

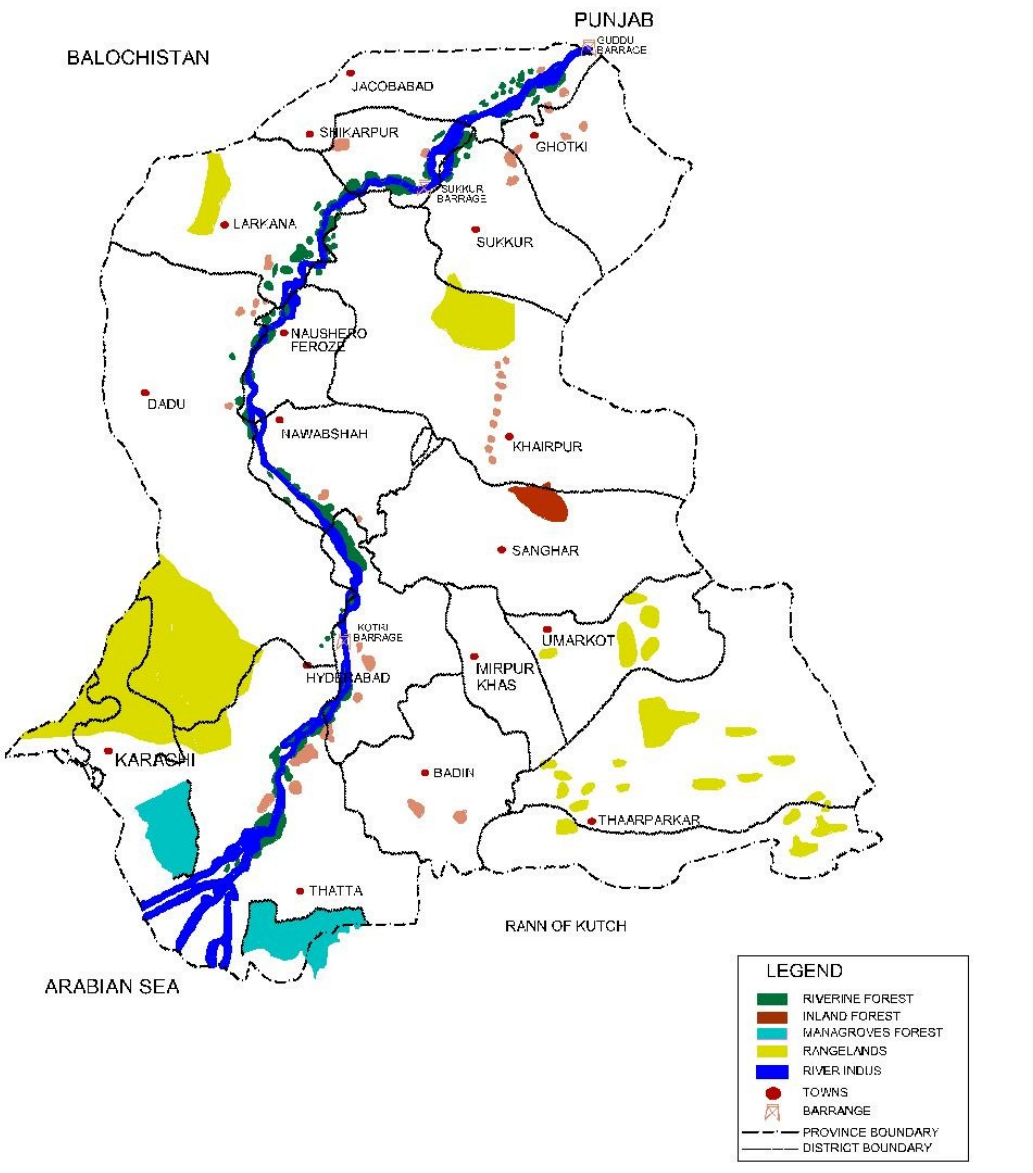
Sindh has four types of forests i) Riverine forests located on both banks of Indus within embankments (bunds), ii) irrigated plantations located in the command area irrigation system (Guddu, Sukkur and Kotri barrages) iii) Coastal forests along the coast and iv) Rangelands located in Thar and Kohistan desert areas. Regarding this study irrigated plantations are discussed. The total area of 82,000 ha is under irrigated plantations in Sindh, of which an area of

65,175 ha is located on left bank of Indus in various districts where as the rest 16,825 ha is located on right bank of Indus. These irrigated plantations are legally declared as reserved forests and are also game reserves and game sanctuaries for wildlife.

Forest Land Resource in Sindh and important flora

Out of Sindh's total land area of 14.091 million ha, an area of 1.126 million ha, is under the control of Sindh Forest Department (SFD) for different types of forests. Although total area controlled by SFD is 8% of the province, but only an area of 2.3% is covered by productive forests. They include riverine forests (0.241 million ha) and irrigated plantations (0.082 million ha).

Fig-6.4: Map of Sindh Forest



Source: IUCN 2004-Sindh State of Development and Environment

Riverine forests are located in Ghotki, Sukkur, Khairpur, Naushahro Feroze, Nawabshah, Hyderabad and Thatta districts on left bank between flood protection embankments and river and in districts Kashmore, Shikarpur, Larkana, Dadu, Jamshoro on right bank of river. Some forests are overlapping on both sides of Active River. The district-wise area located on left side/bank of Indus is shown in following Table 6.2.

Table 6.2 District-wise area of Riverine forests in Sindh

District	Area (Ha)
Ghotki	6,210
Sukkur	43,174
Khairpur	11,980
Naushahro Feroze	14,957
Nawabshah	22,994
Hyderabad	34,504
Thatta	23,322
Total	**157,141**

Source: Forest Management Plans, 2001

Four tree species namely Acacia nilotica (Babul/kikar), *Prosopis cineraria* (Kandi), *Populus euphratica* (Bahan), *Tamarix dioica* (Lai) and *Tamarix aphylla* (Lawa) are mainly found in riverine forests. Riverine forests are an important ecosystem sustaining biodiversity, habitats for wildlife and providing several environmental and ecological functions. Riverine forests support thousands of people by providing pasturage, fuel wood, timber, fodder, pods of Babul, gum, honey, lac and flowers for medicine etc., in addition to which hundreds of people are employed in forest operations.

Irrigated Plantations: Irrigated plantations of Sindh, also known as inland forests, were once riverine forests but isolated from Indus waters by earthen embankments constructed in the 1930s. These plantations are irrigated from Sukkur, Kotri, and Guddu barrage irrigation systems. The areas under these plantations in the command area of Guddu, Sukkur and Kotri barrages is 18,000 ha, 35,000 ha and 29,000 ha, respectively. Of the total area of 82,000 ha under irrigated plantations in Sindh, an area of 65,175 ha is located left bank of Indus in various districts where as the rest 16,825 ha is located on right bank of Indus. District-wise area of irrigated plantations is shown in Table 6.3.

Table 6.3: District-wise Area of Irrigated Plantations on Left Bank of Indus in Sindh

District	Area (Ha)
Ghotki	11,431
Khairpur	5,013
Naushahro Feroze	634
Nawabshah	1,933
Sanghar	9,121
Umerkot	500
Hyderabad	3,282
Tando Muhammad Khan	7,918
Thatta	15,833
Badin	9,510
Total	65,175

Source: Forest Management Plans, 2001

The principal species are *Dalbergia sisoo* (Shisham) in Upper Sindh while *Acacia nilotica* (Babul) in the lower Sindh. Due to the fact that Shisham is water demanding species it was replaced by Babul and *Eucalyptus camaldulensis*. Eucalyptus was increasingly planted in all the plantations as it was a fast growing tree used for industrial purposes.

The details of flora and associated information are given in the detailed baseline study (Annexure C) of EIA report.

6.5.3 Fauna

The project area is rich in wildlife species. Many of the large wildlife species commonly found in Sindh are also found in the project area. Studies conducted and reported in the literature provide that there are 35 protected areas including 13 game reserves, 3 wetland complexes, 40 bird species 21 mammals and 29 reptiles and several varieties of insects.

The details of all types of fauna, protected areas, wetlands, Ramsar sites etc. are further described in the Annexure C of the report.

6.5.4 Ramsar Recognized sites in Sindh and study area

The study area has three wetland complexes viz Deh Akro II wetland complex, Chotiari wetland complex and Coastal wetland Complex. They are considered as biodiversity hotspots due to the availability of diverse habitats and relatively low anthropological disturbance.

The Indus Dolphin Reserve is spread over 135 km from the Sukkur upstream to the Guddu Barrage. In 1974, the entire area was declared the home of the endangered Blind Dolphin (IUCN Red Data Book). The major threats it faces include split populations of the dolphins due to dams and barrages on the River Indus, reduction in habitat size during dry season, high turbidity, pollution, and hunting. The number of dolphins at the site has increased from 150 in 1974 to 620 in 2001.

Jubho Lagoon is a shallow, small brackish water lagoon with mudflats and marshes that support a large concentration of migratory birds including flamingos and endangered Dalmation pelicans, a rare species in the world. This was declared a Ramsar site in 2001 because of the efforts made by IUCN Pakistan.

Nurruri Lagoon is also a brackish, privately owned lagoon with barren mudflats that is visited by large concentrations of migratory water birds. It was also declared a Ramsar site in 2001. Increased salinity, sea intrusion, population pressures, agricultural and industrial pollution are major threats to this site.

Deh Akro is a wildlife sanctuary consisting of four major habitats; desert, wetland, marsh, and agricultural. Located 330km northeast of Karachi, it is a natural inland wetland ecosystem, which supports a variety of rare and endangered wildlife species. This area hosts a considerable number of rare fauna. Many indigenous fish species are also found here. Water scarcity during a persistent dry spell is adversely affecting this area.

Runn of Kutch is part of the great Thar desert and comprises of stablized sand dunes, with broad inter-dunal valleys of alluvial soil, connected across the frontier with India, which includes permanent saline marshes, coastal brackish lagoons, tidal mudflats, and estuarine habitats. The site supports many locally and globally threatened species, including the Great Indian bustard (Choriotis nigficeps), Houbara bustard (Chlamydotisundulata), Sarus crane (Grus antigone), and hyena (Hyeana hyaena) and supports more than 1% of the biogeographical population of flamingos.

Indus Delta is the fifth largest delta in the world. The fan-shaped delta consists of creeks, estuaries, mud flats, sand dunes, mangrove habitat, marshes and sea bays. It shelters 82,669 mangroves, mostly Avicenna marina which comprises 97% of the total mangrove area in the country and is said to be the largest coastal mangrove forest in the world. A large number of species of birds (including the threatened Dalmatian pelican) of fish and shrimps, and of dolphins (Plumbeous dolphin, Finless porpoise, and Bottlenose dolphin), humpback whale and reptiles are found here. The area is rich in archaeological and religious heritage.

6.6 Socio-economic profile

6.6.1 Population:

Sindh with its 43 millions population stands second largest and with an area of 140914 Sq.Km stands third largest province of Pakistan. In the census 1998 with 2.8% per annum Growth Rate 30.4 million population of Sindh was reported. The portion of Pakistan's Population in Sindh during 1951 was 18% which increased to 23% in 1998 and it is also increasing continuously due to migration from other parts of the country and abroad. Density per Sq.Km in 1951 was 43, which has also been increased to 216 per Sq.Km in 1998. The population growth rate in the urban areas is also proportionately very high as compared to other areas of the country, as a result the rural and urban population increased from 40:60 to 52:48 in 2010.

REF: "Todays" News Paper Mon, April 2012 & Social Walfare Department

6.6.2 Agriculture & Crops

Agriculture is the foundation of Pakistan's economy. It contributes about 25 percent to the Gross Domestic Product (GDP) of the country. Sindh is a major contributor of staple crops in the country, producing 35percent of rice, 28 percent of sugarcane, 20 percent of cotton and 12 percent of wheat, respectively. A majority of the people of Sindh depend on agriculture as their main source of livelihood.

About 40 percent of the land in Sindh is arableland and 5 percent of it is rangeland. The total cultivated area in Sindh is 5.88 million hectares and the net area sown is 2.39 million hectares. The total cropped area is 3.10 million hectares, of which 0.71 million hectares are sown more than once.

Sindh grows a variety of field and horticultural crops. Wheat, cotton, rice, and sugarcane are the major field crops, which constitute 68 percent of the total cropped area, while mango, banana and chilies are the major horticultural crops. Among the horticultural crops, Sindh produces 73 percent bananas, 34percent mangoes, and 88 percent of the chilies. Of the total cropped area of 3.1 million hectares in the year 2000-01, almost 50 percent of the area was under food crops (wheat, rice, maize, sorghum, millet and barley), 25 percent under cash crops (cotton, sugarcane). There maining area was under fodder (9.1 percent),pulses (4.7 percent), condiments (4.1 percent),oilseeds (3.8 percent), fruits (3.3 percent), and vegetables (1.4 percent).

Crop yields in Sindh are generally low and have remained either stagnant or have increased at slow rates. The low availability of quality seed of crop varieties continues to be of major concern or agriculture. The use of crop inputs such as fertilizer and pesticides has increased

considerably without a corresponding increase in yield levels. The supply of substandard and adulterated pesticides and fertilizers is also affecting crop yields and the cost of production.

There is increasing degradation of the resource base such as soil, and current farming practices do not adequately address the issue of sustainability of crop production systems. This is in addition to the high cost of inputs and unstable market prices. The farming community is, for the most part, below the poverty line and this is a major constraint to the development of agriculture.

Farm mechanization is limited to the use of tractors and wheat threshers. Laser levelers are a recent introduction with considerable potential for enhancing yield levels and better use of irrigation water. Current water scarcity related problems demand the adoption of efficient water management practices.

Agro-Ecological Zones

The irrigated areas of the province have been divided into three major agro-ecological zones, two of which are further divided into sub-zones, as given below.

Zone A Rice/wheat zone of the right bank of river Indus (upper Sindh) Sub-zone A1 Main area Sub-zone A2 Piedmont soil region

Zone B Cotton/wheat zone of the left bank of river Indus Sub-zone B1 Guddu Barrage command area Sub-zone B2 Sukkur Barrage command area

Zone C Rice/wheat/sugarcane zone of lower Sindh. 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 activities, therefore, concentrated in the Zones A, Band C. Zone A: It covers the districts of 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

The majority of people engaged in the farming are traditional crops and livestock farmers growing various types of crops and animals for their subsistence and gain. The outputs from agricultural crops and livelihood are main sources of livelihood of the project area.

6.7 Poverty Status:

Poverty in the project area varies from geographic tract to tract. Poverty is pervasive and deep in rural Sindh. The data collected during the Feasibility study reveals that about 37% of the rural population lives below the poverty line compared to 33% in Pakistan on an overall basis.

Over 70% of the rural population is landless. The agriculture sector continues to be an essential component of Pakistan economy. It currently contributes 21% to GDP.

Agriculture generates productive employment opportunities for 45% of the country's labor force and 60% of the rural population depends upon this sector for its livelihood. It has a vital role in ensuring food security, generating overall economic growth, reducing poverty and transforming towards industrialization. Data shows that rural households, including the landless, derive 56% of their income from agriculture, directly or indirectly. A typical poor household in rural Sindh has little assets or land, depends on wage income, and is significantly larger than the non-poor or even compared to the average poor household of Pakistan. The rural poor tend to be employed mostly as agriculture wage workers. The concentration of poor is the highest among categories of households where the head is an unpaid family worker, sharecropper, or owner-cultivator owning less than 2 hectares of land. The poverty headcounts in these categories are 60%, 50% and 40% respectively. Rural Sindh is highly dependent on public services with little role of the private sector. In this context our project aims to bring the major reforms to improve the public service delivery, job creation and trained labor at village level, Employment in agro based industry, increase in labor wages and stimulate rural growth, that will raise the agricultural and nonagricultural wages which are fundamental for reducing poverty in rural Sindh and unpaid persons of poor families can earn a respectable amount for their livelihood.

6.8 Women in Agriculture

Within the agriculture sector there is unique relationship that exists between the women and nature. Women are pre-dominant in all the sub-sectors of agriculture namely farming, processing and distribution. As farm owners, farm partners and farm laborers women are estimated to account for 50 to 60% of food consumed in the project area (WWF, Social Survey, 2009). The predominant role of women in agriculture has enabled most women farmers to become increasingly responsible for educational and other material needs of their wards, especially for female headed households.

Gender issues in the project area are as under:

Women face in carrying out economic activities as follows:

- Access to and control over land due to traditional/cultural problems

- Access to credit due to lack of collateral, inadequate savings needed for equity payment required for loans, cumbersome bureaucratic procedures for accessing formal credit facilities
- Access to training due to ignorance on the awareness of training programs and low educational qualifications
- Access to hired labor on their farms due to rural urban migration
- Access to other inputs, fertilizer, extension services, information technology Customary laws of access to land and inheritance

6.9 Urbanization Issues in Sindh

Environmental, social and economic information of Sindh, in terms of the Human Development Index (HDI) ranking within Pakistan, the urban areas of Sindh have the highest ranking with an HDI of 0.659, greater than that of Pakistan as a whole, while the rural areas of Sindh have an HDI of 0.456, which is the lowest in the country. More than 11 million men and women in Sindh are unemployed and around 15 million live below the poverty line. The privatisation of public owned enterprises and institutions has contributed to unemployment.

Urbanization in Sindh is a major environmental issue, as 48.9 per cent of the province resided in urban areas. Karachi alone contained 63 per cent of Sindh's urban population. A large housing demand-supply gap had resulted in the development of katchi abadis. The rapid and uncontrolled growth of the city had resulted in unregulated development and inappropriate land-use changes.

More than 50 per cent of Karachi's population lives in informal settlements. Master plans for Karachi and other cities of Sindh had been developed but never implemented or given legal cover. In addition, planning and building control institutions had been ineffectual. Building by-laws and zoning regulations are violated due to the powerful nexus of politicians, bureaucrats and developers.

Cities and towns do not have space for cargo terminals, transport facilities, small scale manufacturing and warehousing. These have been developed in the inner cities creating immense environmental degradation, inappropriate land-use changes and the demolition of much of Sindh's built-heritage, which lies within the inner cities, said the report.

It called for developing realistic plans for urban areas of Sindh, including proper mapping of cities with details of their social, physical and environmental conditions, as well as taking into consideration the potential of the existing interest groups and the state of financial constraints.

Sindh's industrial units, except those concerned with consumer products, have been closing down because of: increase in the cost of production; deteriorating law and order situation; investors having taken advantage of bank loans and preferring to declare their units sick; and discontinuation of previously granted tax holidays.

The absence of a rail-based mass transit system for Karachi and efficient transport facilities also pose immense problems for the commuting public, and is the major cause for stress-related diseases, it was added.

Regarding the coastal and marine ecosystem, the efforts to control the marine pollution in the territorial waters of Sindh can be bolstered through the enforcement of the Sindh Fisheries Ordinance 1980 with necessary amendments to cover agriculture effluents.

Furthermore, provincial laws relating to over-fishing in territorial waters are quite comprehensive, but these regulations need to be seriously enforced including imposition of severe penalties.

The seasonal ban on fishing can only become effective when applied to all commercial fishing crafts without any concessions or exceptions.

The dwindling wildlife resources in Sindh were increasingly exposed to natural calamities and hazards inflicted by humans. If protection of wildlife is devolved to the district levels, there may be more public participation, and the chances of wildlife conservation could perhaps be addressed more effectively.

Air is the key issue, which needed to be addressed on priority basis. In the environment sector efforts are being made to ensure that the environmental impact assessment of development projects be taken into account in the case of all government and private projects.

The natural resource management ought to be improved; and there should be the promotion of greater equity regarding the distribution of water, prepared in collaboration with the Planning and Development Department, government of Sindh.

6.10 Deforestation in Sindh

In Sindh the prouctive forests are the riverine forests located along Indus and irrigated plantations located in the command area of three barrages. The riverine forests of Sindh, mostly growing along the river Indus in the flood plains are spread over an area of 2,41,000 ha and irrigated plantation over 82,000 ha but are disappearing very rapidly. Depletion in the forest area not only threatens the sustainability of agricultural production systems but also endangers the economy of the country. Every year extensive areas of arable agricultural and forestlands are degraded and turned into wastelands over time, due to natural causes or human interventions. Depletion in forest cover, therefore, has an important impact on socio-economic development and ecological balance. High population growth rate in Pakistan is one of the main causes for rapid deterioration of the physical environment and natural resource base.

The dry climate, erratic MAR that is 200 mm/year, erosion, no flood or flood less than required and shortage of irrigation water are the natural reasons for the destruction of forest system of Sindh.

The social reasons that have largely affected our ecosystem involve illicit wood cutting, lawlessness, encroachment of cultivation, poor literacy, increasing population with the growing rate of 2.8 % and poor rural development, lack of awareness and over gazing. These mentioned causes have largely affected the ecosystem of the province. These are not the only causes that have affected the ecosystem; the official negligence has caused enough damage too.

The forest department in Sindh face shortage of staff, deficit budgets, lack of good governance, lack of public participation, income oriented management approach and most of all the use of inappropriate seeds and skilled management.

The new challenges that are affecting the forests of Sindh; the most important one is the climate change. Due to this change in climate the average rainfall in the province has reduced significantly. Poverty, food insecurity and bio-diversity conservation are rapidly changing their shape in this new world resulting in much worse impact on the ecology.

During recent decades the large scale deterioration of forests and natural resources is an eye opener. The degradation of forests and other natural resources has affected the ecology, environment, health and economy. The ecological problems with living organisms such as animals and plants and environmental problems such as increase in temperature and carbon dioxide, these factors have contributed to change in regional climate, health problems such as skin, eye diseases and sunstroke and economic problems such as loss of income to rural population and resources which depend on forests such as livestock. Therefore, it was necessary

to carry out land cover/use research focusing on the monitoring and management of the present and past state of forests cover and other related objects using RS (Remote Sensing) technologies. The RS is a way of mapping and monitoring the changes taking place in forests cover and other objects on a continuing basis. The forests of Sindh are vanishing quickly due to the construction of barrages /dams on upper streams to produce hydroelectricity and irrigation installations which reduce the discharge of fresh water into the downstream Indus basin. Moreover, anthropogenic activities, livestock population, increased grazing, load and illegal tree cutting have contributed to this. The forests are turning into barren land and most of the land is used for agriculture. These uncontrolled changes contribute to climate change and global warming. These changes are difficult to monitor and control without using RS technology. The integrated classes such as water body, grass/agriculture land, dry/barren land and forest cover maps show the temporal changes taking place in the forests cover for the last 30 years period.

The results show significant changes in sub-tropical forests cover, the overall forests cover in April, 1979 was 22.67%, April, 1992 17.38%, April, 1998 12.28%, April, 2000 6.15%, April, 2006 7.51%, and April, 2009 5.97%. The overall change observed in forest area is 25.07%.

6.11 Cultural Heritage

This chapter of report provides the baseline of important archeological and heritage sites. A large number of sites exist in the Province having archeological, historical, cultural, and religious significance, and the ones that have been officially notified and protected under the Antiquity Act, 1975. The data/information has been collected from primary and secondary data sources and surveys in the study area conducted prior to preparation of this report.

The stakeholders

The stakeholders governing the Cultural and archeological heritage include: the Government of Pakistan, the provincial government of Sindh, its Local Body system, the national and provincial institutions dealing with history, archaeology and culture such as the Ministry of Culture and Tourism, Government of Pakistan, the Pakistan Tourism Development Corporation (PTDC), the Department of Culture and Tourism, Government of Sindh, Sindh Tourism Development Corporation (STDC), Directorate of Archaeology, Government of Sindh, the government-run Sindhi Adabi Board, Sindh Text Book Board, Sindhology Department of University of Sindh, Archeological departments of Universities and NGOs representing civil society besides knowledgeable persons can deliver a lot through individual as well as collective effort.

There is lot of local knowledge and awareness with the individuals located in the small villages and towns in the study area. Also a number of NGOs have emerged in Sindh with great cultural

awareness. During the process of meetings with stakeholders the information on this aspect of EIA was collected. The combined approaches of all stakeholders have contributed in the study area's cultural heritage in a befitting manner.

Following list provides the names of heritage sites in the study area, their location in the district and its status of protection.

1. KOTDIJI - a pre-Indus site in Khairpur district. (Protected).
2. KAHOO JO DARO - a major Buddhist site at Mirpurkhas. (Protected).
3. LAKHYAN JO DARO - a mature Indus site in Sukkur city area. (Protected).
4. VINJNOTH - a mature Indus site near Sukkur. (Protected).
5. AROR DARO is a mound having characteristics of a Buddhist site. (Unprotected).
6. ARORE is a stone-age site near Rohri in Sukkur district. It contains a Hindu temple of Kalkan Devi, an ancient mosque attributed to Arab general Mohammed Bin Qasim and a stone-age factory of flint and other tools. (Protected)
7. AGHAN KOT is a fort near Badin. (Unprotected)
8. ASOORAN JO DARO is located near Badin. (Unprotected)
9. DARO Tando Jam: It is a mound having archaeological significance located near Tando Jam in Hyderabad district. (Unprotected)
10. BRAHMAN ABAD: It is also called Mansoorah. Basically a site of Rai dynasty turned capital of Sindh by Muslims after conquest of Sindh by Arab General Mohammed Bin Qasim. (Protected)
11. BUDDHA JO TAKAR: It is a Buddhist Stupa in ruins near Tando Mohammed Khan. (Unprotected)
12. RUINS of Badin - It is probably a Buddhist site near Badin. (Protected).
13. THUL MIR RUKUN: It is the only Buddhist Stupa of Sindh in good shape. It is located at Daulatpur Safan near Moro in Naushehro Feroz district. (Protected)
14. BAKHAR FORT: Both ruins and a fort of Bakhar were the capital of Sindh in Raja Dahar's reign. (Protected)

15. DAHLEEL KOT: It is a fort made from baked bricks near Sakrand. (Unprotected)

16. KALHORA TOMB – Tomb of Ghulam Shah Kalhoro, a ruler of Kalhoro dynasty of Sindh at Hyderabad. (Protected)

17. TOMB of Ghulam Nabi Kalhoro is also at Hyderabad. (Protected)

18. GANJO TAKAR CAVES-: It is a stone-age site near Hyderabad. (Unprotected)

19. HYDERABAD FORT: Also known as Neron Kot, this magnificent fort is made of fine baked clay bricks used by Kalhora rulers of Sindh. (Protected)

20. KACHO QILO, Hyderabad: It is a fort made of clay bricks at Hyderabad used by Kalhora rulers of Sindh. (Protected)

21. KOTDIJI FORT: It is the most beautiful and well maintained fort of Talpurs made of red baked bricks by the side of National Highway near Khairpur (Mirs'). (Protected)

22. KOT LALOO in Nawabshah district is a shambles these days. (Unprotected)

23. MASOOM SHAH MINARET: Hovering over city of Sukkur, the Masoom Shah's minaret is a monument of Kalhora dynasty. (Protected)

24. MOOMAL JI MA'ARI: Located at Mirpur Mathelo about 10 kilometers in east of Ghotki, there are ruins of a palace attributed to Moomal, the heroine of Sindh's famous folklore of Moomal-Rano. The site is about 40 feet above ground level. (Protected)

25. WATAYO'S GRAVE: Last resting place of Watayo Faqir, a legend of Sindh's folk wisdom. It is located at Nasarpur town of Hyderabad district. (Unprotected)

26. TOMB of Mian Noor Mohammad Kalhoro, ruler of Sindh, located at Daulatpur in Naoshehro district. (Protected).

27. RAKAS JO ROONO: It is a cave near Kotdiji. (Unprotected)

28. ROOPA MA'ARI: The ruins of Sindh's ruler Dodo Soomro's palace near Badin. (Unprotected)

29. MIR SHAHDAD JO QUBO The tomb of Talpur ruler Mir Shahdad at Shahpur Chakar in Sanghar district. (Protected)

30. SATIYUN JO ASTHAN: Site of chaste women at Sukkur. (Protected)

31. ARORE: At Arore, there are two tombs of 'Sohagin' (woman her husband alive or in company) and, 'Dohagin' (woman with her husband dead or separated). They are constructed in Exposed Brick style of architecture. (Unprotected)

32. CHITTORI: The group of Talpur tombs at Chittori in district Mirpur Khas. (Protected)

33. HYDERABAD: A group of Talpur tombs at Hyderabad besides those of the rulers of Sindh. (Protected)

34. TOMB OF SOHNI: Shrine of Sonhi, heroine of Sindh's folklore of Sohni-Mehar at Shahdadpur (Sanghar district). (Unprotected)

35. TOMB OF SASSUI: At Sanghar Patyoon in Lasbelo district of Balochistan. (Unprotected)

36. SHADI SHAHEED: The stone-age factory of flint in Khairpur district. (Unprotected)

37. NEENH TAKAR: A hill with unique formation located at Arore near Rohri. (Unprotected)

38. KARAR LAKE: A small sweet water lake located at Bhit Shah attributed to the memory of Sindh's greatest poet Shah Abdul Latif Bhitai. (Protected)

39. TOMBS OF MIRS: Located at Hyderabad, the tombs of Sindh's Talpur rulers are unique in architecture. (Unprotected)

Sites in Thar Desert

1. UMARKOT: Locally known as Amarkot, the fort is famous for the birth of Moghul emperor Akbar the great and imprisonment of Marui by Sindh's ruler Umar Soomro. (Protected)

2. THAHARIYO HALEPOTO: The coalfield of Thar where ruins of Buddhist period exist near Slamkot of Thar district. (Unprotected)

3. RUINS OF PA'ARI NAGAR: The ruins of Jain temples and settlements near Nagar Parkar town of Thar district. (Unprotected)

4. NAO KOT: Built by Talpur rulers of Sindh on the first sand dune of Thar near Mirpurkhas. (Protected)

5. TALPUR TOMBS: Ruins of four tombs of Talpur rulers are scattered in Tharparkar district. (Unprotected)

6. MARUVI'S WELL: A monument attributed to Marui, the heroine of Sindh's folklore of Umar-Marui located at Bhalwa village in Nagar Parkar taluka of Thar district. According to the legend, Maruvi was abducted by King Umar from this well and captivated in Umarkot. (Protected)

7. GORI TEMPLE: A magnificent Jain temple in Nagar Parkar taluka of Thar Desert. (Protected)

8. ROOPLO KOLHI'S MONUMENT: The site where Rooplo Kolhi was executed by British troops while in pursuit of conquering Sindh in 1843 AD. (Unprotected)

9. MIRGHI KUNN: A Hindu tirath in Gordharo River of Karoonjhar Mountain where people drop ashes of the dead in the water of a natural spring. (Unprotected)

10. JAIN TEMPLES: Located at Nagar Parkar town of Thar, the ruins of Jain temples are magnificent in architecture. (Unprotected)

11. ANCHALYA SAR: A Shiva temple and natural spring about 200 feet above ground level in Karoonjhar mountain of Thar. (Unprotected)

12. KAJLA SAR: A legendary pond of water near Pa'ari Nagar in Thar. (Unprotected)

13. KAROONJHAR TIRATHS: A number of Hindu tiraths located in Karoonjhar with pre-Camberian stone formation at Nagar Parkar town of Thar. (Unprotected)

14. BHODESAR MOSQUE: Built by Mohmmed Shah Begro in mid eighties near Bhodesar small water storage tanks near Nagar Parkar town of Thar. (Protected).

6.12 Protected Areas

There exist one national park, nineteen wildlife sanctuaries and five game reserves in the project area. A list of these protected areas is provided in Table 6.4.

Environmental Hotspots

The environmental hotspots in the Province are essentially the wildlife protected sites. In addition, heavily forested areas particularly in riverine, that desert and Kohistan areas are also included in the environmental hotspots in the Province. No project interventions will be carried out inside or at these hotspots.

The details of fauna and related information are given in the detailed baseline study (Annexure III) of EIA document.

No project activity shall be carried out in a protected area near sensitive habitats or ecological zones

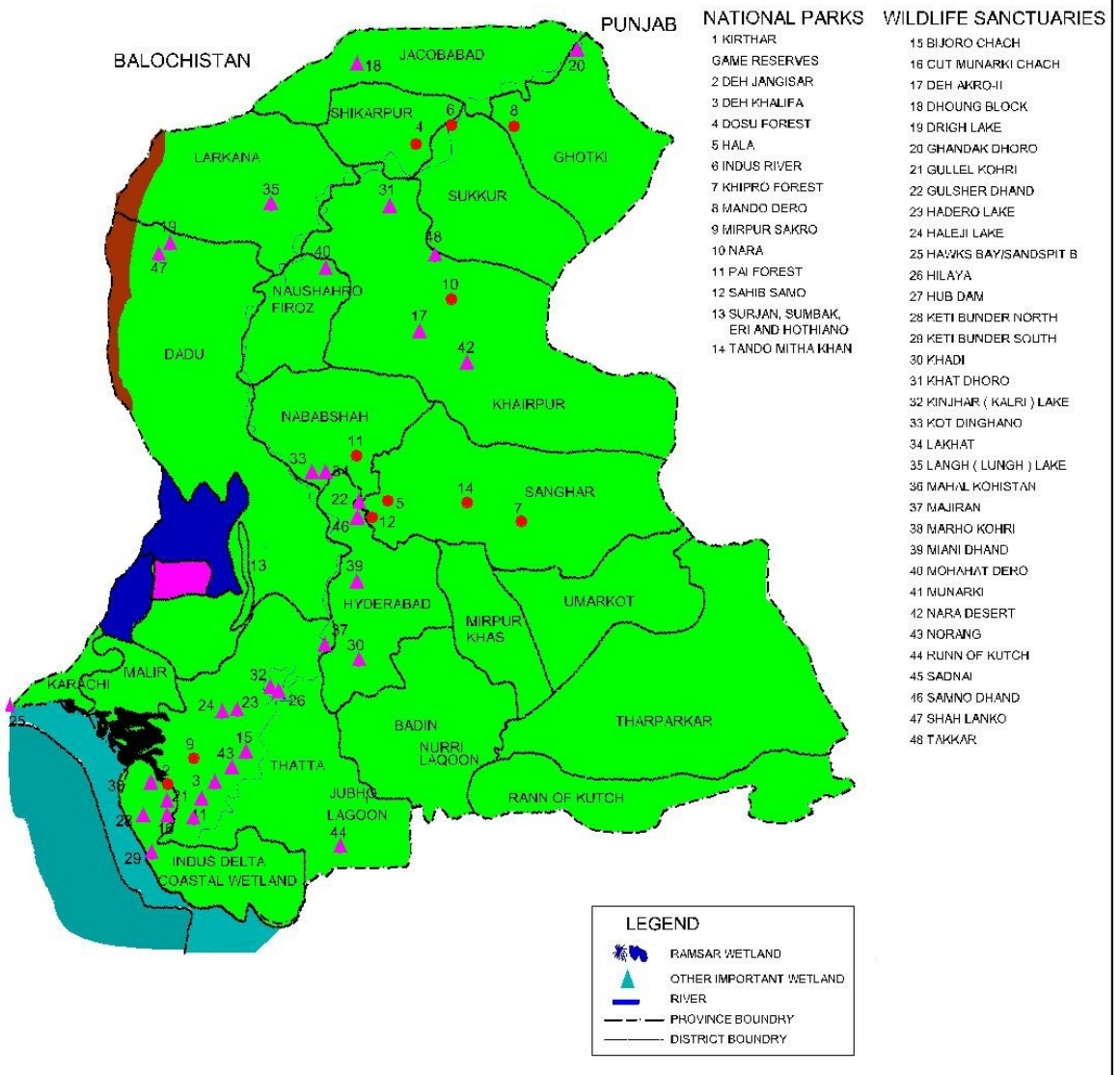
Table.6.4 Protected Areas in Sindh and Study Area

S. No	Name of Protected Area	Area (ha)	District	Habitat
1.	Kirthar National Park	308733	Dadu/Karachi	Arid/Semi Arid
	Wildlife Sanctuaries			
2.	Bijoro Chabh	121	Thatta	Wetland
3.	Cut Munarkt Chach	405	Thatta	Wetland
4.	Deh Akro-II	20243	Nawabshah	Wetland complex
5.	Dhoung Block	2098	Shikarpur	Riverine Forest
6.	Drigh Lake	164	Larkana	Wetland
7.	Ghandak Dhoro	31	Jacobabad	Wetland
8.	GulIel Kohri	40	Thatta	Wetland
9.	Gulsher Dhund	24	Hyderabad	Wetland
10.	Hub Dam	27219	Karachi	Wetland
11.	Hudero Lake	1321	Thatta	Wetland
12.	Hudero Lake	1321	Thatta	Wetland
13.	Haleji Lake	1704	Thatta	Wetland
14.	Hilaya	324	Thatta	Wetland
15.	Keti Bunder North	8948	Thatta	Wetland
16.	Keti Bunder South	23046	Thatta	Wetland
17.	Khadi	81	Thatta	Wetland
18.	Khat Dhoro	11	Larkana	Wetland
19.	Kinjher Lake	130468	Thatta	Wetland
20.	Kot Dinghano	30	Nawabshah	Wetland
21.	Lakhat	101	Nawabshah	Wetland
22.	Lung Lake	19	Larkana	Wetland
23.	Mahal Kohistan	70577	Dadu	Arid/Semi Arid
24.	Majiran	24	Thatta	Wetland
25.	Marho Kotri	162	Thatta	Wetland
26.	Miani Dhand	57	Hyderabad	Wetland

S. No	Name of Protected Area	Area (ha)	District	Habitat
27.	Mohabat Dero	16	Nawabshah	Wetland
28.	Munarki	12	Thatta	Wetland
29.	Nara Desert	223590	Sukkur/Khairpur	Desert
30.	Norang	243	Thatta	Wetland
31.	Rann of Kutch	320463	Badin/Tharparkar	Desert& Marshy
32.	Samno Dhund	23	Hyderabad	Wetland
33.	Sadnai	84	Thatta	Wetland
34.	ShahLanko	61	Thatta	Wetland
35.	Takkar	43513	Khairpur	Desert/Semi Desert

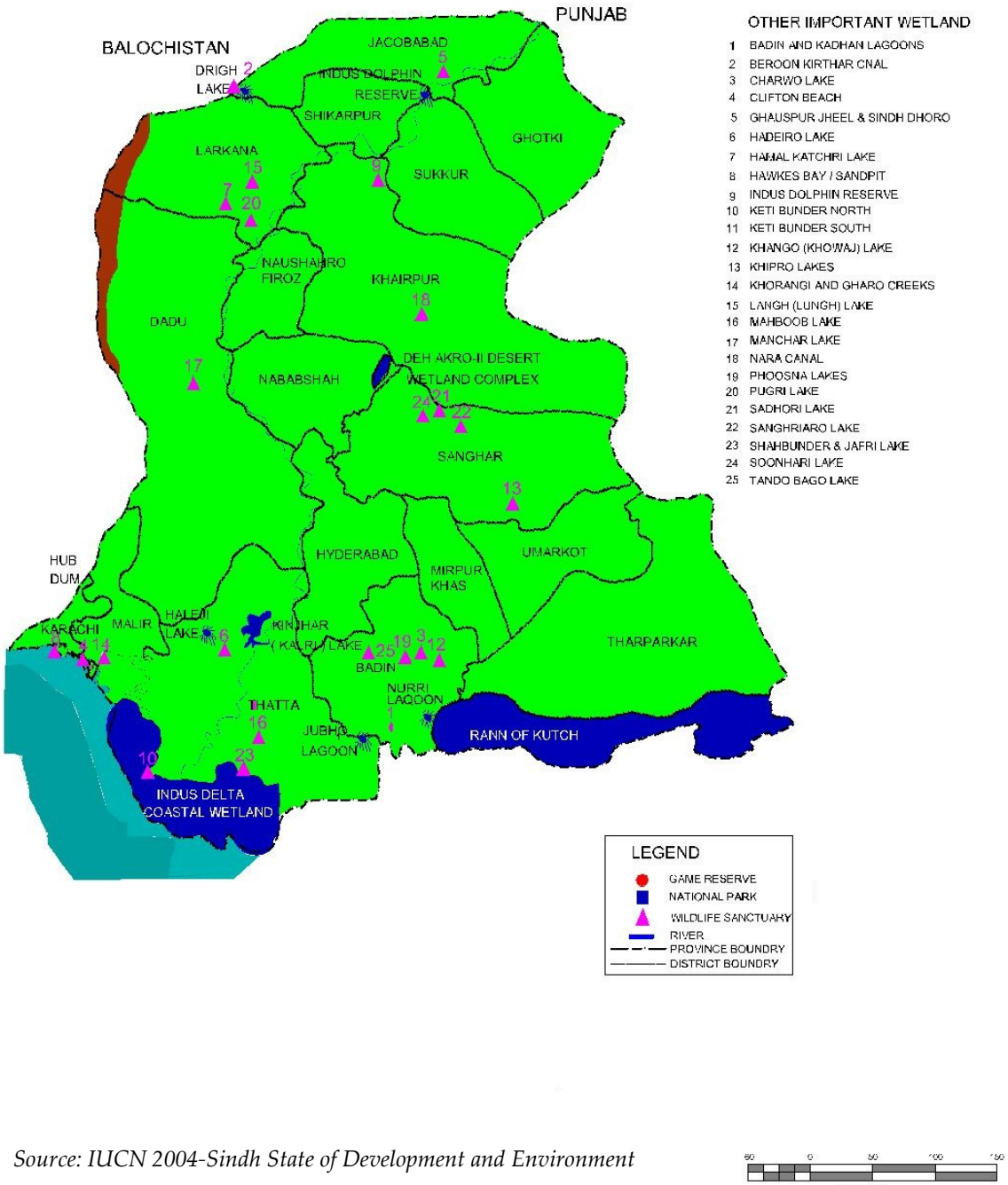
Ref: IUCN 2004-Sindh State of Development and Environment

Fig. 6.5: Protected Areas of Sindh



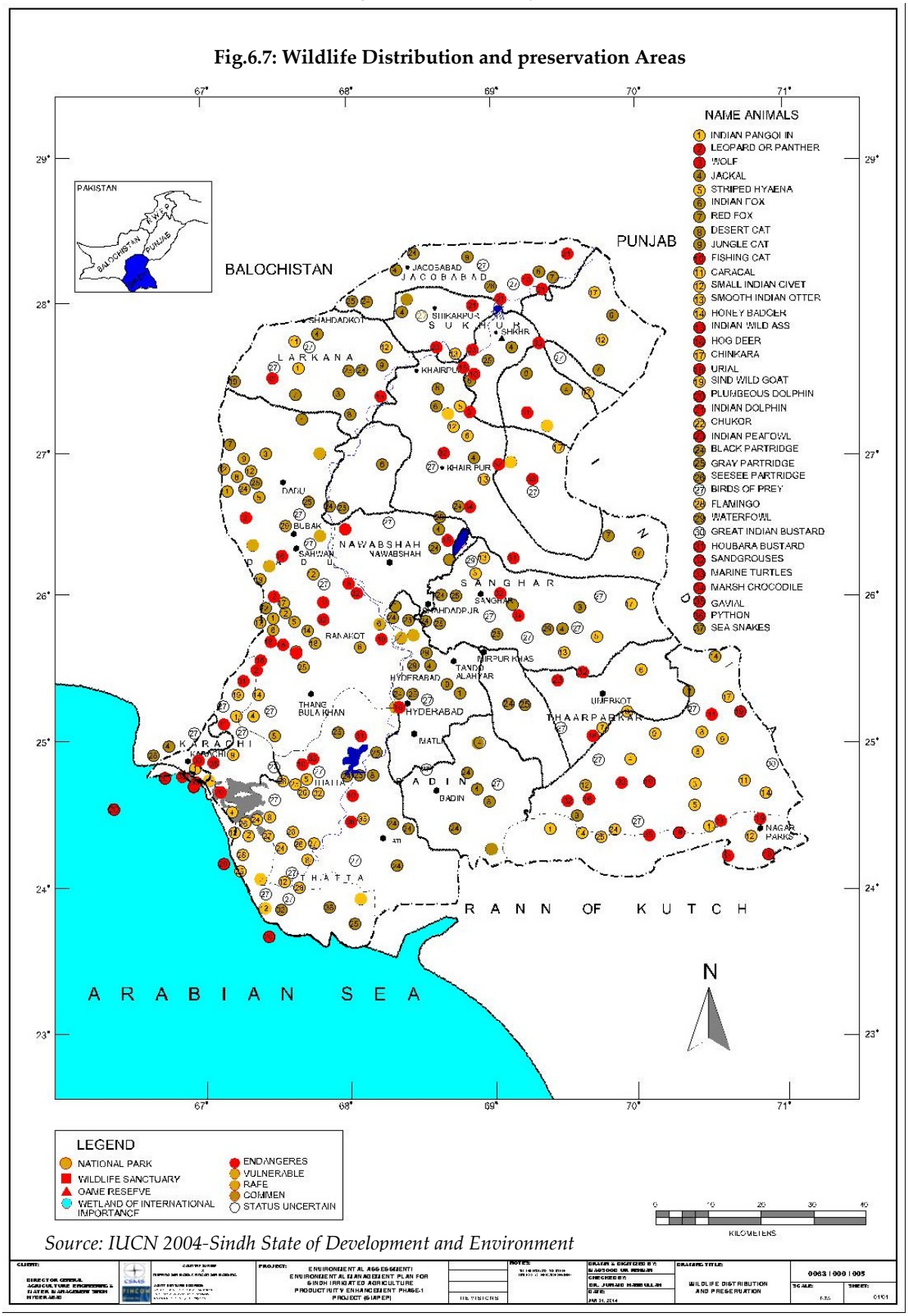
Source: IUCN 2004-Sindh State of Development and Environment

FIg.6.6: Location of Sindh Wetlands



Source: IUCN 2004-Sindh State of Development and Environment

Fig.6.7: Wildlife Distribution and preservation Areas



Source: IUCN 2004-Sindh State of Development and Environment

Chapter 7

Stakeholder Consultations and Disclosure

This Chapter provides the objectives, process and outcome of the stakeholders consultations and disclosure conducted as part of the Environment Assessment Study.

7.1 Objectives

The primary Objectives of stakeholder's consultations are given below;

- To provide two-way communication channel between stakeholders and the project proponents
- To develop and maintain communication links
- Provide key project information to the stakeholders and to solicit their views on the project and its potential and perceived impacts
- Ensure that the views and concern of the stakeholders are incorporated into project design and implementation with the objectives of reducing or mitigating negative impacts and enhancing benefits of the project

7.2 Scope of the objective

- To discuss the project in detail to the stakeholders.
- To describe the benefits of project ,
- To describe the potential impacts;
- To obtain the view, Comments, apprehensions, and recommendations from the stakeholders and its impacts.
- To make the project people friendly,
- To promote participatory approach in project design and implementation,
- To increase the projects ownership by the beneficiaries.

The aim of the participation of the local population is to safeguard the interests of people and ultimately improve the well being of population and assure that the project will not create any Negative impact on the people directly or indirectly. Public consultation will reveal new Information, improve understanding and enable better choices to be made.

7.3 Participation Framework

Stakeholder analysis was carried out to identify relevant stakeholders on the basis of their ability to influence the project or their vulnerability to be negatively impacted from it. This approach ensured that no relevant groups are excluded from the consultation, and appropriate engagement strategies are developed for each stakeholder.

Key stakeholders consulted at various levels include:

People directly affected by the Project and Project beneficiaries (ie, farmers, WCA members, other villagers).

7.4 Who Attended the Consultative Workshop

Following Government departments stakeholders attended the consultative workshops:

- Environment Department
- Agriculture Department
- Irrigation Department
- Forest Department
- Wildlife Department
- Revenue and District Administration
- Social Welfare Department
- Agricultural Engineering Department
- Water Management
- World Wide Fund
- Grass Root NGOs

7.5 Directly Affected People

- Sindh Abadgar Board elected representative
- Agriculture Associations
- Farmers
- Land owners
- Water Users' Association members
- Water Course Associations
- Villagers

7.6 Consultation Process

The consultations with the project stakeholders were carried out while conducting the present EA. A participatory and consultative approach was employed for information gathering and data collection.

Meetings and consultations were held with a range of key informants as well as government and civil society stakeholders at different levels. The focus group discussions with smaller groups of grassroots stakeholders were held, whereas discussions with the institutional stakeholders were arranged in consultation workshops. These discussions were held with project affected people, project beneficiaries and other local communities at Hyderabd, T.M.Khan, Mirpurkhas, Nawabshah, Sukkur, Shikarpur, Larkana and Thatta for all the 24 districts of the project area/districts. An attempt was made to consult stakeholders from all of the distinct of the province with respect to the environmental, agriculture and water aspects. This process of stakeholder consultation was conceived to interact meaningfully with affected communities and other stakeholders. The consultations also helped better understand local knowledge with respect to the various sets of issues and concerns, and integrate these into the project design and EMP.

7.7 Importance of Stakeholders Consultation

Consultation workshops should be ensured during planning, designing, execution and monitoring of the project.

- All the stakeholders should be invited to participate in the consultation workshops
- Suggestions of the general public should be sought through press or other mass media,
- NGOs, particularly those working in similar project types and activities were actively involved
- Citizens' Community Boards (CCBs) in the concerned areas should frequently be contacted on matters concerning the progress, adverse impacts and mitigating measures

A 3- Stage public participation was planned:

Stage 1: Agenda Setting (i.e. study approach and planning objectives, key issues and public aspirations)

Stage 2: Discussion on various possible Outline Concept Plan Options

Stage 3: Presentation of Recommended Development Option (PODP) and Study findings

7.8 Agenda of Public Consultation

Detailed program for all workshops was prepared including time, activities and resource persons.

TIME	ACTIVITY	RESOURCE PERSON
9.0 - 10.0 AM	Registration of Participants	Registration desk official
10.0 – 10.05 AM	Recitation from Holy Quran	Any participant
10.05 – 10.15 AM	Welcome Remarks	Client/Consultant's Representative
10.15 – 10.30 AM	Objectives and Process of Workshop	Consultant
10.30 – 11.00 AM	**Presentation 1:** Components of the Proposed Project	Consultant
11.00 – 11.30 AM	**Presentation 2:** Environmental Assessment – Objectives and Process	Consultant
11.30–12.0 Noon	**Presentation 3:** Environmental Impacts and Mitigation Measures	Consultant
12.0 – 1.0 PM	Discussion on the presentations and suggestions/ inputs/comments by the stakeholders	All participants
1.0 – 1.30	Presentation of main outcomes of workshop	Consultant

PM		
1.30 – 1.45 PM	Concluding Remarks	Representative of client or consultant
2.0 PM	Conclusion of workshop	

7.9 Conduction of Consultation workshop

The first consultative workshop was held on October, 22 2013 at Indus Hotal Hyderabad. The participants were from four districts Hyderabad, Matiari, Tando Allahyar and Jamshoro. Fifty One individual's attended the workshop. The participant were Eleven Water Management Officers (WMOs), Two Deputy Directors (DDs), Six Assistant Directors (ADs), One Training Supervisor, Seven Engineers & Sub-Engineers, Fourteen Grower & Farmers, One AAE and One AAO. The following points, view and apprehension were noted.

- The capacity building and awareness program of farmers should be conducted on regular basis said by the Deputy Directors.
- Water Management Officers address the water-borne diseases caused by over irrigation.
- Grower said that effective investment is needed for the bed-furrowing with the help of laser leveling.
- Trees and livestock are important elements of the rural agricultural economy. The tree cutting caused by the water course improvement should be compensated through plantation of appropriate tree species at appropriate locations. This point was commonly discussed by Assistant Directors, Engineers & Growers.
- Noise and Air Pollution generated by the Agriculture activities must be monitor, said by the training monitor.

The second consultative workshop was held on October, 23 2013 at District Council Hall T M Khan. The participants were from two districts Tando Muhammad Khan and Badin. Forty Eight individuals attended the workshop. The participant were Seven Water Management Officer (WMO), One Deputy Directors (DD), Seventeen Assistant Director (AD), Six Chairman, One General Secretary, Two Engineers & Sub-Engineers, fourteen Grower & Farmers, One AAE and one AAO, One SE. The following points, view and apprehension were noted.

- Water Management Officer Discussed about the care of trees.

- Drip irrigation should be promoted in areas having undulating terrain. This point was given by the Engineers.
- Grower & Farmers discussed the national water policy. They said it needs to be diviced addressing judicious use of the available water for irrigation.
- General Secretary said the laser land leveling equipment should be provided to the rental services.
- Deputy Director pointed out that the private sector should be motivated to participate in promoting the modern irrigation techniques.

The third consultative workshop was held on October, 24 2013 at Sufiyana Restaurant, Mirpurkhas. The participants were from three districts Mirpurkhas, Umerkot and Tharparkar. Seventy One individuals attended the workshop. The participant were Nine Water Management Officer (WMO), Seven Deputy Directors (DD), Thirteen Assistant Director (AD), One Regional Incharge Environment, Four Government, Seven FTI, One Incahrge, Two Social Engineer, Seven Engineers & Sub-Engineers, Twenty Grower & Farmers, One NGO Officer and Two Computer Operator. The following points, view and apprehension were noted.

- Importance of the trees was discussed in detail. This point was highlighted by the NGOs.
- The use of FM radio should be promoted for the awareness raising and capacity building of farmers for the improved irrigation techniques. This point was given by social engineer and computer operator commonly.
- The traditional flood irrigation system is no more viable in view of the water shortage, hence high efficiency irrigation methods should be promoted through the Project. This point was discussed by the Deputy Director Agriculture.
- The lining of the water courses should be carried out beyond the current limit of 30 percent, said by the Grower.
- The quality of water course lining needs to be improved, and the Department team should regularly monitor this aspect, said by the Assistant Directors.
- Water Management Officers pointed out that Environmental Impacts of brick kilns, which would provide bricks for the Project, needs to be highlighted.

- local manufacturing of drip irrigation systems and their parts should be encouraged, said by the engineers & sub-engineers.

The fourth consultative workshop was held on November, 4 2013 at Gymkhana Restaurant, Nawabshah. The participants were from three districts Sanghar, Nawabshah and Naushahro Feroze. Sixty Three individuals attended the workshop. The participant were Ten Water Management Officer (WMO), Seven Deputy Directors (DD), Ten Assistant Director (AD), Two Incharge, One President, Four Engineers & Sub-Engineers, Twenty Seven Grower & Farmers and One NGO Officer.

Trees and livestock are important elements of the rural agricultural economy, said by the farmers. The following points, view and apprehension were noted.

- The tree cutting caused by the water course improvement should be compensated through plantation of appropriate tree species at appropriate locations, said by the Deputy Directors.
- The tree plantation can be used for nitrogen fixing of soil, as wind breaker particularly in areas that experience sand/wind storms. Trees should be saved said by the NDOs Officers.
- Engineers & Sub-Engineers said that the drip irrigation should be promoted in areas having undulating terrain.
- The laser land leveling equipment should be provided to the rental services, said by the Growers.
- Assistant Directors Agriculture said that demonstration systems should be arranged at regional level to show the modern irrigation techniques.

The fifth consultative workshop was held on November, 5 2013 at Hotel Forum Inn, Sukkur. The participants were from three districts Khairpur, Sukkur and Ghotki. Sixty Three individuals attended the workshop. The participant were Eleven Water Management Officer (WMO), Seven Deputy Directors (DD), Ten Assistant Director (AD), Four Government Servant, Two Divisional Forest Officer, Two Incahrge, Three General Secretary, Two President, Three Engineers & Sub-Engineers, One Accountant, Four NGO Officer and Eleven Grower & Farmers. The following points, view and apprehension were noted.

- Environmental impacts of project were discussed by the Divisional Forest Officers.

- Pollution generated by Brick kilns was highlighted by the General Secretary & President of the Associations.
- Engineers pointed out that local manufacturing of drip irrigation systems and their parts should be encouraged.
- Mitigation factor of the Negative Environmental Impacts was discussed in detail by the Government Officials and NGOs Officers.
- Assistant Director said the traditional flood irrigation system is no more viable in view of the water shortage, hence high efficiency irrigation methods should be promoted through the Project.
- Tube-wells should be installed giving due consideration to their location and inter-tube-well distance, said by the Grower and farmers.

The sixth consultative workshop was held on November, 6, 2013 at Gymkhana Shikarpur. The participants were from three districts Shikarpur, Kandhkot and Jacobabad. Forty Five individuals attended the workshop. The participant were Seven Water Management Officer (WMO), Three Deputy Directors (DD), Seven Assistant Director (AD), Two Agriculture Officer, Two Divisional Forest Officer, One General Secretary, One Forest Officer, Eleven Engineers & Sub-Engineers, One JCD and Eighteen Grower & Farmers. The following points, view and apprehension were noted.

- The lining of the water courses should be carried out beyond the current limit of 30 percent, said by the Grower and Farmers.
- The quality of water course lining needs to be improved, and the Department team should regularly monitor this aspect, said by the Assistant Directors.
- The soil and water pollution caused by the left over plastic tubing and other parts for the drip/sprinkler irrigation system needs to be addressed, said by the Deputy Directors.
- The drip irrigation system is currently suitable for large farmers having more resources available to them and having more know-how/awareness. The barriers for its adaptation by the small farmers need to me removed, said by the Water Management Officers.
- Pest management component needs to be included in the Project, addressing the use of pesticides (and other chemical inputs) in the high efficiency irrigation techniques, pointed out the Divisional Forest Officer.

- Awareness raising and capacity building components should also be included in the Project. Additionally, this aspect needs further field research as well, said by the Agriculture Officer.
- The contaminated water in the canals is causing diseases, since it is used for drinking purposes as well in many areas, pointed out by the Engineers.

The Seventh consultative workshop was held on November 7, 2013 at Hotel Green Palace. The participants were from three districts Larkana, Qambar Shahdadkot and Dadu. Sixty Three individuals attended the workshop. The participant were Sixteen Water Management Officer (WMO), Four Deputy Directors (DD), Seven Assistant Director (AD), Two Agriculture Officer, One General Secretary, One Forest Officer, Three Environmental Officer, Two Social mobilizer, Six Engineers & Sub-Engineers, and Twenty Grower & Farmers. The following points, view and apprehension were noted.

- The use of solar energy should also be explored for pumping groundwater, said by the Grower.
- Pollution generated in the result of water courses, High Efficiency Irrigation system must be control, said by the Environmental Officers. They also emphasized about the mitigation factors.
- Trees are sometimes cut down for improving the water courses. The compensatory tree plantation should be included in the Project, pointed by the Deputy Directors.
- Water User Associations should be involved in water sharing, said by the Grower & farmers.
- The Department should also encourage the farmers to build small water storage tanks to store irrigation water, said the Farmers.
- Laser leveling is highly beneficial for water conservation, highlighted by the Engineers.
- Social Mobilizer said that the tube-wells are being misused and there exists no law to control the installation of new tube-wells.
- The Department should promote small dams and sprinkler/drip irrigation in barani areas of the Province, said by the Engineers.

The Eighth consultative workshop was held on November 28, 2013 at Gymkhana, Makli. The participants were from two districts Thatta and Karachi. Sixty Three individuals attended the

workshop. The participant were Eleven Water Management Officer (WMO), Four Deputy Directors (DD), Five Assistant Director (AD), Eight Agriculture Officers, Two Incharge, One FTI, Ten Engineers, Sub-Engineers & Computer Operator, and Fifteen Grower & Farmers, Five person were Without Designation. The following points, view and apprehension were noted.

- Washing of clothes on lined water courses resulting in pollution of irrigation water, said by the Water Management Officers.
- Availability of additional water quantity resulting in cultivation of more area under agriculture resulting in more use of pesticides, said by the Farmers.
- Silting operation in WCs resulting in un-attended earth, pointed out by Assistant Director Agriculture.
- Lining of WCs resulting in deterioration of existing soil, said by the Deputy Director.
- Temporary of diversion channels left unattended, said by the Computer Operator.
- Re-alignment of Water Courses resulting in cutting of trees, pointed by the Grower & Farmers.

7.10 Schedule of Workshops

Summary of Consultative Workshops

For Environmental Assessment of Sinsh Irrgated Agriculture Productivity Enhancement Phase-I Project (SIAPEP)

S. No.	Workshop For districts	Day and Date	Venue of Workshop
1	Hyderabad, Matiari , Tando Allahyar and Jamshoro	**Tuesday October 22, 2013**	Indus Hotel Hyderabad
2	Tando Muhammad Khan and Badin	**Wednesday October 23, 2013**	District Council Hall T M Khan
3	Mirpurkhas, Umerkot and Tharparkar	**Thursday October 24, 2013**	Sufiyana Restaurant, Mirpurkhas
4	Sanghar, Nawabshah and Naushahro Feroze	**Monday November 4, 2013**	Gymkhana Restaurant, Nawabshah
5	Khairpur, Sukkur and Ghotki	**Tuesday November 5, 2013**	Hotel Forum Inn, Sukkur
6	Shikarpur, Kandhkot and Jacobabad	**Wednesday**	Gymkhana

		November 6, 2013	Shikarpur
7	Larkana, Qambar Shahdadkot and Dadu	**Thursday November 7, 2013**	Hotel Green Palace
8	Thatta and Karachi	**Wednesnday November 28, 2013**	Gymkhana, Makli

7.11 Summary of Participants in EA workshops of "Sindh Irrigated Agriculture Productivity Enhancement Project" (SIAPEP)

S. No.	Districts	Participants in Workshops
1.	Hyderabad, Matiari , Tando Allahyar and Jamshoro	51 Participants
2.	Tando Muhammad Khan and Badin	48 Participants
3.	Mirpurkhas, Umerkot and Tharparkar	71 Participants
4.	Sanghar, Nawabshah and Naushahro Feroze	63 Participants
5.	Khairpur, Sukkur and Ghotki	63 Participants
6.	Shikarpur, Kandhkot and Jacobabad	45 Participants
7.	Larkana, Qambar Shahdadkot and Dadu	63 Participants
8.	Thatta and Karachi	63 Participants
Total Participants		**473 Participants**

This Project has received close public attention and that was necessary to adopt a pro-active approach to consult and involve the public. In order to foster community support and general consensus on the key issues and promote public participation in the process and ownership of the outcome, the public should be closely engaged throughout the entire study process.

7.12 Meetings with stakeholders

Meetings were held with key officials and opinion leaders to gauge level of awareness and involvement with the project, concerns of project implementation, and to obtain relevant documents or baseline information. The consultation and participation also help to gather information on the mandates and permitting requirements to inform the development of

program/project. The lists of meetings and participants contacted and issues discussed were recorded and presented in the public consultations reports.

The stackholders concerns raised during the consultative workshops were addressed through following mitigation measures/actions:

Stakeholder Concern	Mitigation Measure proposed/action taken
The capacity building and awareness program of farmers should be conducted on regular basis.	A regular capacity building and awareness program for the farmers regarding project intervention including IPM Plan has been proposed in the EIA/Project.
The issue of water-borne diseases caused by over irrigation and use of pesticides should be addressed.	The stagnant water will be avoided and judicious use of soft insecticides with IPM approach shall be followed.
Effective investment is needed for the bed-furrowing with the help of laser leveling.	Adequate investment for laser leveling has been provided.
Trees and livestock are important elements of the rural agricultural economy. The tree cutting caused by the water course improvement should be compensated through plantation of appropriate tree species at appropriate locations. This point was commonly discussed by Assistant Directors, Engineers and Growers.	Considering the planting of trees as an important component of environment it has been proposed to plant at least two trees at appropriate locations in consultation with the WCAs and the project staff as compensatory plantation to overcome the adverse impact of tree cutting.
Noise and Air Pollution generated by the Agriculture activities must be monitored.	These aspects of the environment will be monitored by the environment specialist. Use of masks on the face for controlling air pollution and noise protectors on the ears will be encouraged to the people working in the Agriculture Activities.
Drip irrigation should be promoted in areas having undulating terrain.	The farmers will be encouraged through awareness for promotion of drip irrigation in undulating terrain.
The need for a national level water policy was stressed.	Higher authorities of irrigation department

Stakeholder Concern	Mitigation Measure proposed/action taken
	may take action at their end.
Laser land leveling equipment should be provided on rental basis also.	The practice already exists. It shall be encouraged more through awareness in the farming community of project area.
Private sector partnership should be encouraged.	Private sector partnership will be encouraged through awareness campaign.
The use of FM radio should be promoted for the awareness raising and capacity building of farmers for the improved irrigation techniques.	FM radio is an effective tool which shall be utilized for awareness and capacity building regarding project interventions.
The lining of the water courses should be carried out beyond the current limit of 30 percent of watercourse length.	The present policy of lining of 30% length of water courses have proved beneficial to the farmers hence the same will be applied in the project. The lining beyond this shall need more resources.
The quality of water course lining needs to be improved, and the Department team should regularly monitor this aspect.	The project implementation and monitoring staff will monitor the quality of water course improvements.
Environmental Impacts of brick kilns, which would provide bricks for the Project, needs to be highlighted.	The emitting smoke from brick kilns containing carbon mono oxide is very dangerous to the human health. Due to the increasing demands of bricks in the project area the construction of new brick kils near thickly populated areas shall be discouraged through line departments.
Local manufacturing of drip irrigation systems and their parts should be encouraged.	The local manufacturers shall be encouraged to install, prepare and market the drip irrigation systems and spare parts.
The tree plantation can be used for nitrogen fixing of soil, as wind breaker particularly in areas that experience sand/wind storms.	WCAs and project staff will ensure to plant nitrogen fixing trees and other plant species serving as wind breakers to combat the adverse impact of wind and sand storms.

Stakeholder Concern	Mitigation Measure proposed/action taken
Demonstration systems should be arranged at regional level to show the modern irrigation techniques.	The demonstration systems will be arranged for modern irrigation techniques each districts of the project area.
Tube-wells should be installed giving due consideration to their location and inter-tube-well distance.	The proper criterion for installation of tubewells shall be followed.
The soil and water pollution caused by the left over plastic tubing and other parts for the drip/sprinkler irrigation system needs to be addressed.	The soil and water pollution caused by the left over plastic tubing and other parts for the drip/sprinkler irrigation system will be addressed during the project implementation with proper disposal.
The drip irrigation system is currently suitable for large farmers having more resources available to them and having more know-how/awareness. The barriers for its adaptation by the small farmers need to me removed.	Small farmers will also be promoted to use drip irrigation system for saving water and geting more area irrigated from available water.
Pest management component needs to be included in the Project, addressing the use of pesticides (and other chemical inputs) in the high efficiency irrigation techniques.	A detailed IPM Plan has been prepared and also included in the EIA Report.
Awareness raising and capacity building components should also be included in the Project.	Awareness raising and capacity building components have been included in the Project.
The use of solar energy should also be explored for pumping groundwater.	The Government has already launched a pilot project for installation of 250 tubewells in Sindh province to operate on solar for using solar energy for pumping groundwater.
Water User Associations should be involved in water sharing.	WCAs of water share holders shall be organized.
The Department should also encourage the farmers to build small water storage tanks to store irrigation water.	Awareness shall be created.

Stakeholder Concern	Mitigation Measure proposed/action taken
Tube-wells are being misused and there exists no law to control the installation of new tube-wells.	An strict government policy is needed.
The Department should promote small dams and sprinkler/drip irrigation in Barani areas of the Province.	The concerned department is already working on promotion of small dams in Barani areas of the province. This project also include sprinkler/drip irrigation for the Barani areas.
Washing of clothes on lined water courses is resulting in pollution of irrigation water.	Washing bays at appropriate places along the water course will be constructed and due care will be taken to monitor this activity to avoid water pollution.
Availability of additional water quantity results in cultivation of more area under agriculture leading to greater use of pesticides.	Judicious use of pesticides through IPM approach shall be encouraged to mitigate the impacts of pesticide hazards.
Silting is watercourses should be considered when designing lining technology.	This will be monitored by the WCAs, project staff and supervision consultants during execution of project activities.
Temporary of diversion channels should not be left unattended.	This will be taken care and Environmental Management Plan WCAs, project staff and supervision consultants during execution of project activities.

Consultation Workshop at Thatta Gymkhana

Consultation Workshop at Thatta Gymkhana

Consultation Workshop at Thatta Gymkhana

Consultation Workshop at Thatta Gymkhana

Consultation Workshop at Indus Hotel Hyderabad

Chapter 8

Impact Assessment and Mitigation

This Chapter assesses the potential Environmental and social impacts of the proposed project titled "Sindh Irrigated productivity Enhancement Project" (SIAPEP). In this chapter the mitigation measures to minimize if not eliminating the potentially negative impacts, in order to ensure that the interventions under the proposed project do not cause environmental impacts beyond the acceptable level have also been provided.

8.1 Positive Impacts

The EIA study reveals that all the interventions of the will have positive environmental and social impacts. The positive environmental and social impacts of the project include increased water conservation, enhanced social mobilization (ie, establishment of WCAs), and increased employment opportunities for skilled people. In addition, the project interventions such as high efficiency irrigation techniques will help discontinue usage of sewage water to irrigate crops particularly vegetables in the peri-urban areas – a practice that poses health risks to the population consuming these vegetables.

8.2 Assessment of Potential Impacts and Mitigation

The potentially negative impacts based upon the project components and the interventions being assessed has been described in the following sub sections.

8.3 Component A: Community Water Infrastructure Improvement

Component A is further divided into two parts A1 & A2:

Sub-Component A1: Community Watercourse Improvement

8.3.1 Watercourse improvement:

Interventions: Land Use, Landform, Tree cutting and Land Take

While improving the 5,500 watercourse, it is sometimes realigned also, thus causing change of land from and land use (this change is on a micro level; at the macro level, no change takes place, since the area in general would remain under cultivation after the completion of the

scheme as well). The land under the watercourse is generally owned by the water users, who greatly benefit from the watercourse improvement, and therefore willingly donate the land.

Impact

The potentially negative impacts of such changes in land use/land form include:

i) Pollution of irrigation water by deterants and soaps due to use washing of clothes,

ii) increased use of pesticides due to availability of additional water and crop cultivation,

iii) un-attended excavated earth/silt due to rehabilitation of WCs,

iv) temporary diversion channels left un-attended,

v) cutting of trees , shrubs and disturbance to to ground vegetation.

Mitigation Measures

Mitigation measures for above environmental issues are as under:

Washing bays to be designed as part of water courses lining,

Integrated Pest Management Plan including trainings, residue testing and capacity building activities to be implemented to reduce the impacts of pesticides,

The excavated earth to be properly dressed and included in the WCAs responsibilities,

Mandatory restoration of land condition after diversion channels for water courses improvement

The care to be taken to avoid cutting of trees but incase of no option minimum number of trees and shrubs be cut but replaced with four trees for each cut tree along the watercourse. Additional tree planting as compensatory planting of trees be also carried out. All trees be maintained so as to obtain required success and growth. The species to be planted should be indigenous and environment friendly preferably nitrogen fixing and woody tree species so as to benefit the local physical environment of the area.

Other social-cum-environmental issues include: Disputes over land ownership, blocked access for people of the area, encroachment into any sensitive habitat and/or protected areas, and encroachment into any sites of archeological, cultural, historical, or religious significance.

The proposed project will not need any land to be acquired and hence it will not cause any involuntary resettlement.

8.3.2 Conflicts in Water Supply Rights

Impact

Increased irrigation water availability as a result of water course improvement and/or adopting high efficiency irrigation techniques can potentially cause local conflicts among the communities.

Mitigation Measures

Conflict avoidance and resolution are some of the key functions of the WCAs. The activities will be undertaken by the Field Teams formed with technical, agronomical, and social staff under the DG,AEWM based in all districts. The project through its Technical Assistance (TA) consultants will offer guidance on using variety of lining materials to be selected by the farmers.

8.3.3 Disruption of Local Routes

Impact

During the construction activities especially the lining of water courses of the project, local routes can potentially be blocked adversely affecting the local communities and their livestock.

Mitigation Measures

The design of water course improvement will include culverts at appropriate locations. Any disruption of local routes will be minimized through astute planning. The activities will be undertaken by the Field Teams formed with technical, agronomical, and social staff under the DG,AEWM based in all districts. The project through its Technical Assistance (TA) consultants will offer guidance on using variety of lining materials to be selected by the farmers.

8.3.4 Loss of Precious Ecological Values

Impact

The project interventions may potentially cause loss of precious ecological assets if they are inappropriately located and encroach into forests/swamp lands or historical/cultural buildings/areas, disrupt hydrology of natural waterways, regional flooding, and drainage hazards. The project is to be implemented in area where there are no areas of ecological values

such as forests, wetlands, wildlife sanctuaries and hot spot areas described in IUCN data Red Book.

Mitigation Measures

During the project activities the prevention of ecological system will be taken care. After completion of activities the disturbances created in the local ecological system will be brought back to the original. The activities will be undertaken by the Field Teams formed with technical, agronomical, and social staff under the DG, AEWM based in all districts.

No project activity shall be carried out in a protected area near sensitive habitats or ecological zones.

8.3.5 Impacts on Women, Children, Vulnerable Groups, and Indigenous People

The project interventions will generally benefit the land owners and growers, however, these interventions are unlikely to negatively affect vulnerable groups such as poor, women and children.

Impact

The proposed interventions are unlikely to negatively affect the gender roles and responsibilities, nor the women of the area. Rather, watercourse improvement and high efficiency irrigation systems are likely to facilitate the women laborers to carryout irrigation and other on-farm activities more effectively. Similarly, construction of washing bays on watercourses will benefit the local population particularly women.

No indigenous people are known to exist in the Province.

Mitigation Measures

No discrimination with respect to religion, caste, gender, or association with any social group will be practiced while selecting the project beneficiaries. The activities will be undertaken by the Field Teams formed with technical, agronomical, and social staff under the DG,AEWM based in all districts.

8.3.6 Clogging of Water Courses

Impact

Improper maintenance of water courses can potentially cause silting and clogging of these channels, thus reducing the irrigation efficiency and water availability.

Mitigation Measures

The WCAs play an important role in maintaining the water courses in good condition. Through social mobilization and capacity building during the project, the sustainability of the WCAs will be promoted

8.3.7 Influx of Workers and Employment

Impact

The water course improvement works will offer employment and/or small contracting opportunities. Influx of laborers/contractors from other regions can potentially cause conflict and tension between communities and these laborers and contractors.

Generally, the proposed interventions tend to reduce time and efforts needed to irrigate the cultivation fields, which may reduce the need of farm labor. However, the increased

Productivity from these fields more than compensates this reduction in farm labor demand. In addition, the high efficiency irrigation techniques increase the demand of labor having better skills and know-how.

Mitigation Measures

Preference will be given to the local contractors and laborers. The WCAs will select the contractors in accordance with the local norms.

8.3.8 Flood Risk for the Poor

Impact

Sindh experienced prolonged flooding by long periods of stagnated water that destroyed crops, irrigation systems, food and seed stock, livestock, and homesteads. These floods have disproportionately affected the very poor, small farmers and landless in rural Sindh, as the loss of livelihood was much greater given their limited assets.

Impact

The ecological disturbance to sites due tree cutting, earth filling and important ecologically endangered floral and faunal species.

Mitigation Measures

Emergency Community Flood Shelters

The sites selection be such that there is no any floral and faunal species for the intervention. In case essentially particular sites are required the compensatory activities be mandatory usch as maximum number tree plantation for shelter, beautification, landscaping and use of products. All disturbed soil be brought back to its original site condition. The trees should be environment friendly, socially acceptable and economically benefial for the poor families. They should also provide shelter for the people and the livestock.

Poor communities, especially those who could not afford to improve their homestead on their own in the flooded areas, have been requesting flood/raised shelters to avoid total loss of livelihood in events of such disaster in future. Farmer community flood shelter can be used for multipurpose activities during off-flood period but it may cause some negative impact due to constructional work, waste management and social activities. To extend the secured benefits of the project to rural poor, this component will provide support for socially and culturally appropriate community flood shelters/centers to be built in areas subject to frequent flooding and on an on-demand basis with beneficiary communities/public sector providing lands to facilitate construction of flood shelters. The activities will be undertaken by the Field Teams formed with technical, agronomical, and social staff under the DG,AEWM based in all districts.

8.4 Component B: Promotion of High Efficiency Irrigation Systems (HEIS)

Component B is further divided into two parts B1 & B2:

8.4.1 Sub-component B1: Small and medium-sized HEISs for 2 ha (5 acres), 4 ha (10 Acres) and 10 ha (25 Acres) farms

Impact

This sub-component would assist small and medium sized farmers to install and operate High Efficiency Irrigation System (HEISs) of different size but mainly with the same irrigation technology, namely drippers and bubblers. It would also include 46 demonstration sites of 2 ha (5 acres) each, two in each district, and finance the associated training of department staff and farmers including women in the installation, operation and maintenance of the HEISs. HEISs would be installed by Service Providers and given on a shared cost basis.

Mitigation Measures

Capacity Building (also refers to Project Component C)

A social awareness campaign and farmer mobilization would be initiated and carried out by consultants supported by 155 Field Teams. In each Field Team responsible for the installation of the HEISs, one person would be trained in operation and maintenance (O&M) as well as in the promotion of HEISs to individual farmers, farmers' groups and Water Course Associations (WCAs).

8.4.2 Component B2: Small HEIS kits for schools and individual households

Impact

The promotion of High Efficiency Irrigation System (HEIS) technology through education and demonstration in some 10,000 primary schools and 100 demonstration sites, at least four in each district will be delivered.

Mitigation Measures

Capacity Building (also refers to Project Component C)

At the primary school level the educational material and training of teachers to promote the application of water saving irrigation technology will be imparted. This should be an important element of the curricula in rural primary school. The activities will be undertaken by the Field Teams formed with technical, agronomical, and social staff under the DG,AEWM based in all districts.

8.5 Component C: Improved Agriculture Practices

Component C is further divided into two parts C1 & C2

8.5.1 Sub-Component C1: Laser Land Leveling and Deep Ripping

Precision land leveling and associated deep ripping equipment will result in higher efficiency and productivity of water use. Laser land leveling saves up to 30% of irrigation water, results in uniform seed germination, and increases fertilizer uptake, which enhances crop yields by up to 20%, especially in crops irrigated by flooding system.

Impact

The equipment for deep ripping and the laser leveling will be provided to individual farmers, WCAs, FOs, CBOs and service providers.

Mitigation Measures

Equipment Procurement measures

With provision of the equipment, efforts will be made to encourage establishment of local supply market which can provide full "after sale services" rather than to dependence on other provinces. Support to farmers in procurement and training in operation of the equipment will be carried out by the engineering wing of the Sindh On-Farm Water Management (OFWM) Department. The activities will be undertaken by the Field Teams formed with technical, agronomical, and social staff under the DG, AEWM based in all districts.

8.5.2 Noise/Vibration Mitigation

Impact

The activities under the proposed interventions, such as laser land leveling, will cause some noise and vibration, however this noise will not be in excess to what is normally generated in a cultivation field/farm during the routine cultivation activities.

Mitigation

If the noise level is more than 85 db levels that will be brought at moderate level that is 70 db. The activities will be undertaken by the Field Teams formed with technical, agronomical, and social staff under the DG, AEWM based in all districts.

8.5.3 Sprinkler irrigation and laser land leveling.

Impact

These interventions will generally be implemented in the existing cultivation fields, hence causing no changes in the land form or land use.

Mitigation Measures

For the intervention under the proposed project where an expansion of the cultivation field/orchard takes place, the following measures will be implemented /included in the design of the project.

The vacant area where orchard/cultivation farm is to be established under the project should be owned by the beneficiary. No involuntary resettlement should result from such expansion of the cultivation area. It should be ensured that the local routes are not blocked by such schemes.

If trees are to be cut for any scheme in a previously vacant area, the farmer/scheme beneficiary will carry out compensatory plantation of appropriate indigenous tree species. Trees thus planted should be at **four times** the number of trees cut for establishing the project.

No intervention should be located inside or at any environmental hotspot. The schemes should not be located in graveyards or shrines.

Land for the realigned water course should be voluntarily donated by its owner(s), and proper documentation should be completed for this donation. The activities will be undertaken by the Field Teams formed with technical, agronomical, and social staff under the DG,AEWM based in all districts.

8.6 Sub-Component C2: Improved Agriculture Production Technology

This sub-component will support improvement in crop and irrigation agronomy practices in the form of demonstration and assistance in improved and modern technologies to increase the benefits of enhanced water availability from watercourse lining and introduction of high efficiency irrigation systems.

Impact

The intervention will include (a) farmer field school (FSS) (b) training of trainer (c) training for the promotion of HEIS and crop diversification (d) exposure visit for farmers (e) promotion of natural pest enemy insects

Mitigation Measures

Mninitoring & Evaluation system will be established to improve monitoring of project outputs delivery, enhance transparency and gather feedback of the project beneficiaries. This system will be managed by an independent third party supervisory consultants team hired from the market.

Training of the master trainers will be made to implement the above mentioned interventions

8.7 Soil Erosion and Topography

No project interventions are likely to involve any large excavation or any other activity causing soil erosion. Some minor excavation is involved in the water course improvement works, but the overall impact of this improvement is reduced soil erosion, which takes place along the unimproved water course.

Impact

Under the project it may involve constructing a small water storage tanks as the water source for drip or sprinkler irrigation. Improper location/construction of pond can potentially cause soil erosion/subsidence. Additionally, the surplus soil if inappropriately disposed can potentially cause blocked drainage, loss of cultivable land, and associated issues.

Mitigation Measures

The following measures will greatly reduce the potential impacts described above:

During the water course improvement works, earthen channels will not be left un-compacted for long durations.

The soil excavated and silt removed during the water course improvement works will be disposed appropriately, ensuring that it is not dumped in the cultivation fields, and does not block the water courses, drains, or local routes.

The small water storage tanks under the schemes will be appropriately located and designed, addressing all aspects including soil erosion, soil subsidence, and seepage.

The scheme design involving excavation of small water storage tanks should include proper disposal of the surplus soil (eg, for the embankment for the small water storage tanks itself).

8.8 Loss of Soil Productivity

Impact

The flood irrigation helps in leaching of salts present in the irrigation water (particularly when groundwater is used) from the soil thus avoiding salt build up in the crop root zone. However, the proposed high efficiency irrigation system may potentially lead to salt build up in the crop root zone since the leaching is unlikely to take place with the controlled irrigation.

Mitigation Measures

Drip irrigation system should be preferred for row crops and for areas having loamy soils.

Soil analyses should be carried out in the fields using high efficiency irrigation systems to detect any salt build up in the crop root zone.

In the fields using drip irrigation systems in areas with little or scanty rainfall, occasional (say, once a year) flood irrigation may be considered to avoid salt build up in the soil, particularly where groundwater is used for irrigation.

Soil testing should be carried out for soil build up prior to start of use of High Efficiency Irrigation System and should be conducted at a biennial basis.

8.9 Reduced Groundwater Recharge

The water course lining while conserving water by reducing the water seepage from the water courses can also potentially reduce the groundwater recharge thus affecting among others the drinking water source for the local population. The groundwater in areas where it is not saline or brackish has become a major source of irrigation water.

Impact

The seepage from the irrigation network and the cultivation fields is among the major sources of recharge to this valuable natural water storage.

Mitigation Measures

One of the design criteria adopted by the Department is to limit the water course lining to 30 percent in the areas with fresh groundwater. This will ensure adequate groundwater recharge from the remaining places.

In addition, the Department should utilize the results of the groundwater studies being carried out by different organizations in the Country. This would help understand the actual impact of the water course lining on the groundwater table.

8.10 Soil and Water Contamination

The application of chemical inputs (fertilizers, pesticides, and herbicides) can potentially cause soil and water contamination, having negative impacts on people, as well as on natural flora and fauna. The high-efficiency irrigation techniques and laser land leveling included in the proposed project generally increase the effectiveness of these inputs, thus reducing the

quantities of these inputs per unit farm produce. Particulalrly in case of the HEIS, the fertilizers and pesticides are msoslty applied directly to the crop root zone, which results into maximum absorption of these chemicals by the plant, thus reducing the possibility and extent of soil and water contamination.

Impact

The installation of the drip or sprinkler system may also generate small quantities of wastes, such as plastic tubing, pieces of metal pipes, and pipe fittings, as well as left over construction material including cement, sand and bricks can potentially cause soil and water contamination.

Mitigation Measures

Judicious use of the 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 the Component of the proposed project.

The capacity building program will also include safe handling of hazardous substances such as pesticides.

Waste disposal guidelines will be included in the design of the project. It will be ensured that no waste or left over construction material is left behind in the cultivation fields.

8.11 Air Quality

Impact

Air quality deterioration in and around the farms participating in the proposed project can potentially be caused by increased use of chemical inputs, since certain volatile substances can become airborne;

Use of diesel engines/tractors for water pumping and laser land leveling; Dust emissions from excavation and other construction works.

Mitigation Measures

Judicious use of the chemical inputs and use of alternate techniques (such as integrated pest management and using disease-resistant seeds) will be promoted through awareness raising and capacity building initiatives, as described earlier.

Awareness raising and capacity building initiative included in the proposed project should also address aspects such:

Keeping the tractors and diesel engines properly tuned and in good working condition using proper fuel.

8.12 Water Consumption and Availability of Water in Downstream Areas

With the implementation of the proposed interventions, the water consumption generally reduces, thus allowing more area to be irrigated with the same amount of water available. This is a positive impact (and the key objective of the project) hence does not require any mitigation.

Impact

Water consumption for any scheme involving new area to be brought under cultivation, may potentially affect other water users.

Mitigation Measures

It will be ensured that any new area development does not negatively affect downstream water users.

The water saved through the project interventions should be used to address the water stress and/or to bring the fallow land under cultivation.

8.13 Water Borne and Water-related Diseases

Impact

Construction and operation of irrigation schemes can potentially cause water borne and water-related diseases. In particular, the ponds constructed to store water can provide breeding areas for mosquitoes, potentially causing maleria and dengue.

Mitigation Measures

The capacity building component of the project will address the importance of safe drinking water and hygienic practices, thus addressing the water borne diseases.

The capacity building program will also address the avoidance and cure of water-related diseases. In particular, ways and means to avoid malaria and dengue will be disseminated to the communities.

8.14 Safety Hazards and Public Health

Improper handling of pesticides and herbicides exposes the farm labor to hazardous and toxic substances. Though, as mentioned earlier, the quantities of pesticides and herbicides applied per unit produce are reduced by using the high efficiency irrigation techniques, or by leveling the land, the overall quantities of these chemical inputs may increase because of the increased productivity and higher intensity of cultivation. This may increase the exposure of the farmers and farm labor to the hazardous substances.

Impact

The small water storage tank constructed for the high efficiency irrigation systems may pose safety hazards for the local population particularly children and also for the livestock. These ponds may also become the breeding areas for disease vectors such as mosquitoes, potentially causing malaria and dengue.

Mitigation Measures

Judicious use of the 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 included in the proposed project.

The above mentioned awareness raising and capacity building initiatives will also address the safe practices to transport, store, handle, and apply the pesticides, herbicides, and fertilizers.

Protective fencing would be erected around the small water storage tanks.

The capacity building program would also address the potential mosquito breeding in the small water storage tanks.

8.15 Impacts on Natural Flora and Fauna

Natural flora and fauna can potentially be negatively impacted by the proposed interventions in the following manners:

Use of excessive chemical inputs causing soil and water contamination, which in turn can potentially harm natural vegetation, beneficial insects, birds, and other faunal species.

Trees may need to be cut to undertake the improvement of watercourses particularly its realignment.

Impact

Trees may need to be cut and natural vegetation removed for implementing any proposed scheme such as drip irrigation in a previously vacant area.

Mitigation Measures

The following mitigation measures will avoid/reduce the potentially negative impacts of the project interventions on the biological resources:

Judicious use of the chemical inputs and use of alternate techniques (such as integrated pest management and using disease-resistant seeds) will be promoted through awareness raising and capacity building initiatives as described earlier in Section 7.3.8.

Cutting of trees would be restricted to only those trees which cause restriction/hindrance in water flow or civil works.

If any trees are to be cut for watercourse improvement works, the WCA will carry out compensatory plantation of appropriate indigenous tree species. Trees thus planted should be at least three times the number of trees cut for establishing the scheme.

If any trees are to be cut for scheme in a previously vacant area, the farmer/scheme beneficiary will carry out compensatory plantation of appropriate indigenous tree species. Trees thus planted should be at least three times the number of trees cut for establishing the scheme.

As mentioned earlier, no schemes will be located inside any wildlife protected areas.

8.16 Damage to Infrastructure

The proposed interventions will improve the on-farm irrigation infrastructure (watercourses), will cause reduced irrigation water requirements per unit produce, and will generally increase irrigated area and productivity of the cultivation fields. These are positive impacts (and the key objectives of the project) hence do not require any mitigation.

Impact

Improvement of some local infrastructure such as culverts for water courses is included in the project design. Similarly washing bays will also be constructed at appropriate locations along the water courses. On the other hand, the construction works can potentially damage the local infrastructure.

Mitigation Measures

The WCA will ensure that any infrastructure such as culverts damaged during the construction works is restored to same or better condition.

8.17 Sustainability of Interventions

Impact

Without appropriate backup support, interventions such as high efficiency irrigation systems are not likely to be accepted by the growers. Any disruption of irrigation in these high efficiency systems may cause water stress and associated damage to the crops.

Mitigation Measures

The project will ensure strong and effective backup support to be provided by the suppliers through appropriate contractual clauses. This arrangement has been quite successful in providing after-sales support to the farmers during the on-going project.

8.18 Use of Pesticides

Impact

Pesticide use is widely practiced in Sindh, Intended to assist farmers in getting rid of pests, extended and indiscriminate has resulted in pest outbreaks as well as negative effects on people working in the agricultural fields and the surrounding environments. Pesticide use also disturbs the agro-ecosystem and kills non-target bio-control agents and environment friendly organisms including birds. Such a disturbance in agro-ecosystem has induced pest resurgence and increased the resistance in resident pest populations. Natural enemies of persistent common pests have been decreasing due to widespread and unchecked pesticide use. Some of other side effects of increased pesticide use have included the contamination of soil and water and chemical residues in the food chain.

Mitigation Measures

All banned and unregistered (23) pesticides items must be avoided

8.18.1 Sickness Incidence of Pesticide Applicators

Impact

Pesticide related sickness is very common in the cotton zone as about 63% of households report sickness during the spraying season, mortalities are about 1 per 400 households while main reported ailments are vomiting, dizziness, and breathing problems.

Mitigation Measures

Regular medical checkup should be made through the Government registered hospitals to assess the sickness incidence of pesticide applicators.

8.18.2 Sickness in Women Cotton Pickers

Impact

About 87% women pickers complaint of a variety of symptoms like headache, nausea, vomiting, skin irritation, general weakness, fever, dizziness, stomach pain, and blisters while picking the cotton during the season. This might be due to pest resdue on the cotton.

Mitigation Measures

Protected devices like gloves, face mask, cap and shoes should be used. Regular medical check-ups are recommended during the cotton season.

8.18.3 Industrial Worker Poisoning

Impact

About half of the labor force, working in the pesticide plants report sickness by inhaling pesticide emissions.

Mitigation Measures

Awareness program should be conducted to avoid the inhaling pesticide emissions regular medical check-ups are recommended during the season.

8.18.4 Pesticide Residue in Food Chain

Impact

Fruits and vegetables are contaminated with pesticide residues to the extent of 40% and 63%-70% of these are above the Maximum Residue Limit (MRL).

Mitigation Measures

All the fruit and vagetable sample should be checked and verified on regular intervals. They must be brought in the Residue Limit.

8.18.5 Irrigation and Drinking Water

Impact

Pesticide residues also found in irrigation and drinking water cotton seed, oil, lint and cattle feed, cottonseed cake, animal milk, and soil. Increased pesticide resistance is resulting in additional applications of pesticides to maintain expected crop yields. The consequences are lower yields and higher production costs. Pesticide use is affecting biodiversity too but it is little understood and appreciated. Some examples are: pollinator damage (honey bee poisoning), soil fauna, wildlife and birds.

Mitigation Measures

Regular water sampling should be made to check the toxicity level in the water testing lab: and to bring the water in the permissible level of guidelines.

8.18.6 Generation of Toxic solid waste

Impact

Toxic waste being generated in the result of pest empty container can produce the hazards for the people working in the field, if they are not properly handled.

Mitigation

All the empty pest container must be incinerated (at high temperature) and certificate of incinerated items should be taken from authorized dealer.

8.18.7 Pesticide Residue Testing

Impact

Pesticide residues are very injurious to the human health, specially the workers who are engaged in this practice.

Mitigation

Pesticide residue testing will be made one a year for 10% of the farmers who have received training in IPM. Control sample will also be taken for crops where farmers did not receive any training. For the sake of validity both results of the concerned staff will be compared.

8.19 Interventions & Mitigation Assessments

Table No. 8.1: Interventions & Mitigation Assessments.

	Physical					*Biological*		*Social*										
	Soil Erosion/Contamination	Air Quality	Surface Water Quality	Groundwater Quality	Water Availability and Consumption	Natural Vegetation	Wildlife	Blocked Access Routes	Noise and Vibration	Impacts on Agriculture	Impacts on Irrigation Network	Safety Hazard	Infrastructure	Public Health	Aesthetic Value	Cultural Issues	Gender Issues	Loss of asset/Livelihood
Watercourse lining	-1	0	-1	-1	+1	-1	0	-1	0	+1	+1	-1	-1	-1	+2	-1	-1	-1
High Efficiency Irrigation	0	0	-2	-1	+1	-1	-1	-1	-1	+1	+1	-1	+1	+1	+1	-1	0	-1
Flood shelters	0	-1	-2	-1	-1	0	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1
Laser Land Leveling	0	0	0	0	0	-1	-1	0	0	+2	0	-1	0	0	N	0	0	N
Capacity building and other 'soft' interventions	-1	0	0	0	0	0	0	-1	-1	0	-1	-1	-1	-1	N	-1	-1	N
Other																		

Key: -2: High negative impact; -1: Low negative impact; 0: insignificant/negligible impact; +1: low positive impact; +2: High positive impact, N: no impact.

8.20 Check List for the Interventions & Mitigation

Table No. 8.2: Check List for Interventions & Mitigation.

S: No	Intervention Activity	Type of Activity		Mitigation Assessment		
		Environment Based	Social Based	Yes	No	Remarks
A.	**Water Courses**					
1.	(Watercourse improvement) Land Use, Landform, Land Take and cutting of trees.	—	While improving the watercourses re-alignment of land required, causing change of land and land use. If trees are to be cut for any scheme in a vacant area, the farmer/scheme beneficiary will carry out compensatory plantation of appropriate indigenous tree with the ratio 1:4.			

S: No	Intervention Activity	Type of Activity		Mitigation Assessment		
		Environment Based	Social Based	Yes	No	Remarks
2.	Clogging of Water Courses	Improper maintenance of water courses can potentially cause silting and clogging of these channels, thus reducing the irrigation efficiency and water availability.	—			
3.	Damage to Infrastructure	Construction works for watercourses can potentially damage the local infrastructure.	—			
4.	Washing of cloths in the lined area of the watercourse	Pollution of Irrigation Water by detergents and soaps. Washing bays to be designed as part of	—			

S: No	Intervention Activity	Type of Activity		Mitigation Assessment		
		Environment Based	Social Based	Yes	No	Remarks
		watercourses rehabilitation works and execution be ensured.				
5.	Reduced Groundwater Recharge	The water course lining while conserving water by reducing the water seepage from the water courses can also potentially reduce the groundwater recharge.				
B.	**High Efficiency Irrigation System**					
6.	High Efficiency Irrigation System	Construction Intervention can disturb the population, soil, trees and can produce	Disputes over land ownership, blocked access for people of the area, encroachment into any			

S: No	Intervention Activity	Type of Activity		Mitigation Assessment		
		Environment Based	Social Based	Yes	No	Remarks
		waste of construction material along with the high noise level of heavy vehicles	sensitive habitat and/or protected areas, and encroachment into any sites of archeological, cultural, historical, or religious significance.			
7.	Laser land leveling.	If trees are to be cut for any scheme in a vacant area, the farmer/scheme beneficiary will carry out compensatory plantation of appropriate indigenous tree with the ratio 1:4	—			
C.	**Emergency Community Flood Shelter**					
8.	Emergency Community	Farmer community flood shelter can be	—			

S: No	Intervention Activity	Type of Activity		Mitigation Assessment		
		Environment Based	Social Based	Yes	No	Remarks
	Flood Shelters	used for multipurpose activities during off-flood period but it may cause some negative impact due to constructional work, waste management and social activities				
D.	**Ecology**					
9.	Loss of Precious Ecological Values	The project interventions can potentially cause loss of precious ecological assets if they are inappropriately located and encroach into forests / swamplands or historical / cultural	—			

S: No	Intervention Activity	Type of Activity		Mitigation Assessment		
		Environment Based	Social Based	Yes	No	Remarks
		buildings /areas, disrupt hydrology of natural waterways, regional flooding, and drainage hazards.				
10.	Soil Erosion and Topography	Project may involve constructing works Improper location/construction can potentially cause soil erosion/subsidence. Additionally, the surplus soil if inappropriately disposed can potentially cause blocked drainage, loss of cultivable land, and associated issues	—			

S: No	Intervention Activity	Type of Activity		Mitigation Assessment		
		Environment Based	Social Based	Yes	No	Remarks
11.	Loss of Soil Productivity	The flood irrigation helps in leaching of salts present in the irrigation water particularly when groundwater is used from the soil thus avoiding salt build up in the crop root zone.	—			
12.	Impacts on Natural Flora and Fauna	Use of excessive chemical inputs causing soil and water contamination, can potentially harm natural vegetation, beneficial insects, birds, and other faunal species.	—			
E.	**Field Irrigation Practices**					

S: No	Intervention Activity	Type of Activity		Mitigation Assessment		
		Environment Based	Social Based	Yes	No	Remarks
13.	Conflicts in Water Supply Rights	—	Increased irrigation water availability as a result of water course improvement and/or adopting high efficiency irrigation techniques (HEIS) can potentially cause local conflicts among the communities			
14.	Disruption of Local Routes	—	During the construction activities of the project, local routes can potentially be blocked adversely affecting the local communities and their livestock.			
15.	Impacts on	—	The project			

S: No	Intervention Activity	Type of Activity		Mitigation Assessment		
		Environment Based	Social Based	Yes	No	Remarks
	Women, Children, Vulnerable Groups, and Indigenous People		interventions will generally benefit the land owners and growers, however, these interventions are unlikely to negatively affect vulnerable groups such as poor, women and children			
16.	Water Consumption and Availability of Water in Downstream Areas	Water consumption involving new area to be brought under cultivation, may potentially affect other water users. The water saved through the project interventions should be used to address the water stress and/or to bring the	—			

S: No	Intervention Activity	Type of Activity		Mitigation Assessment		
		Environment Based	Social Based	Yes	No	Remarks
		fallow land under cultivation.				
F.	**Hazards**					
17.	Noise and Vibration	The activities under the proposed interventions, such as laser land leveling, will cause some noise and vibration	—			
18.	Air Quality	Use of diesel engines/tractors for water pumps and laser land leveling; Dust emissions from excavation and other construction works	—			
19.	Water Borne and Water-related Diseases	Stored water can provide breeding areas for mosquitoes, potentially causing	—			

S: No	Intervention Activity	Type of Activity		Mitigation Assessment		
		Environment Based	Social Based	Yes	No	Remarks
		malaria and dengue. Concerned pathology tests are required to check Surveillance.				

8.21 Check List for the Interventions of Integrated Pest Management & Mitigation Assessments

Table No:8.3 Check List for the Interventions of Integrated Pest Management & Mitigation Assessments

S: No	Intervention Activity	Type of Activity		Mitigation Assessment		
		Environment Based	Social Based	Yes	No	Remarks
1.	Pesticide use is widely practiced in Sindh	Intended to assist farmers in getting rid of pests, extended and indiscriminate has resulted in pest outbreaks as well as negative effects on people working in the agricultural fields and the surrounding environments Mitigation All banned and unregistered (23) pest items must be avoided.				

S: No	Intervention Activity	Type of Activity		Mitigation Assessment		
		Environment Based	Social Based	Yes	No	Remarks
2.	Sickness Incidence of Pesticide Applicators		Pesticide related sickness is very common in the cotton zone. Main reported ailments are vomiting, dizziness, and breathing problems. Mitigation Regular medical checkup should be made through the Government registered hospitals to assess the sickness incidence of pesticide applicators			
3.	Sickness in Women Cotton Pickers		Variety of symptoms like headache, nausea, vomiting, skin irritation, general weakness, fever, dizziness,			

S: No	Intervention Activity	Type of Activity		Mitigation Assessment		
		Environment Based	Social Based	Yes	No	Remarks
			stomach pain, and blisters while picking the cotton during the season. Mitigation protective apparatus and devices must be supplied to the cotton pickers. Regular medical check-ups are recommended during the cotton season			
4.	Industrial Worker Poisoning		Labour force, working in the pesticide plants report sickness by inhaling pesticide emissions. Mitigation protective apparatus and devices must be supplied. Awareness program should be conducted to avoid the inhaling pesticide emissions regular medical check-ups are			

S: No	Intervention Activity	Type of Activity		Mitigation Assessment		
		Environment Based	Social Based	Yes	No	Remarks
			recommended during the season			
5.	Pesticide Residue in Food Chain	Fruits and vegetables are contaminated with pesticide residues to the extent of 40% and 63%-70% of these are above the Maximum Residue Limit (MRL). Mitigation All the fruit and vegetable sample should be checked and verified. They must be brought in the Residue Limit.				
6.	Pesticide residues also found in irrigation and drinking	Pesticide residues also found in irrigation and drinking water cotton seed, oil, lint and cattle feed, cottonseed cake,				

S: No	Intervention Activity	Type of Activity		Mitigation Assessment		
		Environment Based	Social Based	Yes	No	Remarks
	water	animal milk, and soil. Mitigation Regular water sampling should be made to check the toxicity level in the water testing lab: and to bring the water in the permissible level of guidelines				
7.	Toxic solid waste	Toxic waste generated in the result of pest empty container can produce the hazards for the people. Mitigation All the empty pest container must be incinerated (at high temperature) and certificate of incinerated items should be taken from authorized dealer.				

S: No	Intervention Activity	Type of Activity		Mitigation Assessment		
		Environment Based	Social Based	Yes	No	Remarks
		Waste disposal guidelines should be included in the design of the project. It will be ensured that no waste or left over construction material is left behind in the cultivation fields.				
8.	Soil and Water Contamination due to Fertilizers, pesticides and herbicides	The application of chemical inputs fertilizers, pesticides, and herbicides can potentially cause soil and water contamination, having negative impacts on people, as well as on natural flora and fauna. Mitigation Use of the chemical inputs and use of alternate techniques (such as integrated pest				

S: No	Intervention Activity	Type of Activity		Mitigation Assessment		
		Environment Based	Social Based	Yes	No	Remarks
		management, using disease-resistant seeds, and mulching) will be promoted through awareness raising and capacity building initiatives				
9.	Safety Hazards and Public Health	Improper handling of pesticides and herbicides exposes the farm labor to hazardous and toxic substances. Mitigation All the safety standared including the ISO 9000 and ISO 14000 should be followed.	—			
10.	Pesticide Residue Testing	Pesticide residues are very injurious to the human health, specially the workers who are engaged				

S: No	Intervention Activity	Type of Activity		Mitigation Assessment		
		Environment Based	Social Based	Yes	No	Remarks
		in this practice. Mitigation Pesticide residue testing will be made one a year for 10% of the farmers who have received training in IPM. Control sample will also be taken for crops where farmers did not receive any training. For the sake of validity both results of the concerned staff will be compared.				

Chapter 9

Environmental and Social Management Plan

This Chapter presents the Environmental and Social Management Plan (ESMP) of the proposed project.

9.1 ESMP Objectives

The ESMP aims to provide the implementation mechanism for the mitigation and control measures for the potential impacts of the project on environment and people discussed in Chapter 8. The specific objectives of the ESMP include the following:

- To provide a mechanism to implement the mitigation and control measures identified during the present ESA.
- To propose institutional arrangements to implement the above-mentioned mitigation and control measures
- To define environmental monitoring requirements to ensure effective implementation of the mitigation and control measures.
- To identify capacity building needs with respect to the environmental and social aspects of the project.
- To specify the documentation requirements with respect to the ESMP implementation.

9.2 ESMP Components

In line with the ESMP objectives presented in Section 8.1 above, the key elements of the ESMP include the following:

- Institutional setup Environmental and social guidelines,
- Monitoring mechanism,
- Environmental and social trainings,
- Grievance redressal mechanism,

- Documentation and reporting system.

9.3 Overall Project Implementation Arrangements

Project Policy Committee (PPC)

This committee will provide planning and strategic guidance for project implementation as well as facilitate inter agency coordination at the highest level. The PPC would be chaired by Additional Chief Secretary P&DD Sindh with Secretaries of Agriculture, Irrigation, and Finance Department, Director General Agriculture Engineering and Water Management (DG AE&WM) Sindh as its member and PD PIU as member /secretary of the PPC. The PPC would initially meet quarterly but once the project would have set its pace, it may hold its meetings twice a year or when needed. The major functions to be performed by the PPC would be, inter alia, as follows.

- Make policy decisions for smooth project execution
- Ensure coordination among all stakeholders
- Arrange bridge financing for local resources during any financial constraint from donors
- Constitute committee/s for resolving any policy related issue
- Can modify implementation mechanism for project interventions
- Resolve issues for smooth implementation of envisaged activities

Project Steering Committee (PSC)

The project steering committee (PSC) would be chaired by Secretary Agriculture, Government of the Sindh with Director General Agriculture Engineering and Water Management (DG AE&WM) Sindh; Project Director Project Implementation Unit (PIU), Chief (Agriculture) Pⅅ Representative from Finance Department; Additional Secretary (Tech.), Agriculture Department, and Director OFWM (Upper & Lower Sindh) as its members. The Director OFWM (lower Sindh) will act as member secretary. The PSC would meet bi-monthly or as and when required to review the physical and financial progress as well as to suggest means to overcome the constraints/bottlenecks faced in the field for execution of project activities. The major functions of PSC would be as follows.

- Approve annual work plan and streamline flow of funds
- Monitor physical and financial progress

- Approve the criteria for selection of beneficiaries under various project components
- To device strategies to resolve the problem identified by the Project Implementation Committee.
- Review monitoring reports and take appropriate actions
- Formulate committee/s to resolve specific issues relating to civil works, unspent funds, rates of construction materials, and make recommendations for decision by the PPC
- Ensure implementation of decisions of Project Policy Committee.
- Review Audit Reports for smooth running of financial management.
- Review subsidy slabs/financial assistance level as recommended by the PIC and to approve modifications for smooth implementation of project activities.

Project Implementation Committee (PIC).

The Project Implementation Committee (PIC) would be chaired by Director General Agriculture Engineering and Water Management, Project Director-Project Implementation Unit and Deputy Director Coordination as members. The Deputy Director coordination will be secretary of PIC. The PIC would be responsible to:

- Ensure implementation of decisions of PPC/PSC.
- Review physical & financial progress.
- Facilitate PIU for smooth execution of project.
- Approval of the recommendations forward by the PIU for selection of all the incremental staff required.
- Approval of Procurement of Goods, Works and Services, recommended by PIU in accordance with the procurement guidelines of World Bank.
- Approve work plan (targets, financial requirements etc.) for awareness, irrigation demonstration sites, pilot testing, research activities, and trainings etc. on annual basis or as required for smooth execution of envisaged activities.
- Review subsidy slabs/financial assistance levels and furnish recommendations to the PSC for approval.

- Devise mechanism for transparent monitoring of project activities.

Project Implementation UInit (PIU)

Project Implementation Unit-PIU will be chaired by Project Director with Directors OFWM (Upper and Lower Sindh), Procurement Specialist, HEIS Specialist, M&E Specialist, Agriculture Specialist, Team Leaders of Project Implementation Supervision Consultants (PISCs) and Monitoring & Evaluation (M&E) Consultants as members. Director OFWM (Upper Sindh) would act as Secretary of the committee. The PIU would meet every month to review the physical and financial progress as well as to suggest means to overcome the constraints faced in execution of project activities. The major functions of PIU would be as follows:

- Selection of Project Implementation & Supervisory Consultants.
- Selection of Monitoring and Evaluation Consultants.
- Selection of Training Consultants.
- Recommendations for selection of all the incremental staff required.
- Prepare annual work plan.
- Review physical and financial progress.
- Coordinate and supervise the project activities.
- Ensure implementation of decisions of Project Implementation Committee.
- Formulate mechanism for effective monitoring of project activities.
- Review the monitoring reports and rectification of the shortfalls.

Implementation Supervision Consultants (ISC). The project implementation supervision consultants (ISCs) would be selected through an international selection process under Component D. They would report to DG, OFWM and check the implementation program, quality of works, delivery of works, and certify the quantities of work carried out and the payments. They would also help the DG, OFWM in project planning and management, quarterly progress reporting, procurement planning, financial management, and overall project management.

Monitoring and Evaluation (M&E), Technical Assistance and Training Consultants (TATC)

The M&E would help in:

(a) Monitoring physical progress;

(b) Monitoring and evaluation of the project impacts;

(c) Supervision of the environment and social issues as well as the environmental and social management plans.

The TATCs would provide technical assistance and training to the service providers for the HEIS and precision land leveling, extension services to individual farmers, and watercourse associations.

9.4 Institutional Setup and Responsibilities Regarding Environmental and Social Activates

A specific Project Implementation Unit (PIU) encompassing all appropriate expertise and a Project Director (PD) within the Directorate General Agriculture Engineering & Water Management (DG,AEWM) would be responsible for implementation of the Project.

Appointment of Senior Envrironmental and Social Specialist (ES)

The DG,AEWM will appoint a dedicated "Senior Environmental and Social Specialist" (ES) for the proposed project at the provincial level. The ES will ensure the effective implementation of ESMP throughout the project implementation. S/he will also maintain liaison and coordination with the Water Management Officers (WMOs). Water Management Officers will report to Deputy Director (DD). Water Management Officers (WMOs) will compile the Environmental and Social data in the field. The WMOs will in turn supervise and coordinate with the Water Courses Associations (WCAs) and farmers for the actual implementation of the environmental and social guidelines and other Environmental & Social Management Plan (ESMP) requirements during the project implementation.

Implementation and Supervision Consultant (ISC)

The Project "Implementation and Supervision Consultant" (ISC) reporting to Project Director / DG,AEWM, will be responsible for the implementation of Environmental & Social Management Plan (ESMP), while Technical Assistance and Training Consultant (TATC) will be responsible for monitoring and evaluating the ESMP. The TATC will be responsible to provide Technical Assistance and Training to the service provider for the High Efficiency Irrigation System (HEIS)

and precies land leveling, extension services to individual farmers, and Water Course Association (WCAs). The department will ensure compliance with mitigation measures with support from the implementation and supervision consultant.

9.5 Environmental and Social Guidelines

Guidelines have been prepared for the different types of interventions included in the proposed project. These guidelines have essentially been prepared on the basis of the mitigation measures discussed in Chapter 8 including the two check lists: "Check List for Interventions & Mitigation Assessments" and "Check List for Integrated Pest Management & Mitigation Assessments". These guidelines will be made part of the agreements to be signed for each scheme under the proposed project.

9.6 Environmental and Social Monitoring

The purpose of the environmental and social monitoring is to ensure the effective implementation of the Environmental and Social Management Plan (ESMP).

The monitoring will be carried out at two tiers. At the first tier, the Water Management Officers (WMOs) will carry out monitoring during their routine visits to the field, with the help of visual observations and discussions with the farmers/WCAs.

At the second tier, the Environmental Specialist (ES) will provide top supervision of the monitoring carried out by the WMOs, with the help of spot checks during their field visits. **The monitoring will be done after each quarter.**

(a) Third Party Monitoring & Evaluation

The Monitoring and Evaluation Consultants (M&E) will carry out a biennial Third Party Validation (TPV) of Environmental Impact Assesment. The TPV will not only assess the compliance with the EIA but the performance of the document in ensuring compliance with Bank safeguards policies.

Post Implementation

The consultant will also be responsible for establishing continued M&E indicators during and post implementation period until project impact attained to full developed level, and to provide training to the counterpart department staff to be able to carry out on their own after demobilization of the consultants upon completion of the project.

(b) Monitoring and Evaluation Validation

The institutional arrangements shall include recruitment of a "Senior Environment and Social Specialist" (ES) be the member of Project Implementation Committee (PIC). In addition, independent Validation shall be carried out after every T**wo Years** by indipendent consultant to asses EIA implementation. Quarterly Progress Reports (QPR) shall be prepared and submitted by the PIC to the Bank for review.

9.7 Environmental and Social "Trainings and Awareness"

The objectives of the environmental and social trainings include providing basic knowledge and information on the key environmental and social issues associated with the proposed interventions to the key project personnel including Water Management Officers (WMOs). The awareness initiatives on the other hand are essentially, meant for the WCA members and farmers participating in the proposed project. The Environmental Specialist (ES) will provide the training to the WMOs.

9.8 Grievance Redressal Mechanism

The grievance redressal and dispute resolution mechanism is built in the Water Courses Associations (WCAs).

9.9 Documentation and Reporting

Complete documentation will be maintained for the entire Environmental Social Management Plan (ESMP) implementation process, which includes Environmental and social checklist.

Environmental and Social Checklist

Environmental and Social Checklist will be filled by the WCAs/farmers, Water Management Officers (WMOs). Visit reports with photographs will be prepared by the WMOs for further submitted to Deputy Director/Senior Environmental Specialist. Quarterly Progress Reports (QPR) shall be prepared and submitted by the Project Implementation Committee (PIC) to the Bank for review. Third Party Validation (TPV) shall be carried out after every T**wo Years** by independent consultant to asses EIA implementation.

The Senior Environmental Social Specialist (ES) will be overall responsible for the above documentation and reporting.

9.10 ESMP Implementation

The successful implementation of the "Environmental and Social Management Framework" (ESMF) depends on the commitment of the Government of Sindh and related departments/institutions, the capacity within the departments/institutions and the appropriate and functional institutional arrangements among others. The key ESMF implementation areas and the relevant institutional roles as well as the institutional arrangement and collaboration for successful implementation of the ESMF of the proposed project have been determined and outlined. The Environmental and Social Monitoring and reporting roles and responsibilities within institutions and among the stakeholders have been mapped out.

9.11 Environmental and Social Monitoring and Reporting

Monitoring is a key component of Environmental Social Impacts during project implementation. Monitoring should be undertaken at implementation phase to verify the effectiveness of impact management including the extent to which mitigation measures are successfully implemented. Monitoring should involve three areas namely:

- Compliance monitoring
- Impact monitoring
- Cumulative impact monitoring

The objective of compliance monitoring is to verify the required mitigation measures accourding to the EPA rules. The project implementing authorities is the main environmental regulators. The objective of impact monitoring is to monitor the Environmental and Social safeguards given to the contractor in contract specifications. Cumulative impact monitoring is to monitor the impacts of the project for which Environmental Assessment has been conducted in the area of influence of the project with consideration to other developments.

The regional offices shall be responsible for ensuring that the checklist in table 8.2 is filled at the start of each intervention, at the completion of civil works and once during implementation of intervention. The senior environment and social specialist of the PIU will compile the non-compliances as reported in the checklists for the quarter and report a summary in the quarterly environmental progress report.

9.12 Institutional Capacity for ESMF Implementation

Environmental Social Management Framework (ESMF) provides the environmental and safeguards for the project and its successful implementation will depend largely on the key stakeholder institutions. This will ensue that the activities of the project are undertaken with due regard for the integrity of the resources to be affected by the project development activities. The roles of major stakeholders are identified in an institutional role identification matrix in which the various components of the project were matched with the institutions which have jurisdiction in the areas of licensing, permitting, assessment, monitoring, etc.

The main institutions to implement and monitor the project and to ensure sound management of the environmental and social aspects include:

- Agriculture Department, Government of Sindh
- Directorate General, Agriculture Engineering & Water Management Sindh.

The capacity building consultant shall also be responsible for developing curricula for health and safety, sanitary, waste handling and disposal and other civic functions and the farmers shall receive training in various aspects of health and safety.

9.13 Capacity Building requirements

Capacity building will be required to implement the recommendations outlined in the Environmental Social Management Framework (ESMF). Implementing actors and field staff will require training in project activities proposed in the feasibility and later on the project especially environmental screening, Environmental Management Plan preparation as well as some other mitigation measures. In addition, it will be essential to build awareness and knowledge in all aspects of the environment among the all stakeholders and institutions involved in execution of the project activities.

During the initial period of the project implementation, a capacity building plan would be prepared by the project authorities describing the capacity building to be provided on Environmental Management process and selected topics on environmental protection. The cost for the training of field staff, water management officers (WMOs), ES and other relavent staff is estimated to be reupees 24.0 millions @0.5 million per training. Forty eight trainings will be provided.

The topics for capacity building in environmental management process and protection are as under:

- Review of environmental and social management process
- Review of the ESMF
- Classification of project activities
- How to prepare EMPs
- How to measure cumulative adverse impacts
- Design of appropriate mitigation measures
- How to monitor mitigation measures
- How to embed the environmental management process into the civil contracts

The topics on environmental protection will also include:

- Integrated Pest Management
- Safe Management of Pesticides
- Management of Herbicides and Fertilizers

The estimated cost for Laboratory Tests including; Pathalogy Labs Test, Water Testing Labs, Pesticide Residue Testing, Incineration Charges of Empty Pesticide Containors is 16.0 millions.

9.14 ESMP Implementation Budget

The cost of ESMP implementation over the project duration of six years has been estimated to be Rs. 40.8 million. This cost includes the personnel cost, third party evaluation, training and laboratory tests with some miscellaneous expenses. It is proposed that the Third Party Validation of the ESMP implementation be done by the Project Monitoring & Evaluation Consultants. The scope and cost for this validation has been included under the relevant head in the main Feasibility Reort. The breakdown of this estimate is provided below:

ESMP Implementation Budget

Description	Appx. Cost (Pak Rs.)	Notes/basis
• **Personnel cost** Environmental and Social Consultant (ESC)	---	No additional manpower is needed. Cost is included in the Feasibility Report.
• **Third Party Validation**		To be done by the Monitoring & Evaluation Consultants
• **Trainings** Field staff, WMOs, ES	24.0 million	@ PKR 500,000 per training; No. of Trainings: 48
• **Laboratory Tests** Pathalogy Test, Water Testing , Pesticide Residue Testing, Incineration Charges of Empty Pesticide Containors	16.0 million	1.5 m/year
• Miscellaneous expensive	0.8 million	
Total (for 6 years)	**40.8 million**	

Note: No. & frequency of the tests depends upon the sickness occuranc, No. of Empty Pesticide Containors & severity of the contaminated water.

9.15 Activity Plan of Environmental Issues and Mitigations

Table.9.1 ACTIVITY PLAN OF ENVIRONMENTAL ISSUES AND MITIGATION

S. No.	Sources	Potential Issue	Mitigation Measure	Responsibility		
				Implementation	Supervision	Monitoring
A.	**Water Courses**					
1.	(Watercourse improvement) Land Use, Landform, Land Take and cutting of trees.	While improving the watercourses re-alignment of land required, causing change of land and land use.	The land under the watercourse is generally owned by the water users, who greatly benefit from the watercourse improvement, and therefore willingly donate the land. If trees are to be cut for any scheme in a vacant area, the farmer/scheme beneficiary will carry out compensatory plantation of appropriate indigenous tree with the ratio 1:4.	Water management Officers (WMOs), A/E	Senior Environmental & Social Specialist	Project Director / DG,AEWM Project Implementation Unit (PIU)

S. No.	Sources	Potential Issue	Mitigation Measure	Responsibility		
				Implementation	Supervision	Monitoring
2.	Clogging of Water Courses	Improper maintenance of water courses can potentially cause silting and clogging of these channels, thus reducing the irrigation efficiency and water availability.	The WCAs will play an important role in maintaining the water courses in good condition.	Water management Officers (WMOs), A/E	Senior Environmental & Social Specialist	Project Director / DG,AEWM Project Implementation Unit (PIU)
3.	Damage to Infrastructure	Construction works can potentially damage the local infrastructure.	The WCA will ensure that any infrastructure such as culverts damaged during the construction works is restored to same or better condition.	Water management Officers (WMOs), A/E	Senior Environmental & Social Specialist	Project Director / DG,AEWM Project Implementation Unit (PIU)
4.	Washing of cloths in the lined area of the watercourse	Pollution of Irrigation Water by detergents and soaps	Washing bays to be designed as part of watercourses rehabilitation works and execution be ensured	Water management Officers (WMOs), A/E	Senior Environmental & Social Specialist	Project Director / DG,AEWM Project Implementation Unit (PIU)

S. No.	Sources	Potential Issue	Mitigation Measure	Responsibility		
				Implementation	Supervision	Monitoring
5.	Reduced Groundwater Recharge	The water course lining while conserving water by reducing the water seepage from the water courses can also potentially reduce the groundwater recharge	Design criteria adopted by the Department are to limit the water course lining to 30 percent in the areas with fresh groundwater.	Water management Officers (WMOs), A/E	Senior Environmental & Social Specialist	Project Director / DG,AEWM Project Implementation Unit (PIU)
B.	**High Efficiency Irrigation System**					
6.	High Efficiency Irrigation System	Construction Intervention can disturb the population, soil, trees and can produce waste of construction material along with the high noise level of heavy.	Proper disposal of constructional material should be made. Noise level should be kept within 70 db.	Water management Officers (WMOs), A/E	Senior Environmental & Social Specialist	Project Director / DG,AEWM Project Implementation Unit (PIU)
7.	Laser land leveling.	These interventions will generally be implemented in the existing cultivation fields During laser land leveling, may be trees are to be cut.	If trees are to be cut for any scheme in a vacant area, the farmer/scheme beneficiary will carry out compensatory plantation of appropriate indigenous tree with the ratio 1:4	Water management Officers (WMOs), A/E	Senior Environmental & Social Specialist	Project Director / DG,AEWM Project Implementation Unit (PIU)
C.	**Emergency Community Flood Shelter**					

S. No.	Sources	Potential Issue	Mitigation Measure	Responsibility		
				Implementation	Supervision	Monitoring
8.	Emergency Community Flood Shelters	Farmer community flood shelter can be used for multipurpose activities during off-flood period but it may cause some negative impact due to constructional work, waste management and social activities	Local community people should be involved to use the emergency community flood shelters. Solid waste generated should be collected ia a begs and be diposed of in the incinerator.	Water management Officers (WMOs), A/E	Senior Environmental & Social Specialist	Project Director / DG,AEWM Project Implementation Unit (PIU)
D.	**Ecology**					
9.	Loss of Precious Ecological Values	The project interventions can potentially cause loss of precious ecological assets if they are inappropriately located and encroach into forests/swamplands or historical/cultural buildings/areas, disrupt hydrology of natural waterways, regional flooding, and drainage hazards.	The mitigation measures described in above will address the potential issues associated with the loss of precious ecological values.	Water management Officers (WMOs), A/E	Senior Environmental & Social Specialist	Project Director / DG,AEWM Project Implementation Unit (PIU)

S. No.	Sources	Potential Issue	Mitigation Measure	Responsibility		
				Implementation	Supervision	Monitoring
10.	Soil Erosion and Topography	Project may involve constructing works of water source . Improper location/construction can potentially cause soil erosion/subsidence. Additionally, the surplus soil if inappropriately disposed can potentially cause blocked drainage, loss of cultivable land, and associated issues.	During the water course improvement works, earthen channels will not be left un-compacted for long durations. The soil excavated and silt removed during the water course improvement works will be disposed appropriately, ensuring that it is not dumped in the cultivation fields, and does not block the water courses, drains, or local routes.	Water management Officers (WMOs), A/E	Senior Environmental & Social Specialist	Project Director / DG,AEWM Project Implementation Unit (PIU)
11.	Loss of Soil Productivity	The flood irrigation helps in leaching of salts present in the irrigation water particularly when groundwater is used from the soil thus avoiding salt build up in the crop root zone.	Soil analyses should be carried out in the fields using high efficiency irrigation systems to detect any salt build up in the crop root zone. Soil testing should be carried out for soil build up prior to start of use of High Efficiency Irrigation System	Water management Officers (WMOs), A/E	Senior Environmental & Social Specialist	Project Director / DG,AEWM Project Implementation Unit (PIU)

S. No.	Sources	Potential Issue	Mitigation Measure	Responsibility		
				Implementation	Supervision	Monitoring
			and should be conducted at a biennial basis.			
12.	Impacts on Natural Flora and Fauna	Natural flora and fauna can potentially be negatively impacted by the proposed interventions. Use of excessive chemical inputs causing soil and water contamination, can potentially harm natural vegetation, beneficial insects, birds, and other faunal species. Trees may need to be cut to undertake the improvement of watercourses particularly its realignment.	Use of the chemical inputs and use of alternate techniques (such as integrated pest management and using disease-resistant seeds) will be promoted through awareness raising and capacity building initiatives. Trees thus planted should be at least three times the number of trees cut for establishing the project.	Water management Officers (WMOs), A/E	Senior Environmental & Social Specialist	Project Director / DG,AEWM Project Managemet Unit (PMU)
E.	**Field Irrigation Practices**					
13.	Conflicts in Water Supply Rights	Increased irrigation water availability as a result of water course improvement and/or adopting high efficiency irrigation techniques can	Conflict avoidance and resolution are some of the key functions of the WCAs. The social mobilization and capacity building components	Water management Officers (WMOs), A/E	Senior Environmental & Social Specialist	Project Director / DG,AEWM Project Implementation

S. No.	Sources	Potential Issue	Mitigation Measure	Responsibility		
				Implementation	Supervision	Monitoring
		potentially cause local conflicts among the communities.	of the project will address formulation and sustainability of the WCAs.			Unit (PIU)
14.	Disruption of Local Routes	During the construction activities of the project, local routes can potentially be blocked adversely affecting the local communities and their livestock.	The design of water course improvement will include culverts at appropriate locations. Any disruption of local routes will be minimized through astute planning. Any temporary blocking of local routes will be discussed in WCA meeting and agreement reached considering.	Water management Officers (WMOs), A/E	Senior Environmental & Social Specialist	Project Director / DG,AEWM Project Implementation Unit (PIU)

S. No.	Sources	Potential Issue	Mitigation Measure	Responsibility		
				Implementation	Supervision	Monitoring
15.	Impacts on Women, Children, Vulnerable Groups, and Indigenous People	The project interventions will generally benefit the land owners and growers, however, these interventions are unlikely to negatively affect vulnerable groups such as poor, women and children.	No discrimination with respect to religion, caste, gender, or association with any social group will be practiced while selecting the project beneficiaries.	Water management Officers (WMOs), A/E	Senior Environmental & Social Specialist	Project Director / DG,AEWM Project Implementation Unit (PIU)
16.	Water Consumption and Availability of Water in Downstream Areas	With the implementation of the proposed interventions, the water consumption generally reduces, thus allowing more area to be irrigated with the same amount of water available. Water consumption involving new area to be brought under cultivation, may potentially affect other water users.	It will be ensured that any new area development does not negatively affect downstream water users. The water saved through the project interventions should be used to address the water stress and/or to bring the fallow land under cultivation.	Water management Officers (WMOs), A/E	Senior Environmental & Social Specialist	Project Director / DG,AEWM Project Implementation Unit (PIU)
F.	**Hazards**					

S. No.	Sources	Potential Issue	Mitigation Measure	Responsibility		
				Implementation	Supervision	Monitoring
17.	Noise and Vibration	The activities under the proposed interventions, such as laser land leveling, will cause some noise and vibration	Noise will not be in excess to what is normally generated in a cultivation field/farm during the routine cultivation activities so no mitigations measure required.	Water management Officers (WMOs), A/E	Senior Environmental & Social Specialist	Project Director / DG,AEWM Project Implementation Unit (PIU)
18.	Air Quality	Air quality deterioration in and around the farms participating in the proposed project can potentially be caused by: Increased use of chemical inputs, since certain volatile substances can become airborne; Use of diesel engines/tractors for water pumps and laser land leveling; Dust emissions from excavation and other construction works.	Use of the chemical inputs and use of alternate techniques (such as integrated pest management and using disease-resistant seeds) will be promoted through awareness raising and capacity building initiatives. Keeping the tractors and diesel engines properly tuned and in good working condition using proper fuel.	Water management Officers (WMOs), A/E	Senior Environmental & Social Specialist	Project Director / DG,AEWM Project Implementation Unit (PIU)
19.	Water Borne and Water-related Diseases (Capacity	Construction and operation can potentially cause water borne and water-related diseases. Stored water can provide	The capacity building component of the project will address the importance of safe drinking water and hygienic	Water management Officers (WMOs), A/E	Senior Environmental & Social Specialist	Project Director / DG,AEWM Project Implementation

S. No.	Sources	Potential Issue	Mitigation Measure	Responsibility		
				Implementation	Supervision	Monitoring
	Building)	breeding areas for mosquitoes, potentially causing malaria and dengue.	practices, thus addressing the water borne diseases. The capacity building program will also address the avoidance and cure of water-related diseases. In particular, ways and means to avoid malaria and dengue will be disseminated to the communities.			Unit (PIU)

9.16 Activity Plan of Interventions of Integrated Pest Management

Table.9.2 Activity Plan of Interventions of Integrated Pest Management

S. No.	Sources	Potential Issue	Mitigation Measure	Responsibility		
				Implementation	Supervision	Monitoring
1.	Pesticide use is widely practiced in Sindh	Intended to assist farmers in getting rid of pests, extended and indiscriminate has resulted in pest outbreaks as well as negative effects on people working in the agricultural fields and the surrounding environments.	All banned and unregistered (23) pest items must be avoided	Water management Officers (WMOs), A/E	Senior Environmental & Social Specialist	Project Director / DG,AEWM Project Implementation Unit (PIU)
2.	Sickness Incidence of Pesticide Applicators	Pesticide related sickness is very common in the cotton zone. Main reported ailments are vomiting, dizziness, and breathing problems.	Regular medical checkup should be made through the Government registered hospitals to assess the sickness incidence of pesticide applicators	Water management Officers (WMOs), A/E	Senior Environmental & Social Specialist	Project Director / DG,AEWM Project Implementation Unit (PIU)
3.	Sickness in Women Cotton Pickers	Variety of symptoms like headache, nausea, vomiting, skin irritation, general weakness, fever, dizziness,	protective apparatus and divices must be supplied to the cotton pickers. Regular medical check-ups are	Water management Officers (WMOs),	Senior Environmental & Social Specialist	Project Director / DG,AEWM Project

S. No.	Sources	Potential Issue	Mitigation Measure	Responsibility		
				Implementation	Supervision	Monitoring
		stomach pain, and blisters while picking the cotton during the season.	recommended during the cotton season	A/E		Implementation Unit (PIU)
4.	Industrial Worker Poisoning	Labour force, working in the pesticide plants report sickness by inhaling pesticide emissions	Awareness program should be conducted to avoid the inhaling pesticide emissions regular medical check-ups are recommended during the season	Water management Officers (WMOs), A/E	Senior Environmental & Social Specialist	Project Director / DG,AEWM Project Implementation Unit (PIU)
5.	Pesticide Residue in Food Chain	Fruits and vegetables are contaminated with pesticide residues to the extent of 40% and 63%-70% of these are above the Maximum Residue Limit (MRL).	All the fruit and vegetable sample should be checked and verified. They must be brought in the Residue Limit.	Water management Officers (WMOs), A/E	Senior Environmental & Social Specialist	Project Director / DG,AEWM Project Implementation Unit (PIU)
6.	Pesticide residues also found in irrigation and drinking water	Pesticide residues also found in irrigation and drinking water cotton seed, oil, lint and cattle feed, cottonseed cake, animal milk, and soil.	Regular water sampling should be made to check the toxicity level in the water testing lab: and to bring the water in the permissible level of guidelines.	Water management Officers (WMOs), A/E	Senior Environmental & Social Specialist	Project Director / DG,AEWM Project Implementation Unit (PIU)
7.	Toxic solid waste	Toxic waste generated in the result of pest empty container	All the empty pest container must be incinerated (at high	Water management	Senior Environmental &	Project Director /

S. No.	Sources	Potential Issue	Mitigation Measure	Responsibility		
				Implementation	Supervision	Monitoring
		can produce the hazards for the people.	temperature) and certificate of incinerated items should be taken from authorized dealer. Waste disposal guidelines should be included in the design of the project. It will be ensured that no waste or left over construction material is left behind in the cultivation fields.	Officers (WMOs), A/E	Social Specialist	DG,AEWM Project Implementation Unit (PIU)
8.	Soil and Water Contamination due to Fertilizers, pesticides and herbicides	The application of chemical inputs fertilizers, pesticides, and herbicides can potentially cause soil and water contamination, having negative impacts on people, as well as on natural flora and fauna.	Use of the 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	Water management Officers (WMOs), A/E	Senior Environmental & Social Specialist	Project Director / DG,AEWM Project Implementation Unit (PIU)
9.	Safety Hazards and Public Health	Improper handling of pesticides and herbicides exposes the farm labor to hazardous and toxic substances.	All the safety standared including the ISO 9000 and ISO 14000 should be maintained.	Water management Officers (WMOs), A/E	Senior Environmental & Social Specialist	Project Director / DG,AEWM Project Implementation Unit (PIU)

S. No.	Sources	Potential Issue	Mitigation Measure	Responsibility		
				Implementation	Supervision	Monitoring
10.	Pesticide Residue Testing	Pesticide residues are very injurious to the human health, specially the workers who are engaged in this practice.	Mitigation Pesticide residue testing will be made one a year for 10% of the farmers who have received training in IPM. Control sample will also be taken for crops where farmers did not receive any training. For the sake of validity both results of the concerned staff will be compared.	Water management Officers (WMOs), A/E	Senior Environmental & Social Specialist	Project Director / DG,AEWM Project Implementation Unit (PIU)

Chapter 10

Conclusions

The Government of Sindh, through its Agriculture Department and Agricultural Engineering and Water Management Wing has planned to up-scale its earlier OFWM projects and undertake the "Sindh Irrigated Agriculture Productivity Enhancement Project" (SIAPEP) in 24 districts of the Province by seeking the World Bank assistance for this purpose. Under above projects 29,480 water courses WCs have been improved and the remaining 17,276 will be improved. According to the previous studies, watercourses improvements have repeatedly shown to yield an economic rate of return of more than 25 percent, and benefits to laser land leveling and irrigation are even higher. Similarly with the implementation of this project, water courses will be improved, high efficiency irrigation systems (HIES) typically will reduce input costs, increase yields, lower irrigation labor, diversify cropping patterns, and will save water.

Under the Component A community water infrastructure improvement will be made. This will help community watercourse improvement and mitigating flood risk for the poors. Component B will promote high efficiency irrigation systems for small and medium-sized HEISs including 2 ha (5 acres), 4 ha (10 Acres) and 10 ha (25 Acres) farms. Small HEIS kits provided for schools and individual households will improve the irrigation systems. Component C will help community improved agriculture practices with laser land leveling, deep ripping and improved agriculture production technology. Component D will help project management, technical assistance (TA), training, studies, monitoring and evaluation with detailed design and construction supervision support consultants, monitoring and evaluation (M&E) of project impact assessment consultants including training, studies and training project management & incremental operation costs

Environmental Assessment

In line with the prevailing operation and safeguard policies of World Bank an environmental assessment (EA) of the Project was carried out.

The main objectives of the Environmental Assessment were to review the state of the environment in the project area as an input to the decision- making process. It will also help to identify ways of environmentally improving the project by preventing, minimizing, mitigating or compensating any adverse impacts. In addition to the above objectives the scope for

Integrated Pest Management (IPM) has also been included. The scope of IPM work included the identification of all project activities that may decrease the usage of pesticides. The list of banned pesticides as indicated in World Bank OP 4.09 (WHO Class IA and IB pesticides) will help the farmers for improving their health. The training on IPM will help the stakeholder to adopt the relevant biological and environmental control methods. Pesticide residue testing will be made to check the health status of the farmers and community persons. Pesticides residue will be prescribed once a year for 10% of the farmers who have received training in IPM. Control sample will also be taken where farmers did not receive any training.

Stakeholder Consultations:

Eight Stakeholder consultations workshops in 24 districts of Sindh to access the Environmental & Social Assessment (ESA) were conducted. Meetings were held with the institutional stakeholders and key environmental and social issues were discussed. Extensive consultations at the grass root stakeholders were carried out during visits to the agricultural farms and fields in various parts of the Province. All the grievance comments and apprehend were documented. Some of the views of the stakeholders are summarized below;

- The capacity building and awareness program of farmers will be conducted.
- The tree cutting caused by the water course improvement will be compensated through plantation with ratio 1:4.
- Noise and Air Pollution generated by the Agriculture activities will be monitor.
- The lining of the water courses should be carried out by 30 percent.
- Laser land leveling will help the farmers for saving the water with enhancement of yield.
- The soil and water pollution caused by the left over plastic tubing and other parts for the drip/sprinkler irrigation system needs to be addressed.
- Washing of clothes on lined water courses resulting in pollution of irrigation water should be monitored.
- Heritage sites in the respective districts should be saved
- Protected areas in the respective districts should be saved
- Wild life in the respected areas should be saved
- Emergency Community Flood Shelters will help the farmers during any disaster

- Pesticide Residue in Food Chain must be monitored and verified through registered laboratories.
- Toxic solid waste generated due to pesticide empty container must be incinerated and verified.

Since our project does not fall uder the schedule I and schedule-II so no IEE or EIA was required but as per the operation policies of the World Bank the Environmental Assessment of the project must be done. Based upon the Environmental Assessment Study and as per the table 8.1 it is observed that most of our interventions fall under category -1 (Low negative impact), 0 (insignificant/ negligible impact) or having no impact (N). So it is concluded that neither IEE nor EIA is required for this project but the mitigation requirement is still required for some of the interventions. Extensive mitigation measures have been proposed, as well as institutional and capacity building measures to ensure that the mitigation measures are implemented. An EMP assigns responsibilities for implementation, monitoring and supervision of the mitigation measures. Once the EMP is implemented the residual environmental impacts are only expected to be positive.

Annexure - A

A. Integrated Pest Management Plan

1. Introduction

1.1 Pakistan is a federation of four provinces, including the Sindh – the province of immediate concern. Sindh is the second largest province of Pakistan in terms of population and the third in area. Sindh's population is about 44 million (24%) out of Pakistan's total of 184 million according to the latest estimates, and its area is about 14 million ha (18%) out of Pakistan's 80 million ha. Majority (51%) of Sindh's population lives in rural areas. The province's hinterland is the southern most part of the Indus valley and it harbors the largest city and the main seaport of the country - Karachi.

1.2 Sindh Province has 3.8 million ha cropped area of Pakistan's 22.4 million ha cropped area, representing 17 percent of country's total cropped area. About 30-35 percent of Sindh's population lives below poverty line, and a majority of the poor are rural. Landholding patterns in Sindh are highly skewed from national norms, with a median farm size of around 11.33 hectares, as compared with 2.83 hectares in Punjab. According to one estimate in 2005, wealthy landlords in Sindh, who held farms in excess of 100 acres and who accounted for less than 1 percent of all farmers in the province, owned 150 percent more land than the combined holdings of 62 percent of small farmers with landholding less than 5 acres. Large landowners dominate production of the four major crops in Sindh—rice, wheat, sugar cane, and cotton.

1.3 Government of Sindh with the assistance of the World Bank have agreed to lauch a project titled, "Sindh Irrigated Agriculture Productivity Enhancement Project (SIAPEP)" over a period of 6 years. The proposed project is an important element of the Government and the Bank's strategy in the water and agriculture sector for Sindh, supporting a systemic infrastructure rehabilitation/modernization, improved service delivery in a socially and environmentally sustainable manner to support the long-term goal of food security and sustainable economic growth. The project supports efficient management of scarce water resources and is designed to augment adaptation under different climate change scenarios. Most of the project interventions are well tested and demand driven, with reasonable co-financing from beneficiary farmers. They are low risk, low cost, and yield high economic and financial returns. The project will also generate substantial social as well as economic benefits. These include enhanced equity in water distribution between tail and head users in watercourse

command area, increased participation by farmers, and cooperation that leads to improved O&M of the system. It generates jobs, provides flood shelters/community centers for mitigating flood risk, and strengthens social cohesion.

The project development objective is to improve water and agriculture productivity for small and medium size farmers in Sindh. This will be achieved through improved water delivery mechanism and irrigation and agronomic practices. Progress towards achieving the development objectives will be measured through the following key performance indicators: (a) increase in watercourse conveyance efficiency by 10%, (b) increase in cropping intensity by 20% (water courses) and 60% (high-efficiency irrigation systems); and (c) increase in crop yields by 10% (water courses) and 20% (high-efficiency irrigation systems).

The project is expected to be the first phase of a long-term (15-18 year) program for improvement of on-farm water management and agricultural practices in Sindh to be implemented over the entire agriculture areas of Sindh. The project includes four components, as described below.

1.4 An integrated social and environment assessment (ISEA) for the previously implemented Sindh On=farm Water Management (SOWM) was prepared in greater details.As the overall impacts of the SOWMP on the environment were expected to be positive and accordingly SOFWMPwas classified it as a category B project under its operational policies (OP 4.01), the same category has also been proposed for the SIAPEP due to interventions of watercourses improvement and agronomic practices which also includes use of pesticides. As also, the preparation of an Environmental Management Plan (EMP) was mandated (OP 4.01 - Appendix C), and the EMP recommended measures to mitigate possible adverse impacts on the environment, including the potential induced impacts of increased pesticide use, a Pest Management Plan (PMP) was prepared in compliance of the Bank's procedures (BP 4.01 - Appendix C), and had formed a part of the EMP; this PMP is being used as a basic document from which a shorter but updated version of the PMP has been prepared. It is mentioned at the outset that the PMP does not recommend procurement of any pest control products or methods nor does the project envisage any such procurement. The PMP included pilot IPMP projects and pesticide residue tests to see the effectiveness of PMP in reducing pesticide residue in worker blood, cattle milk and produce.

2. Current Pest and Pesticide Management Approaches

2.1 The pest problems first emerged with the introduction of high yielding and fertilizer responsive crop varieties in the country in the decade of 60s and 70s. For example, the introduction of delta pine cotton, IRRI – 6 rice, and Mexican wheat varieties brought in their wake pests which caused colossal damage to crops. In the late 50s, plans were conceived to spot spray the diseased crops.

Various crop rotations are in vogue in different parts of Sindh; rotation mostly practiced is wheat-cotton in upper Sindh on the left bank of the Indus river canal command area, while in the southern parts, it is rice-wheat and sugarcane. Considerable area around large towns is

planted with vegetables while fruit orchards (mainly mango and banana) are scattered all over. Floriculture is also getting popular to meet the demands of the Karachi city.

Main Agricultural Pests/Diseases by Crop

2.2: Major Field Cops. In Sindh, ground plant protection measures (mostly pesticide sprays) are employed on 24% of the cropped area of all field crops including vegetables and orchards as compared to 21% on the national basis. However, plant protection on cotton and sugarcane account for 69% and 15% respectively of their cropped area in the province. Pests/diseases on these crops are amply mentioned in the comprehensive PMP for SOFWM. However, these two crops are relevant under the SIAPEP. Incase of rice, 28% of the cropped area in Sindh is sprayed with pesticides. Stem borers and white backed plant hopper (*Sogatellafurcifera*) are the main pests of the rice crop. The diseases caused include: leaf blight, brown leaf spot, stem rot, and smuts.

Crop Losses

2.3 Reliable data on crop losses due to insect pests and diseases is generally not available. Various reports in the public sector archives put losses in crop production due to insects at 20-30%. The first incidence of white backed plant hopper as a major pest in 1976 caused losses of up to 60% paddy yield in Sindh.

2.4 Post-harvest losses (PHL) are significant in the case of grain cereals: for example, wheat and rice which are stored for long durations, the national average storage loss is estimated at 3.5% over a period of 5 months and could be as high as 15% if stored for 2-3 years. According to some informal estimates, PHL in Sindh could be as high as 35%in the case of dates, 15% in the case of onions and chilies. Alflatoxin contamination is reported to affect80% of the chili crop.

Pesticide Use

2.5 The use of pesticides have steadily increased in the countryfrom about 250 metric tons (MT) in the mid 1950s, to about 670 MT in 1980 when pesticide business was transferred to the private sector. Pesticides consumption was 3,672 MT in 1981, 20,213 MT in 1991, and 47,592 MT in 2001. It kept on increasing until the middle of first decade of the 21st century (129,598 MT in 2004), but started declining persistently (105,164 MT in 2005), albeit with fluctuating consumption thereafter. In 2008, the consumption of pesticides was reported at 39,186 MT; in 2009 it was 40,643 MT but jumped to 73,632 MT in 2010.

2.6 On the basis of three-years moving averages of the pesticide use in the country, the decline in the use of pesticides from 2005 to 2010 has been considerable; from 104,298 MT to

51,557 MT respectively at an annual decline rate of 12.9%. Prior to this period, the pesticide use had increased at an annual rate of 14.5% from 1992 to 2005. Cotton is the singular largest crop whereupon pesticide use is the highest; 51% of the entire cropped area for all crops in 2000, 64% in 2005, 55% in 20102 and 47% in 2011. In Sindh also, cotton accounted for about 50% but dropped to 32% in 2000, increased to 83% in 2005 and steadily came down to 60% in the years of 2010 and 2011. The latest figures of these recent years show that fruits and vegetables account for 21-22% of all cropped areas in Sindh (more or less similar to the national average usage of 15-22% on fruits and vegetables). However, a striking difference is that in 2000, Sindh's fruits and vegetable sector has accounted for 49% of pesticides use as compared to 20% at the national level. The reductions could be attributed to the various reasons, including the introduction and adoption of IPM practices and genetically modified (GM) crops, as for example Bt-cotton in particular, diminishing return to the costly pesticides, and to lesser extent on the awareness of the externalities of pesticides.

2.7 The excessive use of pesticides has disturbed the agro-ecosystems in the region. Pesticides have been instrumental in the killing of non-targeted and friendly organisms, including birds, and have also induced pest resurgences. In some cases, resistance to pesticides has developed and outbreaks of secondary pests have been witnessed. There have also been deleterious effects of pesticide use on human health, natural resources and the environment.

Safety: Storing and Disposal

2.8 Adequate comments are provided in the original PMP of SOFWM Project on the pesticides formulation facilities and their practices in the country. While country law provides for the storage places to: (i) be away from populated areas; (ii) be properly ventilated; (iii) have protected electric installations; (iv) have firefighting equipment; (v) be equipped with protective and safety clothing; and (vi) have emergency showers and eyewash facilities; these requirements are seldom met. Also the rules for disposal are also generally disregarded. There are also accountability issues of six thousand tons of out-dated pesticides lying in different stores in Pakistan as most of the containers leak and contaminate soil. The usual practice in factories is to dig holes and bury the contents. Preventive measures are not adopted to decompose the poisonous material. It used to be a common observation about a decade ago that end users do not dispose off the empty papers, cardboard or plastic packs by enclosing them in weatherproof containers and glass containers are not crushed in sacks, as required by law. A survey conducted by the National Fertilizer Development Center (NFDC) in 2002 had revealed that about 48% of pesticide users simply threw away pesticide packing, 34% buried it, and surprisingly 3% washed and reused it. However vigorous campaigns be

the public and private sectors on the safe disposal as well the introduction IPM practices and education since then could have had some positive impacts as well.

2.9 During the preparation of SOWMP's PMP, an emerging issue was raised in that the inventory of outdated pesticides needs to be updated and safe disposal arranged. However, the implementation documents of the said SOWMP do not provide adequate information whether any progress was made on this issue. Further, this issue needs to be examined in the historical perspective. The quantity of outdated pesticides was reported by the Plant Protection Department of the Federal Ministry of Agriculture, as of 1999, in the Agri Stat Book. The issue is about three decades old when pesticide sales and distribution, then handled by the provincial public sector extension departments, was privatized in 1984. Much of the stocks of pesticides were depleted, sold out or held at remote areas; yet because of poor bookkeeping by the extension agents, were not properly accounted for. In all likelihood, no such stock can exist after three decades. However, public sector auditing kept such stocks outstanding against the extension agents. It is therefore recommended that inventory should to be updated and a policy decision be taken at the appropriate government level waiver off the outstanding stock that exist on paper only. Similar situation is not possible in the Project areas because agriculture extension department does not handle any pesticide anymore for sales and distribution to the farmers.

Externalities of Pesticide Use

2.10 The cost of pesticide use is much more than the cost of the pesticide itself. The social cost is enormous which is generally disregarded while determining the economic gains in terms of higher crop yields. These costs include: occupational poisoning, food residues, drinking water contamination, pest resistance, loss of biodiversity, cost of prevention and abatement measures and the cost of awareness campaigns. Further, there are health related issues; such as (a) ***Sickness Incidence of Pesticide Applicators,*** pesticide-related sickness is very common in the cotton zone as about 63% of households report sickness during the spraying season, mortalities are about 1 per 400 households while main reported ailments were vomiting, dizziness, and breathing problems; (b) ***Sickness in Women Cotton Pickers,***about 87% women pickers complain of a variety of symptoms like headache, nausea, vomiting, skin irritation, general weakness, fever, dizziness, stomach pain, and blisters; (c) ***Industrial Worker Poisoning,*** about half of the labor force, working in the pesticide plants report sickness by inhaling pesticide emissions; and (d) ***Pesticide Residue in Food Chain,*** fruits and vegetables are contaminated with pesticide residues to the extent of 40% and 63%-70% of these are above the Maximum Residue Limit (MRL)

2.11 Other externalities. Pesticide residues also found in irrigation and drinking water, cotton seed, oil, lint and cattle feed, cottonseed cake, animal milk, and soil. Increased pesticide resistance is resulting in additional applications of pesticides to maintain expected crop yields. The consequences are lower yields and higher production costs. Pesticide use is affecting biodiversity too but it is little understood and appreciated. Some examples are: pollinator damage (honey bee poisoning), soil fauna, wildlife and birds.

2.12 Monetization of Pesticide Externalities. Clearly there are substantial costs that the society has to bear on account of harmful effects of pesticides. Periodic research needs to be carried out on the economic costs of pesticide-related externalities. An assessment made in 2000 shows (Appendix 1) that the external costs of pesticide use in Pakistan amounts to about Rs. 11.7 billion annually

Integrated Pest Management (IPM)

2.13 No single method of pest control is adequate to give satisfactory results in all situations. Therefore an integrated approach needs to be adopted. For this purpose, Integrated Pest Management (IPM) is the best available alternative. IPM has no standard definition, but is commonly referred as a diverse mix of approaches to manage pests; keep them below damaging levels by using control options that range from cultural practices to chemicals. Technologies involved, such as use of bio-pesticides (derived from *neem, dhatura* and*aak* that are local tree/bushes and tobacco), augmentation releases of predators/parasites, development of pest resistant species, crop rotation, cultural practices, and balanced use of fertilizers.

Integrated Plant and Soil Nutrient Management (IPSNM)

2.14 The concept of Integrated Plant and Soil Nutrient Management (IPSNM) entails the management of both organic and inorganic plant nutrients for optimal production of the cultivated crop, forage, and tree species while conserving the natural resource base that is essential for the long-term sustainability of the agro-ecosystems and the environment. Organic fertilizers bring about many useful changes in the chemical, microbiological and physical properties of soil that enhance soil fertility. The effect is long-term and not immediate, and, therefore, farmers hesitate to use organic fertilizers. High levels of organic residue incorporation especially in fine textured soils, improves its structure as indicated by several of the parameters such as soil porosity, pore size distribution, bulk and particle densities, aggregate stability, water holding capacity, aeration, infiltration, and hydraulic conductivity. The recycling of soil derived nutrients is also improved through proper organic residue management.

National Integrated Pest Management Project (Nat-IPM)

2.17 Currently, the focal point of all IPM activities in Pakistan is the NARC. With a view to up-scaling its ongoing IPM activities, NARC has been implementing a national IPM project that was approved in 2001-02 by the federal government for a total outlay of Rs 950 during the 10 years perspective plan, 2001 to 2011. It was executed by the Nat-IPM Coordinator at NARC in collaboration with Provincial Deputy Commissioners District Officers (Agriculture) in four provinces, Department of Plant Protection, Karachi, Federal and Provincial Agriculture Extension and Research Institutes, and Universities of Agriculture at Faisalabad, Tandojam and Peshawar. The main objective of the project is expanded and sustainable implementation of IPM in Pakistan, rationalizing the use of pesticides while maintaining production levels, and increasing farmers' profit.The specific targets laid down, initially were: (i) training of 500 extension staff and 55,000 farmers in IPM technologies through 20 ToFs and 840 FFSs; (ii) development of 840 village organizations in 20 districts of Pakistan; (iii) studies to recommend policy options to reduce indiscriminate/overuse of pesticides; (iv) training of 250 teachers of colleges and universities in IPM philosophy; (v) establishment of IPM information network and website, and issuance of newsletter; and (vi) training of public sector professionals and students (200) in IPM related research and development. No update is available yet on the achievement of the targets and outcomes of the Nat-IPM.

3. Policy, Regulatory Framework, and Institutional Capacity

3.1 At present the Ministry of National Food Security and Research is controlling agency for the import and production of pesticides, while the department of Plant Protection (Karachi) is responsible for the registration and regulation of Pesticides. The rules and regulations for Pesticides manufacturing, import and usage are stated in the Agriculture Pesticide Ordinance Government of Pakistan 1971 and the Agriculture Pesticides Rules Government of Pakistan 1973. These rules and regulations are based on guidelines from Food and Agriculture Organization (FAO). The Ordinance was amended later with respect to import of Pesticides and punishment for defaulters. To assist and advise the Federal Government on the technical aspects of the Pesticide Ordinance, the Agricultural Pesticide Technical Advisory Committee (APTA) was established. It comprises representatives from Universities, Government Departments, Pakistan Agriculture Research Council and Central Cotton Committee.

Integrated Pest Management as a Coping Strategy

3.2 The IPM approachis defined as a knowledge-intensive process of decisionmaking that combines various strategies (biological, cultural, physical and chemical) tomanage pests.

The IPM program adopted by the Federal Government aims in the first instance at improving sustainable agricultural production by reducing the use of chemical pesticides, and promoting the adaptation of IPM strategies to field and horticultural crops through Farmer Field School (FFS) methodology. The Ten Year Perspective Plan (2001-11) has also emphasized IPM as follows:

"It has been estimated that around 25 percent of crop outputs are lost due to attack of pests and diseases. Although the application of pesticides has increased over the years, its indiscriminate use should be avoided as it kills useful insects and predators, and causes environmental degradation. In order to reduce pesticide application ad promote biological control of insects and pest, Integrated Pest Management (IPM) programs will be undertaken. Adulteration of pesticides will be controlled through strict implementation of the Pesticide Act."

Laws, Rules and Regulations

3.3 The first law called The Agricultural Pesticide Ordinance, 1971 was promulgated. The Agricultural Pesticide Rules under the law were framed in 1973. The 1971 Ordinance is a comprehensive law for regulating imports, formulation, sale, distribution, and use, and establishing of institutions, ensuring quality control, and prescribing penalties for offences. It was amended in 1979 to let pesticide business transition from public sector to private sector, thereafter in 1992 to allow pesticide imports under generic names, and lastly in 1992 to strengthen the punishment provisions for adulteration.

Institutional Framework

3.4 Under the Act and Rules, an Agricultural Pesticide Technical Advisory Committee (APTAC) was established to advise the Federal Government on all matters relating to agricultural pesticide use and approve the registration of pesticides on the recommendations of the APTA Sub-Committee. The former is headed by the Secretary, Ministry of Food, Agriculture and Livestock, and the latter by the Plant Protection Adviser and Director General, Department of Plant Protection, Karachi. At the federal level, the Department of Plant Protection is responsible for the registration of pesticides, monitoring of import, and assuring quality control, while at the provincial level, the Provincial Agricultural Extension Departments are responsible for standardization of doses, registration of distributors and dealers, and quality control through its inspectors and pesticide laboratories.

3.5 Registration of Pesticides. Registration is carried out in three categories: (i) under trade name for which efficacy trials are done in the field for 2 years and registration takes place over a period of 2-3 years; (ii) under generic name for which government analyst's report is considered sufficient; and (iii) importation of pesticides registered in countries of

manufacture on the basis satisfactory documentary proof. By 2000, a total of 2,116 pesticides were registered: 498 products trade names, 792 under generic names, and 826 on the basis of registration in the country of manufacture.

3.6 Banned Pesticides. In 1994, twenty three (23) pesticides were deregistered and their use banned in the country (Appendix 3). Four products have been recommended for de-registration on the basis of WHO hazard classes Ia (extremely hazardous) and Ib (highly hazardous). Pakistan also subscribes to FAO/UNEP code of conduct and has placed 17 products on FAO/UNEP Prior Informed Consent (PIC) list. However, despite the restrictions, banned pesticides are still in use on a limited scale as these are smuggled from the neighboring countries.

3.7 Enforcement Experience. Implementation of the laws is generally poor. Although an adulterator can be given a punishment of 7 year imprisonment and a fine of Rs. one million, no such punishments have ever been awarded. Fines, at maximum, have been of the order of a few thousand rupees. Inspectors draw samples and have them tested in laboratories. Data show that a very small percentage of samples are sub-standard or adulterated whereas the fact is that the proportion is much higher. The problem of adulteration and use of spurious pesticides generally is due to import of sub-standard products, formulation of pesticides using less active ingredient, adulteration by distributors during re-packing, adulteration by pesticide dealers, and preparation of totally spurious material and labeling them as pesticides.

4. Rationale for the Pest Management Plan

Adverse Environmental and Health Impacts

4.1 The detailed PMP of the SOWMP gave a good rational on the indiscriminate use of pesticides affecting the environment adversely, disturbing the ecosystem balance, resulting in the loss in biodiversity, as well direct effects on human and animal health, based a national pesticide survey conducted by NFDC in 2002. The results of these are shown in the following two tables:

Environmental Problems on National Basis

	Freq (Number)	Percentage	Cumulative
Soil Pollution	245	5	5
Water Pollution	253	6	11
Environmental Pollution	1,276	28	39
Health Hazard	1,102	24	63
Fish Pond	92	2	65
Animal Health	429	10	75
Habitual Change	1,100	24	99
Others	10	0	100

Source: NFDC National Pesticide Survey 2002

Different Types of Sickness Symptoms Reported

Symptoms	Freq (Number)	Percentage	Cumulative
Headache	456	15	15
Dizziness	621	21	36
Irritation of skin, eyes, nose. Throat	706	24	60
Vomiting	435	15	75
Blurred vision	138	5	80
Heart trouble	187	6	86
Cancer	158	5	91
Fatality	15	1	92
Other	247	8	100

Source: NFDC National Pesticide Survey 2002

World Bank Procedures

4.2 For any Bank funded project, whereby an increased use of pesticides is apprehended, the Bank's policies and procedures require that a Pest Management Plan (PMP) should be prepared. Under the SIAPEP, the labor intensive crops that would enhance the livelihoods of small landholder and tillers are expected to have increased cropped area higher crop yields as well, which could result in correspondingly higher use of pesticides, unless mitigation measures on the effective use of IPM practices are promoted and farmers are encouraged to employ them. Therefore a PMP is considered to be an integral part of the SIAPEP.

Emerging Issues

4.3 A number of issues that emerge from the discussion on pesticides and IPM. The 12 issues drafted in the SOWMP's PMP, as relevant to Sindh, are appended in Appendix 4. Gists of those issues that are relevant to this PMP are. (a) Review of Registration Procedures, (b) Amendment of Existing Legislation to Strengthen Enforcement, (c) Enhancement of the Awareness of Stakeholders, (d) External Costs of Pesticides (e) Deepening of IPM Philosophy in Educational Institutions, (f) Training of Farmers with due focus on gender, (g) Enhancement of Coordination among Donors/Decision Makers, and (h) WTO Implications

5. Implementation of the PMP of SOFWM Project

Background – Main Objective and Strategy

5.1 Inthe productivity enhancement component of the SOFWM Project, an "Integrated Pest Management Plan" was prepared. The primary objective of it was to train 10,500 farmers in pest and pesticide management, with particular emphasis on IPM practices. This initiative was further complemented by a National IPM Project that has been executed by NARC. From its overall target of training 55,000 farmers nationwide, Sindh also got its due share. The main element of the strategy is an eco-system based system of agricultural crop management that does not exclude the use of pesticides but at the same time promote an integrated approach to use all available options for controlling pest population for sustainable productivity with no adverse effect on human beings, animals and the environment. The ToF/FFS training system through its strategy of making farmers self-reliant by acquiring basic knowledge of crop management was designed to achieve the objectives of the IPM Plan. This IPM Plan also introduced the concept of Integrated Plant and Soil Nutrient Management (IPSNM), which promotes not only long-term sustainability of the agro-ecosystems and the environment but, inter alia, also pro-IPM strategies such as improved crop rotations, better managing plant-soil-pest-predator interactions and maximizing crop, soil and animal biodiversity to reduce diseases and pest outbreaks. About 25 demonstrations of one hectare plots each were planned to promote IPSNM.

5.2 Pesticide Residue. In the ToF/FFS system of training, control plots, where prevalent practices of pesticide use are undertaken and experimental plots where farmers practice IPM, are laid out. Samples of pesticide residue on crops, particularly cotton, rice, fruits and vegetables, would be collected from both kinds of plots and the quantity of pesticide residue determined. This would help establish the usefulness of adopting IPM practices. The work of pesticide residue determination would be contracted out to existing research laboratories that possess the desired facilities (National Centre of Excellence in Analytical Chemistry, University of Sindh, Jamshoro,). Monitoring of pesticide residue would be carried out

throughout the project period and information disseminated widely to help bring down the level of residue to below the Maximum Residue Limit (MRL). Post-harvest use of pesticides, particularly on vegetables would also be monitored. An analytical study on the work done would be prepared in the last year of the project period.

Performance of the PMP

5.3 As IPM Plan was a component of the SOFWMP, it was implemented by the DG Agricultural Engineering and Water Management. The target of training farmers through FFS on IPM, as revised, was 4650. This target was fully achieved following the training of 90 farmers during April-June, 2012. The target of training of 300 farmers on 'safe use of pesticide' through FFS was 300 was also accomplished. The target of 150 refresher courses for facilitators was achieved as well in second quarter 2012, as 98 facilitators were trained in 4 batches, adding to the 52 refresher courses conducted earlier. The pesticide residues, analysis of 150 samples of soil, human blood of cotton and chili pickers and animal milk, was planned, for which 110 samples werecollected by the end of June, 2011 and the remaining 40 samples in June 2012. The results were received of all 150 samples.

5.4 The IPM Plan successfully followed a participatory process learning approach for farmers through FFS in strengthening capacities on IPM and FFS. The program activities have been carried out as per the work plans in different crops in three AWBs. The crops were selected based on their importance and also the need and scope for the use of IPM for their improved production and reduction in the use of pesticides. Activities implemented in each zone are based on the local disease/insect-pest problems and needs.

5.5 Review of Policy and Laws was initiated as the discussion for amendments in the Agricultural Pesticide Ordinance 1971 is underwaywith the Agriculture Department of the Sindh Government.

5.6 Awareness and Dissemination of Information. Under this sub-component, different types ofcampaigns like media, seminars and printedmaterials on IPM approach through organizingseminars, workshops and field demonstration,etc., were carried out. These activities covered pesticide handling usage, storage anddisposal, type of pesticide application equipment, protective measures and ecologicallyfriendly methods and promotion of bio-pesticides.

6. Integrated Pest Management Plan (IPMP) of SIAPEP

Background

6.1 The Agriculture Department, Sindh has prepared feasibility study for forthcoming SIAPEP. The "Pest Management Plan (PMP)" is embedded mainly in the project projectactivities and investments for the productivity enhancement of crops targeted under the SIAPEP. While there is no separate cost estimated for the PMP, Integrated Pest Management (IPM) and Integrated Plant and Soil Nutrient Management (IPSNM) are the core capacity building measures of the line departments for promoting of good agriculture practices (GAP) that include both IPM and IPSNM. The PMP presented here highlights those activities designed in the Agriculture part of the project that has major and substantial relevance to the IPM and IPNSM, in addition to suggesting specific areas and topics of IPM that have not been specified in the PC-1 but can be included while designing and implementing the operational plan of the SIAPEP.

Objectives

6.2 The main objectives of the Pest Management Plan are threefold:

- Promotion of IPM: To minimize pesticide usage while increase the productivity of agricultural crops targeted in the SIAPEP through Integrated Pest Management (IPM), Integrated Plant and SoilNutrient Management (IPSNM) and Good Agricultural Practices (GAP), because they include the rational use of chemical pesticides, promote cultural practices and the use of nutrients from organic resources;

- Management of Pesticides: To monitor the pesticides management such as their usage before, during and after, and the level of pesticide residues on targeted crops in normally-treated and IPM-treated areas and to disseminate information to stakeholders on the usefulness of undertaking IPM practices.

- Capacity Building: To raise awareness of all stakeholders about the IPM approach to crop management, and train extension agents and farmers through FFS system to become practitioners of IPM.

Components

The component C2 of SIAPEP addresses the capacity building on IPMP.

Component C2: Under this sub-component the project will invest heavily in training of farmers to improve their crop and irrigation agronomy practices. Interventions will include: (a) establishing Farmer Field Schools with a focus on IPM (b) training of FFS facilitators (c) in-country exposure visits of farmers (d) demonstration of beneficial insects rearing on the

farm and (e) training in crop production under High Efficiency Irrigation System (the drip system).

The second aspect of IPMP for SIAPEP is monitoring of pesticide residues for which annual tests will be conducted on 10% of the interventions over the yearly period. These will be produce residue tests.

Capacity Building Under Component C

This sub-component will support improvement in crop and irrigation agronomy practices in the form of demonstration and assistance in improved and modern technologies to increase the benefits of enhanced water availability from watercourse lining and high efficiency irrigation systems. The interventions will include:

(a) Establishing 1500 farmers field schools (FSS) for about 10 crops on about 30% of the project renovated watercourses with the members of the watercourse associations. This training will focus on proper land preparation; soil fertility and crop nutrition management; improved irrigation techniques; integrated pest management and safe handling of pesticides; and on-farm post-harvest losses management. Necessary training materials including brochures and training modules will be developed for training of facilitators and later for use of farmers in the FFSs. Curricula of these trainings be based on the outcome of Rapid Needs Assessment Surveys conducted with a representative sample number of Watercourse Associations. These will also help to establish benchmarks on important aspects of the crop against which to measure the effectiveness of the FFS training program.
(b) Training 750 field facilitators to conduct training of the farmers in the FFS established. These trainers will be selected from the agriculture extension department, Water Management & Agriculture Engineering Department, local NGOs and lead educated farmers;
(c) Arranging exposure visits for 1000 farmers, selected out of the FFS participants based on their active participation and contribution to the success of the FFS program. These visits will be within the country to best practice areas and exhibitions; and
(d) Establish 200 Natural Enemies Farm Reservoirs (NEFRs) as demonstration centers to promote rearing of beneficial insects on the farmers' fields. This will target mealy bug, pink bollworm and spotted bollworm for cotton and okra crops and fruit flies in mango and guava crops. Local Extension and Research will actively be encouraged to partner for their knowledge, information sharing and where needed capacity development.

To implement these activities, the project will hire the services of a firm with expertise and experience in crop production technologies, irrigation agronomy, integrated pest management under the FFS methodology, biological control of pests, and on-farm post-harvest management technologies.

(e) Training of all farmers receiving the HEIS (the drip system) in crop production under this system. This training would be performed by the field teams of the OFWM Department

with assistance from HEIS service provider and the Project Implementation Assistance Consultants.

(f) Project will establish an ICT based M & E system to facilitate monitoring delivery of sub-component outputs, enhance transparency and gather feedback of the project beneficiaries. This system will be operationalized jointly with the M & E team of the project.

(g) While delivering the project outputs it will be made sure that these also reach to woman farmers where possible. An estimated target of 20% share is set for woman farmer beneficiaries.

Monitoring of Pesticide Use and Residue.

The work of testing pesticide residue on agricultural crops, particularly fruits and vegetables, should eventually be done on payment basis by existing research laboratories. Samples would be collected from control and experimental plots of the on-going and future Nat-IPM programs under the ToF/FFS system, or from such plots which may come into existence from year 2 of the SIAPEP in association with FFS groups. The test results would thus establish the usefulness of adopting IPM practices. Monitoring of pesticide use and residues would be carried out throughout the project period and efforts made to bring down the level of residue to below MRL. The testing would also benefit from the more extensive testing and monitoring program underway in Sindh Agriculture Growth Project.

Appendix 1.1

Ahmed (2002), "External Costs of Pesticide Use in Pakistan"

Externality Category	Rs. in Millions
Health:	**833.0**
Applicators	42.0
Pickers	765.0
Industry	0.6
Distribution	25.0
Pesticide Residues:	**110.0**
Production:	**7,034.0**
Pesticide Resistance	5,667.0
Animal Loss	1,304.0
Wild Honeybee Loss	63.0
Biodiversity Loss:	**3,745.0**
Total Externality Cost (Annual)	**11,742.0**

Source: Ahmad 2002

Appendix 1.2

Farmers Field Schools, Participatory Development Technology

And FFS Curriculum Development for SAGP

Farmer Field Schools (FFS)

A2.1The methodology used to deliver extension to target beneficiaries would be the Farmer Field School (FFS) approach. Although the FFS methodology has been used previously by provincial extension services all over Pakistan, closer examination of the methods employed indicate that what is often represented as FFS is, in fact, the long established Training and Visit model that has been shown to be a far less effective extension tool. A number of FFS's were visited during the course of the project preparations and in every case, the extension officer was instructing farmers on some aspect of production system under discussion. It was also apparent that these meetings were taking place near an extension centre or some communal focal point, rather than in a farmer's field.

A.2.2 The core of the FFS approach is Learning by Doing. Farmers are not given a prescriptive agenda. They meet regularly at a prescribed interval in a farmer's field and choose amongst themselves the topics for discussion. The role of the Facilitator is to help guide the group in deciding what to examine and how to go about it, not to teach. If the farmers have a problem, they are encouraged to experiment and seek solutions to those problems through a process of constructive investigation. In this way, farmers are empowered to seek answers to their own problems. Where this is not feasible, the facilarors can take a lead role and propose alternative methodologies. However, in order to facilitate greater sustainability to the whole extension approach, the Project intends to train Lead Farmers (LFs) as well as facilitators to lead the FFS. The Facilitator and the Lead Farmers would regularly attend training sessions with Master Trainers (MT), to ensure that both the faand the LF were aware of both technical and group support functions. Facilitators would encourage groups to consider key aspects such as varietal suitability, post-harvest handling and marketing. Both EFs and LFs would also be schooled in leading problem-solving exercises.

A.2.3 The optimum size for a FFS is 15 to 25 participants. The number of meetings held by each group would be determined by the cropping calendar and could range from weekly at certain

periods to monthly in others. One Lead Farmer could facilitate two FFSs and would be paid a small stipend to do so. The LF would also receive a bicycle, which they would pay for, out of their stipend. The LF would also be issued a number of tools and equipment, such as moisture meters, sprayers and soil testing kits that would allow them to demonstrate better production technologies to members of the group. Any novel equipment demonstrated to the group would be available for purchase by a group member at subsided cost. The Extension Facilitator would supervise up to four LFs and would be issued with a motorcycle, which would be paid for by the EF over the depreciation period of the machine. Some of the tools issued to the LF would also be issued to the EF. Each FFS would be expected to run for approximately three hours and would not be held at a frequency of more than once a week, at the peak of the cropping calendar. Marketing activities would naturally occur at the end of the season. The key likely areas of exposure of the farmers through the FFS approach are outlined below.

A.2.3.1 **Cultural Practices** - The focus of all cultural practices would be to introduce GAPs to all activities along a crop's production and post-harvest management chain. This would include varietal selection, cultural practices such as weeding and spraying, and the correct application of fertilizers. Due consideration would be given at all times to the effects of such practices on the quality of the produce and the environment.

A.2.3.2 **IPM** - IPM extension would focus on developing an environmentally sensitive approach to pest management. Although the FFS approach is rooted in the principles of farmers defining and answering their own problems, there are skill sets that would greatly aid them in defining their problems. In the field of IPM there are four steps that go to make an effective IPM program, which are (i) Monitoring; (ii) Setting Action Thresholds; (iii) Prevention (cultural & mechanical) and (iv) Control, including pheromone traps, biological controls and targeted spraying. Lead Farmers and Extension Facilitators would be trained in how to lead farmers are guided discussions to effectively implement IPM within their GAPs.

A.2.3.3 **OFS&WM – On-Farm Soil & Water Management**; efficient use of available water would be a major theme. There is scope to look at alternative irrigation technologies such as drip to see if the investment in infrastructure would yield beneficial results for participating farmers. OFS&WM extension would work with farmers to minimize the effects of inappropriate irrigation frequencies through the introduction of moisture meters and measured inflows of water.

A.2.3.4 **Post-Harvest Handling & Quality** – This activity would seek to improve the harvesting techniques and subsequent post-harvest handing to produce to ensure that optimum quality was maintained at all times. Washing, sorting and grading practices would be considered, along with improved packing techniques. Removal of field heat

and maintaining a conducive environment for the produce, whether for drying, curing or processing, would raise the standard of the final produce leaving the farm.

A.2.3.5 **Marketing** – Embedded within the FFS timetable would be a time to discuss marketing issues. The ideal time to do this would be at the end of the cropping calendar, but the group itself would eventually decide this. Horticultural crops are often produced on a commercial basis and farmers use a variety of channels to sell their crops. The marketing sub-activity with the FFS would seek to maximize the returns a farmer could expect from selling their produce, either within their existing contractual arrangements or by seeking more advantageous marketing avenues, such as collective marketing strategies. However, no particular model would be favored, with the choice left to the participants. Marketing activities could include organized meetings between farmers and traders to discuss issues related to varieties, quality, quantity, timing and price. Exchange visits to other production areas and markets would also be beneficial to both farmers and traders, especially regional markets. Finding and opening new markets, based on existing production or tailoring varieties or processing to suit the demands for new markets would be actively promoted.

A.2.3.6 **Producer Marketing Organizations (PMO).**Subject to sufficient demand, the extension activity would foster the development of PMOs that could emerge from formal or non-formal farmer organizations. PMOs increase off-farm incomes and support business development when their members have had the benefit of market orientation, have input suppliers are mobilized, market linkages are developed and a greater awareness of markets has been created among producers. The project extension activity, may use innovate ways to leverage experience and resources resulting from Farmer Field School trainings. The FFS producer groups could be clustered to form a Produce Market Organization, comprising 10 FFS groups. The PMO could be organized to sell directly to wholesalers and processors, or to traders, but would gain greater bargaining power due to their size and greater volume of produce to sell. Individual PMOs could be eventually organized into district level PMOs. The PMO formationwould help producers negotiate better access to markets, while also providing members with information, training, and the development of quality assurance standards. Importantly, the PMO would play an advocacy role, with a stronger collective voice, and offer better access to research, extension, inputs and market services. The PMO could be further strengthened to become an apex body for the horticulture sector.

Participatory Technology Development (PTD)

A.2.4 After a single cropping season, for those farmers that are interested, PTD is a possible next step, allowing farmers to further their knowledge of plant ecosystems through discovery-based learning. After FFS graduation, farmer sub groups can select their priority crops and identify their limiting factors. A Common Interest Group (CIG) could emerge as a part of discussions on "what next". Each CIG or PTD unit comprise of a number of farmer with common interest in a specific issue(s) for their crop. In this manner, the momentum of the FFS is not lost and farmers are constructively encouraged to continue meeting and problem solving together.

A.2.5 PTD is an approach, which involves farmers in developing agricultural technologies that are appropriate to their particular situation, local bio-climatic conditions and resources. It is a practical process in which farmers identify a specific problem, bring their knowledge and practical experience to test a number of options, including new technologies and interact with facilitators to solve their problem with the most suitable technologies available. In this way, farmers and the facilitators are able to identify, develop, test and apply new technologies and practices. PTD seeks to reinforce the existing creativity and experimental capacities learned by farmers through FFS, and help them keep control over the process of generating innovations. As it is a 'bottom up' approach, as with FFS, facilitators do not come to the farmers with off-the-shelf options and packages, but rather help them to find better solutions for themselves, which fit their resources and situations. The LF and EF therefore facilitate the process of innovation of technology most suitable for farmer's localized need.

A.2.6 This field-based participatory research and extension method, which is an extension of the FFS approach, not only results in enhanced agricultural yields but also increases farmers' confidence. Even more importantly, it provides an opportunity to share experiences, which may include successes and failures. It creates social cohesion and a spirit of collective action amongst rural farmers; PTDs would be a self-managed group. This extension activity would provide basic training at the initial stage to orientate the farmers in research and technology development and could provide initial agricultural inputs, technical guidance and facilitation of the processes with farmers. Unlike FFS, PTDs farmers specify the objective, develop criteria to verify indicator, identify the key elements to be address and pinpoint the suitable time to address the issues, hence PTD farmers get together based on the problem calendar instead of regular sessions. In this way, farmers utilize their time more efficiently compared to routine FFS.

A.2.7 The main focus of all PTD groups is on new technologies and methods of crop protection, cultivation, irrigation and improved cultural practices. Through the PTDs the farmers apply a

number of new technologies in perennial and annual horticulture, along with IPM. Activities on pesticide safe management and use would also be incorporated in the curriculums with respect to the crops and pests farmers will need to use pesticides. The issues and problems are then discussed in groups and corrective measures are taken after consultation with facilitators. Some of the important elements in PTD are to compare the traditional methods of crop protection practices with new technologies; old against new varieties, and test the quality of crops and products in the farmer's own environment.

Curriculum development for the FFS

A.2.8 Although the core of the FFS approach is learning by doing, there is a need to ensure over the period of a single FFS cycle, groups of farmers are exposed to the best agricultural practices that pertain to the crop they are growing, taking into consideration the variety used, resources available and the degree of mechanization available to the farmer. This required knowledge forms the basis of Good Agricultural Practice (GAP). The skill in delivering this GAP to farmers is to ensure it is woven into the fabric of the FFS in such a way that Lead Farmer (LF) and the Extension Facilitator (EF) are able to introduce GAPs and allow farmers to experiment with the ideas and techniques being proposed, while not seeming to lead them in what have up to now been traditional training for delivering extension.

A.2.9 To begin this process, a curriculum has to be developed by the Department of Agriculture, supported by technical expertise drawn from all relevant sources. This process can be achieved by running a series of concentrated workshops where specialists can gather and flesh out what should form the basis for GAP's in any particular crop. It must be borne in mind that these GAP's would be transmitted to LFs and EFs by Master Trainers (MT) and for this reason it is advisable to have MT's present as the GAPs are developed. There are nine universal steps that form the core for any curriculum development:

a) Determine the scope and limitations of the farming system.
b) Identify the elements of the GAP that need to be communicated.
c) Select and sequence the delivery of the GAP information based on the seasonal calendar and the structure of FFS delivery.
d) Develop performance objectives linked to the GAP.
e) Develop a likely instructional schedule, linked to the crop calendar.
f) Structure delivery in a 'learning by doing' approach.
g) Develop instructional material appropriate to the environment and the educational level of the target audience. This material should augment the FFS session, not form the core of it.
h) Develop Monitoring and Evaluation (M&E) criteria that would allow the project to test if the curriculum was effective.
i) Implement the curriculum embedded in the FFS

A.2.10 Any material developed would need to be tested with target farmers to see that it was being understood and as the material was disseminated during the FFS activities, the M&E finding would need to feed back into any of the steps above to take corrective action needed to improve the GAP curriculum.

Appendix 1.3

Banned Pesticides (Active Ingredients)

1. BHC
2. Binacryl
3. Bromophos ethyl
4. captafol
5. Chlordimeform
6. Chlorobenzilate
7. Chlorthiophos
8. Cyhexatin
9. Dalapon
10. DDT
11. Dibromochloropropane + Dibromochloropropene
12. Dicrotophos
13. Dieldrin
14. Disulfoton
15. Endrin
16. Ethylene dichloride + Carbontenachloride
17. Leptophos
18. Mercury Compound
19. Mevinphos
20. Toxaphene
21. Zineb
22. Heptachlor
23. Methyl Parathion

Appendix 1.4

Emerging Issues as Identified in the PMP of SOFWM AF Project

There are a number of issues that emerge from the background materials of the PMP of SOEWM Project. An effort has been made to address a number of them, as relevant to Sindh province, in the Plan that has been laid out in para 6 of this document. The issues are:

(i). **Review of Plant Protection and IPM Policies**. There is a need to discuss pesticide related issues at the provincial level and enunciate a provincial policy which is non-existent;

(ii). **Review of Registration Procedures**. Provincial government is concerned with the registration of only distributing companies. Rules, in this regard, need to be reviewed and made more stringent so that malpractices of adulteration etc are minimized;

(iii). **Amendment of Existing Legislation to Strengthen Enforcement**. From the provincial point of view, legislation needs to be reviewed for framing amendments that would lead to better enforcement of the pesticide law;

(iv). **Enhancement of the Awareness of Stakeholders**. This is the most pertinent and important issue that would be addressed by the Plan;

(v). **External Costs of Pesticides**. There is very little awareness of the externalities associated with the pesticide use. Decision makers, therefore, need to be particularly sensitized about it.

(vi). **Introduction of IPM Philosophy in Educational Institutions**. This is part of the awareness raising program that would need to be launched;

(vii). **Training of Farmers**. The main stakeholder is the farmer. He needs to be trained to identify, understand, and resolve pesticide related problems;

(viii). **Training of Women**. Pesticides in Pakistan are mainly targeted at cotton and okra crops. The cotton and okra pickers are mainly women who are exposed to the hazards of pesticide use and, therefore, need to be trained;

(ix). **Enhancement of Coordination among Donors/Decision Makers**. The main actors in the field of IPM are government, donors, and international organizations. Their efforts need to be coordinated;

(x). **Stronger Partnership among Research, Extension and Farmers**. This partnership would need to be forged on stronger footings;

(xi). **Disposal of Obsolete Pesticides**. Large stocks of outdated and obsolete pesticides have been stored at various places. Their inventory needs to be updated and safe disposal arranged; and

(xii). **WTO Implications**. The developed countries, USA and EU included, have framed regulations disallowing import of agricultural products with pesticide residues above a certain limit. More emphasis, therefore, would have to be laid in the future on the need for producing pesticide free agricultural commodities for export.

Annexure B

List of Participants of Workshops

List of Participants with names, occupations and contact numbers for each districts are as under:

Venue: Indus Hotel Hyderabad		**District: Hyderabad, Tando Allahyar, Matiari, Jamshoro**	
Date: 22-10-2013			
S.No	**Name of Participant**	**Designation / Position**	**Contact Number**
1	Dabeer Hussain	Water Managemt Officer	0300-3017873
2	Maqsood Ahmed Memon	Water Managemt Officer	0300-3007251
3	M. Ayub Burdi	DD(F) Mitiari	0333-2601779
4	Shakeel Ahmed Vistro	AAO, NPIW, Jamshoro	0300-9270138
5	Israr Ahmed Samoo	Sub-Engineer	0300-3082085
6	Ahmed Dahri	Sub-Engineer	0301-3559146
7	Abdul Hameed	Growers	0300-3090162
8	Kashif Memon	Assistant Director (F)	0300-3077939
9	Ali Akber Mangi	Assistant Director (F)	0301-3534554
10	Bashir Hussain Dasti	AAE (WCD) Matli	0333-7592077
11	kamal Chhachar	Grower	0345-3628433
12	Amir Bux Chhachar	Grower	0345-6263139
13	Imram Majeed Khanzada	D.D. (HYD/TLD)	0300-2604899
14	Engr. Naushad Ali Jamali	A.D.G Agriculture	
15	Nisar Ahmed Mari	WMO (SM)	0333-2619790
16	Saifullah Memon	AD (WM)	0321-3042850
17	Khawar Hhanzada	WMO (Engineer)	0300-8372127
18	Mir Muhammd Jamali	Grower	0300-8371707
19	Ali Nawaz Memon	WMO (Engineer)	0345-2181220
20	Mohammad Amir Changezi	WMO (SM)	0333-2836538
21	Moula Bux Dalur	Grower	0300-3040814
22	akbar hissain Bhabanro	Grower	0300-3012496
23	Muhammad Zubair Soomro	WMO (Engineer)	0333-2600508
24	Mumtaz Ali Mangi	Training Supervisor (FAO)	0346-8544147

25	Liaquat Janwari	Farmer	
26	Almgir Tunio	Jr.Engi	
27	Raheel Memon	Jr. Engineer G3 engineering	0334-2080987
28	Zohaib Bughio	Grower Hyderabad	
29	G.S. Shah	Farmer Jamshoro	
30	Imdad Ali	Farmer Jamshoro	
31	M. Suliman Memon	Grower Hala	
32	M.Ramzan	LandLord Matari	
33	Haji Sher Muhammad	Farmer matari	
34	Muhammad Ayoub	Sub-Engineer	0346-3653079
35	Mohammad Hashim Memon	Assistant Director (sehum)	0345-348547
36	Wajid azir Baloch	Water Managemt Officer	0345-3683984
37	Saifuddin Abbasi	Water Managemt Officer	0300-3378227
38	Muhammad Hassan	Environmental	0344-3261619
39	Zulfiquar Ali	Sub-Engineer	0301-3534544
40	Allah Rakhio	Grower	0343-3540180
41	khalid hussain Bukhari	WMO (Engineer)	0334-8144109
42	Ghulam Shah Talpur	Grower	0300-3648106
43	Toseef Pasha Memon	Water Management Officer	0333-2634987
44	M. Ramzan Jedi	S.E	0300-3030788
45	Imran Bux Jamali	Grower	0300-3226521
46	Nazir Hussain Jamali	Grower	0306-3436985
47	Abdul Hafeez Jamali	Sub-Engineer	0302-3906021
48	M.Iesa Dahri	Grower Matiari	
49	M.Ibrahim	Grower T.Jam	
50	Irshad Ali Mangi	Farmer	
51	Assistant Director	E.P.A Hyderabad	

Venue: District Council Hall Tando Mohammad Khan **Date: 23-10-2013**			**District: Tando Mohammad Khan & Badin**
S.No	**Name of Participant**	**Designation / Position**	**Contact Number**
1	Shahid Iftikhar	Assistant Director (Field)	0331-4295768
2	Zia-ur-Rehman	Assistant Director	0300-3300667
3	Munawar Das	Assistant Director (F)	0333-2838450
4	Muhammad Malook	Assistant Director (F)	0345-3666816
5	Jawed Iqbal	WMO	0333-2804641
6	Ghulam Murtaza Mastoi	WMOT	0333-2625803
7	Ali Ahmed Sahto	WMO, Ft: mullakaraw TMK	0333-2804633
8	Jamal Akbar Abro	Sub-Eng: FTI swoded	0333-2646173
9	Anwar Ali	TNN Member TMK	0334-2183347
10	Umar Hayat Qureshi	Farmer TMK	0300-3008523
11	Afzal Sathio	AD(F) TMK	0333-2804993
12	Asif Haider	WMO TMK	0312-3026195
13	Mir Muhammad Murad TMK	AD (F) Shaikh Bhirkio	0300-3795513
14	Syed Khurshid Akram	incharge k.ghannar	0300-2016712
15	Syed Shamim Haider	incharge kadhan	0300-3014903
16	Ghulam Ali	president (SRDO) TMK	0333-2811804
17	Tariq Ali Dahraj	Assistant Director (F) TMK	0333-1306886
18	Sanaullah Kaka	Assistant Director	0321-3003472
19	Shakeel Ahmed Rehman	DD (NPIW/OFWM) Badin	0346-3726552
20	Dr. Kubir Ahmed Nazar	Abaadgaar	0301-3510323
21	Mushtaq Ali Nazamani	Pperator in URP, Grower	0300-3077706
22	Amir Bux Chandio	AD (F) Saeed Pur	0300-3040396
23	Ghulam Haider Nazmani	Pperator in URP, Grower	0333-2800888
24	Moazam Khan	Owner	0344-43144250
25	Ghulam Mustafa Shah	Small Grower	0333-2540959
26	Mushtaq Ahmed Burrio	Chairman Bhaneri Minor	0345-3666865
27	Mangol Singh TMK	AD (F) F/T.B.Mari	0333-2812917
28	Nawaz Ali Sahto	chairman (5L-Janki) TMK	0333-2801927
29	Eng: A. Haq Zamar	Grower (Lakhat TMK)	0336-6183138
30	Nabi Bux Sahto TMK	General Sec: sindh chamber of (F)	0333-2622459
31	Amir Ali Baloch	Assistant Director Saeed Pur	0333-2806463

32	Gul Hassam Katiar	Sub-Engineer	0333-2812453
33	Syed Sajjad Haider Shah	ADC-I TMK	
34	Ghulam Qadir Junejo	ADC-II TMK	
35	Salman Qazi	AAE TMK	0333-2671424
36	Abdul Shakoor	AAE TMK	0333-31690031
37	Sharaz Hussain	Assistant Director (F)	0333-3130810
38	Gulzar Hussain Shah	WMO (Eng:) NPIW	0336-3350880
39	Jahangeer	MO	0333-2543196
40	Bashir Ahmed Memon	S/E	0315-3967333
41	Muhammad Usman	Zamindar	0333-2817149
42	shakeel ahmed Almani	Chairman SIDA WNO	0343-3320055
43	Muhammad Aslam Soomro	Assistant Director (F)	0333-2644765
44	Muhammad Hanif Shaikh	Assistant Director (F)	0336-3669789
45	Ghulam Sarwar Channa	Assistant Director (F)	0343-8330119
46	Aalamullah Memon	Water Management Officer	0334-6688810
47	Haji Allah Warayo	Zamindar	
48	Muhammad Saleem Shaikh	Deputy Dierctor (F) TMK	

Venue: Sufiyanai Resturant		**District: Mirpurkhas, Umerkot, Tharparkar**	
Date: 24-10-2013			
S.No	**Name of Participant**	**Designation / Position**	**Contact Number**
1	Mohammad Kaleem	Grower	0313-3165984
2	Osaf Rasool Shah	Grower	0345-3700777
3	Muhammad Ali Arisa	Grower	0300-3329817
4	Moin-u-din	AD(F) Umerkot	0300-3072231
5	Abdul Khalique Khaskhili	AD(F) Jhuddo	0300-3790986
6	Abdul Hameed Bughio	AAE (MPS)	0332-9333923
7	Dujesingh Sodho	AD (F) Kunri	0342-2071687
8	Khuda Bux Memon	Deputy Director Mithi	0300-3075235
9	Engr: Noor-u-din Sanggari	AD (MPS)	0336-2881119
10	Ali Nawaz	FTI (MPS)	0300-9378554
11	Engr: Abdul Sattar Pirzada	FTI (MPS)	0334-5475508
12	Imran Zafar Kingrechi	Sr.sociologist/resetlment specialist	0334-2679449
13	Uttam K. Rajani	AD (F) Pitharo	0345-3742312
14	Ameet Kumar	Jr.Engineer	0334-8201353
15	Jamil Ahmed	WMO	0346-3614842
16	Aijaz Ali Thaheem	Mirpurkhas	0332-2712850
17	Abdul Aziz	Member W/C 8-AL	0333-1272266
18	Zia-ul-Kareem Narejo	WMO Field Team Samaro	0345-9032820
19	Najaf Ali Shah	Member W/C 17-AL saeed ali	0333-2655913
20	Zohaib Bughio	C.O Environemnt	0308-3006001
21	Raheel Ahmed	Jr.Engineer	0334-2080987
22	Eng: Sohail Memon	Jr.Engineer G3 EC	0301-3512596
23	Shafique Khan	WMO	0331-3658717
24	Muhammad Arif Shaikh	AD (F) D/nan	0301-3554778
25	Syed Altaf Hussain Shah	Member Area Water Board Nara Canal	
26	Nabi Bukhsh Laghari	Chairman	0300-3314619
27	Rafique Ahmed Bugio	Zamindar	0333-2971263
28	Muhammad Umar Bugio	Zamindar	0333-2971117
29	Khalid Hussain Memon	Deputy Director OFWM	0300-3212066
30	Norr Muhammad Talpur	Grower	0334-2556233
31	Imdad Ali	Grower	0333-2966623
32	Om Parkash Rathi	WMO (Engr:)	0333-2968472
33	Taj Muhammad Baloch	Farmer	0333-2980511
34	Soofi Abid	AD Pithoro	0333-2718480
35	Shakeel Ahmed Shaikh	AD Dhonnaro	0334-2638985

36	Muhammad Ali Kalohro	Zamindar	0331-3708805
37	Muhammad Yaqoob Sajjadi	Sub-Engineer (NPIW)	0300-3317185
38	Subhash Chanter	Sub-Engineer (NPIW)	0345-3609082
39	Baso Saeed	Sub-Engineer (NPIW)	0300-3313589
40	Narash Kumar	Assistant Director	0332-2804131
41	Ghulam Murtaza	Assistant Agronomist	0306-3010415
42	Gohram Baloch	AO Agri: Extension MPK	0333-2961588
43	Fazal Ilahi Memon	Grower	0300-3313003
44	Jahanzaib Zain	AD (F) kot Ghulam	0333-2650690
45	Herchand Rai	Deputy Director Umerkot	
46	Dilshad Ali Dharej	Assistant Agricultre Engineer	0300-3233429
47	Ghulam Muhammad	Office Assistant	0302-2091100
48	Engr: Alamgir Tunio	Sr.Engineer G3 EC	0300-4994423
49	Shahnawaz Tareen	Sr.Engineer G3 EC	0334-9991231
50	Muhammad Shoib (AD,EPA)	Incharge Reginol Sindh E.P.A	0333-2965040
51	Muhammad Bux	Grower	
52	Shahid Lund	Jr.Sociologist G3 EC	0300-2308190
53	Taj Muhammad Rahimoon	Govt: Servant	0345-1323140
54	Muhammad Akram Jatoi	Govt: Contrector	0300-3315944
55	Phutal Khan	Farmer	
56	Ghulam Hussain	Farmer	
57	Ahmed	Govt: Servant	0333-2462442
58	Muhammad Yasir	Farmer	0333-2756836
59	Anwar	Farmer	
60	Roshan Magsi	WMO Pitharo	0332-2801245
61	Mukhtiar Ahmed F.T (MPK)	Sub-Engineer	0300-3056202
62	Mr. Abid Ali Rind	Divisional Forest Officer MPK	
63	M.Hanif Khoso	N.G.O Bhaan Beli	
64	D.O.F Umerkot	Umerkot	0238-570357
65	Imran Ali Bhutto	D.O.F Mithi	023-262061
66	Ket Khemani	Grower Mithi	0300-2168603
67	Liaqat Ali Junejo	Grower Umerkot	
68	Inayat Ali Lagari	Grower Mirpurkhas	
69	Azizullah Kumbhar	Grower Umerkot	
70	Mangho Mal	Grower Mithi	
71	Shoaib Ahmed	Regional Incharge Environment	

Venue: Gymkhana SBA		**Disrrict: NawabShah,Sanghar,N.Feroze**	
Date: 04-11-2013			
Sr.No.	**Name of Participant**	**Designation / Position**	**Contact Number**
1	Imdad Ali Bhambro	WMO (Engr) FT SKD	0300-3225881
2	Ali Nawaz Channar	D.D Agri: Ext: V.F	0333-7019568
3	Zeeshan Ali	W.M.O-SM (NPIW) Nawab Shah	0333-7015144
4	Abbas Keerio	Deputy Director (OFWM)	0305-3267800
5	Mehran Ali Kolachi	Deputy Director N/Feroze	0301-3543738
6	Abdul Hakeem Solangi	W.M.O (Engr) NPIW D/Pur	0300-3237688
7	Badrul Hassam Memon	A.D(F) NPIW D/Pur	0301-3535061
8	Ghulam Rasool Zardari	Grower D/Pur	0305-8456227
9	Gulam Mumtaz Samoo	W.M.O (F.T) N/Shah	0300-3235458
10	Muhammad Yousuf Bhatti	A.D(F) Kandiaro N/F	0301-3582292
11	Hadi Bux Channa	A.D(F) N.Feroze	0301-3898987
12	Abdul Jabbar Burriro	President MSWA, ABA N/F Taluka Kandiaro	0301-3528062
13	Guhram Khan Mari	W.M.O N/F	0300-3028396
14	Abdul Hakeem Malik	Sub-Engineer N/F	0302-3215459
15	Zulfiqar Ali Jalbani	Assist: Director N/F	0300-3062887
16	Nadir Ali Jalbani	Grower	0300-3063525
17	Muhammad Hassan Mangi	Sub-Engineer N/F	0301-3582297
18	Muhammad Farooq Soomro	W.M.O (Engr) N/F	0300-3060959
19	Ishtique Ali Memon	W.M.O (S/M) N/F	0333-2522939
20	Fiaz Ahmed	W.M.O (Engr) N/F	0300-3241504
21	Sikandar Ali Kalhoro	Assist: Agri: Engineer N/F	0302-2832264
22	Salamullah Khan	Grower (Moro)	0300-3621755
23	Faiz Muhammad Bughio	President Helath Environmental Creative Society Moro	0343-3428786

24	Abdul Rasool Ghanghro	Grower (Kandiaro)	0300-3200891
25	Kamran Bhatti	NGO Kandiaro	0333-4552285
26	Tufail Ahmed Jalbani	Grower (Bhiria city N/F)	0300-3070782
27	Sami Samoo	Engineer	0333-7016142
28	Ghazi Salah-u-ddin Channa	A.D. (F) NPIW N/Shah	0300-3211423
29	Mazhar Ali Chandio	S.F NPIW	0303-2066821
30	Javed Ahmed Abbasi	Sub-Engineer SOFWM	0302-3232418
31	Asadullah Memon	A.D. (F) NPIW Sakrand	0300-3037966
32	Shamsuddin Memon	A.D. (F) SOFWM Qazi Ahmed	0300-3232830
33	M. Hanif Arain	A.E.E, OFWM Sakrand	0306-8295570
34	Nazir Hussain Rahu	A.D, OFWM Sakrand	0300-3240318
35	Gulsher Kaka	W.M.O Sakrand	0300-3225338
36	Aijaz Ahmed	W.M.O N/Shah	0303-2071465
37	Mr. Ghulam Rasool Zardari	Grower	0305-8456227
38	Mr. Rafique Qureshi	Grower	0305-2937637
39	Mr. Abdul Hameed Lakhmir	Grower	0333-7018640
40	Mr. Ahmed Hussain Bhangwar	Grower	0315-3536307
41	Mr. Dur Muhammad Jamali	Grower	0300-3211261
42	Mr. Qurban Bhangwar	Grower	0300-3210968
43	Aslam Pervaiz Memon	Incharge A.D	0302-3201572
44	Mehrab Khan Qureshi	Zamindar	0303-3798690
45	Ameer Ali Shah	Grower N/F	
46	Mir Hassan Bughio	Grower N/F	
47	Ghulam Mustafa Rajpar	zamindar N/Feroze	0300-3230710
48	M. Sajid Memon	Grower N/F	
49	Abbas Ali Keerio	D.Director	0305-3267800
50	Osama Anwer	D.F.O N.Shah	0300-2189388
51	Rashid Ali Dahri	D.F.O S.F	0244-9370184
52	Imtiaz Ali Solangi	D.F.O S.F N.Feroze	0242-448963
53	Qurban Keerio	Grower N.Feroze	0301-2429719

54	M.Ajmal Arain	Grower Bhiria City N.Feroze	0300-8315621
55	G.Sarwer Keerio	Grower N.Feroze	
56	Gul Hassan Keerio	Grower Sanghar	
57	Abdul Hamid Dahri	Grower Sanghar	
58	Farooq Ahmed	Grower Sanghar	0333-2194815
59	Mola Bux Keerio	Grower Khipro	0346-8913580
60	Noor Muhammad	Grower Khipro	
61	Ali Hassan Keerio	Grower Jhole	
62	M.Alam Hingoro	Grower Khipro	
63	Abdul Haq Mari	Grower Shahdadpur	

Venue: Hotel Forum Inn		**District:Sukker,Khairpur,Ghotki**	
Date: 05-11-2013			
Sr.No.	**Name of Participant**	**Designation / Position**	**Contact Number**
1	Mr. Mureed Ali Talpur	Sindh EPA	0346-2379455
2	Mr. Abdul Razzaq Alvi	WMO Ghitki	0342-3915582
3	Khan Habib	WMO (OFWM) Sukkur	0333-7248138
4	Anwar Ali Khoso	DDF (OFWM) Sukkur	0333-7118558
5	Ghulam Asghar Mehar	ADF(OFWM) Khangarh	0300-9318224
6	Ali Mehmood Kaladi	AD(F) Chandka	0321-3142454
7	Ayaz Ali	WMO Kairpur	0302-3634438
8	Tariq Aziz Rajpar	AD(F) Akri	0300-7046008
9	M. Zahoor Rajpar		
10	M. Acahr khaskhili	SAFWO Sukkur	0300-3110372
11	Asalan Saleem Qureshi	WMO (FT) Sukkur	0300-8315599
12	Rahim Bux Mehar	ALMEHBN	0333-7163607
13	Mohammad Tariq Jatoi	I/C Asist: Director	0346-3410050
14	Mohammad Shoib Chand	Forest Officer	0345-2853989
15	Abdul Hafeez Chand	Forest Officer	0331-3078082
16	Mujeeb-ur-Rehman Kalwar	Vice Resident Sindh Abadgar Board Ghotki	0344-33179112
17	Abdul Sattar	A/D: Irrigation officer	0300-3114397
18	Mukesh Kumar	A/D (FT) Khairpur	0300-9312502
19	Taj Muhammad	Grower	0301-3412367
20	Abdul Khalique	Grower	0303-3717023

21	Hafiz Nizamuddin	Grower	0300-3130402
22	Ali Hasan Mehar	Coordinate WWF Pakistan	0300-3145972
23	Kubra Maghsi	SOFWUF	
24	M. Ashraf Pathan	Mobilizer Reverside Project	0333-3441474
25	Anwar Ahmed Channar	D.D Ghotki	0307-3424546
26	Irshad Ahmed Jotoi	Assist: Irrigation Engineer	0307-3638057
27	Abdul Majid	Accountant FA Ghitki	0300-3133800
28	M.Javed Pathan	Water Manag: Officer	0300-9314463
29	Abdul Rafique Dhamdhra	ADF Ghotki	0305-3200867
30	Mr. Ghulam Sarwar	Small Grower Farmer	0312-3420115
31	Abdul Sami Dhamdhra	President Dhamdhra	0301-3836652
32	Asadullah Bhutto	Small Grower Farmer	0302-3620217
33	Anwar Ali Noorani	Assistant Director	0302-3675225
34	Qazi Abdul Sattar	General Sceretary	0333-7225937
35	Ubaidullah Anwar	Sindh Abadgar Ghitki	0334-6906030
36	Ghulam Qasim Jokhio	President ch: Gokar Dist: Ghotki	0300-9318343
37	Mir Muhammad Mehar	WMO	0302-2986748
38	Abdul Roshan	Assist: Director	0300-3243708
39	Ali Khan	Chairman	0322-3691770
40	Ghulam Qasim	Grower (M.Dino Mehar)	0344-3390048
41	Mahesh Kumar	Grower (Keshar)	0343-3315682
42	Nazir Ahmed	WMO	0300-3299008
43	Abdul Karim	WMO Sukkur	0301-3403082
44	Abdul Qayyoom	WMO Engineer	0301-3431644
45	Abdul Latif Memon	Assist: Director Sukkur	0334-2814443
46	Mushfiquar Ahmed	WMO Engineer	0342-3008200
47	Aijaz Ali Khoso	AD(F)	0300-3322020
48	Nisar Pathan	Manager SRSO	0300-3114735
49	Dr. Abdul Nabi Mallah	D.O Agri: Extension khairpur	0345-3512973
50	Haji Ahmed	Grower	0344-8127457

51	Syed Nadeem Shah	Deputy Director (OFWM)	0300-3359601
52	Mehmood Khan		0300-3148132
53	Mohammad Rafique	W.M.O	0345-3892941
54	Farooq Ali	Assistant Director	0304-3590111
55	Muhammad Shah Rajpar	Assistant Director	0302-3657599
56	Attaullah Shah	Grower	0301-3869234
57	Khalil-ur-Rehman	Water Manag: Officer	0300-3115681
58	M.Aslam Shaikh	Regional Director Environmental Sukkur	071-9239091
59	Ali Hassan Mallah	WWF Sukkur	0300-3145972
60	M/S Kubra Mangrio	WWF Sukkur	
61	M.Rafiq Maka	D.F.O S.F Sukkur	0723-652050
62	Zeshan Durani	D.F.O S.F Khairpur	
63	Jawad Maher	Land lond Sukkur	

Venue: Gymkhana Shikarpur		**District:Shikarpur,Kandhkot,Jacobabad**	
Date: 06-11-2013			
S.No	**Name of Participant**	**Designation / Position**	**Contact Number**
1	Abdul Sattar Burriro	Grower	0306-3109480
2	Zafar Ali Katbar	W.M.O (Engr)	0300-8980809
3	Asif Ali Dayo	OFWM Shikarpur	0333-7280190
4	Khuda Bux Kalwar	A.D Agri: Ext: Khanpur	0333-7171473
5	Imdad Ali Mughal	Agri: Manag Aijaz Khan	0333-7268429
6	Ali Nawaz Polar	Grower	0306-3672697
7	Ghulam Sarwar Soomro	Zamindar	0333-7272347
8	M. Ramzan Siddique	D.D.A / A.D.A	0333-7273606
9	Haji Ameer Bux Pohore	General Secretary Abadgar Board	0300-3156988

10	Shabbir Ahmed Khoso	A.D (F) F.T, Dilmurad tcd	0300-3133932
11	Ghulam Muhammad Samoo	W.M.O (SM) District Jcd	0305-3275050
12	Asghar Ali Samoo	W.M.O (SM) District Jcd	0333-2457987
13	Mehboob Ali Dayo	Sub-Engineer (SM) District Jcd	0333-7353190
14	Abid Ali	Sr, FSL Coordinater	0301-5559597
15	Eid Muhammad	Sub-Engineer	0333-7341744
16	Bashir Ahmed Dayo	W.M.O (Engr)	0306-3102957
17	Aftab Ahmed Shaikh	W.M.O (Engr)	0300-2200381
18	Akhkaque Nabi Channa	Computer Operator	0300-3428803
19	Aftab Ahmed Noor	Water Management Officer	0333-7266494
20	Nadir Hussain Dayo	Sub-Engineer	0346-3385721
21	Naseem Ahmed	Sub-Engineer	0306-2911567
22	M. Sallem	Sub-Engineer	0335-3134607
23	Bakhat Ali	Farmer	0303-3168540
24	Ali Akbar	Farmer	0300-5450746
25	Muhammad Aslam Shaikh	Deputy Director (W.M Shikarpur)	0315-4410443
26	Qamruddin Memon	Agri: Officer A.E	0332-3943205
27	Syed Manzoor Ali Shah	Agriculture Officer	0332-3947286
28	Parvaiz Ahmed	Sub-Engineer	0343-3852566
29	Imran Hayyar Khan	Computer Operator	0333-7266003
30	Ghulam Muhammad	Employee	0301-3676482
31	Haji Saadat Baloch	Zamindar	0346-3661288
32	Ali Asghar Haleepota	Sub-Engineer	0332-2240310
33	Ashfaque Ahmed Shaikh	Water Management Officer	0314-7303333
34	Rashid Ali Noorani	Sub-Engineer	0321-3004889
35	Naveed Ahmed Burriro	Assist: Director For:	0333-7265881
36	Junaid Ahmed Samoo	Abaadgar Tehsil Khanpur	0333-7271338
37	Dr. Naveed Ahmed Abro	Zamindar	-
38	D.F.O	Forest Department Shikarpur	-
39	District Officer	S.F Shikarpur	-
40	Faiz Muhammad Jatoi	Zamindar Shikarpur	-

41	Dr. Naveed Maher	Zamindar Shikarpur	-
42	Mola Bux Kumbhar	Zamindar Shikarpur	-
43	Sahib Dino Pathan	Zamindar Shikarpur	-
44	Ahmed Bux khoso	Kandh Kot	-
45	Noor Muhammad Panhwer	Jcd	-

Venue: Hotel Green Palace		**District:Larkana,Qambar @ Shahdadkot, Dadu**	
Date: 07-11-2013			
Sr.No.	**Name of Participant**	**Designation / Position**	**Contact Number**
1	Ashfaque Ahmed	Water Management Officer	0306-3276854
2	Aziz Ahmed Khoso	Sub-Engineer	0343-3265552
3	Hidayat Ullah Soomro	Water Management Officer	0333-7398723
4	Muzaffar Ali Butt	Water Management Officer	0333-13336238
5	Nabi Bux Bhatti	Assistant Director(F)	0336-3710570
6	M. Arsalan	Water Management Officer	0334-9200073
7	Naseer Ahmed Chandio	Grower	0307-2104852
8	Arbab Ali Burdi	Grower	0300-5060730
9	Aurangzeb Solangi	Water Management Officer	0333-7550648
10	Mohsin Ali Sangi	Water Management Officer	0333-7544174
11	Zaffuruddin Mugheri	Grower	0300-3422803
12	Zeeshan Hussain	Computer Operator	0314-7729685
13	Amanullah	A.D (F) F.T: Kamber	0336-3142880
14	Shamsuddin Mugheri	A.D (F) F.T: Wagon	0333-7549846
15	Sultan Ahmed Jamali	Grower	0306-3483382
16	Abdul Hafeez Soomro	Sub-Engineer	0302-3994687
17	Ayaz Hussain Jamali	Water Management officer	0313-3691655
18	Hassan Din Jonejo	Water Management Officer	0333-7521046
19	Atta Mohammad Chhajri	Assistant Director(F)	0333-7569186
20	Wajid Ali Shaikh	Assistant Director(F)	0333-7548380

21	Asif Raza Jamali	Water Management Officer	0300-3415828
22	Muhammad Saleh Burdi	Assistant Director(F)	0333-7556640
23	Shaique-u-Rehman	Assistant Director(F)	0300-3620911
24	M. Haneef Shaikh	Deputy Director Kamber	0334-2789616
25	A. Sushan Shah	D.D. (Tech) PMU Larkana	0302-3483181
26	Chaudry Kunnar Oad	W.M.O Officer Agri:	0333-7556174
27	Shah Muhammad Channa	Assistant Director(F)	0300-3423620
28	Muhammad Sadiq	Deputy Director	0300-3226906
29	Hizbullah Solangi	Sub-Engineer	0301-2802199
30	Ch: Asghar Soomro	Sub-Engineer	0300-8983928
31	Gh: Hussain Shah	W.M.O Engineer	0300-3237542
32	Riaz Ali Mallah	W.M.O Engineer	0307-2113229
33	Naveed Aman Laghari	W.M.O Engineer/SM	0333-7547472
34	Gulzar Ali Suhag	Social Mobilizer (WM)	0333-7538313
35	Javed Ahmed Shaikh	A.D (F.T) Nasirabad	0334-2073175
36	Kailash Kumar	A.D (F.T) Dokri	0345-3831728
37	Abdul Hameed Bhatti	W.M.O	0333-7539470
38	Abdul Karim	Zamindar	0303-3671489
39	Muhammad Nawaz Soomro	S.Engineer F.T Seeta	0346-3639470
40	Kamran Ahmed	W.M.O (F.T) K.N Shah	0331-3490034
41	Mujeeb-ur-Rehman Tunio	Grower	0322-8215778
42	Liaquat Ali Mehassar	Zamindar	0300-3401868
43	Engr: Ghulam Hussain Shaikh	W.M.O	0333-7554493
44	Waheed-u-Rehman Laghari	Assistant Director (Ratodero)	0305-3728004
45	Muneer Hussain	Zamindar	0322-3803909
46	Abdullah	W.M.O	0335-3136213
47	Ashfaq Ahmed Soomro	Agri: Officer (H.Q)	0345-3830280
48	Aqeel Ahmed	Larkana	0300-3418141
49	Muhammad Ali Unnar	D.F.O Larkana	074-9410215
50	Ajmal Hussain Tunio	Environmental Department Larkana	0313-3273950

51	Zahid Hussain	Grower	0346-3702750
52	Aziz Ali Kalhoro	Grower Dokri	
53	Gulam M.Lakhiar	Grower Dadu	
54	M.Yousf Lakhiar	Grower Dadu	
55	Bashir Ahmed channa	Grower Dadu	
56	Shafiq M.	Grower Dadu	
57	Faqeer M.Somroo	Grower Dadu	
58	Faiz M.Bughio	Grower Dadu	
59	Ali Khan Bhond	Grower Dadu	
60	Inayat Ali Soomro	Grower Dadu	
61	M.Anwer Kalhoro	D.F.O Larkana	
62	Arshad Kumario	D.F.O Larkana	
63	Ali Hassan Khatian	Grower Ratodero	

Venue: Gymkhana Makli Thatta		**District: Thatta,Karachi**	
Date: 28-11-2013			
S.No	**Name of Participant**	**Designation / Position**	**Contact Number**
1	Ayazuddin	A.D Gadap Karachi	0321-2021345
2	Tariq Khan	W.M.O Gadap Karachi	0322-2291181
3	Mir Nusrat Ali	Sub Engineer Gadap Karachi	0334-3702925
4	Khawand Dino Buriro	W.M.O	0334-3662696
5	Noheed Barak	W.M.O	0343-3344450
6	Fazlur Rehman Baloch	Zamindar	0321-2103176
7	Haji Mohammad Baloch	Zamindar	0333-2113362
8	Zahoor Baloch	Zamindar	0321-8766415
9	Abdul Razzaq Baloch	Zamindar	0321-2454156
10	Mohammad Haneed Qureshi	Assistant Director	0302-2486703
11	Salahuddin Junejo	P.S.O NSTHRI Thatta	0301-3584919
12	Dad Mohammad	Zamindar	0321-3711612
13	M. Uris Chohan	A.D.F Shah Burder	0300-2906732
14	Ghulam Mustafa	W.M.O	0321-3719370
15	Sanaullah Soomro	Agriculturist	0300-9245003
16	Haroon Yousus	Agriculturist	0306-2398747
17	Abdul Wajid Khan	Assistant Director (F) Thatta	0333-2683763

18	Mohammad Fayaz Kubar	W.M.O (F.T) MP Batharo	0300-3154789
19	Sarfaraz	Agriculturist Officer	0321-3713293
20	Mukhtar Ahmed	A.D (F) F.T Dero	0300-3500388
21	Shah Hussain Shah	A.D (F) F.T Thatta	0300-3033910
22	Kashif Maqbool Mughal	A.D (F) F.T MP Sakro	0321-2574048
23	Muneer Ahmed Abbasi	Regional Incharge	0303-3457939
24	Ali Nawaz	Field Supervisor ROH	0333-3182112
25	Aqeel Ahmed Abro	W.M.O Thatta	0321-2143955
26	Shoukat Ali	Grower	0322-3831030
27	Ghulam Abbas Kalhoro	Water Management	0300-3070704
28	Nizamuddin	A.D (F) Sajawal	0333-7234689
29	Ali Mohammad	Grower	0333-2125398
30	Khair Mohammad	Grower	0321-325241
31	Nazar Merbahar	Grower	0300-3031342
32	Muhammd Mughpal	A.D (F) F.T Garho	0343-3342003
33	Nisar Ahmed	Sub Engineer	0341-3237924
34	Abdul Sattar Khulji	Sub Engineer	0334-3186007
35	Shah Mohammad Qureshi	Sub Engineer	0321-3112969
36	Wajid Sharif Siddiqui	W.M.O	0334-3760408
37	Muneer Ahmed Abbasi	Regional Incharge	0303-3457939
38	Arshad Ali Abro	Sub Engineer	0306-3122313
39	Lal Mohammad	Agricultural	0332-571703
40	Mohammad Ismail	Agricultural	
41	Shahnawaz	Agricultural	0321-3191052
42	Pehlaj Rai	W.M.O	
43	Ghulam Ali	Agricultural	0300-2455935
44	Nazar Mallah	Agricultural	0323-7350972
45	Uris	Zamindar	0343-3340401
46	Haji Mohammad Ilyas	Farmer	0321-2163741
47	Haji Nabi Bux Baloch	Malir Karachi	0321-2151862
48	Haji Ahmed Baloch	Malir Karachi	0333-2177669
49	Abdullah	Senior Engineer	0341-3020702
50	Dost Ali		
51	Haji Adam Salaar		
52	Ahmed Khan Nizamani	Computer Operator	0347-3667350
53	Aijaz Jatoi	Grower	0301-3588641
54	Ghulam Hyder Lakhakhi	Grower	0302-2116005
55	Ghulam Asghar	Johar jamali	0300-3095899
56	Mukhtiar Ali Khawaji	Thatta	0333-3701526
57	Dr. Shabbir Hyder shah	Thatta	0333-2440722

58	Sohail Ahmed	W.M.O	
59	Shaukat Ali	S.E	0302-2825080
60	Abdul Razzaq Waraich	Sub Engineer	0301-2367881
61	Muhammad Saleh	Sub Engineer	0333-3031233
62	Maftoon Shaikh	W.M.O	0333-3562129
63	Arbab Raheem	Grower	0322-8371709

Annexure C

Baseline Studies on Flora, Fauna and Heritage Sites

Baseline Study of Floral/Vegetation in Designated Area

The Regional Plan for the left bank of Indus, delta and coastal area covers the pre-feasibilities of structural and non structural interventions, selected by the stakeholders through a consultative process, Identifying the problems to address the proper drainage of saline effluent, storm water and flood water. In addition, adoption of measures to improve the wetlands in delta area and coastal zone recognizing their environmental importance for the benefit of local population are also incorporated.

Irrigated Zone

The study area comprises of Ghotki, Sukkur, Khairpur, Naushahro Feroze, Nawabshah, Sanghar, Mirpur Khas, Umar Kot, Matiari, Tando Allahyar, Tando Muhammad Khan, Thatta and Badin district, the left Bank of Indus River. This is an irrigated zone commanded under Guddu Barrage, Sukkur Barrage and Kotri Barrage with its network of canals distributaries and water courses. Where there is sweet water available in sub-soil, the agriculture is raised by installation of tubewells. The main crops raised in Kharif and Rabi season are Cotton, Wheat, Sugar cane, Rice. Besides various vegetables like Cabbage, Chilies, Radish, Tomato, Onion, Coriander, Brinjal, Citrus, Lady finger, Mint, Bitter gourd and fruits like Date palm, Papita, Grewia, Mango, Jaman, Guava, Banana, Mulberry, Nustberry, Sugar apple, Berry, Oil seeds of rape, and Sunflower is raised.

The agricultural zone is conspicuous of tree growth in various forms. Trees are grown not only with agricultural crop in the form of agroforestry but also as solitary or as in groves for shade, firewood and forage for cattle. The area is also marked with irrigated plantations raised by Sindh Forest Department to cater the needs of timber, fireweed and forage. In Ghotki, Sukkur and Khairpur the main species being the Talhee (*Dalbergia sissoo*) where as in rest of the irrigated plantation, Babul (*Acacia nilotica)* constitutes the predominant species. In addition to this various fast growing species like Mulberry, (*Morus alba*) Neem (*Melia azadirech*), Cono (*Conocarpus lanrceofolius*) are also raised for various economic and environmental returns.

In the agricultural fields, the trees are raised along field boundaries, water courses, in linear fashion as shelterbelts or wind breaks and individual scattered trees. The main species growing as shelterbelts or wind breaks are Eucalyptus, Conocarpus, Neem and *Agata grandiflora* (Manjadri).

The raising of *Acacia nilotica* (Babul) on close spacing in a block plantation for shorter rotation is a common practice of agro forestry in lower region, particularly in Sanghar, Matiari, Hyderabad and Mirpur Khas districts. The main objectives is to improve the fertility of soil on one hand and getting economic return in the form of small timber for mines. In addition to the hurries, area is utilized to get fodder for animals.

There are various trees growing along roads, opens spaces, otaques and open spaces for shade and aesthetic purpose. They include, *Poinciana pulcherima* (Gold Mohar), *Albizzia procera* (Siris), *Melia azedarach* (Bakain), *Tamarindus Indica* (Tamarind) and *Pithecolobium dulce*, (Jungle Jalebee) and *Cassia fistula* (chimkani).

TABLE 1: TREES GROWING IN IRRIGATED ZONE

Ser No	Botanical Name	English Name	Local Name
1.	*Acacia nilotica*	Gum acacia	Baber
2.	*Albiaaiz procera*	Indian walnut	Achosirhan
3.	*Azadirachta indica*	Ash-leaved bead tree	Nim
4.	*Cassia fistula*	Pudding pipe tree	Amaltas
5.	*Conocarpus lancefoleus*	Ethiopian teak	Kono
6.	*Dalbergia sisso*	Shisham	Talee
7.	*Eucalyptus camaldulensis*	Red-gum	Sufado
8.	*Ficus bengalensis*	Ficus	Bur
9.	*Pithecellobium dulce*	Jangle pithecolobium	Jungle Jalebee
10.	*Salmalia malabarica*	Silk cotton tree	Simal
11.	*Sesbania aegyptica*	Egyptian sesbania	Manjathri
12.	*Terminalia arjuna*	Terminalia	Aarjan
13.	*Thespesia populnea*	Tulip tree	Pyrus peepal

Ref: Sindh Forest Department Government of Sindh, 2005

Arid and Semiarid Zone

This is the area, where irrigation supplies, cannot command the area, or is insufficient to cater the needs of agriculture, or tree plantations. It falls in Umar Kot, Digri, Tando Bago and Badin districts. This area is conspicuous for various Xerophytes, Grasses, Creepers and Climbers. The species require irrigation to a minimal quantity and frequency. They sustain high temperature, Sodicity of soil and water logged conditions. The main species being *Prosopis spicegera,* (Kandi), *Prosopis glandulosa* (Devi), *Capparis aphylla* (Kirar), *Zizyphus mauritiana* (Ber), *Acacia jacquemontii* (Baveri), *Salvadora oleoides* (Khabar),

Tamarix aphylla, Tamarix dioeca (Lao), Tamarix articulate (Laee) and Acacia Senegal. Various shrubs and herbs include, Calligonum palygonides, (Phog), *Aerva tomentosa* (Booh), *Sacchrum spontaneum* (Munj), *Solarium xanthocarpum* (Kanderi) and *Alhajee maurorum* (Kandero).

Various grasses also grow in this tract which depends upon rain water. They are *Panicum antidotale, (Gum), Chrysopogan jawarancusa (Kathari) and Desmostaechya bipinnata* (Dhub).

In Badin, the main arid species is Devi (*Prosopis julifloira*). The species is drought resistant species, require less quantity of water, growing on sites where sub-soil water level is below 80-100 feet. This species is a source of shade, forage, fire wood. Many people manufacture Coal in kilns and earn their lively hood. This Coal is used in manufacture of bricks. The species regenerates quickly through coppicing and propagate extensively through seed.

TABLE 2: TREE GROWING ARID AND SEMIARID ZONE

Ser No	Botanical Name	English Name	Local Name
1.	*Acacia jacquemontii*	Desert acacia	Baveri
2.	*Acacia Senegal*	Senegalian acacia	Khoomhhat
3.	*Aerva tomentosa*	Woolly Amaranthus	Boah
4.	*Alhajee maurorum*	Camel thom	Kandero
5.	*Amaranthus gracilis*	Amaranth strawberry blight	Mareero
6.	*Andropogon annulatus*	Sheda grass	
7.	*Argemone Mexicana*	Prickly poppy	Kanderi
8.	*Brachiaria ramose*	False creeping paspalum	Gandhaer
9.	*Calligonum polygonoides*	Calligonum	Phog
10.	*Calotropis procera*	Mudar/Rubber bush	Ak
11.	*Capparis spinosa*	Thorny caperbush	Kerar
12.	*Casuarina equisetifoia*	Indus pine	
13.	*Chenopodium album*	White goosefoot	Sag
14.	*Crotalaria burhia*	Rattle cord – hemp	Khup
15.	*Cucumis callosus*	Bitter cucumber	Chibhir
16.	*Datura alba*	Thorn apple	Dhotoro
17.	*Dodonaea viscose*	Dodonaea – Hob bush	Sanatho

18.	*Euphorbia royleana*	Milk Herb weed	Thoohar
19.	*Leptadenia pyrotechnica*	Leptadenia	Khip
20.	*Poa tenella*	Meadow grass	Drubh
21.	*Prosopis cineraria*	Prosopis	Kandi
22.	*Prosopis glandulosa*	Mesquite	Devi
23.	*Salvadora oleodes*	Salvadora	Khabar
24.	*Solanum xanthocarpum*	Thorn apple	Kandari
25.	*Suaeda fruticosa*	Goosefoot	Lani
26.	*Tamarix aphylla*	Tamarisk	Lawo
27.	*Tamaix dioica*	Tamarisk	Laee
28.	*Zizyhus mauritiana*	Berry	Ber

Ref: Sindh Forest Department Government of Sindh, 2005

Reserved Forests in the study Area

Of the total area of 82,000 ha under irrigated plantations in Sindh, an area of 65,175 ha is located on left bank of Indus in various districts where as the rest 16,825 ha is located on right bank of Indus. These irrigated plantations are legally declared as reserved forests and are also game reserves and game sanctuaries for wildlife. The names of forests located on left bank of Indus and their area are listed in Tabel 3:

Table 3: District-wise Area of Irrigated Plantations on Left Bank of Indus in Sindh

District	Area (Ha)
Ghotki	11,431
Khairpur	5,013
Naushahro Feroze	634
Nawabshah	1,933
Sanghar	9,121
Umerkot	500
Hyderabad	3,282
Tando Muhammad Khan	7,918
Thatta	15,833

Badin	9,510
Total	65,175

Ref: WWF-Ecosystem Management Plan 2007

Flora of Wetlands

There are many wetlands, locally called Dhoras which are inundated due to inadequate drainage system or excessive rain and storm water. The main Dhoras are, Rainee Dhoro, Husainabab – Mehrabpur Dhoro, Kandiaro - Moro Dhoro, Mehrab pur Bachal rahu Dhoro, Sohni Dhoro, Bhai khan Dhoro, Puran Dhoro, Digri – Sarfaraz Dhoro, Pangrio Dhoro, Hakro Dhoro, Naro Dhoro and Pithoro Dhoro. It was observed that storm water from catchment area ponds in these Dhoras, spill over and inundates the crops and settlements due to blockages. They are actually abandoned River courses on the sides of Indus. These Dhoras are obstructed by water courses, rail, roads and unauthorized settlements. They provide valuable feeding and resting grounds for many migrant birds, especially during seasonal migration. Collectively, these wet lands support large number of resident and migratory water birds. These wetlands are highly resilient. Major changes in water supplies from year to year causes only temporary changes in the cycle of flood and descication. But the species range remains almost unchanged. As salinities increase, plants may be replaced by blue-green algae *Cynobacteriaeaea* which, on decaying, on edge of Dhoras, provide food for swarms of flies, on which many birds feed.

The most widespread plants appeared *Typha angustata*, (Reed), which has an economic value as a source material for constructing temporary houses and shelters. Other hydrophytes like *Phragmites karka and Nymphaea lotus*, also occurs naturally. Aquatic vegetation, dominates the open water area, comprises of water lilies and *Potomogeton pectinatus*. Submerged aquatic vegetation dominates the open water area, filling the whole water profile from bottom to surface comprises of *Hydrilla verticellata*, (Panijo Booto) *Utricularia*, *Juncus maritimus* (Rush-kal), *Justica hetrocarpa* (Water willow), *Azolla pinnata*. (Water velvet) *Eragrostis poaedes* (Makhnee gah), *Ipomea aquatica* (Naro), *Juncellus lavigatus* (Sedge) *Arundo donax* (Reed grass), *Bergia suffruticosa* (Panijo phog) and *Elusine aegyptica* (Gandher). This test of vegetation is clearly a critical aspect of the wetland ecosystem, the main food source for large and varied fish population in Dhoras.

Typha angustata (Reed) and juncus maritamus (rush) does not resists high level of salinity. They are fresh water plants thriving in water where electrical conductivity does not exceed about 3.5 m 5/cm. *Potomogeton pectinatus* can tolerate E.C upto 4.7m s/cm, where as other aquatic species can tolerate E.C more than 6.mS/Cm. The presence of substantial populations of submerged aquatics seems to be important flood source for both fish and water birds.

TABLE 4: PLANTS GROWING IN PONDS

Ser No	Botanical Name	English Name	Local Name
1.	*Arundo donax*	Reed grass	Nar
2.	*Azolla pinnata*	Water velvet	Benafsho
3.	*Bergia suffruticosa*	-	Pani-jo-phog
4.	*Hydrilla verticillata*	Water thyme o oxygen weed	Pani-jo-booto
5.	*Juncus martimus*	Rush	Kal
6.	*Justica heterocarpa*	Water villow	Abi bed
7.	*Lotus garcinii*	Lotus	Paboro
8.	*Phragmites karka*	Water grass	Naro gah
9.	*Scirpus capitatus*	Sedge	Delo
10.	*Typha angustata*	Elephant grass	Pan
11.	*Typha elephantine*	Elephant grass	Pan

Ref: Sindh Forest Department Government of Sindh Working Plan for Coastal Mangroves 1987

Mangroves/coastal areas

The Indus delta is built up by the discharge of large quantities of silt, washes down in Indus River from Kara Kuram and Himalayan Mountain ranges. The delta spread over in Kharochan Taluka over 108, 753 ha in study area. There are about 10 creeks and mud flats. Mangroves are dependent upon fresh water discharges from river Indus. The mangroves are dominant by a single species, *Avicennia marina*, which is over 95% of the trees, through a few stands of *Ceriops tagal, Brugiuirfera conjugate, Aegiceras carniculatum and Rhizophora mucronata* also occur. They are adapted to water logged and oxygen deficient tidal mud flats, where no other plant survive. These forests besides being environmental value, also protect the Karachi and Bin Qasim Ports from siltation and erosion. They act as breeding ground for shrimps, birds providing low grade timber in house construction, poles for boats, fuelwood for curing shrimps and fodder for live stock. It is a livelihood for animals. Local people use *Rhizaphora* poles is many house hold products. Mangroves protect the coast from wind and ocean currents.

TABLE 5: TREES GROWING IN MANGROVES

Ser No	Botanical Name	English Name	Local Name
1.	*Avicennia marina*	Avicennia	Timar
2.	*Aegiceras carniculatum*	Black mangrove	Cheeanr

3.	*Bruguiera conjugate*		
4.	*Ceriops tagal*	Yellow mangrove	Kiriri
5.	*Rhizophora mucronata*	Coman mangrove	Kumeree

Ref: IUCN 2004-Sindh State of Development and Environment

Baseline survey of Fauna in the study area

The study area comprising of 24 districts located on left bank of Indus is rich in natural resources, having diverse and productive habitats, ecosystems and faunal and floral resources. They protected areas, reserved and protected forests, wetlands, variety of fish both marine and inland, wildlife, agriculture and live stock and wetland resources. Some of wetlands of the study area are internationally recognized Ramsar sites. The wildlife in the study area consists of marine and terrestrial species and migratory birds visiting the area every year.

This chapter of report provides the baseline of Fauna in various types of ecosystems in the study area. The data/information has been collected from primary and secondary data sources and surveys in the study area conducted prior to preparation of this report.

List of protected areas in study area

Table 6 shows the list of protected Areas in Sindh and the Study area

Table 6: Protected Areas in Sindh and Study Area

S. No	Name of Protected Area	Area (ha)	District	Habitat
1.	Kirthar National Park	308733	Dadu/Karachi	Arid/Semi Arid
	Wildlife Sanctuaries			
2.	Bijoro Chabh	121	Thatta	Wetland
3.	Cut Munarkt Chach	405	Thatta	Wetland
4.	Deh Akro-II	20243	Nawabshah	Wetland complex
5.	Dhoung Block	2098	Shikarpur	Riverine Forest
6.	Drigh Lake	164	Larkana	Wetland
7.	Ghandak Dhoro	31	Jacobabad	Wetland
8.	Gullel Kohri	40	Thatta	Wetland
9.	Gulsher Dhund	24	Hyderabad	Wetland

10.	Hub Dam	27219	Karachi	Wetland
11.	Hudero Lake	1321	Thatta	Wetland
12.	Hudero Lake	1321	Thatta	Wetland
13.	Haleji Lake	1704	Thatta	Wetland
14.	Hilaya	324	Thatta	Wetland
15.	Keti Bunder North	8948	Thatta	Wetland
16.	Keti Bunder South	23046	Thatta	Wetland
17.	Khadi	81	Thatta	Wetland
18.	Khat Dhoro	11	Larkana	Wetland
19.	Kinjher Lake	130468	Thatta	Wetland
20.	Kot Dinghano	30	Nawabshah	Wetland
21.	Lakhat	101	Nawabshah	Wetland
22.	Lung Lake	19	Larkana	Wetland
23.	Mahal Kohistan	70577	Dadu	Arid/Semi Arid
24.	Majiran	24	Thatta	Wetland
25.	Marho Kotri	162	Thatta	Wetland
26.	Miani Dhand	57	Hyderabad	Wetland
27.	Mohabat Dero	16	Nawabshah	Wetland
28.	Munarki	12	Thatta	Wetland
29.	Nara Desert	223590	Sukkur/Khairpur	Desert
30.	Norang	243	Thatta	Wetland
31.	Rann of Kutch	320463	Badin/Tharparkar	Desert& Marshy
32.	Samno Dhund	23	Hyderabad	Wetland
33.	Sadnai	84	Thatta	Wetland
34.	ShahLanko	61	Thatta	Wetland
35.	Takkar	43513	Khairpur	Desert/Semi Desert

Ref: IUCN 2004-Sindh State of Development and Environment

Game Reserves in the Study Area

Under Wildlife Protection Act, 1972 Game Reserves has been declared. List of Game Reserves is shown in Table 7:

Table 7: List of Game Reserves in Sindh and Study Area

S. No	Game Reserves	Area (ha)	District	Eco-zone
1.	Deh Jangisar	314	Thatta	Arid/Semi Arid

2.	Deh Khalifa	429	Thatta	Arid/Semi Arid
3.	Dosu Forest	2312	Larkana	Riverine Forest
4.	Hala	954	Hyderabad	Riverine Forest
5.	Indus river Dolphin Game Reserve (From Sukkur to Guddu Barrage)	44200	Jacobabad/Ghotki/Shikarpur & Sukkur	River Indus
6.	Khipro Forest	3885	Sanghar	Irrigated Forest
7.	Mando Dero	1234	Sukkur	Semi Arid & Cultivated
8.	Mirpur Sakro	777	Thatta	Semi Arid
9.	Nara	109966	Khairpur	Desert & Wetland
10.	Pai Forest	1969	Nawabshah	Riverine Forest
11.	Sahib Samo	349	Hyderabad	Riverine Forest
12.	Surjan, Sumbak, Eri & Hothiano	406302	Dadu	Arid/Semi Arid
13.	Tando Mitho Khan	5343	Sanghar	Desert & Semi Arid

Ref: IUCN 2004-Sindh State of Development and Environment

Wetlands in Sindh and study area

Table 8: List of Wetlands of International Importance in Sindh

Name of Site	Location	District	Surface Area (hectares)	Wetland Type	Recognition RAMSAR Site No, (RS#)
Keenjahar (Kalri) Lake	24° 56 N 68° 03 E	Thatta	134682	Freshwater lake	1976 RS#99
Drigh Lake	27°34N 68° 06 E	Larkana	1641 1822	Slightly brackish lake	1976 BS#100
Haleji Lake	24° 47 N 67° 46 E	Thatta	1704	Artificial freshwater lake	1976 RS#t01
Indus Dolphin	28° 01 N 69° 15 E	Between Guddu and	125,0001 442002	River	2001 RS#1065

Reserve		Sukkur Barrages			
Jubho Lagoon	24° 20 N 68° 40 E	Thatta	706	Brackish lagoon, mudflats, marshes	2001 RS#1067
Nurri Lagoon	24° 30 N 68° 47 E	Badin	2540	Brackish lagoon, mudflats	2001 RS#1069

Ref: IUCN 2004-Sindh State of Development and Environment

Table 9: List of Wetlands in Sindh and Study Area

Name of Site	Location	District	Surface area (hectares)	Wetland type
Ghauspur (Rup) Jheel	28° 08N 69° 06E	Jacobabad	Combined with SDL6002	Freshwater lake
Sindhi Dhoro Lake (SDL)	28° 09N 69° 04E	Jacobabad		Freshwater lake
Hamal Katchri lake	c.27° 23N 67° 55E	Larkana	unknown	Shallow lake, associated marshes
Pugri Lake	27°18N 68° 03E	Larkana	unknown	Shallow brackish lake
Manchar lake	26°25N 67°39E	Dadu	ca, 6000 ha	Freshwater lake and marshes
Nara Canal area	26°00-27°15N 68°47-69°18E	Khairpur and Sanghar	ca. 300000	200 small, freshwater, brackish and saline lakes and marshes
Soonhari lake	26° 10N 69° 04E	Sanghar	245	Small saline lake and brackish marshes
Sadhori lake	26° 12N 69°07E	Sanghar	Unknown	Shallow freshwater lake
Sanghriaro lake	26° 07 N 69° 12 E	Sanghar	380	Shallow brackish lake
Khipro lakes	25°32-25°49N 69°29-69°38 E	Sanghar	ca. 30000	30 small brackish and saline lakes
The Tando Bago lakes	24°45-24°50 N 68°50-69°05 E	Badin	unknown	11 shallow fresh and slight brackish lakes and marshes

Name of Site	Location	District	Surface area (hectares)	Wetland type
Phoosna lakes	24° 48 N 68° 54 E	Badin	160 ha	2 shallow slightly brackish lakes
Charwo Lake	24°50N 69° 00 E	Badin	100 ha	Shallow freshwater lake and marshes
Khanjo (Khowaja lake)	24°47N 69° 05 E	Badin	ca. 500	Freshwater lake and associated marshes
The Badin and Kadhan lagoons	24°15-24° 30 N 68°35-69°05 E	Badin	unknown	Very shallow brackish lagoons and wet mudflats
Shahbundar Salt Waste and Jafri lakes	24°06-24°12 N 67°54-68°15 E	Thatta	ca. 20000 ha	Salt waste and large brackish to saline lake
Mahboob Shah Lake	24° 30 N 68° 03 E	Sujawal	100 ha	Small fresh to brackish lake and marshes(small lakes in the region: Karo, Karajo, Chatch and Ghungri)

Ref: IUCN 2004-Sindh State of Development and Environment

Wetlands in Sindh and study area

Table 10: List of Wetlands of International Importance in Sindh

Name of Site	Location	District	Surface Area (hectares)	Wetland Type	Recognition RAMSAR Site No, (RS#)
Keenjahar (Kalri) Lake	24° 56 N 68° 03 E	Thatta	134682	Freshwater lake	1976 RS#99
Drigh Lake	27°34N 68° 06 E	Larkana	1641 1822	Slightly brackish lake	1976 BS#100
Haleji Lake	24° 47 N 67° 46 E	Thatta	1704	Artificial freshwater lake	1976 RS#t01
Indus Dolphin Reserve	28° 01 N 69° 15 E	Between Guddu and Sukkur Barrages	125,0001 442002	River	2001 RS#1065

Jubho Lagoon	24° 20 N 68° 40 E	Thatta	706	Brackish lagoon, mudflats, marshes	2001 RS#1067
Nurri Lagoon	24° 30 N 68° 47 E	Badin	2540	Brackish lagoon, mudflats	2001 RS#1069

Ref: IUCN 2004-Sindh State of Development and Environment

Table 11: List of Wetlands in Sindh and Study Area

Name of Site	Location	District	Surface area (hectares)	Wetland type
Ghauspur (Rup) Jheel	28° 08N 69° 06E	Jacobabad	Combined with SDL6002	Freshwater lake
Sindhi Dhoro Lake (SDL)	28° 09N 69° 04E	Jacobabad		Freshwater lake
Hamal Katchri lake	c.27° 23N 67° 55E	Larkana	unknown	Shallow lake, associated marshes
Pugri Lake	27°18N 68° 03E	Larkana	unknown	Shallow brackish lake
Manchar lake	26°25N 67°39E	Dadu	ca, 6000 ha	Freshwater lake and marshes
Nara Canal area	26°00-27°15N 68°47-69°18E	Khairpur and Sanghar	ca. 300000	200 small, freshwater, brackish and saline lakes and marshes
Soonhari lake	26° 10N 69° 04E	Sanghar	245	Small saline lake and brackish marshes
Sadhori lake	26° 12N 69°07E	Sanghar	Unknown	Shallow freshwater lake
Sanghriaro lake	26° 07 N 69° 12 E	Sanghar	380	Shallow brackish lake
Khipro lakes	25°32-25°49N 69°29-69°38 E	Sanghar	ca. 30000	30 small brackish and saline lakes
The Tando Bago lakes	24°45-24°50 N 68°50-69°05 E	Badin	unknown	11 shallow fresh and slight brackish lakes and marshes
Phoosna lakes	24° 48 N 68° 54 E	Badin	160 ha	2 shallow slightly brackish lakes

Name of Site	Location	District	Surface area (hectares)	Wetland type
Charwo Lake	24°50N 69° 00 E	Badin	100 ha	Shallow freshwater lake and marshes
Khanjo (Khowaja lake)	24°47N 69° 05 E	Badin	ca. 500	Freshwater lake and associated marshes
The Badin and Kadhan lagoons	24°15-24° 30 N 68°35-69°05 E	Badin	unknown	Very shallow brackish lagoons and wet mudflats
Shahbundar Salt Waste and Jafri lakes	24°06-24°12 N 67°54-68°15 E	Thatta	ca. 20000 ha	Salt waste and large brackish to saline lake
Mahboob Shah Lake	24° 30 N 68° 03 E	Sujawal	100 ha	Small fresh to brackish lake and marshes(small lakes in the region: Karo, Karajo, Chatch and Ghungri)
Hadero Lake	24° 49 N 67° 52 E	Thatta	1321	Brackish lake
Hawkes Bay / Sandspit and adjacent creeks	24°47-24°52N 66°50-66°59 E	Karachi	20 km beaches ca. 2000 tidal creeks	Sandy beaches, complex creeks and shallow tidal lagoons, inter tidal mudflats and mangrove swamps
Clifton Beach	24° 47 N 67°05E	Karachi	8 km beach	Sandy beach, tidal mudflats, sand dunes
Korangi (KC) and Gharo (GC) creeks	24°47N 67° 11E	Karachi	KC 48386 GC 64370	Tidal creeks, mangrove swamps, tidal mudflats
Outer Indus Delta	23° 45-24° 45N 67° 10-68° 15E	Karachi to Indian border	ca. 300000 200000 mangroves	Tidal river channels, creeks, sandy islands, mangrove swamps, inter tidal flats
Langh (Lungh) Lake	27° 30N 68°05E	Larkana	19	Formerly a freshwater lake fed by rice paddies, now water diverted elsewhere.

Name of Site	Location	District	Surface area (hectares)	Wetland type
				Wetland has completely disappeared

Ref: IUCN 2004-Sindh State of Development and Environment

Ramsar Recognized sites in Sindh and study area

The study area has three wetland complexes viz Deh Akro II wetland complex, Chotiari wetland complex and Coastal wetland Complex. They are considered as biodiversity hotspots due to the availability of diverse habitats and relatively low anthropological disturbance.

The Indus Dolphin Reserve is spread over 135 km from the Sukkur upstream to the Guddu Barrage. In 1974, the entire area was declared the home of the endangered Blind Dolphin (IUCN Red Data Book). The major threats it faces include split populations of the dolphins due to dams and barrages on the River Indus, reduction in habitat size during dry season, high turbidity, pollution, and hunting. The number of dolphins at the site has increased from 150 in 1974 to 620 in 2001.

Jubho Lagoon is a shallow, small brackish water lagoon with mudflats and marshes that support a large concentration of migratory birds including flamingos and endangered Dalmation pelicans, a rare species in the world. This was declared a Ramsar site in 2001 because of the efforts made by IUCN Pakistan.

Nurruri Lagoon is also a brackish, privately owned lagoon with barren mudflats that is visited by large concentrations of migratory water birds. It was also declared a Ramsar site in 2001. Increased salinity, sea intrusion, population pressures, agricultural and industrial pollution are major threats to this site.

Deh Akro is a wildlife sanctuary consisting of four major habitats; desert, wetland, marsh, and agricultural. Located 330km northeast of Karachi, it is a natural inland wetland ecosystem, which supports a variety of rare and endangered wildlife species. This area hosts a considerable number of rare fauna. Many indigenous fish species are also found here. Water scarcity during a persistent dry spell is adversely affecting this area.

Runn of Kutch is part of the great Thar desert and comprises of stablized sand dunes, with broad inter-dunal valleys of alluvial soil, connected across the frontier with India, which includes permanent saline marshes, coastal brackish lagoons, tidal mudflats, and estuarine habitats. The site supports many locally and globally threatened species, including the Great Indian bustard (Choriotis nigficeps), Houbara bustard

(Chlamydotisundulata), Sarus crane (Grus antigone), and hyena (Hyeana hyaena) and supports more than 1% of the biogeographical population of flamingos.

Indus Delta is the fifth largest delta in the world. The fan-shaped delta consists of creeks, estuaries, mud flats, sand dunes, mangrove habitat, marshes and sea bays. It shelters 82,669 mangroves, mostly Avicenna marina which comprises 97% of the total mangrove area in the country and is said to be the largest coastal mangrove forest in the world. A large number of species of birds (including the threatened Dalmatian pelican) of fish and shrimps, and of dolphins (Plumbeous dolphin, Finless porpoise, and Bottlenose dolphin), humpback whale and reptiles are found here. The area is rich in archaeological and religious heritage.

Common birds in the study area

The area is very important of resident and migratory bird species. More than 100 species of have been recorded from the area. Table 6 lists the important birds of the study area:

Table 12: Important Birds of Sindh and study area

S. No	English Name	Scientific Name	Local Name
1.	Great Bustard	Ardeotis nigricps	Barri Tiloor, Hukria
2.	Houbara/Macqueen's Bustard	Chlamydotis macqueeni	Tiloor, Houbaia
3.	Common/ Blue Peafowl	Paro cristatus	Neela More, Mor
4.	Black Francolin/ Partridge	Francolinus francolinus	Kala Titer, Karo Titar
5.	Grey Francolin/ Partridge	Francolinus pondicerianus	Bhura Titer, Achho Tittar
6.	Yellow Legged Green Pigeon	Treron phocnicoptera	Harrial Kabutar
7.	Red Turtle Dove	Streptopclia tranquebarica	Surkh Fakhta
8.	Dalmatian Pelican	Pelecanus crispus	Hawasal, pain Pakhhi
9.	Lesser Flamingo	Phoenicopterus minor	Lum Dheeng/Laakho Jani
10	Oriental Darter/Anhinga/Snake bird	Anhinga melanogaster	Jall Kawwa
11.	WhiteStork	Ciconia ciconia	Safaid Laqlaq/Achhhi Toor
12.	Painted Stork	Mycteria leucocephala	Rangeen Laqlaq, Chit rod toor
13.	Greater Painted Snipe	Rostratula benghalensis	Rangeen Isnif
14.	Sociable Lapwing	Vanellus gregarius	Tattihri, Sehkari teeto

15.	Pheasant tailed Jacana	Hydrophasianus	Peehoo, Peehoorri
16.	Spot Billed Duck	Anas poecilorhyncha	Hanjar Batakh, Khanjar
17.	Marbled Teal	Marmaronetta ahgustirostris	Mar Marin Batakh
18.	Mallard	Anas platyrhynchos	Neel Sar, Neergi
19.	Brahminy/ Ruddy Shefduck	Tadorna ferruginea	Surkhab, Lallo Hanj
20.	Brown Headed Gull	Larus brunaicephalus	Bhori Sar Kina
21.	Caspian Tern	Sterna caspia	Caspian Dhumarah, Kekrah
22.	Indian Skimmer/ Scissors-Bill	Rynchops albilcullis	Qainchi Chounch/Pann Cheer
23.	Sarus Crane	Grus antigone	Sarus Koonj
24.	Imperial Eagle	Aquila heliacal	Shahi Oqab
25.	Pallas's Fish Eagle	Haliacctus leucorhyplus	Palasi Oqab, Machh manga
26.	Peregrine Falcon	Falco peregrines	Behri/Kala Shaheen
27.	Saker Falcon	Falco cherrug	Charagh/Saker Baaz
28.	Eurasian Eagle Owt/Great-HornedOwl	Babo bubo	Oqabi Ullu
29.	Lesser Golden-backed Woodpecker	Dinopium benghalense	Sunheri Khatkhat
30.	Sindh Pied Woodpecker	Picoides assimilis	Sindhi Khatkhat
31.	Blue Cheeked Bee Eater	Merops persicus	Barra Mugs Khot/Traklo
32.	Golden Oriole	Oriolus oriolus	Sunheri Peelak, Peelkio
33.	Indian Treepie/ Rufous Treepie	Devdrocitta vagabunda	Nabatati Zagh/Katar Khaan
34.	Common/ Punjab Raven/ Desert Raven	Corvus corax subcorax	Doodh kaag/Paharri Kawwa
35.	Pied Crested/Jacobin Cuckoo	Clamator jacobinus	Choti Dar Koel/Tarro
36.	Rosy Starling/Rosy Pastor	Sturnus roseus	Tillear, gulabi Myna
37.	Jordan's Babbler	Chrysomma altirostre	Jorden Ki Ghoghai, Doomni, Pinjhrro
38.	Sindh Jungle Sparrow	Passer pyrrhonotus	Sindhi Gorria, Jungli Chirria
39.	Red Avadavat/redMunia	Amandara formosa	Surkh Piddi, Garrho Cheeho
40.	Baya Weaver	Ploceus philippinus	Baya, Borrhi

Ref: IUCN 2004-Sindh State of Development and Environment

Mammals in the study area

A variety of mammals are found in the study area that include Hog deer, Chinkara, Desert Cat, Fishing Cat, Caracal, Smooth coated Ottor, Wild boar, Desert hare, Foxes, Jackal and Feral wild ass. Table ..lists the important mammals in Sindh and the study area:

Table 13: Important Mammals of Sindh and study area

S. No	English Name	Scientific Name	Local Name
1.	Sindh Ibex / Persian Wild Goat	Capra aegagrus blythi	Sarah, Pahari Bakra
2.	Afghan Urial / Asian Wild Sheep	Ovis vignei blanfordi	Gad, Pahari Dumba
3.	Indian Desert Gazelle / Chinkara	Gazella bennettii	Chinkara, Hiran
4.	Black Buck / Indian Savana Antilope	Antilope cerricapra	Kala Hiran
5.	Hog Deer / Parah Deer	Axis porcinus	Phara, Barasingha
6.	Blue Bull / Nilgai	Boselaplus tragocamelus	Neel Gai, Rojh
7.	Indian Wild Ass / Gorkhar / Onagar	Equus hemionus	Khur Jungli Gadha, GorkharKhuchhar
8.	Striped Hyaena		Hyaena hyaena
9.	Indian Desert Wolf	Cains lupus pallipus	Bherria, Bagharr
10.	Indian Desert Fox	Vulpes vulpes pusillus	Lomrri, Lomarr
11.	Caracal / Red Lynx	Felis caracal	Siah Gosh, Harola
12.	Jungle Cat / Swamp Cat	Felis chaus	Jungli Billi
13.	Fishing Cat	Prionailurus viverrinus	Machhi khor billi
14.	Small Indian Civet	Viverricula indica	Mushk Billi, Rasse
15.	Honey Badger / Ratel	Mellivora capensis	Bijju, Gor Pat
16.	Scaly Anteater / Pangolin	Manis crassicandata	Chiunti Khor, Chhalerano
17.	Indus Blind Dolphin	Platanista minor	Bulhann, Susu Dolphin, Andhy Dolphin
18.	Smooth Coated Otter	Lutrogale perspicillata	Udh Bilao, Luddharr
19.	Flying Fox / Fulvous Fruit Bat	Rousettus leschenaultii	Urra Lomrri, Meva Khore Chimgadar
20.	Blue Whale / Sulphur Bottom Whale	Balaenoptera musculus	Neeli Whale, Mangrail
21.	Mouse-like Hamster	Calomyscus hotsoni Hamster	Chooha

Ref: IUCN 2004-Sindh State of Development and Environment

Table 14: Important Mammal Species of Wild Animals of the Arid Zones of Sindh

Sr. No.	Common Name	Zoological Name	Habitat	Status
1.	Indian Gazelle (Chinkara)	Gazella gazelle	Thar, Nara bordering area and Kirthar National Park	Original population of Thar and Nara seems to be exterminate
2.	Sindh Ibex (Sarain)	Capra agagrus	Arid hills and rocks of Kirthar range and Kirthar National Park (K. N.Park)	Protected in Kirthar National Park and areas of local sardars
3.	Urial	Ovis orientalis	Kirthar range and K.N. Park.	Protected in K. N. Park and Daryaro mountains of Larkana
4.	Nilgiri	Boselaphus tregocamelus	South of Nagarparkar migrant from India	Rarely found
5.	Asiatic wild ass	Equis hemionus	Ran of Kutch and Thar	Endangered
6.	Indian crested porcupine	Hystrix mica	Thar, Nara and Kohistan	Common
7.	Indian Hare	Lopus migrcollis davanus	Thar and Kohistan	Common in Mithi and Diplo
8.	Indian Pangolin	Manis crassicaudata	Kohistan	Rare
9.	Panther or Leopard	Panthera pardus	Kohistan	Rare
10.	Indian Wolf	Canis lupus pallipea	Kirthar range and Thar	Rare
11.	Jackal	Canis aurius	Thar, Nara and Kohistan	Common
12.	Desert Fox	Vopus vulpus pusilla	Tharparkar and Kohistan	Rare
13.	Wild cat	Verricula indica	Thar	Rare
14.	Common mangoose	Herpestes edwardsi	Tharparkar	Rare
15.	Striped Hyena	Hyena hyena	Thar and Kohfstan	Rare

16.	Desert cat	Fells libyca	Tharparkar	Rare
17.	Honey Badger	Mellivora capensia	K.N Park	Rare
18.	Wild boar	Sus scrota	Nara	Common

Ref: IUCN 2004-Sindh State of Development and Environment

Reptiles and Amphibians in the study area

A considerable population of marsh crocodiles is recorded in chotiari and Deh Akro II complexes. A variety of snakes and monitor lizards and geckos are also found in the area. Table 9 lists the important Repties in Sindh and the study area.

Table 15: Important Reptiles and Amphibians of Sindh

S. No	English Name	Scientific Name	Local Name
1.	Indian Ocean Green Turtle	Chelonia mydas	Samundri Subz Katchhwa
2.	Pacific Olive Ridley Turtle	Lepidochelys olivacea	Sumundri Zaituni Katchhwa
3.	Spotted Pond Turtle	Geoclemys hamiltoni	Talabi Katchhwa
4.	Indian Sawback River Turtle	Kachuga tecta	Daryai Katchhwa
5.	Starred Tortoise	Geochelone elegans	Sitara Katchhwa
6.	Marsh/Snub-Nosed Crocodile	Crocodylus palustris	Magar Much, Mugger, Wagu
7.	Yellow/Striped Monitor – Lizard	Varanus flavescens	Goh, Dhari Dar Goh
8.	Fat-Tailed/Leopard Gecko	Eubleparis macularius	Hann Khann, Cheetah Chhupkali
9.	Banded Dwarf Gecko	Tropiocolotes helenac	Dhari Dar Chhoti Chhupkali
10.	Sindh Broad Tailed	Gecko teratolepis fasciata	Sindh Moti Dum Chhupkali
11.	Orange Tailed Sand Skink	Eumeces schncideri	Narangi Dum Regmahi, Makh Chatti
12.	Indian Sand Swimmer	Ophiomorus tridactgylus	Regmahi, Makh Chatti
13.	Indian Spiny Tailed Lizard	Uromastix hardwicki	Sandha, Sandho
14.	Indian Chameleon	Chamaeleo zeylanicus	Rung Badal Girgit
15.	Indian Rock Python	Molurus	Azdaha, Arrarh Blah
16.	Russelle Sand Boa	Eryx conicus	Russelle Ki Do Muhi
17.	Oxus/Black Cobra	Naja oxiana	Kala Naag, Cobra

18.	Indian Common Krait	Bungarus caeruleus	Sang Choor, Peeun Blah
19.	Russelle's Viper	Vipera russelii	Ghorriala, Dumbhar Blah
20.	Red Spotted Diadem Snake	Sphalcrosoplis arenarius	Shahi Naag, Korarr
21.	Pakistan Ribbon/Sand Snake	Psammophis leithi	Regis Amp, Shehgi
22.	Glossy Bellied Racer	Coluber ventromaculatus	Paharri Samp, Par Blah
23.	Common Rat Snake/Dhaman	Ptyas mucosus	Dhamman, Kua Mar
24.	Sindh River Snake	Enhydris pakistanicus	Daryai Samp
25.	Beaked Sea Snake	Enhydrina schistosus	Chonch Dar Samundari Samp
26.	Annulated Sea Snake	Hydrophis cyanocinctus	Dhari Dar, Samundari Samp
27.	Slender Blind Snake	Typhlops porrects	Andha Samp, Sampolia
28.	Tiger Bull Frog	Rana tigerina	Maindak Dedhar
29.	Indus Toad	Bafo andersori	Khushki Ka Maindak

Ref: IUCN 2004-Sindh State of Development and Environment

Common fish types in study area

About 60 species of fish have been recorded in the study area. Common fish species are listed in Table 10 as under:

Table 16: List of common fish types in study area

Scientific name	**Common name**
Catla catla	*Thailhi*
Labeo rahita	*Rohu*
Labeo calbasu	*Dahi*
Labeo gonius	*Seriah*
Osteobrma catio	*Makhni*
Puntius sophore	*Chidu*
Puntius ticto	*Popri*
Puntius sarana	*Khirni*
Chela lebuca	*Dannbhra*
Cirrhinus reba	*Suni*
Cirrhinus mrigala	*Morakhi*

Ref: IUCN 2004-Sindh State of Development and Environment

In coastal area various fish, shrimp and mud crab species are available.

Baseline survey of Archeological and Heritage Sites in the study area

This chapter of report provides the baseline of important archeological and heritage sites. The data/information has been collected from primary and secondary data sources and surveys in the study area conducted prior to preparation of this report.

The stakeholders

The stakeholders governing the Cultural and archeological heritage include: the Government of Pakistan, the provincial government of Sindh, its Local Body system, the national and provincial institutions dealing with history, archaeology and culture such as the Ministry of Culture and Tourism, Government of Pakistan, the Pakistan Tourism Development Corporation (PTDC), the Department of Culture and Tourism, Government of Sindh, Sindh Tourism Development Corporation (STDC), Directorate of Archaeology, Government of Sindh, the government-run Sindhi Adabi Board, Sindh Text Book Board, Sindhology Department of University of Sindh, Archeological departments of Universities and NGOs representing civil society besides knowledgeable persons can deliver a lot through individual as well as collective effort.

There is lot of local knowledge and awareness with the individuals located in the small villages and towns in the study area. Also a number of NGOs have emerged in Sindh with great cultural awareness. During the process of meetings with stakeholders the information on this aspect of EIA was collected. The combined approach of all stakeholders has contributed in the study area's cultural heritage in a befitting manner.

List of project area's heritage sites

Following list provides the names of heritage sites in the study area, their location in the district and its status of protection.

1. KOTDIJI - a pre-Indus site in Khairpur district. (Protected).
2. KAHOO JO DARO - a major Buddhist site at Mirpurkhas. (Protected).
3. LAKHYAN JO DARO - a mature Indus site in Sukkur city area. (Protected).

4. VINJNOTH - a mature Indus site near Sukkur. (Protected).
5. AROR DARO is a mound having characteristics of a Buddhist site. (Unprotected).
6. ARORE is a stone-age site near Rohri in Sukkur district. It contains a Hindu temple of Kalkan Devi, an ancient mosque attributed to Arab general Mohammed Bin Qasim and a stone-age factory of flint and other tools. (Protected)
7. AGHAN KOT is a fort near Badin. (Unprotected)
8. ASOORAN JO DARO is located near Badin. (Unprotected)
9. DARO Tando Jam: It is a mound having archaeological significance located near Tando Jam in Hyderabad district. (Unprotected)
10. BRAHMAN ABAD: It is also called Mansoorah. Basically a site of Rai dynasty turned capital of Sindh by Muslims after conquest of Sindh by Arab General Mohammed Bin Qasim. (Protected)
11. BUDDHA JO TAKAR: It is a Buddhist Stupa in ruins near Tando Mohammed Khan. (Unprotected)
12. RUINS of Badin - It is probably a Buddhist site near Badin. (Protected).
13. THUL MIR RUKUN: It is the only Buddhist Stupa of Sindh in good shape. It is located at Daulatpur Safan near Moro in Naushehro Feroz district. (Protected)
14. BAKHAR FORT: Both ruins and a fort of Bakhar were the capital of Sindh in Raja Dahar's reign. (Protected)
15. DAHLEEL KOT: It is a fort made from baked bricks near Sakrand. (Unprotected)
16. KALHORA TOMB – Tomb of Ghulam Shah Kalhoro, a ruler of Kalhoro dynasty of Sindh at Hyderabad. (Protected)
17. TOMB of Ghulam Nabi Kalhoro is also at Hyderabad. (Protected)
18. GANJO TAKAR CAVES-: It is a stone-age site near Hyderabad. (Unprotected)
19. HYDERABAD FORT: Also known as Neron Kot, this magnificent fort is made of fine baked clay bricks used by Kalhora rulers of Sindh. (Protected)
20. KACHO QILO, Hyderabad: It is a fort made of clay bricks at Hyderabad used by Kalhora rulers of Sindh. (Protected)
21. KOTDIJI FORT: It is the most beautiful and well maintained fort of Talpurs made of red baked bricks by the side of National Highway near Khairpur (Mirs'). (Protected)
22. KOT LALOO in Nawabshah district is a shambles these days. (Unprotected)

23. MASOOM SHAH MINARET: Hovering over city of Sukkur, the Masoom Shah's minaret is a monument of Kalhora dynasty. (Protected)
24. MOOMAL JI MA'ARI: Located at Mirpur Mathelo about 10 kilometers in east of Ghotki, there are ruins of a palace attributed to Moomal, the heroine of Sindh's famous folklore of Moomal-Rano. The site is about 40 feet above ground level. (Protected)
25. WATAYO'S GRAVE: Last resting place of Watayo Faqir, a legend of Sindh's folk wisdom. It is located at Nasarpur town of Hyderabad district. (Unprotected)
26. TOMB of Mian Noor Mohammad Kalhoro, ruler of Sindh, located at Daulatpur in Naoshehro district. (Protected).
27. RAKAS JO ROONO: It is a cave near Kotdiji. (Unprotected)
28. ROOPA MA'ARI: The ruins of Sindh's ruler Dodo Soomro's palace near Badin. (Unprotected)
29. MIR SHAHDAD JO QUBO The tomb of Talpur ruler Mir Shahdad at Shahpur Chakar in Sanghar district. (Protected)
30. SATIYUN JO ASTHAN: Site of chaste women at Sukkur. (Protected)
31. ARORE: At Arore, there are two tombs of 'Sohagin' (woman her husband alive or in company) and, 'Dohagin' (woman with her husband dead or separated). They are constructed in Exposed Brick style of architecture. (Unprotected)
32. CHITTORI: The group of Talpur tombs at Chittori in district Mirpur Khas. (Protected)
33. HYDERABAD: A group of Talpur tombs at Hyderabad besides those of the rulers of Sindh. (Protected)
34. TOMB OF SOHNI: Shrine of Sonhi, heroine of Sindh's folklore of Sohni-Mehar at Shahdadpur (Sanghar district). (Unprotected)
35. TOMB OF SASSUI: At Sanghar Patyoon in Lasbelo district of Balochistan. (Unprotected)
36. SHADI SHAHEED: The stone-age factory of flint in Khairpur district. (Unprotected)
37. NEENH TAKAR: A hill with unique formation located at Arore near Rohri. (Unprotected)
38. KARAR LAKE: A small sweet water lake located at Bhit Shah attributed to the memory of Sindh's greatest poet Shah Abdul Latif Bhitai. (Protected)
39. TOMBS OF MIRS: Located at Hyderabad, the tombs of Sindh's Talpur rulers are unique in architecture. (Unprotected)

Sites in Thar Desert

1. UMARKOT: Locally known as Amarkot, the fort is famous for the birth of Moghul emperor Akbar the great and imprisonment of Marui by Sindh's ruler Umar Soomro. (Protected)
2. THAHARIYO HALEPOTO: The coalfield of Thar where ruins of Buddhist period exist near Slamkot of Thar district. (Unprotected)
3. RUINS OF PA'ARI NAGAR: The ruins of Jain temples and settlements near Nagar Parkar town of Thar district. (Unprotected)
4. NAO KOT: Built by Talpur rulers of Sindh on the first sand dune of Thar near Mirpurkhas. (Protected)
5. TALPUR TOMBS: Ruins of four tombs of Talpur rulers are scattered in Tharparkar district. (Unprotected)
6. MARUVI'S WELL: A monument attributed to Marui, the heroine of Sindh's folklore of Umar-Marui located at Bhalwa village in Nagar Parkar taluka of Thar district. According to the legend, Maruvi was abducted by King Umar from this well and captivated in Umarkot. (Protected)
7. GORI TEMPLE: A magnificent Jain temple in Nagar Parkar taluka of Thar desert. (Protected)
8. ROOPLO KOLHI'S MONUMENT: The site where Rooplo Kolhi was executed by British troops while in pursuit of conquering Sindh in 1843 AD. (Unprotected)
9. MIRGHI KUNN: A Hindu tirath in Gordharo river of Karoonjhar mountain where people drop ashes of the dead in the water of a natural spring. (Unprotected)
10. JAIN TEMPLES: Located at Nagar Parkar town of Thar, the ruins of Jain temples are magnificent in architecture. (Unprotected)
11. ANCHALYA SAR: A Shiva temple and natural spring about 200 feet above ground level in Karoonjhar mountain of Thar. (Unprotected)
12. KAJLA SAR: A legendary pond of water near Pa'ari Nagar in Thar. (Unprotected)
13. KAROONJHAR TIRATHS: A number of Hindu tiraths located in Karoonjhar with pre-Camberian stone formation at Nagar Parkar town of Thar. (Unprotected)
14. BHODESAR MOSQUE: Built by Mohmmed Shah Begro in mid eighties near Bhodesar small water storage tanks near Nagar Parkar town of Thar. (Protected).

Annexure D

REGISTERED No. M-302
L-7646

THE GAZETTE OF PAKISTAN

EXTRAORDINARY
PUBLISHED BY
AUTHORITY

==========

ISLAMABAD, THURSDAY, JUNE 15, 2000

==========

PART II

Statutory Notifications (S. R. O.)

GOVERNMENT OF

PAKISTAN

MINISTRY OF ENVIRONMENT
LOCAL GOVERNMENT AND RURAL DEVELOPMENT

NOTIFICATION

Islamabad, the 13th June, 2000

S.R.O. 339 (I)/2000. - In exercise of the powers referred by section 33 of the Pakistan Environmental Protection Act, 1997 (XXXIV of 1997), the Pakistan Environmental Protection Agency, with the approval of the Federal Government, is pleased to make the following regulations, along with the list of the projects under Schedule- I and Schedule-II : -

SCHEDULE I

(See Regulation 3)

List of projects requiring an IEE A. Agriculture, Livestock and Fisheries, etc.

1. Poultry, livestock, stud and fish farms with total cost of more than ten million rupees.
2. Projects involving repacking, formulation or warehousing of agricultural produce.

B. Energy

1. Hydroelectric power generation less than 50 MW.
2. Thermal power generation less than 200 MW.
3. Transmission lines less than 11 KV, and large distribution projects.
4. Oil and gas transmission systems.
5. Oil and gas extraction projects including exploration, production, gathering systems, separation and storage
6. Waste-to-energy generation projects.
7.

C. Manufacturing and processing

1. Ceramics and glass units with total cost of more than fifty million rupees.
2. Food processing industries including sugar mills, beverages, milk and dairy products, with total cost less than one hundred million rupees.
3. Man-made fibers and resin projects with total cost of less than one hundred million rupees.
4. Manufacturing of apparel, including dyeing and printing, with total cost of more than twenty five million rupees.
5. Wood products with total cost of more than twenty five million rupees.

D. Mining and Mineral Processing

1. Commercial extraction of sand, gravel, limestone, clay, sulphur and other minerals not included in Schedule II with total cost of less than one hundred million rupees.
2. Crushing, grinding and separation processes.
3. Smelting plants with total cost of less than fifty million rupees.

E. Transport

1. Federal or Provincial highways (except maintenance, rebuilding or reconstruction of existing metalled roads) with total cost of less than fifty million rupees.

2. Ports and harbor development for ships less than five hundred gross tons.

F. Water management, dams, irrigation and flood protection

1. Dams and reservoirs with storage volume less than fifty million cubic meters or surface area less than eight square kilometers.

2. Irrigation and drainage projects serving less than fifteen thousand hectares.

3. Small-scale irrigation systems with total cost less than fifty million rupees.

G. Water supply and treatment

Water supply schemes and treatment plants with total cost less than twenty-five million rupees.

H. Waste disposal

Waste disposal facility for domestic or industrial wastes, with annual capacity less than ten thousand cubic meters

I. Urban development and tourism

1. Housing schemes.
2. Public facilities with significant off-site impacts e.g. hospital wastes.
3. Urban development projects

J. Other Projects

Any other project for which filing of an IEE is required by the Federal Agency under sub-regulation (2) of regulation 5.

SCHEDULE II
(See Regulation 4)

List of projects requiring an EIA

A. Energy

1. Hydroelectric power generation over fifty megawatts.

2. Thermal power generation over two hundred megawatts.

3. Transmission lines (eleven kilovots and above) and grid stations.

4. Nuclear power plants.

5. Petroleum refineries.

B. Manufacturing and processing

1. Cement plants.

2. Chemicals projects.

3. Fertilizer plants.

4. Food processing industries including sugar mills, beverages, milk and dairy products, with total cost of one hundred million rupees and above.

5. Industrial estates (including export processing zones).

6. Man-made fibers and resin projects with total cost of one hundred million rupees and above.

7. Pesticides (manufacture or formulations).

8. Petrochemicals complex.

9. Synthetic resins, plastics and man-made fibers, paper and paperboard, paper pulping, plastic products, textiles (except apparel), printing and publishing, paints and dyes, oils and fats and vegetable ghee projects, with total cost more than ten million rupees.

10. Tanning and leather finishing projects

Mini g and mineral processing

1. Mining and processing of coal, gold, copper, sulphur and precious stones.

2. Mining and processing of major non-ferrous metals, iron and steel rolling.

3. Smelting plants with total cost of fifty million rupees and above

D. Transport

1. Airports

2. Federal or Provincial highways or major roads (except maintenance, rebuilding or reconstruction of existing roads) with total cost of fifty million rupees and above.

3. Ports and harbor development for ships of five hundred gross tons and above.

4. Railway works.

E. Water management, dams, irrigation and flood protection

1. Dams and reservoirs with storage volume of fifty million cubic meters and above or surface area of eight square kilometers and above.

2. Irrigation and drainage projects serving fifteen thousand hectares and above.

F. Water supply and treatment

Water supply schemes and treatment plants with total cost of twenty-five million rupees and above.

G. Waste Disposal

1. Waste disposal and storage of hazardous or toxic wastes including landfill sites and incineration of hospital toxic waste.

2. Waste disposal facilities for domestic or industrial wastes, with annual capacity more than ten thousand cubic meters.

H. Urban development and tourism

1. Land use studies and urban plans in large cities.

2. Large-scale tourism development projects with total cost more than fifty million rupees.

I. Environmentally Sensitive Areas

All projects situated in environmentally sensitive areas

J. Other projects

1. Any other project for which filing of an EIA is required by the Federal Agency under sub-regulation (2) of regulation 5.

2. Any other project likely to cause an adverse environmental effect.