Pakistan
Water and Power Development Authority

JACOBABAD, SHIKARPUR AND KASHMORE DRAINAGE PROJECT

ENVIRONMENTAL & SOCIAL IMPACT ASSESSMENT REPORT

March, 2024

برقاب

MMP
MM Pakistan (Pvt) Ltd.

Jacobabad, Shikarpur and Kashmore Drainage Project

Environmental & Social Impact Assessment Report

March, 2024

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LIST OF ABBREVIATIONS

Abbreviation	Term
ABD	Asian Development Bank
AFs	Affectees
BHU	Basic Health Unit
BPL	Below Poverty Level
BS	Begari Sindh
C & W	Communication & Works
CAS	Compulsory Acquisition Surcharge
CBD	Convention on Biological Diversity
CCA	Cultivable Command Area
cfs	Cubic Feet Per Second
CITIES	Convention on International Trade in Endangered Species
CNIC	Computerized National Identity Card
CO	Carbon Monoxide
CO_2	Carbon Dioxide
CSC	Construction Supersession Consultants
CSD	Commission on Sustainable Development
CSO	Construction Supervision Organizer
Dba	Decibel
DC	Deputy Commissioner
DEM	Digital Elevation Method
DG	Director General
DMS	Detailed Measurement Survey
DRC	District Road Culvert
DU	Drainage Unit
EA	Environmental Assessment
EC	Electrical Conductivity
EIA	Environmental Impact Assessment
EMC	Environmental Monitoring Committee
EPA	Environmental Protection Agency/Act
EPD	Environmental Protection Department
EPs	Entitled Persons
ES	Executive Summery
ESC	Environmental Social Consultant
ESF	Environment and Social Framework
ESIA	Environmental Social Impact Assessment
ESMP	Environmental Social Management Plan
ESOs	Environmental and Social Organizers
ESR	Environmental and Social Report
ESS	Environmental Social Standard
ESS	Environmental and Social Supervisor
ESU	Environmental Social Unit
FAO	Food and Agricultural Organization
FOs	Formers Organizations

Abbreviation	Term
GA	Grass Area
GDP	Gross Domestic Product
GEF	Global Environmental Facility
GHGs	Green House Gasses
GIS	Geographic Information System
GoP	Government of Pakistan
GoS	Government of Sindh
GRM	Grievance Redressal Mechanism
HAP	Hazardous Air Pollution
HIV/AIDs	Human Immunodeficiency Virus / Acquired Immunodeficiency Syndrome
HSE	Health Safety & Environment
IBIS	Indus Basin Irrigation System
IEE	Initial Impact Assessment
IFIs	International Finance Institutions
ILO	International Labour Organization
IMF	International Monetary Fund
IUCN	International Union for Conservation of Nature
JSK	Jacobabad , Shikarpur & Kashmore
Kfw	Kreditanstalt für Wiederaufbau (German Bank)
Km	Kilometre
LAA	Land Acquisition Act
LDP	Livelihood Development Plan
MAF	Million Acre Feet
mm	Millimeter
MNA	Member National Assembly
MPA	Member Provincial Assembly
N_2O	Nitrous Oxide
NCS	National Conservation Strategy
NDMA	National Disaster Management Authority
NEAP	National Environmental Action Plan
NEQS	National Environmental Quality Standard
NGOs	Non-Government Organizations
NOC	No Objection Certificate
NoX	Nitrogen Oxide
O & M	Operation & Maintenance
O_3	Ozone
PAPs	Project Affected Persons
PC-1	Planning Commission Proforma 1
PD	Project Director
PEPA	Pakistan Environmental Protection Act
PGA	Peak Ground Acceleration
pH	Potential of Hydrology
PM	Project Manager
PM_{10}	Particulate Matters
PMD	Pakistan Metrological Department

Abbreviation	Term
PMO	Project Management Officer
PPE	Personal Protective Equipment
Qcm	Flood Plain Deposits of middle Terrace (A Geological Terminology)
Qf	Flood Plain Deposits (A Geological Terminology)
Qfx	Flood Plain Deposits of Low Terrace (A Geological Terminology)
Qm	Meander Belt Deposits(A Geological Terminology)
Qmx	Meander Belt Deposits of Low Terrace (A Geological Terminology)
R & R	Resettlement & Rehabilitation
RAP	Resettlement Action Plan
RBMP	Right Bank Master Plan
RBOD	Right Bank Outfall Drain
RE	Resident Engineer
RFP	Request for Proposal
RNR	Renewable Natural Resources
RoW	Right of Way
RSC	Residual Sodium Carbonate
SAR	Sodium Adsorption Ratio
SCARP	Salinity Control and Reclamation Projects
SCR	Social Complaint Register
SEPA	Sindh Environmental Protection Act/Agency
SEQS	Sindh Environmental Quality Standards
SFA	Social Framework Agreement
SGW	Saline Ground Water
SIDA	Sindh Irrigation and Drainage Authority
SMO	Scarp Monitoring Organization
SMS	Social Media Services
SO_2	Sulphur Dioxide
TDS	Total Dissolved Solid
TMP	Traffic Management Plan
ToR	Term of Reference
TSP	Total Suspended Solid
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNESCO	United Nation Education Scientific & Cultural Organization
UNPF	United Nations Population Fund
UNICEF	United Nations International Children's Emergency Fund
UNIDO	United Nations Industrial Development Organization
WAPDA	Water and Power Development Authority
WB	World Bank
WEC	WAPDA Environmental Cell
WHO	World Health Organization
WMO	World Meteorological Organization
WP	Work Plan
WWF	Worldwide Funds for Nature

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EXECUTIVE SUMMARY

EXECUTIVE SUMMARY

INTRODUCTION

Waterlogging and soil salinity are leading to land degradation and desertification problems worldwide. It can significantly reduce the agricultural practices and crop yields of affected lands. The present study is designed to control waterlogged and saline affected areas.

The project area comprising of districts Jacobabad, Shikarpur and Kashmore receives irrigation from non-perennial Begari and Desert Canals originating from Guddu Barrage. Absence of drainage system in the Project area not only depresses yields of Rice crop, but also reduces land availability for sowing of crop. Due to non-availability of the surface drainage system a large number of agriculture land of the Project area is converting into barren land resulting in the economic problems of growers.

Addressing the issue of waterlogging and salinity in these districts, WAPDA has decided to conduct feasibility study, detailed engineering design, tender documents and PC-1 of Jacobabad, Shikarpur and Kashmore.

The Environmental Social Impact Assessment (ESIA) study includes environmental legislation and requirements, field investigation along with Right of Way (RoW) for proposed drains comprising physical, biological and socio-economic environmental conditions of the Project area including Public/Stakeholders consultations leading to identification of impacts, proposing mitigation measures and development of Environmental Social Management Plan (ESMP).

POLICY, LEGAL AND ADMINISTRATION FRAMEWORK

The Project screening and categorization was carried out as per guidelines of Section 17 of Sindh Environmental Protection Act 2014. The act requires that every new project have to be proceeded by an Initial Environmental Examination (IEE) or Environmental Impact Assessment (EIA) depending upon the size and severity of impacts anticipated on commissioning of the project. Sindh Environmental Protection Agency (Review of IEE and EIA) regulations 2014 have been notified under Section 37 of SEPA 2014. These regulations categorize projects in three separate schedules which require either an IEE (Schedule-I) or an EIA (Schedule -II) or Environmental Checklist (Schedule -III), where provision of Section 17 shall apply water management, dams, irrigation and flood protection have been placed in Schedule-II, category F-2. So that JSK Project is required an EIA/ESIA. World Bank Environmental and Social framework uses categories of high risk, substantial risk, moderate risk, or low risk. All categories except low risk required an EIA of the Project.

PROJECT DESCRIPTION

The Jacobabad, Shikarpur and Kashmore Drainage Project area comprises three districts: Jacobabad, Shikarpur and Kashmore, covering nine Drainage Units (DU-5 to DU-13) identified by Right Bank Master Plan study- 1992 (RBMP). It has a gross area of 6 97,912 ha (1.70 million acres) and cultivable command area (CCA) is 617,672 ha (1.53 million acres) being irrigated through Desert and Begari Sindh Canals. The Consultants are tasked to prepare the “Feasibility Study, Detailed Engineering Design, Tender Documents and PC-I for Jacobabad, Shikarpur and Kashmore Drainage Project”. There are three existing drainage systems in the Drainage Unit (DU-13) i.e., Lakhi, Shikarpur and Sindh Wah. These three drainage systems were constructed for eradication of waterlogging and salinity problems. The gross area of Drainage Unit-13 Shikarpur area is 70,608 ha (174,476 acres) of which 61,461 ha

(151,870 acres) is cultivable commanded area. Furthermore, 11 main drains have been proposed. Salient features of the project are given in Table ES.1.

Table ES.1: Salient Features of the Proposed Project

Proponent	Water And Power Development Authority (WAPDA)
Project Location	Districts: Jacobabad, Shikarpur and Kashmore
Total Discharge of Effluent	3208 cfs
Total Permanent L and Required	8362 (Acres)
Components (detail of proposed main drains,)	1) Badani drain (Length 18.41 Km & Width 250 ft) disposed of into BS Feeder Canal 2) Begari drain-1(Length 50.76 Km & Width 250 ft) disposed of into Begari Canal. 3) Begari drain-2 (Length 16.42 Km & Width 250 ft) disposed of into Begari Canal. 4) Bhayo drain (Length 10.10 Km & Width 250 ft) disposed of into River Old Creek 5) Bhurgri drain (Length 44.10 Km & Width 250 ft) disposed of into RBOD-III drain. 6) Dadpur drain (Length 31.33 Km & Width 250 ft) disposed of into RBOD-III drain. 7) Miranpur drain (Length 14.02 Km & Width 250 ft) disposed of into RBOD-III drain. 8) Shahdad kot drain (Length 9.33 Km & Width 250 ft) disposed of into RBOD-III drain. 9) Doda pur drain (Length 56.70 Km & Width 250 ft) disposed of into RBOD-III drain. 10) Manjhipur drain-1 (Length 43.06 Km & Width 250 ft) disposed of into Desert Canal. 11) Manjhipur drain -2 (Length 14.75 Km & Width 250 ft) disposed of into Desert Canal. 12) Jacobabad drain- (Length 59.90 Km & Width 250 ft) disposed of into Hairdin Drain 13) Golo drain (Length 12.47Km & Width 250 ft) disposed of into BS Feeder Canal
Components (detail of proposed branch and sub drains)	51 Branch and 13 Sub drains are associated with all 13 main drains have been proposed. Width of branch and sub drains are 125 & 100 ft. respectively.
Other Components	• Construction camps will be stablished. • 3 Railway lines crossings. • 57 bridges and 178 road culverts • 240 Watercourse, 72 junction / outfalls and inlets 1134 and total structures are 550.

ENVIRONMENTAL BASELINE CONDITIONS

Physiography

Project area of Jacobabad, Kashmore and Shikarpur contains two types of deposits, i.e. alluvium and piedmonts deposits. The Indus basin soils are mostly thick alluvium deposited by rivers and are of recent origin. Soils near river courses are the most recent and vary in texture from sand to silt loam and silty clay loams. They have a low organic content and are collectively known as the khaddar soils. Away from the river, toward the middle of the doabs, older alluvial soils (called bangar) are widely distributed. These soils are medium to fine in texture, have low organic content, and are highly productive under conditions of irrigation and fertilization. In some waterlogged areas, however, these soils are salinized. Strongly alkaline soils are localized in some small patches.

The other deposits lying in the area is Piedmont deposits that, in geology is a landform created at the foot of the mountains by debris deposited by shifting streams. Such an alluvial region in a humid climate is known as a piedmont.

Soil

The soils of the Project area comprise piedmont plains and Indus alluvials. The piedmont plains has largely level to nearly level topography except some undulating sandy areas. The Indus alluvials consist of level areas, partially covered abandoned meandering channels and marsh lands (dhands). The soils of the piedmont plain are predominantly clayey (silty clay loam to silty clays/clays). Typha species is the dominant vegetation growing in these channels and can be identified on the imagery by their black tone. The soils are of greyish brown colour, massive to weakly structure in the upper subsoil and stratified below. They are moderately to strongly calcareous.

Climate

Climate of the area has hot desert climate with extremely hot summers and mild winters. District Jacobabad is well known for consistently having among the highest temperature in South Asia, with a mean summer temperature of 37 ºC (99 ºF), the highest recorded temperature is 52.8 ºC (127 ºF) and the lowest recorded temperature is -3.9 ºC (25.0 ºF). Rainfall is low and mainly occurs in the monsoon season (July – September). The average annual rainfall is 122.5 mm as per 1991-2020 period. District Shikarpur lies at about 69 m above sea level. Shikarpur's climate is a classified as desert with very little rainfall, the average annual temperature is 27.1ºC. and average precipitation is 124 mm. District Kashmore annual rainfall is 94.53 mm / year.

Groundwater

The ground water is mostly saline except along the Indus River where tubewells are sunk for irrigation or in the old extinct river channels where some hand pumps are pumping potable water.

Flora

Acacia nilotica (Sindhi Babur), Azadirachta indica Adr. (Neem), Eucalyptus spp, (Sufaido), Phoenix dactylifera (Khajji) are common trees in the project area. Forest is mainly located at near the banks of river Indus as well canals.

Fauna

The area is rich in fauna waterfowl, Jackals, Foxes, Deer, Pig and Herons are seen in fishponds. Partridge, Wild Duck, Geese, Kunj, Sand Grouse, Tilur and, Quail are available in the area.

Population of District Jacobabad, Shikarpur and Kashmore

District of Jacobabad's population according to census survey 2017 is 1,006,297 which is almost 2.1% of Sindh's population of about 47.9 million. About 70% of Jacobabad's population resides in rural areas and 30% resides in the urban areas. Jacobabad's population comprises of 515,480 males and 490,778 females with 51% and 49% of the district's population respectively. District of Jacobabad spans over an area of 2,771 sq. km which is 2.0% of Sindh's total area of 140,914 sq. km. The population density of the district is 363/sq. km. District Jacobabad comprises of 3 talukas, namely: -Ghari Khairo Taluka, -Jacobabad Taluka, and -Thul Taluka.

District of Shikarpur's population according to census survey 2017 is 1,231,481 which is almost 2.6% of Sindh's population of about 47.9 million. About 75.4% of Shikarpur's population resides in rural areas and 24.6% resides in the urban areas. Shikarpur's population comprises of 634,985 males and 596,477

females with 51.6% and 48.4% of the district's population respectively. District of Shikarpur spans over an area of 2,577 sq. km which is 1.8% of Sindh's total area of 140,914 sq. km. The population density of the district is 478/sq.km.

Population of district Kashmore according to census survey 2017 is 1,089,169 which is almost 2.3% of Sindh's population of about 47.9 million. About 77% of Kashmore-Kandhkot's population resides in rural areas and 23% resides in the urban areas. Population comprises of 564,843 males and 524,307 females with 52% and 48% of the district's population respectively. District of Kashmore-Kandhkot spans over an area of 2,551 sq. km which is 1.8% of Sindh's total area of 140,914 sq. km. The population density of the district is 427/sq. km. District Kashmore-Kandhkot comprises of 3 talukas, namely: Kandhkot Taluka, Kashmore Taluka, and Tangwani Taluka.

PUBLIC CONSULTATION AND PARTICIPATION

Meetings with institutional stakeholders, like Government departments, were held to discuss project interventions and their potential impacts on the local communities and environments (physical, biological, social). Government officials were informed about the salient features of the project, its location and activities. Government departments includes: Forest department, Wildlife department, Agriculture department, Revenue department, Irrigation department, Environmental Protection Agency department were visited in three districts and divisional headquarter Larkana. Community consultation were also carried out through informal meetings at the project area, covering issues related to Environmental, Social and Resettlement aspects. Following Table presents detail of scoping sessions/meetings

Table ES.2: Meetings Held in the Project Area with Affected Persons

Sr.No.	Proposed Drain	District	Number of Participants / Affected Persons
1	Begari drain 1 and its associated branch & sub drains	Jacobabad Kashmore	57
2	Begari drain 2 and its associated branch & sub drains	Shikarpur	50
3	Bhurgari drain and its associated branch & sub drains		10
4	Dadpur drain and its associated branch & sub drains	Jacobabad	12
5	Dodapur drain and its associated branch & sub drains	Jacobabad Shikarpur	32
6	Miranpur drain and its associated branch & sub drains	Jacobabad	11
7	Jacobabad drain	Jacobabad	19
8	Manjhipur drain 1 & manjhipur drain 2	Jacobabad	40
9	Shahdadkot drain	Shahdadkot	9
10	Drainage Unit 13 (Rehabilitation)	Shikarpur	10
11	Golo drain	Kashmore	12
12	Badani drain	Kashmore	7
13	Bhayo drain	Kashmore	6
14	Women Consultation	Jacobabad & Shikarpur	26
Total			**301**

ASSESSMENT OF ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

The Environmental Impact Assessment is an important component of this report. The execution of different components of the Project will have some adverse impacts on the physical, biological and

socio-economic environment. Some adverse impacts are the drain structure, spoil disposal, barrow areas, labour camp areas, installation areas, access roads and transportations, contamination due to Diesel/Petrol and spills, release of other contaminants, air quality, noise level and safety hazards materials etc. In the report, main environmentally positive and negative impacts are identified. Suitable actions to mitigate the negative impacts or to enhance the benefits of the positive impacts for the affected persons are also considered.

ENVIRONMENTAL SOCIAL MANAGEMENT PLAN (ESMP)

The ESMP consists of Organizational Structure and Responsibilities, Mitigation Measures Implementation Plan, Environmental and Social Monitoring, Communication and Documentation, Change Management, Environmental & Social Trainings, Environmental and Social Management Costs, Site Specific Environmental Management Plans including Health Safety & Environment (HSE) Plan.

RESETTLEMENT ASPECTS

Due to the construction of the Project, 8,362 Acres of land will be lost, 5,925 trees will be cut down, 304 houses, and government infrastructure, such as 57 Bridges, 178 road culverts (width greater than 20 feet), 3 railway crossings, and 240 watercourses will either be damaged or reconstructed.

CONCLUSION

The study was carried out to assess the environmental and social impacts of the proposed surface drains. The assessment was done keeping in view provincial and federal legislations as well as international guidelines

Baseline environmental and socio-economic information was collected from a variety of sources, including reports of previous studies, published literature, field visits, interviews, consultations/discussions held with different stakeholders like concerned officers of relevant government departments, area elites, NGOs and especially the project affected people. The information collected was used to compose profiles of the physical, biological, and socio-economic environments likely to be affected by the Project.

Adverse Impacts

- Loss of agricultural land.
- Land fragmentation.
- Increased soil erosion and degradation.
- Degradation in air quality.
- High noise & vibration level during construction.
- Dust emissions during construction.
- Cutting of trees and other vegetation.
- Loss of habitat and biodiversity.
- Disruption to public life during construction.

The proposed project activities were reviewed and an assessment made of the potential impact of these activities on physical, biological and socio-economic environments as described in Chapter 6 of the

report. Where appropriate, mitigation measures were recommended to keep the adverse environmental impact within acceptable limits.

The conclusions drawn are:

- Approximately 93,683 hectares of land will come under cultivation due to the implementation of the project.
- Production of Rice & Wheat will be increased up to 33 & 57% respectively.
- The surface drainage environmental assessment study indicated that drainage in general has positive effect, if properly operated and maintained.
- Reduction in seasonal swamp area prone to flooding will result in increased crop area, yields and production.
- Provision and rehabilitation of drainage unit 13 will reduce soil salinity, and improve land capability.
- Improved socio-economic conditions of the people consequent to better-irrigated agriculture will result in attracting more people to work in the project area. The present tendency of urban drift will also decrease.
- Decrease mosquito breeding and other water borne pathogens causing malarial fever and other diseases.
- With the increased income and improvement in status, a greater number of children will go to schools.
- The establishment of agro based business activities will demand skilled and unskilled labour in the Project area.
- The construction of infrastructure will require employment of technical and non-technical people. Therefore, the implementation of the proposed project will increase employment opportunities in the Project area.

INTRODUCTION

1 INTRODUCTION

1.1 Overview

Waterlogging and soil salinity are leading to land degradation and desertification problems worldwide. It can significantly reduce the agricultural practices and crop yields of affected lands. The present study is designed to control waterlogged and saline affected areas.

The project area comprising of districts Jacobabad, Shikarpur and kashmore receives irrigation from non-perennial Begari and Desert Canals originating from Guddu Barrage. Absence of drainage system in the Project area not only depresses yields of Rice crop, but also reduces land availability for sowing of crop. Due to non-availability of the surface drainage system a large number of agriculture land of the Project area is converting into barren land resulting in the economic problems of growers. Following pictures shows the condition of waterlogging and salinity in the project area.

Figure 1.1: Pictures Shows the Waterlogging and Salinity Condition of the Project Area

Addressing the issue of waterlogging and salinity in these districts, WAPDA has decided to conduct feasibility study, detailed engineering design, tender documents and PC-1 of Jacobabad, Shikarpur and Kashmore.

This report describes the findings of the Environmental Social Impact Assessment (ESIA) study for the proposed Jacobabad Shikarpur and Kashmore Drainage Project. The ESIA study has been conducted in compliance with the mandatory requirements of Section 17 of Sindh Environmental Protection Act 2014 and World Bank Environmental Social Standards (ESS 1 – ESS 10).

1.2 Project Background

The irrigation system was constructed in the Project Area in 1930's & 1960's without provision of drainage system. Project Area is irrigated by two main canals Begari Sindh Feeder and Desert Canal off-taking from Guddu Barrage. Nearly 30-40% of gross area is mostly cultivable and gets flooded during Kharif and another 9 to 10% is converted into swamps. Absence of a drainage system not only depresses yields of rice crop, but also reduces land availability for Rabi crop. Due to unavailability of the surface drainage system, a large number of agriculture land of these districts is converted into barren land and badly affects the yield per acre, resulting in economic problems for growers.

1.3 Objective of the Project

The objective of the project is to prepare feasibility study, detailed engineering design / tender documents and PC -1 to cater waterlogging and salinity problems by developing / rehabilitation of 09 No. drainage units (DU 05 to 13) covering gross area of about 697,912 hectares of Jacobabad, Shikarpur and Kashmore districts in Sindh Province.

1.4 The Project at a Glance

- Construction of proposed 13 main drains named:
  1. Badani drain, located in district Kashmore. Total length of drain is 18.41km, width of drain is 250 ft. and depth of drain is 8.5 ft.
  2. Begari drain 1, located in districts Jacobabad and Kashmore. Total length of drain is 50.78 km, width of drain is 250 ft. and depth of drain is 8.5 ft.
  3. Begari drain 2, located in district Shikarpur. Total length of drain is 16.42, width of drain is 250 ft and depth of drain is 8.5 ft.
  4. Bhayo drain, located in district Kashmore. Total length of drain is 10.10, width of drain is 250 ft. and depth of srain is 8.5 ft.
  5. Bhurgari drain, located in districts Jacobabad and Qambar-Shahdadkot. Total length of drain is 44.10 km, width of drain is 250 ft. and depth of drain is 8.5 ft.
  6. Dadpur drain, located in district Jacobabad. Total length of drain is 31.33 km, width of drain is 250 ft. and depth of drain is 7.5 ft.
  7. Dodapur drain, located in districts Jacobabad and Shikarpur. Total length of drain is 56.70 km, width of drain is 250 ft. and depth of drain is 8.5 ft.
  8. Miranpur drain, located in district Jacobabad. Total length of drain is 14.02 km, width of drain is 250 ft and depth of drain is 7.5 ft.
  9. Jacobabad drain, located in district Jacobabad. Total length of drain is 59.90 km, width of drain is 250 ft. and depth of drain is 6.5 ft.
  10. Golo drain, located in district Kashmore. Total length of drain is 12.47 km, width of drain is 250 ft. and depth of drain is 6.5 ft.
  11. Manjhipur drain 1, located in district Jacobabad. Total length of drain is 43.06 km, width of drain is 250 ft. and depth of drain is 6.5 ft
  12. Manjhipur drain 2, located in district Jacobabad. Total length of drain is 14.75 km, width of drain is 250 ft. and depth of drain is 6.5 ft
  13. Shahdadkot drain, located in district Qambar – Shahdadkot. Total length of drain is 9.33 km, width of drain is 250 ft and depth of drain is 6.0 ft.
- Total length of all 13 main drains are 381.35 km, and width of drain is 250 ft.
- Construction of 51 Branch drains is associated with all 13 main drains. Total length of all 49 branch drains is 188.59 km and width is125 ft.
- Construction of 13 Sub drains is associated with all 13 main drains. Total length of all 13 sub drains is 24.08 Km, width is 100 ft.
- Rehabilitation of existing Drainage Unit No. 13 falling in district Shikarpur. Total length of main, branch and sub drains are 209 km.
- Watercourse crossing structures are 240.
- Construction of 57 bridges in the project area.
- Construction of 178 road culverts in the project area

1.5 Location of the Project

The project area lies on the right bank of river Indus having gross command area of about 1.7 million acres out of 1.8 million hectares of Guddu-Sukkur Right bank within the administrative boundaries of Jacobabad, Shikarpur and Kashmore districts in province Sindh. Coordinates of the project area are Latitude 27°-42' to 28°-26' N and Longitude 68°-52' to 69°-57' E. Larkana is divisional headquarter of the Project Area.

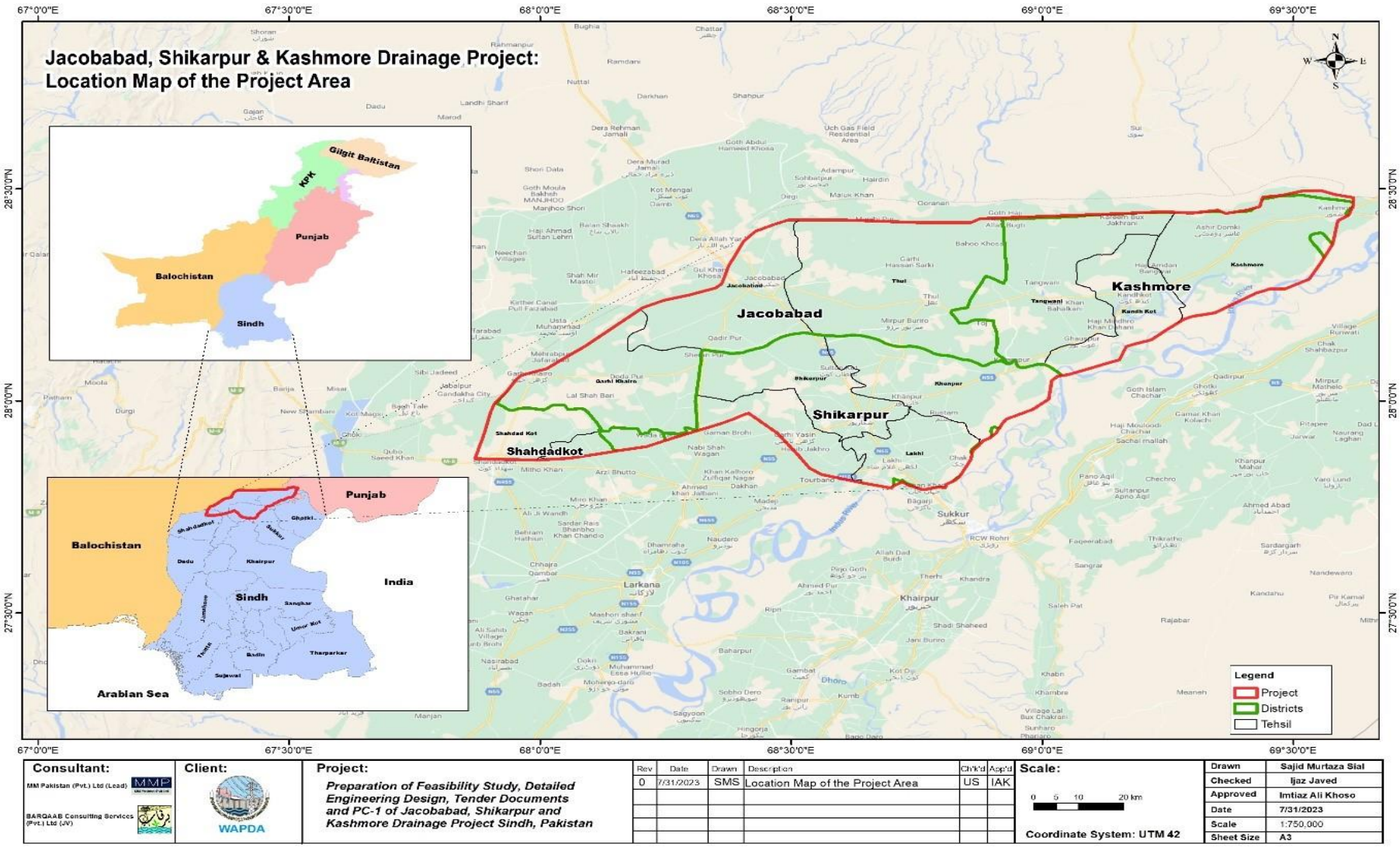


Figure 1.2: Location Map of the Project Area

1.6 Proponent of the Project

Water and Power Development Authority (WAPDA) Pakistan is Project Proponent for the preparation of Environmental Social Impact Assessment (ESIA).

1.7 Scope of ESIA

As per TOR mentioned in RFP of the project the scope of the study includes but not limited to:

i. The environment and population resettlement aspects of the project shall be assessed and quantified consideration of the following aspects:

- Detailed socio-economic survey with participation of Govt. of Sindh and representatives of affectees.
- Identification of scaling of positive and negative impacts.
- Identification of measures for mitigation of positive impacts.
- Establishment of environmental monitoring and evaluation system.
- Estimation of costs of implementation of afore said mitigation and enhancement measures.
- Preparation of draft / final template of ESIA Study Report.

ii. The environmental studies should be compatible with good interval practices to avoid any environmental related issues in future.

1.8 ESIA Study Objectives

The main objectives of the Environmental Social Impact Assessment (ESIA) are:

- To assess the existing Environmental and Socio-economic conditions of the project area.
- To identify likely impacts of the proposed project on the natural, human and social environment of the area and to predict and evaluate these impacts and to determine significance of these impacts generated from selected effluent disposal option in the light of the technical and regulatory concerns.
- To propose appropriate mitigation measures to be incorporated in the design of the project to minimize if not eliminate the adverse impacts.
- To assess the compliance status of the proposed activities with respect to the environmental legislation.
- To develop an Environmental Social Management Plan (ESMP) to provide an implementation mechanism for the Environmental as well as social mitigation measures identified during the study.

Another objective of the ESIA is to satisfy the Bank's requirement on Environment Assessment (EA). The World Bank and Asian Development Bank requires EA of projects proposed for Bank financing to help ensure that they are environmentally sound and sustainable. EA evaluates a project's potential environmentally risks and impacts in its area of influence; identifies ways of improving project selection, siting, planning, design and implementation by preventing, minimizing, mitigating, or compensating for

adverse environmental impacts and enhancing positive impacts; and includes the process of mitigating and managing adverse environmental impacts throughout project implementation.

1.9 The Project Screening and Categorization

The project screening and categorization was carried out as per guidelines of Section 17 of Sindh Environmental Protection Act 2014. Act requires that every new project have to be proceeded by an Initial Environmental Examination (IEE) or Environmental Impact Assessment (EIA) depending upon the size and severity of impacts anticipated on commissioning of the project. Sindh Environmental Protection Agency (Review of IEE and EIA) regulations, 2014 have been notified under Section 37 of SEPA 2014. These Regulations categorize projects in three separate schedules which require either an IEE (Schedule-I) or an EIA (Schedule -II) or Environmental Checklist (Schedule -III), where provision of Section 17 shall apply water management, dams, irrigation and flood protection have been placed in Schedule-II, category F-2, thus required an EIA/ESIA. World Bank Environmental and Social framework uses categories of high risk, substantial risk, moderate risk, or low risk. All categories except low risk required an EIA.

1.10 Methodology of ESIA

Environmental Social Impact Assessment (ESIA) is a systematic process that identifies and evaluates the potential impacts (positive and negative) that a proposed project may have on the physical, biological and socio - economic environment. It identifies mitigation measures that need to be implemented in order to avoid, minimize or reduce the negative impacts, and also identifies measures to enhance positive impacts. Collection of baseline data chart through variety of sources (primary and secondary) as shown in Figure 1.3.

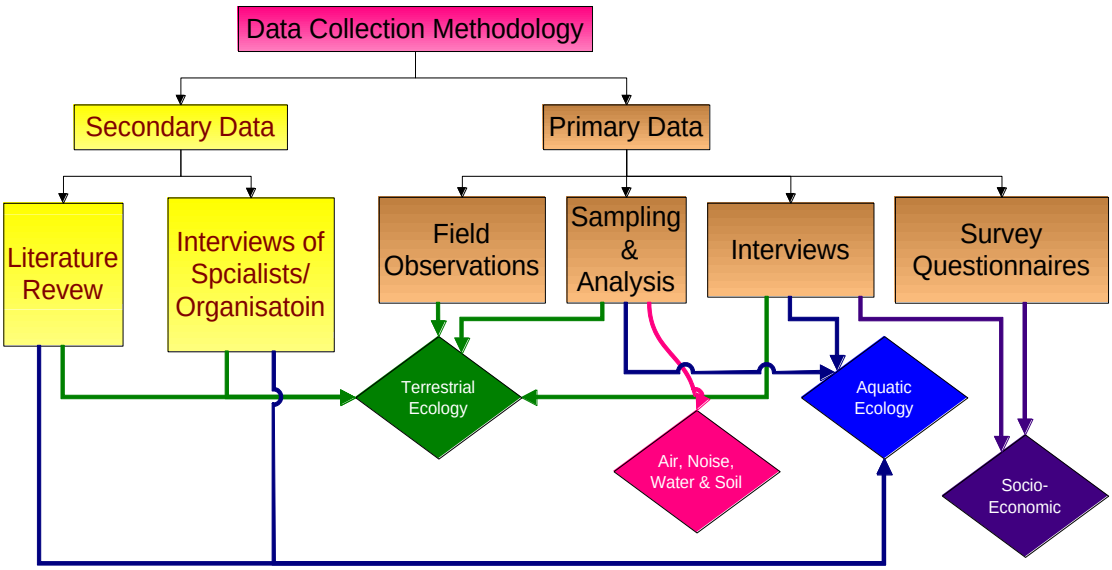


Figure 1.3: Collection of Baseline Data through Variety of Sources (Primary and Secondary)

The key steps that were followed while conducting the ESIA/ESMP are briefly described below:

1.10.1 Literature Review

Consultants carried out a desk study through collection and review of guidelines, updated data and authenticated reports related to the project. Following literature and reports were reviewed.

- Sindh Environmental Protection Act – 2014.

- Sindh Environmental Protection Agency - IEE / EIA Regulations 2014.
- Provincial Environmental Legislation, National Environmental Legislations and World Bank Environmental Social Standards.
- RBOD-3 Reports,
- Environment related Chapters from RBOD Reports.
- District Disaster Management Plans published by Provincial Disaster Management.
- Census Reports of 2017 and Digital Census Survey 2023.
- Google Earth Satellite Imaginary

1.10.2 Selection of Route Alignment or Right of Way of the Proposed Drains

The selected a route keeping all the guidelines and legislations in view for the route of drains and the consultants physically verified the routes from environmental and social point of view avoiding graveyards, settlements, government infrastructure, oil depots, etc. The width of main, branch and sub drain has been proposed 250,125 and 100 ft. respectively. Following figure shows RoW of the proposed Jacobabad Drain as a sample only one sheet out of fourteen google sheets have been included.

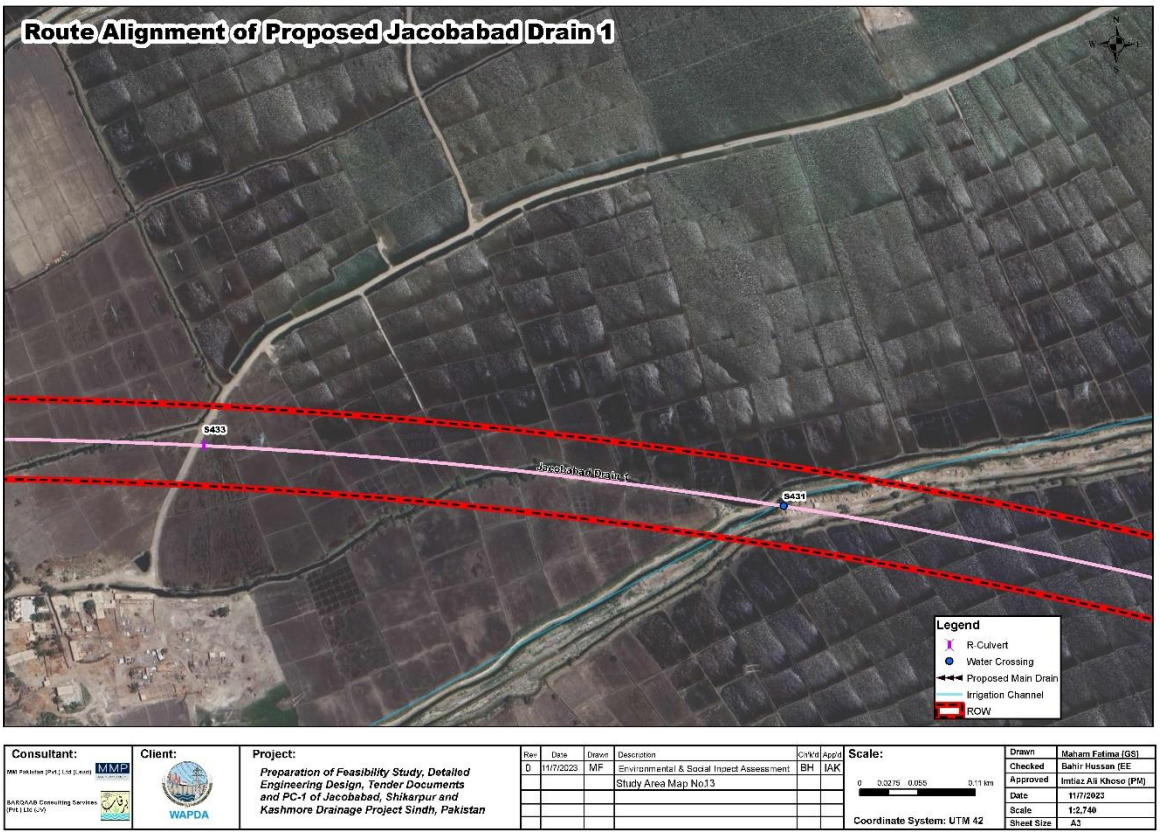


Figure 1.4: Shows the Sample Sheet of RoW for Conducting Environmental Study

1.10.3 Reconnaissance and Detailed Surveys

A team, including environment, drainage, resettlement and social experts with junior environmentalist, junior GIS specialist, surveyor, and enumerator carried out the environmental and social survey in order to investigate various domains of environmental and socio-economic sector to highlight various issues

and concerns that may lead to the identification of aspects and subsequent assessment of impacts. The survey included collection of environmental and social baseline information within the RoW of the proposed drains on following aspects:

- Climate & Rainfall
- Land
- Soils
- Geology and geomorphology
- Land use
- Surface & groundwater
- Flora and fauna
- Wetlands
- Fish ponds
- Fish hatcheries
- IUCN Listed Areas/Ramsar Declared Sites/World Heritage Sites,
- National parks
- Forest Areas,
- Infrastructure & Social Services
- Villages/Towns / Cities.

Pictures during Reconnaissance Surveys are shown below:

Figure 1.5: Pictures during Reconnaissance Surveys

1.10.4 Environmental Baseline Conditions

Various aspects of the environment i.e. physical, biological and socio-economic were studied and key parameters kept in view are listed below:

1.10.4.1 Physical Environment

This part of work specified the present condition of the study area with regards to; Topography, Surface Geology, Soils, Hydrology, Groundwater, Seismology, Ambient Air Quality, Agriculture and Land Utilization and Climate Change.

1.10.4.2 Biological Environment

Flora, Floral Endangered Species, Fauna, Fauna Endangered Species have been described.

1.10.4.3 Social Environment

Social surveys of the project area were carried out with regard to developing the socio-economic baseline conditions of the general settled population. The following major aspects were covered in the socio-economic baseline survey of the sample population settled along the RoW:

- Demographic Characteristics,
- Literacy Ratio,
- Education,
- Occupations,
- Livelihood,
- Income,
- Living Standard,
- Available Social Infrastructure,
- Gender Status,
- Needs of the People and other Aspects.

1.10.5 Public/Stakeholder Consultations

Stakeholder consultations were carried out during the ESIA study. Meetings were held in Jacobabad, Shikarpur, Kashmore and Divisional headquarter Larkana with the Government institutional stakeholders and key environmental and social issues discussed. Extensive consultations with the grass root stakeholders (land-affectees owners) were carried out at the project sites. Efforts were made to solicit the concerns and views of rural women as well.

1.10.6 Assessment of Impacts and Mitigation Measures

During the field work emphasis was laid on; the environmental including biological issues, socioeconomic conditions with respect to project interventions in order to determine the potential impacts of the proposed project. The potential impacts were characterized in order to determine their significance. Mitigation measures were suggested wherever required to minimize the significant environmental impacts. A management framework was also developed for the implementation of the mitigation measures identified during the study.

1.10.7 Report Structure

The ESIA report has been structured on the standard format, prescribed by the EPA. The report has been prepared in the following chapters:

Chapter-2 (Policy, Legal and Administrative Framework)

Described legal and administrative framework as per requirements of the provincial, federal environmental agencies and World Bank guidelines.

Chapter-3 (Project Description)

Provided a simplified discussion of the proposed main, branch and sub drains, outfall options, pumping stations, rehabilitation of existing drainage facilities, identified hydraulic structures.

Chapter-4 (Alternatives Analysis)

In this chapter, alternatives of the project have been analysed.

Chapter-5 (Environmental Baseline Conditions)

Description of the physical, biological and socio-economic environment have been discussed and presented in this chapter.

Chapter-6 (Public Consultation and Participation)

Identified the relevant stakeholders, developed an appropriate framework for stakeholder (primary and secondary) consultation and carried out consultation as an integral part of the planning and design process have been covered with pictorial views in this chapter.

Chapter 7 (Assessment of Environmental Impacts and Their Mitigation Measures)

Environmental impacts have been assessed and mitigation measures for design, construction and operation phases have been provided in this chapter.

Chapter-8 (Environmental Social Management Plan)

A detailed Environmental Social Management Plan has been prepared and included in this chapter.

Chapter-9 (Resettlement Aspects)

Discussed the resettlement planning, policy framework, costs and other aspects.

Chapter-10 (Conclusion and Recommendations)

Conclusion and Recommendations have been suggested.

1.10.8 Composition of Study Team

Team composition is as under:

- Imtiaz Ali Khoso (Project Manager)
- Bashir Hussain Laghari (Expert Environment)
- Malik Parwaiz Akhtar (Junior Resettlement Specialist)
- Kamran Khan (Junior Environmentalist)
- Miss Aqsa (Junior Ecologist)
- Khuram Riaz (Junior Sociologist)
- Miss Fazeela Khoso (Gender Representative)
- Sajid Murtaza Sail (GIS Expert)
- Hajra Irshad (Compute Operator).

CHAPTER 2

POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK

2 POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK

Pakistan in general and Sindh particular, where the project area is located, has adequate legal cover for protecting the environment. The policies, administration framework and guidelines have been considered during the preparation of this report. It is expected that the project authorities will comply with all relevant Sindh environmental protection legislation and regulations relating to environment.

Administration on environment has been divided into federal and provincial government. International issues such as the environmental policy and regulation has been managed by Ministry of Climate Change. On the other hand, national environmental matter has been managed by provincial government.

In Sindh province, Sindh EPA has responsible for the provincial matters. All of the environmental technical issues such as EIA, environmental monitoring, and enforcement of law /environmental quality standards are headed by Director General of Sindh EPA. The present structure of EPA is shown in Figure 2.1.

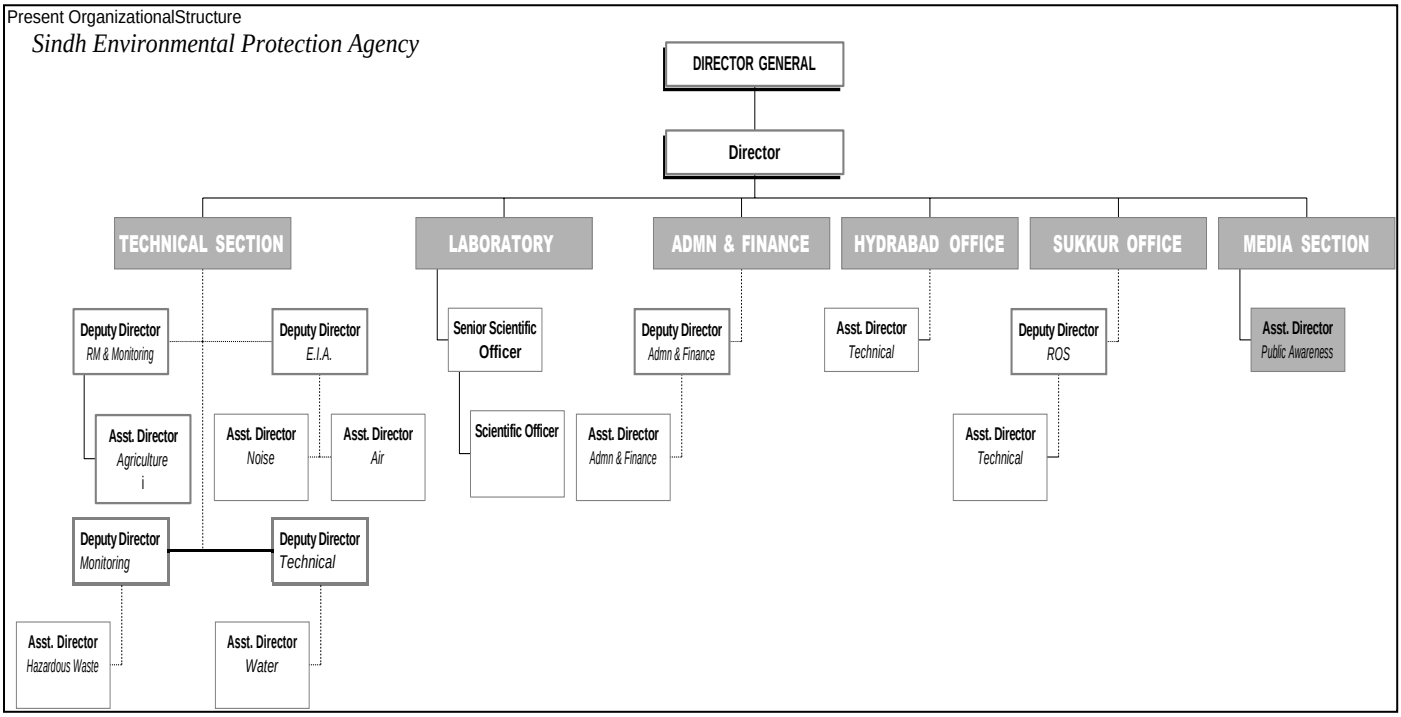


Figure 2.1: Present Organization Structure of EPA

Source: EPA Web Site

2.1 Provincial Environmental Legislation, Policies & Guidelines

2.1.1 Sindh Environmental Protection Act, 2014

Pakistan Environmental Protection Act, 1997 was the core legislation of Pakistan related to Environment. After the approval of 18th amendment, powers of Federal EPA have been delegated to provincial EPAs for the conservation and protection of environment. Sindh Environmental Protection Agency as a part of Sindh Act No. VIII of 2014 prepared Sindh Environmental Protection Act (SEPA), 2014 which was passed by the provincial assembly of Sindh on 24th February 2014 and asserted by the Governor of Sindh on 19th March, 2014 and notified on 20th March, 2014. It is a comprehensive

legislation and provides legislative framework for protection, conservation, rehabilitation and improvement of the environment. It contains concrete action plans and programs for the prevention of pollution and promotes sustainable development.

Act has 11 parts with 37 Sections followed by sub-sections and clauses. Part VI is related to the environmental examinations and assessments while part X is related to the public participation.

The law stipulates:

- No Proponent of a Project shall commence construction or operation unless he has filed with the Government Agency designated by Provincial EPAs an EIA/ESIA and have obtained a NOC;
- Establishment and Formation of the Pakistan Environmental Protection Council;
- Powers and Functions of the Federal and Provincial EPA;
- Prohibition of certain discharges or emissions.
- National Environmental Quality Standards (NEQS), for wastewater, air emissions and noise; and Law also empowers provincial Government to issue notices and to enforce them for the protection of the environment.

2.1.2 Sindh Environmental Protection Regulations, 2014

Under Section 37 of the SEPA, 2014 EPA, Sindh has formulated Regulations, 2000 which are approved by the Government. A Project falling under any category specified, in Schedule II, requires the Proponent to file an EIA/ESIA with the Agency to initiate the process of NOC. After the submission of IEE or EIA/ESIA, the Agency will confirm that the document submitted is complete for the purpose of review. During this time, should the federal agency require the Proponent to submit any additional information; the IEE or EIA/ESIA will be returned to the Proponent for revision, clearly listing those aspects that need further discussion. Subsequently, the Agency shall make every effort to complete an IEE/EIA review.

As per SEPA, 2014 and Sindh EPA Regulations, 2000, Schedule-II, an EIA/ESIA study is required for the drain Project. In accordance with the requirements of the TOR, the EIA/ESIA will include the assessment of drain route with regard to interference with the protected areas, recommendation of mitigation measures and its cost estimate, review of regulatory measures, development of environmental monitoring and management plans and recommendations to enhance the institutional capability.

2.1.3 Approval from Sindh Environment Protection Agency

As per the 2014 Regulations, Proponent will submit an EIA/ESIA report for their project activities to EPA Sindh (Environment Protection Agency Sindh), and seek approval on the same from the agency. Ten hard copies and 2 soft copies of the EIA/ESIA report will be submitted to SEPA. It will then grant its decision on the EIA/ESIA as per the rules and procedures set out in the 2014 Regulations.

The following rules will apply:

- A fee is payable to SEPA for review of the EIA/ESIA;
- The EIA/ESIA submission is to be accompanied by an application in the format prescribed in Schedule V of the 2014 Regulations;

- SEPA is bound to conduct a preliminary scrutiny and reply within four weeks of the submission of the report a) confirming completeness, or b) asking for additional information, if needed;
- WAPDA will publish a public notice in any English, Urdu and Sindhi national newspaper for general circulation in the area affected by the project. The public notice will mention the following:
- The type of project;
- The location of the project;
- The name and address of the proponent;
- The places at which the EIA/ESIA can be accessed;
- The date, time and place for public hearing of any comments on the project or its EIA/ESIA;
- The date set for public hearing will not be earlier than fifteen (15) days from the date of publication of the public notice
- In the review process SEPA may consult a Committee of Experts, which maybe constituted on the request of the DG SEPA;
- On completion of the review process, the decision of SEPA will be communicated to the proponent in the form prescribed in Schedule V;
- Where an EIA/ESIA is approved, SEPA can impose additional controls as part of the conditions of approval;
- SEPA is required to make every effort to complete the EIA/ESIA review process within four months;
- The approval will remain valid for the project duration mentioned in the EIA/ESIA but on the condition that the project commences within a period of three years from the date of approval. If the project is initiated after three years from approval date, the proponent will have to apply for an extension in the validity period. The SEPA on receiving such request grant extension (not exceeding 3 years at a time) or require the proponent to submit a fresh EIA/ESIA if in the opinion of SEPA changes in baseline conditions or the project so warrant;
- After receiving approval from SEPA the proponent will acknowledge acceptance of the conditions of approval by executing an undertaking in the form prescribed in Schedule VI of the 2014 Regulations;
- The 2014 Regulations also require proponents to obtain from SEPA, after completion of the project, a confirmation that the requirements of the EIA/ESIA and the conditions of approval have been duly complied with;
- The SEPA in granting the confirmation of compliance may impose any additional control regarding the environmental management of the project or the operation, as it deems necessary.
- Detailed regulations of the project have been described in the separate ESIA report already submitted to the client.

The overall flow of obtaining the approval of EIA is shown in Figure 2.2.

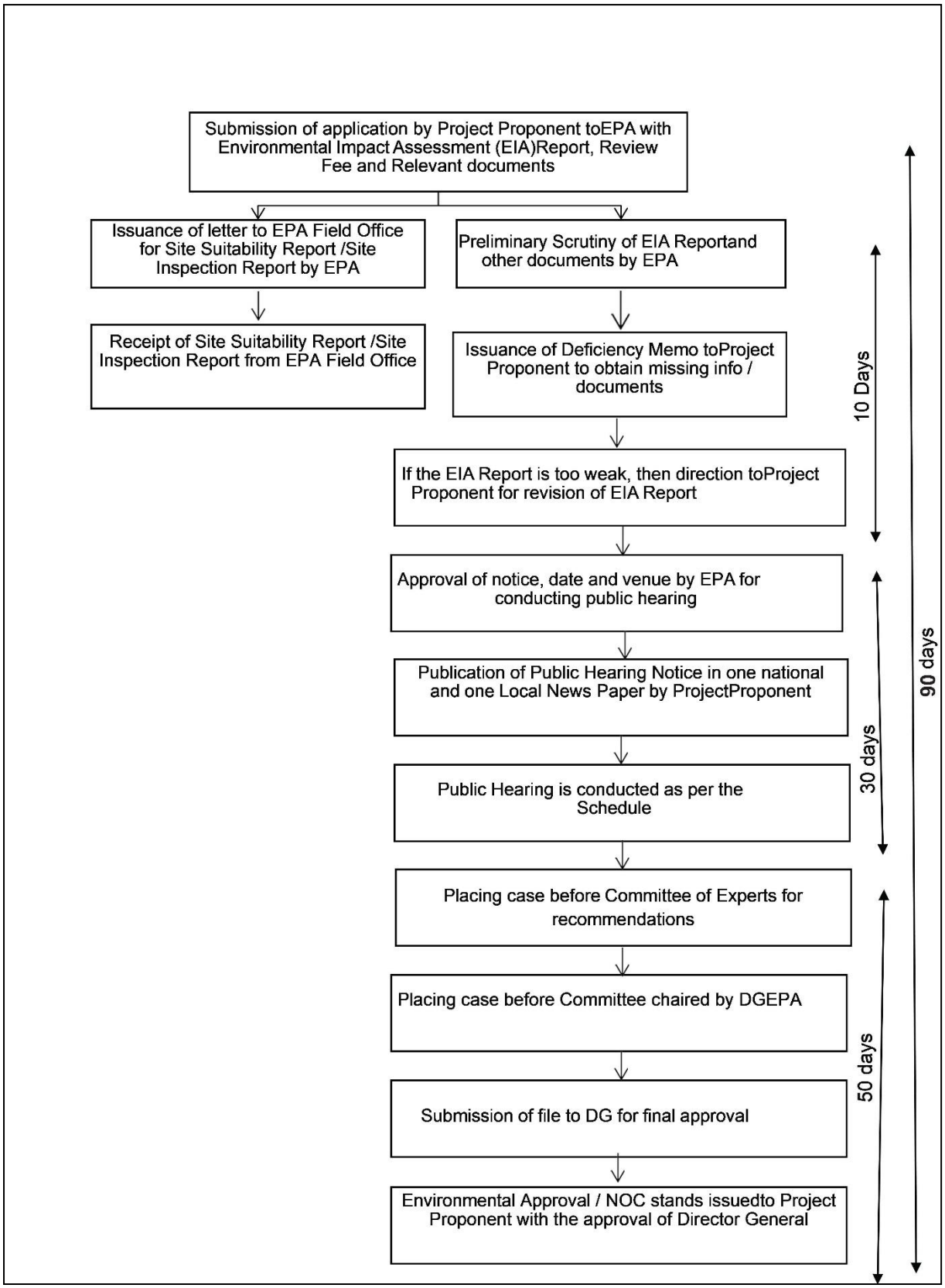


Figure 2.2: EIA Approval Process through Diagram

Source: EPA Web Site

2.1.4 Sindh Wildlife Protection Act 2020

This Act is enacted to make provision for protection, conservation, preservation, sustainable use of wildlife for establishment, management and maintenance of protected in the Province of Sindh.

2.1.4.1 Main Salient Features of the Law

- The Sindh Wildlife Protection, Preservation, Conservation and Management Bill, 2020 aims to enhance protection for wildlife.
- Article 9 provides for the actions prohibited in the protected area and any wildlife habitat including: hunting, shooting, killing, injuring, trapping, snaring, draining or diverting the water resource for the purpose other than the purpose which is essential for health of wildlife.
- No person shall hunt, kill, trap and capture, or smuggle, possess and trade in wildlife such as mammals, birds, reptiles or parts thereof unless permitted.
- No person shall trade in captive breed animals, wildlife trophies or meat, or process or manufacture goods or articles from trophies or meat, unless he be in possession of a valid license issued under the provisions of this Act.
- Sindh Wildlife Department will investigate concerned cyber-crime cases with the Federal Investigation Agency (FIA).
- Any person keeping wild animals without any permit or license will be awarded six months sentence, under the law. The law also prohibits illegal sale and purchase of birds at shops and markets without license.
- The legislation has wider coverage, protecting even those wild animals that enter Sindh via trans-boundary migration or as a result of human activity.
- All wild animals, from a common crow to a turtle or other exotic species, are protected now.
- The law, authorized wildlife inspectors to register FIRs against persons charged with wildlife criminal offences.
- Under the law, any person posting pictures of hunted animals and birds on social media can be sent to jail for six months.
- Under the law all acts hurting wild animals, whether intentionally or unintentionally, amount to cruelty and are strictly prohibited. It further prohibits the use of wild animals for fighting and baiting.
- As per the law, people using undersized cages and enclosures, which cause discomfort to animals, for handling and transporting wild animals will also be dealt with strongly.
- This Act will be applicable to the construction as well as operation and maintenance activities of the proposed project.

2.1.5 Sindh Forest Act 2012

Forest Act 1927 was promulgated in pre-independence days mainly for protection of government owned forest in the subcontinent. The same Act was adapted by the government of Pakistan on independence and is still enforce in Sindh Province.

The limited role of forests for providing timber, fuelwood and fodder has now changed to provision of environmental services including soil and water conservation, provision of clean air and clean water and provision of safeguards against environmental hazards including cyclones and floods. The forests are now regarded as center of biodiversity and a cover against global warming and climate change.

2.1.6 The Sindh Irrigation Act, 1879

This Act has relevance to the study due to the presence of the extensive irrigation network in the project area. This Act covers the construction, maintenance and regulation of canals for the supply of water and for the levy of rates of water supplied in the Sindh. In this Act “canal” includes channels, pipes and reservoirs constructed and maintained by the Government for the supply for storage of water. Under section 27 of the Act a person desiring to have a supply of water from a canal for purposes other than irrigation shall submit a written application to a Canal Officer who may, with the sanction of the Provincial Government give permission under special conditions. The Act also prohibits the damaging, altering, enlarging or obstructing the canals without proper authority.

This Act will be applicable to the construction as well as O&M activities of the proposed project.

2.1.7 Sindh Irrigation (Amendment) Act, 2011)

Following new section shall be added: -

“62-C. (1) Notwithstanding any grant or lease by any authority or any judgment or decree of any court in favour of any person, the land of all the natural or artificial depression courses meant for discharge of flood or rain waters shall stand resumed to Government and shall be exclusively used for such purpose.

(2) Any person in possession of Government land mentioned in sub-section (1), shall vacate such land within seven days of the commencement of this Act.

(3) Whoever fails to vacate the land as required under sub- section (2), shall be punished with imprisonment which may extend to ten years and shall also be liable to fine which may extend to rupees one million: Provided that the offence punishable under this sub- section shall be non-bail able.

2.1.8 Sindh Water Management Ordinance (2002)

This ordinance provides for the establishment of public systems for the distribution and delivery of irrigation water, the removal of drainage water and the management of flood waters. The Ordinance also provides for the establishment of the Sindh Irrigation and Drainage Authority (SIDA) and defines its composition. The Authority will act as a reform agent, take over the main irrigation (barrages), drainage and flood protection infrastructure, and implement participatory water management. The tasks the Authority must perform are outlined in detail in the text. The Authority shall further establish a Water Allocation Committee at each barrage and a Community Advisory Committee for the smooth interaction with the local communities in which the Authority operates.

The Government may constitute Area Water Boards (AWBs) and Farmers Organizations (FOs) to take over the management of the main and branch canals, and distributaries and water courses. Composition, functions and tasks are set out in the text.

The Ordinance further provides for: the setting up of watercourse associations and drainage beneficiaries groups made up of non-elected farmers to energize the farming community and improve service delivery; the establishment of a Regulatory Authority of Irrigation, Drainage and Flood Protection

to promote effective interaction and collaboration between the Authority, Boards, organizations, associations and beneficiary groups; offences and penalties; etc.

This Ordinance repeals the Sind Irrigation Water Users Association Ordinance, 1982.

2.1.9 Sindh Environmental Quality Standards (2016)

In exercise of the powers conferred by section 37 of the Sindh Environmental Protection Act, 2014, the Sindh Environmental Protection Agency, with the approval of Government, presented Sindh Environmental Quality Standard in December 2014 which outlines different types of contaminants in air, water and noise, and their acceptable limits.

The SEQS promulgated under the SEPA 2016 specify standards for industrial and municipal effluents, gaseous emissions, vehicular emissions, and noise levels. During the whole project span, SEQS will apply to the gaseous emission generated from vehicular exhaust, stacks emissions & to the ambient air quality during project activities.

2.1.10 Sindh Public Property Act, 2010

The act has been passes to avoid illegal encroachments and provide measures for removal of encroachment from public property and to retrieve possession. This act is applicable if there is any encroachment at the proposed public / government land.

2.1.11 Sindh Resettlement & Rehabilitation Policy, 2022

In Sindh, several provincial and municipal laws and regulations govern the principles of land ownership, transfer, and acquisition. The Land Acquisition Act (LAA) of 1894 is the primary legislation, which provides the principles and the process of acquisition of lands for government and private projects and provides compensation to affected persons. The LAA treats a title-based relationship with the land as a basis of eligibility and as a result does not cover displacement of informal settlements. The LAA also envisages cash payment as the only form of compensation without any provision for relocation and resettlement support for the displaced populations.

This resettlement policy, titled *Sindh Resettlement and Rehabilitation Policy 2022*, shall cover all types of displacement in Sindh – for instance, (a) development-induced displacement caused by project interventions; (ii) displacement caused by natural/climate related disasters; and (c) displacement caused by 'non-development project' related AEDs or eviction of informal settlers. Therefore, this policy, subsequent to its formal adoption, shall apply to all types of displacements. For development projects in Sindh, this policy will cover both public and private sectors involving physical and/or economic displacement ofpeople.

Under this R&R Policy, any displacement or resettlement, irrespective of its causes (i.e., development project, non-development project/to free public land or natural/climatedisasters), would be implemented as an adequately designed and coordinated 'project' that reduces vulnerability and enables environmental and social sustainability.

2.1.12 Sindh Hazardous Substances Rules, 2014

The Sindh Hazardous Substances Rules, 2014 are a set of rules derived from the Sindh Environmental Act, 2014 and are first of the very specific hazardous substances regulations brought into force in 2014 after the initial draft set of rules devised in 2003. They represent specific regulations with aspect of handling, storage and disposal of hazardous substances and issuing an approving license to the user

or facility. The Schedule-I of the Rules enlists the hazardous substances that are under the scrutiny of the Sindh-EPA.

- Under its licensing terms, the Rules highlight particular components as follows:
- Employment of Qualified technical personnel;
- Packing and labelling;
- Conditions of Premises;
- Safety precautions;
- Trainings;
- A comprehensive safety plan;
- Waste management Plan and
- Transporting of hazardous substances.

2.1.13 Sindh Fisheries Ordinance (1980)

The Ordinance provides for the issuing of a fishing license or permit that are mandatory for fishing in public water, for the sale or trade or processing of fish in markets and factories, for the declaration of sanctuary of any public water at any time and the related restrictions, for the disposal of wastes and sewerage that must be treated to prevent water pollution, for banning the use of explosives and toxic or poisonous agents in the fishing activities and, for restricting to sport fishing the use of fishing craft. Fishery Officers shall be appointed under this Ordinance and their powers extended to inspecting persons, vessels, premises and licenses in order to verify compliance with the ordinance. Offences are dealt with and penalties may be confiscation, fines or imprisonment depending on the nature of the offence.

2.2 National Environmental Legislation, Policies & Guidelines

Pakistan has had laws that contain provisions for environmental protection. These laws which were partly inherited from pre-independence days dealt with air and water quality, canal irrigation, land tenure and use, forest conservation, wildlife protection, energy development, pesticides use, noise, public health etc. Not only did these laws prove ineffective, punishment for violation was mild and easy to circumvent, but these laws also did not adequately cover the subject areas and several of these laws became outdated. Many aspects of environmental degradation remained uncontrolled and under-regulated. Pakistan therefore responded to its environmental concerns by introducing laws, establishing environmental protection institutions and developing human resources and technical capability through local resources and foreign assistance.

2.2.1 Pakistan Environmental Protection Act, 1997

Section 12 of Pakistan Environmental Protection Act 1997 lays down requirements for Initial Environmental Examination (IEE) and Environmental Impact Assessment (EIA/ESIA). This section states that:

- No proponent of a Project shall commence construction or operation unless he has filed with the Government Agency designated by Federal Environmental Protection Agency or Provincial Environmental Protection Agencies, as the case may be, or, where the Project is

likely to cause an adverse environmental effect, an environmental impact assessment, and has obtained from the Government Agency approval in respect thereof.

- The Government agency shall, subject to standards fixed by Pakistan Environmental Protection Agency,

  a) Review the initial environmental examination and accord its approval, or require submission of an environmental impact assessment by the proponent; or

  b) Review the environmental impact assessment and accord its approval subject to such conditions as it may deem fit to impose, require that the environmental impact assessment be re-submitted after such modifications as may be stipulated or reject the Project as being contrary to environmental objectives.

Federal Government Notification August 2000 titled "Policy and Procedures for the Filing, Review and Approval of Environmental Assessments" contains schedules A, B and C listing requirements of IEE or EIA/ESIA as follows.

EIA Requirements: Pak - EPA in August 2000 issued "Policy and Procedures for Filing, Review and Approval of Environmental Assessment", which includes Schedules A, B and C defining development projects in terms of requirements for EIA and IEE.

Schedule 11: defines projects, which require an EIA. It deals with list of major projects, which have the potential to affect a large number of people. The impact of such projects may be irreversible and could lead to significant changes in land use and in the social, physical and biological environment. The Section of Schedule ii Para E relating to Water management, dams, irrigation, and flood protection sector is reproduced below.

Schedule ii Para E

E- Water management, dams, irrigation and flood protection

- Dams and reservoirs with storage volume of 50 million cubic meters and above or surface area of 8 square kilometres and above
- Irrigation and drainage projects serving 15,000 hectares and above

Schedule i: defines projects, which require an IEE. It deals with projects where the range of environmental issues is comparatively narrow and issues can be understood and managed through less extensive analysis.

Thus, Drainage project is covered by Schedule ii, which requires preparation of a full ESIA report, for submission to EPA Sindh for their approval.

Furthermore, as per Sindh Environmental Protection Agency review of IEE and EIA Regulation 2014 classifies projects based on expected degree of adverse environmental impacts and lists then in two separate schedules.

Schedule-I: List projects that may not have significant environmental impacts and therefore require an IEE.

Schedule-II: List projects that may have potential significant environmental impacts require preparation of an EIA.

This Project also falls schedule II and requiring preparation of an EIA/ESIA Report.

2.2.2 National Sustainable Development Strategy, May 2012

Strategic Goals: The environment section enlists detailed strategic goals for addressing air and water pollution, land degradation and forestry issues, waste management, improving environmental governance and protection of the country's unique biodiversity. The overall focus is on safeguarding the environment by: Conserving and enhancing the natural resource base while protecting biodiversity and managing fragile ecosystems through an integrated natural resource management approach. Enhancing the life support system by addressing air and water pollution and reducing the ecological footprint of growth through strengthening the regulatory framework and community-based interventions. Preparing for climate change and its accompanying uncertainties through comprehensive adaptation and mitigation planning and concrete implementation measures.

2.2.3 National Conservation Strategy (NCS) 1992

The National Conservation Strategy (NCS) is the primary Policy document of the Government of Pakistan on national environmental issues. The Policy was approved by the Federal Cabinet in March 1992. The Strategy also attained recognition by international donor agencies, principally the KfW Bank. The NCS identifies 14 core areas including conservation of biodiversity, pollution prevention and abatement, soil and water conservation and preservation of cultural heritage and recommends immediate attention to these core areas in order to preserve the country's environment.

A midterm review of the achievements of NCS in 2000 concluded that achievements under NCS have been primarily awareness raising and institutional building rather than actual improvement to environment and natural resources and that NCS was not designed and is not adequately focused as a national sustainable development strategy (GoP, November 2000). The need therefore arose for a more focused National Environmental Action Plan (NEAP) required to bring about actual improvements in the state of the national environment with greater emphasis on poverty reduction and economic development in addition to environmental sustainability.

The National Environmental Action Plan was approved by the Pakistan Environmental Protection Council under the chairmanship of the President/Chief Executive of Pakistan in February 2001. NEAP now constitutes the national environmental agenda and its core objective is to initiate actions that safeguard public health, promote sustainable livelihoods, and enhance the quality of life of the people of Pakistan.

2.2.4 The Nantional Environmental Policy 2005

A National Environmental Policy has been approved by the Federal Cabinet in its meeting held during June 2005. This policy has already been endorsed by the Pakistan Environmental Protection Council during 2004. The new policy has total 171 guidelines on sectoral and cross-sectoral issues. The objectives of new policy include assurance of sustainable development and safeguard of the natural wealth of country. The following are the approved Sectoral Guidelines;

- Water Supply and Management;
- Air Quality and Noise;
- Waste Management;
- Forestry;
- Biodiversity and Protected Areas;
- Climate Change and Ozone Depletion;

- Energy Efficiency and Renewable;
- Agriculture and Livestock;
- Multilateral Environmental Agreements.

2.2.5 National Climate Change Policy, 2021

The updated National Climate Change Policy- 2021's goal is to steer Pakistan towards climate resilient and low carbon development. Thus, it would provide a comprehensive framework for addressing the issues that Pakistan faces and will face in future due to changing climate. This policy document is a 'living' document and will be reviewed and updated regularly to address emerging concepts and issues in the ever-evolving science of climate change.

2.2.6 National Forest Policy Pakistan, 2001

This policy covers the Renewable Natural Resources (RNR) of Pakistan i.e., forests, watersheds, rangelands, wildlife, biodiversity and their habitats. The policy seeks to launch a process for eliminating the fundamental causes of the depletion of RNR through the active participation of all the concerned agencies and stakeholders, to realize the sustainable development of the resources. It is an umbrella level policy providing guidelines to the Federal Government, Provincial Governments and territories for the management of their RNR. In consonance with it, the Provincial and District Governments may devise their own policies in accordance with their circumstances.

The goal of this policy is to foster the sustainable development of RNR of Pakistan, for the maintenance and rehabilitation of its environment and the enhancement of the sustainable livelihoods of its rural masses especially women, children and other vulnerable groups.

The elements of the policy are as follows:

- Reducing the impact of socio-economic causes;
- Population planning in critical ecosystems;
- Providing substitutes to firewood in the wooded mountains;
- Reducing poverty, poverty of opportunity and Powerlessness;
- Reducing political interference in the Forestry and Wildlife Departments;
- Renovating and invigorating the institutions of RNR;
- Supporting Local Governments in the sustainable development of their RNR;
- Policies for fragile ecosystems;
- Riverain forests;
- Irrigated plantations;
- Preservation of relict and unique forests;
- Wildlife;
- Rangelands and desert ecosystems; and
- Planting of trees and fodders on farmlands.

2.2.7 Cutting of Trees (Prohibition) Act, 1992

The Act consists of 11 sections. It shall be prohibited, without a prior written approval of the authorized officer, to cut, fell or damage any tree growing in the two zones as specified in section 3. Penalty

provisions are given in section 4 and the fines shall vary depending on the zone in which the offences have taken place. Section 6 deals with the seizure and confiscation of property.

2.2.8 Guidelines for Sensitive and Critical Areas (1997)

The guidelines for sensitive and critical areas, 1997, identify officially notified protected areas in Pakistan, including critical ecosystems, archaeological sites, etc., and present check lists for environmental assessment procedures to be carried out inside or near such sites. Environmentally sensitive areas include archaeological sites, biosphere reserves and natural places and wildlife sanctuaries and preserves. These guidelines are valuable as the project area in the vicinity of wildlife sanctuary (also a Ramsar site) for the Indus blind dolphin.

2.2.9 Guidelines for the Preparation and Review of Environmental Reports (1997)

These guidelines are a part of package of Pakistan Environmental Protection Ordinance 1997 and National Environmental Quality Standards, regulations and other guidelines. The scope of these guidelines are confined to those aspects of environmental report preparation and review which are of a general nature. Sector specific provision are not included, nor are the subject of public consultation, which is dealt with separately.

2.2.10 Guidelines for Public Consultation (1997)

The Pakistan Protection Ordinance 1997 requires Public Participation during the review of an ESIA (section 12(3)). The “Policy and Procedure for filling, review and approval of environmental assessments” requires proponents to consult with the affected community and relevant NGOs during the preparation of an environmental report.

2.2.11 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.

2.2.12 National Disaster Risk Reduction Policy, 2013

Disasters have an enormous and significant adverse impact on the development of key sectors of economy like agriculture, infrastructure, housing, health, and education and above all the environment, they result in a serious social and economic set-back to the sustainable development. Disasters also pose threat to increasing poverty and resultantly backslide the national development targets set to achieve the Millennium Development Goals (MDGs). Climate change induced disasters pose even greater threat to sustainable development in developing country like Pakistan which is ranked quite amongst the most vulnerable countries. Continuous floods of 2010, 2011 and 2012 are seen as an indication of more intense and frequent extreme events in the future.

Disaster risk reduction interventions were being carried out in the country till date by different departments / agencies in isolation at national, province and district levels. There was a strong need to give them directions and sound guidelines to align their activities in line with the true spirit of National Disaster Management Act, 2010 to counter the threats of disasters faced by the country. NDMA, being the lead focal agency for disaster preparedness and management, has therefore, embarked upon formulation of a comprehensive National Disaster Risk Reduction Policy through wider consultations with all stakeholders including all provinces, state of AJ&K and regions. This policy covers disasters risk reduction in a more holistic way and introduces a proactive and anticipatory approach by laying special emphasis on risk assessment and prevention.

2.2.13 Pakistan Labor Policy, 2010

The main objective of the Labour Policy, 2010 is the social and economic well-being of the labour of Pakistan. The Labour Policy, 2010 has following four (04) parts:

- Legal Framework;
- Advocacy: rights of workers and employers;
- Skill development and employment; and
- Manpower export.

2.2.14 Land Acquisition Act 1894

The Land Acquisition Act, (LAA) 1894, is a "law for the acquisition of land needed for public purposes and for companies and for determining the amount of compensation to be paid on account of such acquisition". The raison d'etre of this piece of legislation is, therefore, two-fold: Firstly, to fulfil the needs of government and companies for land required by them for their projects, and secondly, to determine and pay compensation to those private persons or bodies whose land is so acquired. The exercise of the power of acquisition has been limited to public purposes. The principles laid down for the determination of compensation, as clarified by judicial pronouncements made from time to time, reflect the anxiety of the law-giver to compensate those who have been deprived of property, adequately. It is with this end in view that the association of the persons interested in the property, with the process of determination of its negotiated market value by the Collector is a highlight of this Act.

2.2.15 The Solid Waste Management Policy (2000)

The policy was promulgated by Pakistan Environmental Protection Act (PEPA), which aims to facilitate control on waste by providing principles of good waste management and reducing waste at source. The guidelines would be consulted during planning and designing the disposed of solid waste from Contractor's camps and their construction waste.

2.3 International Environmental Legislation, Policies & Guidelines

2.3.1 World Bank Guidelines

The World Bank Environmental & Social Standards identifies a number of areas of concern, which will be addressed during Impact Assessment. It sets out guidelines for the determination of impacts, provides a checklist of tools to identify possible biodiversity issues and suggests possible mitigation measures. Possible development project affects different areas such as Wetlands, Protected Areas, Sanctuaries and Forests etc. Mentioned below ESS will be reviewed with detailed in ESIA (if client's requirement) of the project. ESS are as under:

ESS 1 Assessment and Management of Environmental and Social Risks and Impacts

ESS 2 Labour and Working Conditions

ESS 3 Resource Efficiency and Pollution Prevention and Management

ESS 4 Community Health and Safety

ESS 5 Land Acquisition, Restrictions on Land Use and Involuntary Resettlement

ESS 6 Biodiversity Conservation and Sustainable Management of Living Natural Resources

ESS 7 Indigenous People/Sub-Saharan African Historically Underserved Traditional Local Communities

ESS 8 Cultural Heritage

ESS 9 Financial Intermediaries

ESS 10 Stakeholder Engagement and Information Disclosure.

2.3.2 Guidelines for Critical and Sensitive Areas

Protected areas are of crucial and growing importance. Properly managed protected areas are based on the establishment of a system, which aims to:

- Safeguard the earth's precious biodiversity;
- Protect outstanding areas of natural beauty; and
- Conserve areas of cultural significance.

In Pakistan, there exists a system of protected areas for the protection of endangered species, habitats, ecosystems, archaeological sites, monuments, buildings and other cultural heritage. The threats to protected areas in Pakistan are commercial-industrial pressures including mining, logging, overgrazing, cutting wood for fuel, development Projects and mismanaged tourism. Protected areas in Pakistan can be broadly categorized into two groups; i.e.

- Ecosystems; and
- Archaeological and cultural sites.

There is no central or federal level legislation for Wildlife conservation in Pakistan. However, each province has its own laws covering protected areas. There are separate Wildlife departments in the provinces that administer protected areas.

It should be noted that the above legislation consists of complicated, lengthy and legal documentation. Logically, only the relevant conservation authorities are in a position to provide the Proponent or Consultant with the most appropriate technical, scientific, administrative and regulatory assistance relating to the different legislations.

The GOP in the past years has taken some concrete steps to preserve, conserve and manage our national heritage, fauna and vegetation through the establishment of protected areas. This is being done through legislation, scientific research and education. In all the provinces, there are statutes that provide for creation and management of national parks, wildlife sanctuaries and game reserves.

The official classification of notified protected ecosystems in Pakistan consists of wildlife sanctuaries, national parks and game reserves.

In addition, there are protected forests, reserved forests, village forests/guzara forests, state forests and rangelands. The relevant conservation authorities supply information on these areas to the Proponent or Consultant. In planning and sitting a Project, the Proponent needs to focus on being sensitive to the particular values of the relevant ecosystem or archaeological and cultural sites.

2.3.3 Convention on Wetlands (Ramsar Convention), 1971

The broad aim of the Convention on Wetlands (Ramsar, Iran, 1971) is to halt the worldwide loss of wetlands and to conserve those that remain through wise use and technology transfer. Contracting Parties have made commitments to:

- Designate at least one site that meets the Ramsar criteria for inclusion in the list of wetlands of international importance;

- Protect the ecological character of listed sites;
- Include wetlands conservation within their national land-use planning; and
- Establish nature reserves on wetlands and promote wetland training.

2.3.4 International Environmental Accords and Agreements

- Convention on Environmental Impact Assessment in a Transboundary Context. Espoo, Finland, 1991.
- United National Framework Convention on Climate Change (UNFCCC), New York.
- Vienna Convention for the Protection of the Ozone Layer. Vienna, 1985 including the Montreal Protocol on Substances that Depleted the Ozone Layer Montreal, 1987.
- FAO International Code of Conduct on the Distribution and Use of Pesticides, Rome, 1985.
- Convention Concerning the Protection of the World Cultural and Natural Heritage (World Heritage Convention), Paris, 1972.
- Convention on Biological Diversity (CBD), Nairobi, 1992.
- Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), Washington, D.C., 1973.
- Convention to Combat Desertification (CCD), Paris, 1994.
- FAO International Undertaking on Plant Genetic Resources, Rome, 1983.

2.3.5 Intergovernmental Organizations

- Commission on Sustainable Development (CSD)
- Food and Agricultural Organization (FAO)
- Global Environmental Facility (GEF)
- International Labour Organization (ILO)
- International Monetary Fund (IMF)
- United Nations International Children's Emergency Fund (UNICEF)
- United Nations Development Programme (UNDP)
- United Nations Education, Scientific and Cultural Organization (UNESCO)
- United Nations Environment Programme (UNEP)
- United Nations Industrial Development Organization (UNIDO)
- United Nations Population Fund (UNFPA)
- World Bank (WB)
- World Health Organization (WHO)
- World Meteorological Organization (WMO)
- Earthwatch Institute Greenpeace International
- IUCN – The World Conservation Union (National Conservation Strategy 1991)
- World Wide Fund for Nature (WWF).

PROJECT DESCRIPTION

3 PROJECT DESCRIPTION

3.1 General

Land drainage is the removal of excess surface and subsurface water from the land to enhance crop growth, including the removal of soluble salt from the soil. The excess water may occur either for a short time or for a prolonged time. The excess water on most lands does not cause any harm to the crops as long as the quantities are small, the occurrence is rare and of short duration, and that the excess occurs during non-critical season. Large quantities of excess water with prolonged duration and frequent occurrences at critical time periods are very harmful to the crops and lead to the drainage problems. The main goals of agricultural drainage from cultivated land are to ensure the harvest grain yield of agriculture products per unit area and therefore to enhance the profitability of farming the land. The surface drainage is applied on flat lands where slow infiltration, low permeability and when waterlogging occurs on the soil surface, whereas a subsurface system is applied when the waterlogging occurs in the soil. The subsurface has three choices vertical (tub well) drainage, open and pipe drains. In Indus Plain over the last 25 years, thousands of public tub wells have been constructed as a part of Salinity Control and Reclamation Projects (SCARPs).

Pakistan possesses the world's largest contiguous irrigation system commonly called as Indus Basin Irrigation System (IBIS). It commands an area of about 14.3 million hectares (35 million acres) and encompasses the Indus River and its major tributaries. The canal system which exists today was started by the middle of the nineteenth century. In contrast to continuous irrigation network, Pakistan's drainage network is in general not interconnected. Consequently, much of the drainage effluent is either retained in the IBIS or disposed of into the irrigation system (i.e. rivers and canals). There is now a wide spread consensus that the lack of effective drainage system for the IBIS is by far the principal threat to the sustainability of agriculture in the Indus Basin.

Waterlogging and salinity are serious environmental problems associated with irrigation in the Indus Basin. A high-water table inhibits root growth and therefore reduces crop yields. The semiarid climate conditions prevailing in Pakistan also lead to salts accumulation in the root zone, further reducing the yields. Low irrigation efficiency coupled with inadequate drainage is the primary cause of waterlogging and salinity in Pakistan. Less than 40% of the total irrigation supplies delivered by the irrigation system are directly used by crops. Most of the rest percolates into the aquifer, causing the water table to rise unless adequate drainage facilities are provided. Other aggravating factors are the flat topography and poor natural drainage.

In Sindh Province, canal head withdrawals have been increasing over time as extension to the irrigation system took place; the last one was completion of Guddu Barrage in 1967. The low diversions were recorded during years of drought and less storage in reservoirs. On the average during this period, Sindh received about 41.4 percent of total canal diversions.

The Jacobabad, Shikarpur and Kashmore Drainage Project area comprises three districts of Kashmore, Shikarpur and Jacobabad covering nine Drainage Units (DU-5 to DU-13) identified by Right Bank Master Plan Study- 1992 (RBMP). It has a gross area of 6 97,912 ha (1.70 million acres) and cultivable command area (CCA) is 617,672 ha (1.53 million acres) irrigated through Desert and Begari Sindh Canals. The Consultants are tasked to prepare the "Feasibility Study, Detailed Engineering Design, Tender Documents and PC-I for Jacobabad, Shikarpur and Kashmore Drainage Project".

There are three existing drainage systems in the Drainage Unit (DU-13) i.e., Lakhi, Shikarpur and Sindh Wah. These three drainage systems were constructed for eradication of waterlogging and salinity problems. The gross area of Drainage Unit-13 Shikarpur area is 70,608 ha (174,476 acres) of which 61,461 ha (151,870 acres) is cultivable commanded area.

3.2 Drainage System

Land drainage is the removal of excess surface and sub-surface water land to enhance crop growth. The flow of water through well-defined channels is known as drainage and the network of such channels is called a “drainage system”. The three most common techniques used to drain excess water are: a) surface drainage, b) sub-surface drainage, and c) tubewell drainage. The subsurface has three choices vertical (tubwell) drainage, open and pipe drains.

3.2.1 Surface Drainage

The surface drainage is applied on flat lands where slow infiltration, low permeability and when waterlogging occurs on the soil surface. A surface drainage system is a method used to control the movement of excess water on the surface of the ground. It is particularly important in agricultural contexts where waterlogged soil can impede plant growth and lead to various problems. It's a relatively straightforward and cost-effective method. It's also visually unobtrusive and doesn't require specialized equipment.

3.3 Rehabilitation of Existing Drainage Facilities

A surface drainage system exists in Drainage Unit (DU-13) which is falling in Shikarpur District with administrative boundaries of Lakhi, Khanpur, Ghari Yasin, Shikarpur and Sukkur talukas of Sukkur & Shikarpur districts. The gross area (GA) of the Shikarpur Drainage Unit-13 is 174,472 acres (70,608 ha) of which 151,870 acres (61,461 ha) are cultivable commanded area (CCA). Figure 3.1 shows the existing drainage network of unit-13 along with land use area.

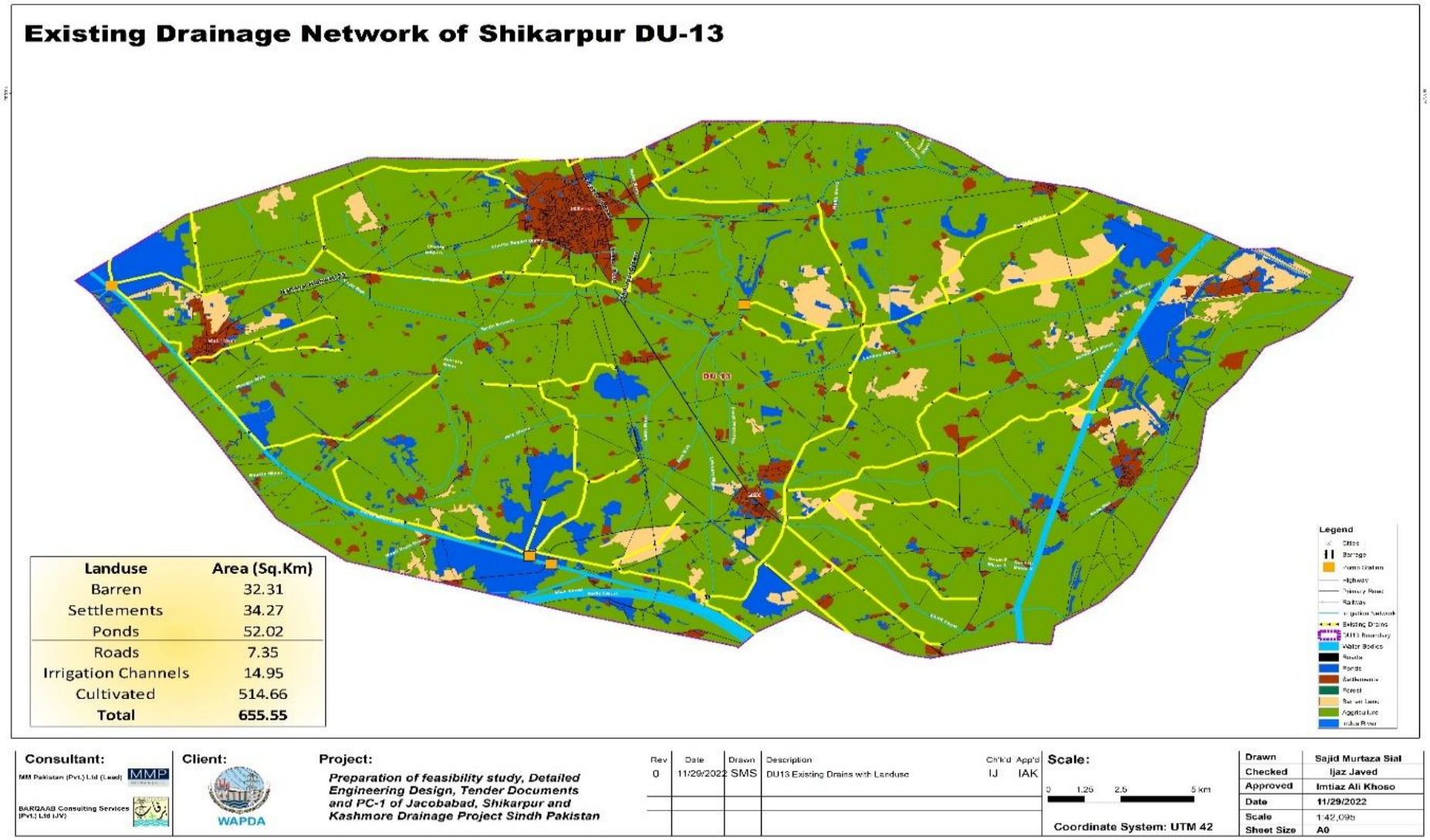


Figure 3.1: Irrigation Network Map of Project Area

It has mainly three drainage systems which were constructed for eradicating the waterlogging and salinity problems in the area. These drains are given below in Table 3.1 with name of main drainage system along with its total branch drains and sub drains and also shows the total length of each system and discharges.

Table 3.1: Main Drainage System in DU-13

Sr. No:	Name of System	Total No: of Main / Branch / Sub-Drains	Total Length of Main / Branch I Sub Drains (RD)	Total Dis. (cfs)
1	Lakhi System	17	407.65	**667**
2	Shikarpur System	11	258.80	**396**
3	Sindh Wah System	5	19.25	**147**
	Total	**33**	**685.70**	**1210**

Source: PC-I, NESPAK, March, 1996

3.4 Justification of Surface Drainage for JSK Project

In Jacobabad drainage project the depth to water rises during Kharif season at surface level due to mainly rice cultivation in the project area. On the other hand, during Rabi season water table starts depleting due to non-availability (non-perennial system) of irrigation water. The groundwater recharge is extremely nominal and it does not significantly contribute to drainable surplus. Keeping in view this phenomenon it is determined that only during monsoon period excess standing water on ground and storm water evacuation is the main issue in the project area. For JSK Project area, surface drainage is proposed to cater the drainage effluent based on irrigation recharge, rainfall runoff and excess standing water on ground.

Surface drainage systems are generally considered to be the most cost-effective option as compare to Sub-surface and vertical drainage. The materials typically used for surface drainage, such as soil-moving equipment, pipes, culverts, and excavation tools, can be relatively inexpensive compared to other drainage methods. Vertical and sub-surface drainage systems, which involve the installation of tubewells & tile drainage, tend to be more expensive compared to surface drainage.

3.5 Proposed Surface Drains Outfall Options

Four options have been evaluated for proposed JSK surface drainage Project.

3.5.1 Option-1

According to option-1, there are 6 Main drains, the drainage effluent of four, out of six, main drains will be disposed of into the existing drains (RBOD-III & Odho), whereas, for the other two main drains (No 3 & 4), pumping stations are proposed to dispose of drainage effluent into irrigation channels (Desert & B.S. Feeder) for reuse, being of good quality. In this option, existing drains (RBOD-III, Hairdin and Odho) require to be remodelled/rehabilitated to cater drainage effluent.

3.5.2 Option-2

According to the 2nd proposed option, there are 8 Main, 35 Branch and 11 Sub- drains discharging 3587 cfs with total length of 299 km for the Project. In option-2, sweet water and saline water zone segregated using DEM and pre-post monsoon water quality data of 2021-22. In this option the drainage effluent (fresh) of 4 out of 8 main drains was proposed to be dispose of into Desert Canal, BS Feeder and Begari Canal. Whereas drainage effluent (brackish) of remaining 4 main drains was planned to disposed of

into existing drains i.e. (RBOD-III & Odho Drains). In this option existing drains (RBOD-III and Odho drains) would not be required remodeling/rehabilitation.

3.5.3 Option- 3

The 3rd proposed option underwent rigorous refinement through ground truthing and extensive field investigation. The 3rd proposed Option underwent rigorous refinement through ground truthing and extensive field investigation. Land use Atlas along with proposed drainage system was also prepared. Both proposed options (1&2) were evaluated/investigated through field ground trothing based on prepared comprehensive land use Atlas. For ground trothing a detailed field survey was conducted for all proposed drains. During ground trothing relevant information i.e., location of proposed drain, sweet & waterlogged area, depth to water table, shallow groundwater, irrigation canal water, surface water and existing drain effluent quality was collected for refinement and finalization of drainage design. In identification & refinement of proposed drains, different aspect was considered in option-3 i.e., ground trothing, natural gradient, water quality, depression ponds, existing irrigation system, land use, cropped area, barren land, and existing Infra-structure.

According to the proposed option-3, there are 12 Main, 48 Branch and 15 Sub- drains discharging **2366.18** cfs with total length of 453.95 km for the Project. In option-3, sweet water and saline water zone segregated using DEM, ground trothing and water quality data collected from SMO as well in the field. In this option, the drainage effluent (fresh) of 6 out of 12 main drains was proposed to be dispose of into Desert Canal, Noor Way & Begari Canal. Whereas drainage effluent (brackish) of remaining 6 main drains are planned to dispose of into existing drains i.e. (RBOD-III & Odho Drains). In this option existing drains (RBOD-III and Odho drains) will required remodeling/rehabilitation. The proposed drains are properly named and marked canal mile wise (reduce distance) keeping in view the nomenclature, and leveling data received through DEM was used for disposal arrangement. The hydraulic design parameter are being analysed for the all proposed drainage system.

During ground, trothing depth to water table data and 31 Nos water quality samples were collected from water pond, standing water, hand-pump, un-cultivated and irrigation canals. The collected water quality samples sent to ISRIP, WAPDA for detail testing. The groundwater quality sample collected (68 Nos.) so far are limited and need further investigation for refinement of brackish area/drainage effluent.

The sweet water and brackish water zones along with proposed drainage system re-verified and refined through ground trothing in the field. During ground trothing, farmers were also interviewed for proposed drainage system and waterlogging condition in the project area. During interview, Interactive Group Dialogues technique was used for getting information regarding perceptions of land & water users for the proposed drainage system. Based on information collected during field verification, land use classification, Interactive Group Dialogues, water quality & depth to water table data, Fresh and Brackish water zones are segregated.

3.5.4 Option 4

In response to the observations and stakeholder feedback, drainage network design option-4 which is actually revision of option-3 was adopted. This option carefully considered the stakeholders' preferences and the existing condition of Odho drain. It diverted Doda and Jagan drain to alternative disposal points RBOD-III within the project area, avoiding any additional burden on the already strained Odho drain. The adoption of demonstrated the project team's commitment to collaborative decision-making and their dedication to ensuring responsible water management and the project's long-term success. According to option-4, there are 11 Main, 47 Branch and 15 Sub-drains with total length of

444.8 km for the Project. The Discharge is 2485 cfs. The drainage effluent of drains will be disposed of into RBOD-III, Begari drain, Noor Wah and Desert canal).

3.5.5 Option 5 (Finalized for Design)

As per the proposed recommended drainage system, the Project incorporates a network of 13 Main drains, 49 Branch drains, and 13 Sub-drains (Figure 3.2), efficiently discharging a total flow of 3110 cubic feet per second (cfs). Detail of proposed recommended drainage system is given at Table 3.2. The entire drainage system (Figure 3.3) spans an impressive length of 593.11 Km (381.31 Km of main drains and 211.80 Km of branch and sub-drains). This meticulously designed configuration ensures optimal water management and enhanced project sustainability.

In proposed recommended drainage system, a well-designed drainage system is proposed, where the effluent from 7 out of the 13 main drains, known for their fresh water content, will be directed towards the River creek, Beghari, Desert and BS. Feeder canal. This strategic routing ensures that the valuable fresh water is effectively utilized. Simultaneously, the effluent from the remaining 6 main drains, which contains Fresh and brackish water, is strategically planned to be disposed of into the existing drains, specifically the RBOD-III and Hairdin Drain (Table 3.2). As part of this option, RBOD-III Drain, will undergo remodeling and rehabilitation to ensure their efficiency and compatibility with the proposed drainage system. The remodeling of RBOD-III Drain will involve upgrades and improvements to enhance its capacity and flow management capabilities. Table 3.2 presents the tentative locations and discharges of the outfall channels.

Table 3.2: Revised Proposed Drainage System of JSK Project along with length, Discharge and Outfall Channels of Main Drains

Main Drainage System	Length of MDs (km)	Discharge (cfs)	Outfall Channels
Badani Drain	18.41	155.00	B.S. Feeder (Fresh Water) (RD-123+377)
Begari Drain-1	50.76	510.29	Begari Canal (Fresh Water) (RD-102+046)
Begari Drain-2	16.46	193.77	Begari Canal (Fresh Water) (RD-134+000)
Bhayo Drain	10.10	54.79	River Creek (Fresh Water)
Bhurgri Drain	44.10	234.46	RBOD-III Drain (Fresh + Saline Water) (RD- 146+260)
Dad Pur Drain	31.33	281.90	RBOD-III Drain (Fresh + Saline Water) (RD-272+260)
Doda Pur Drain	56.70	572.54	RBOD-III Drain (Fresh + Saline Water) (RD-156+000)
Golo Drain	12.47	66.77	BS Feeder Canal (Fresh + Saline Water) (RD-177+000)
Jacobabad Drain	59.50	356.09	Hairdin Drain (Fresh Water) (RD-429+538)
Manjhi Pur Drain-1	43.06	319.53	Desert Canal (Fresh Water) (RD-290+138)
Manjhi Pur Drain-2	14.75	117.52	Desert Canal (Fresh Water) (RD-326+244)
Miran Pur Drain	13.94	198.53	RBOD-III Drain (Fresh + Saline Water) (RD-252+474)
Shahdad Kot Drain	9.33	49.23	RBOD-III Drain (Fresh + Saline Water) (RD-120+253)
TOTAL	**381.31 (plus 211.80 Dis/sub-drain)**	**3110.42**	

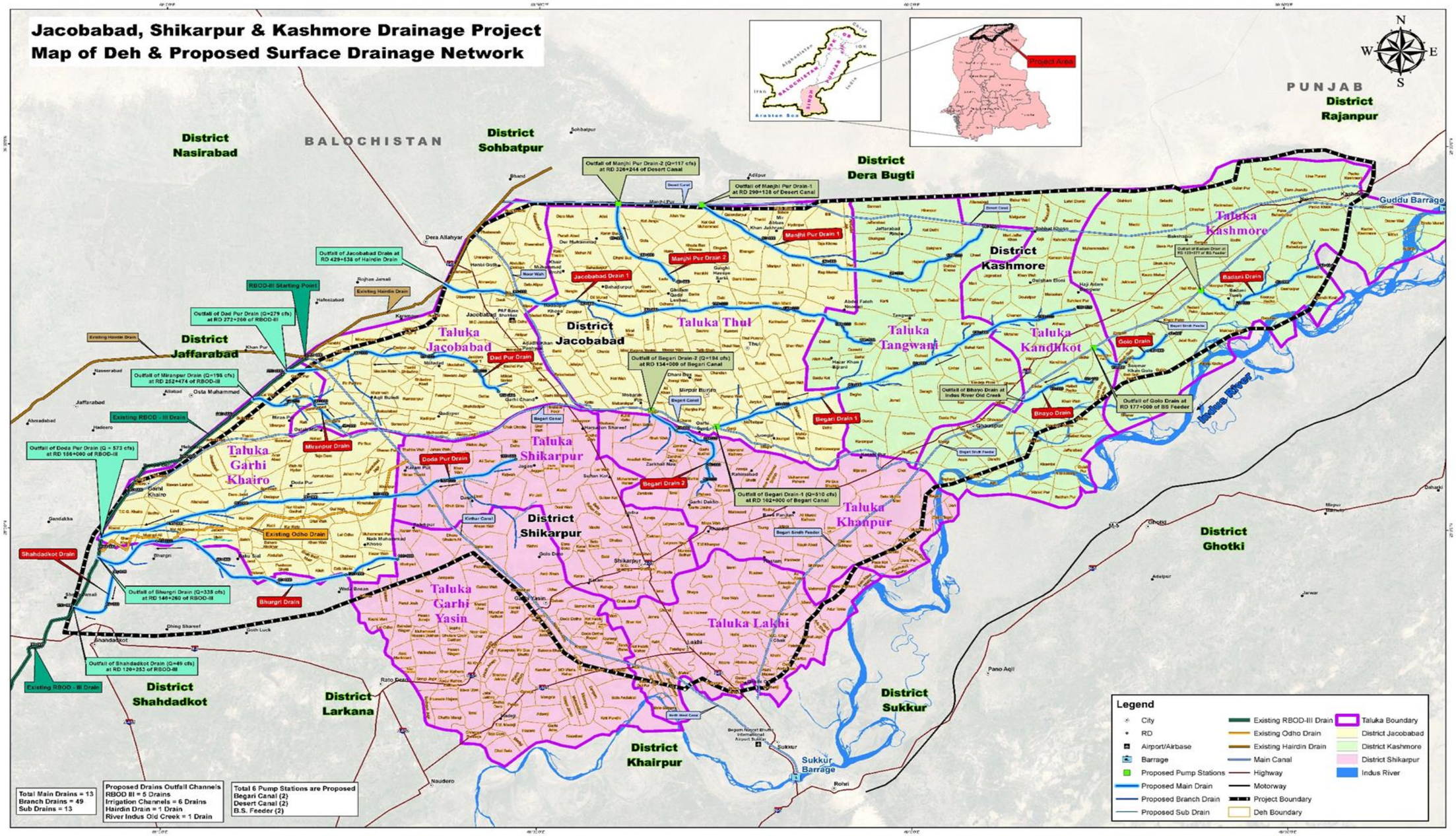


Figure 3.2: Proposed Surface Drainage along with Disposal Location of JSK Drainage Project on Deh Map

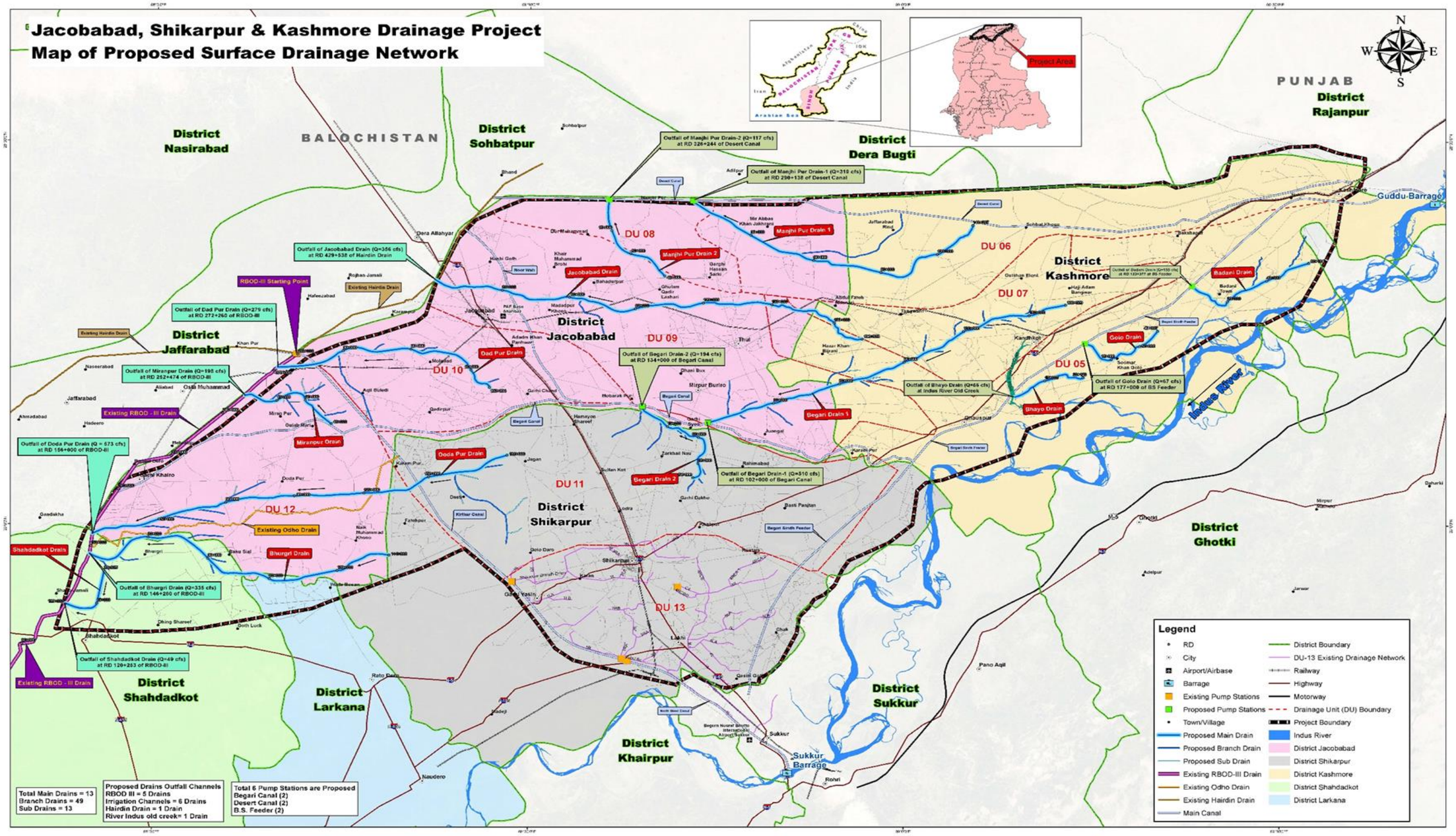
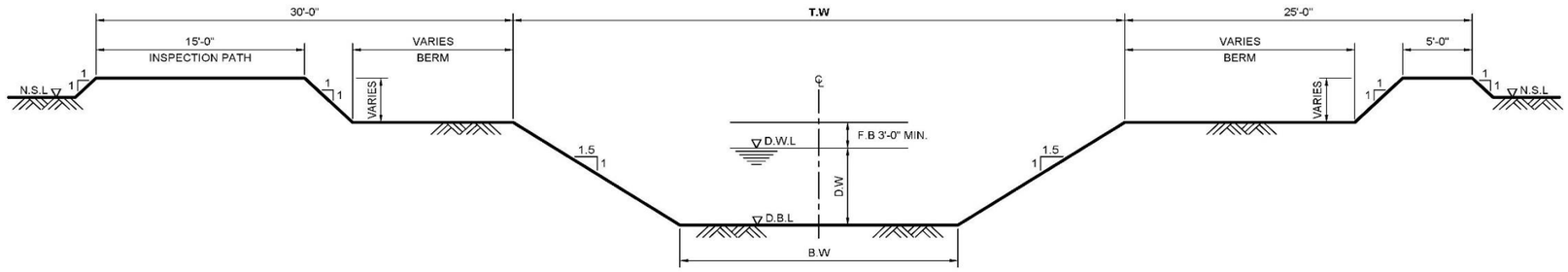
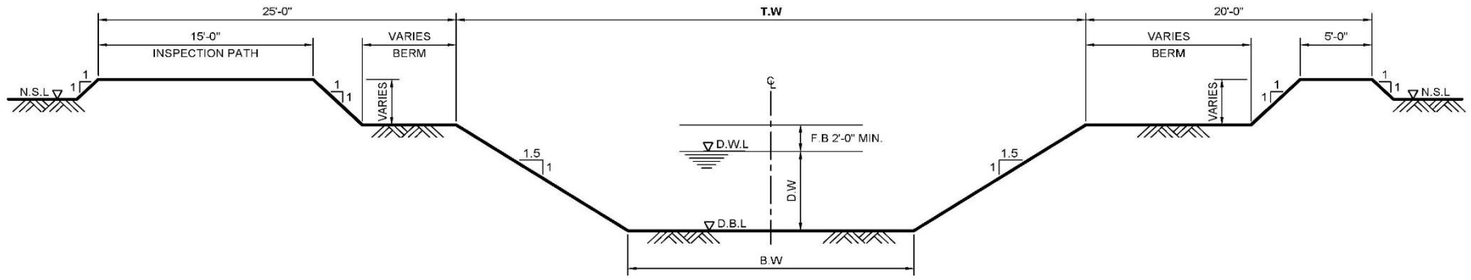


Figure 3.3: Proposed Surface Drainage along with Disposal Location of JSK Drainage Project



TYPICAL X-SECTION OF MAIN DRAIN

Scale 1"=10'



TYPICAL X-SECTION OF BRANCH DRAIN

Scale 1"=10'

TYPICAL X-SECTION OF SUB DRAIN

Scale 1"=10'

ABBREVIATION:

D.W.L	DESIGN WATER LEVEL
D.B.L	DESIGN BED LEVEL
D.W	DEPTH OF WATER
F.B	FREE BOARD
T.W	TOP WIDTH
B.W	BED WIDTH

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Consultants:
MM Pakistan (Pvt.) Ltd. (Lead)
BARQAAB Consulting Services (Pvt.) Ltd (Jv)

Client:
WAPDA

Project:
Preparation of Feasibility Study, Detailed Engineering Design, Tender Documents and PC-1 of Jacobabad, Shikarpur and Kashmore Drainage Project, Sindh, Pakistan

Rev	Date	Drawn	Description	Ch'k'd	App'd
0	09-02-2024	M.A	FOR MID TERM REPORT	G.M	I.A.K

Title:
TYPICAL CROSS SECTION OF PROPOSED DRAINS

Designed	Gul Muhammad
Drawn	M. Aslam
Checked	Gul Muhammad
Approved	Imtiaz Ali Khoso
Scale at A3	AS SHOWN

Drawing No. 1097-MMP-XX-DR-G2-D-0001

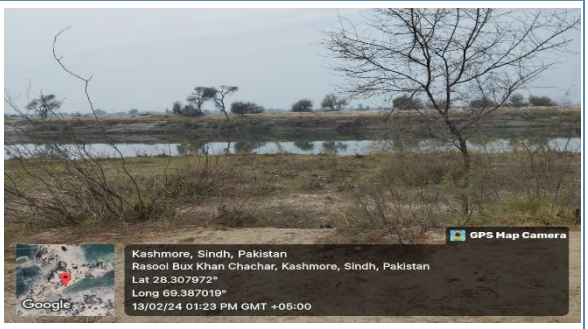
Rev	Status
0	TEN

Figure 3.4: Typical Cross Section of Proposed Main Branch and Sub Drains

3.5.6 Location of Effluent Outfall for Proposed Drains

Drainage effluent outfall area for proposed drains have been physically visited from environmental and social point of view avoiding physical, biological and social loss. Following table shows details of effluent outfall areas.

Table 3.3: Details of Effluent Outfall Areas

Proposed Drains	Length of the Proposed Drains	Effluent Discharge (cfs)	Outfall into	Outfall Area Picture
Badani Drain	18.41	155.00	B.S. Feeder (Fresh Water) (RD-123+377)	
Begari Drain-1	50.76	510.29	Begari Canal (Fresh Water) (RD-102+046)	
Begari Drain-2	16.46	193.77	Begari Canal (Fresh Water) (RD-134+000)	
Bhayo Drain	10.10	54.79	River Creek (Fresh Water)	
Bhurgri Drain	44.10	234.46	RBOD-III Drain (Fresh + Saline Water) (RD-146+260)	

Proposed Drains	Length of the Proposed Drains	Effluent Discharge (cfs)	Outfall into	Outfall Area Picture
Dad Pur Drain	31.33	281.90	RBOD-III Drain (Fresh + Saline Water) (RD-272+260)	
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Manjhi Pur Drain-1	43.06	319.53	Desert Canal (Fresh Water) (RD-290+138)	
Manjhi Pur Drain-2	14.75	117.52	Desert Canal (Fresh Water) (RD-326+244)	

Proposed Drains	Length of the Proposed Drains	Effluent Discharge (cfs)	Outfall into	Outfall Area Picture
Miran Pur Drain	13.94	198.53	RBOD-III Drain (Fresh + Saline Water) (RD-252+474)	
Shahdad Kot Drain	9.33	49.23	RBOD-III Drain (Fresh + Saline Water) (RD-120+253)	

3.6 Design Criteria for JSK Drainage Project

3.6.1 Drainage Discharge

In the context of the Jacobabad Project Area, a detailed water balance analysis was conducted by combine effort of MMP's Hydrology, Groundwater and Agriculture consultants to assess the drainable surplus, accounting for both present and future conditions. This analysis considered various factors including rainfall, irrigation, evaporation, and crop water consumption.

During August 2022, an unprecedented rainfall event occurred, which was instrumental in determining the quantum of rainfall runoff for the assessment of drainable surplus. This event yielded a runoff rate of 0.75 cusecs/sq.mile. Given the significant monsoonal nature of August, it was considered appropriate to take 50% of this value (0.38 $ft^3/sec/mi^2$) as a representative figure for rainfall runoff.

Table 3.4 reveals that highest groundwater drainable surplus of 2.60 $ft^3/sec/mi^2$ was observed in the month of August under the projected future cropping pattern. Factoring in the rainfall runoff, the maximum total drainable surplus for design purposes was calculated as 2.25 $ft^3/sec/mi^2$ (1.87 $ft^3/sec/mi^2$ from groundwater and 0.38 $ft^3/sec/mi^2$ from rainfall runoff). Based on this, surface drains were designed to accommodate this surplus.

Table 3.4: Drainable Surplus of JSK Drainage Project

	Inflow			Outflow				Drainage Surplus
	1	2	3	4	5	7	8	
	Rainfall Runoff	Canal Supplies	Total Inflow (RO+Canal)	Crop Consumptive Use	Evaporation from Pond	Total Outflow	Inflow-Outflow	cfs per sq mile
	Acre ft	Acre ft	Acre ft	Acre ft	Acre ft	Acre ft	Acre ft	
Jan	13579	263412	276991	113180	34304	147484	129507	0.80
Feb	27158	125411	152569	158859	49897	208756	-56187	-0.35
Mar	31684	109873	141557	191802	62371	254173	-112616	-0.70
Apr	13579	0	13579	95077	77964	173041	-159462	-0.99

	Inflow			Outflow				Drainage Surplus
	1	2	3	4	5	7	8	
	Rainfall Runoff	Canal Supplies	Total Inflow (RO+Canal)	Crop Consumptive Use	Evaporation from Pond	Total Outflow	Inflow-Outflow	cfs per sq mile
	Acre ft	Acre ft	Acre ft	Acre ft	Acre ft	Acre ft	Acre ft	
May	18105	124591	142697	9413	101873	111285	31411	0.19
Jun	22632	584165	606796	190539	113307	303847	302950	1.87
Jul	81474	1264736	1346210	1042051	100833	1142884	203326	1.26
Aug	117685	1042435	1160121	661325	77964	739289	420832	2.60
Sep	67895	862846	930742	549040	77964	627004	303738	1.88
Oct	9053	355080	364133	293163	62371	355534	8599	0.05
Nov	4526	213586	218113	33237	46778	80015	138098	0.85
Dec	13579	186888	200467	79532	31185	110718	89749	0.56
Total	**420951**	**5133024**	**5553975**	**3417220**	**836810**	**4254030**	**1299945**	

For the Jacobabad, Shikarpur, and Kashmore Surface Drainage Project, the design discharge for all proposed drains has been calculated using a drainable surplus of 2.25 $ft^3/sec/mi^2$ keeping in view all review data as well as proposed by MMP consultants. This drainable surplus is composed of two main components:

3.6.1.1 Storm Water Surplus

A value of 0.75 $ft^3/sec/mi^2$ is allocated for the storm water surplus. This component represents the excess water that results from storm events and needs to be efficiently drained to prevent flooding and waterlogging in the project area.

3.6.1.2 Irrigation Drainable Surplus

The remaining 1.5 $ft^3/sec/mi^2$ is attributed to the irrigation drainable surplus. This portion represents the water surplus resulting from irrigation activities, which needs to be properly managed to ensure optimal crop growth and minimize water wastage.

By considering both the storm water surplus and irrigation drainable surplus, the project aims to establish an effective surface drainage system that can handle varying water inflows, prevent waterlogging, and promote sustainable agricultural practices.

It is pertinent to note that the estimation of the drainable surplus is crucial for determining the appropriate design discharge for the proposed drains. By accounting for both the storm water and irrigation components, the project can ensure that the drainage system can effectively handle water during different periods, including heavy rainfall events and irrigation activities.

3.6.1.3 Bed Depth

Bed depth of Main drain were used between 2.5 to 5ft, branch and sub-drain drain ranged from 2.5 to 18 ft to achieve the minimum required velocity.

3.6.1.4 Bed Slopes

To achieve the minimum desirable velocity of 1.0 ft/sec, a minimum bed slope is used which can be relaxed for branches and sub-drains so that minimum velocity is maintained. The hydraulic calculation shows that bed slope validate with the velocity results.

3.6.1.5 Manning's Roughness Coefficient

In the Begari surface drainage project feasibility study, it was noted that the initial Manning roughness coefficient value of 0.025 used for the channel surface was not based on actual observations. To rectify this, a revision was made, and the Manning roughness coefficient was adjusted to a more appropriate value of 0.030 for drains.

The Manning roughness coefficient is a critical parameter in hydraulic design calculations as it represents the resistance to flow within the channel. It takes into account factors such as the roughness of the channel surface, vegetation, and other obstacles that affect water flow. A more accurate and reliable value for the Manning coefficient is essential for precise hydraulic design and proper functioning of the drainage system.

3.7 Hydraulic Drainage Design

In the hydraulic design calculations of the Jacobabad, Shikarpur, and Kashmore Surface Drainage Project, key parameters have been carefully selected to ensure optimal drainage performance. These parameters include:

3.7.1.1 Drainage Coefficient (C)

A drainage coefficient of 2.25 $ft^3/sec/mi^2$ has been chosen. This coefficient quantifies the rate at which water is removed from a given area. This particular coefficient value accounts for the local drainage characteristics and helps in estimating the flow rate.

3.7.1.2 Roughness Coefficient (Manning's n):

A roughness coefficient of 0.030 has been utilized. The updated value of 0.030 for the Manning roughness coefficient falls within the range of 0.030 to 0.035, which is commonly used in hydraulic design calculations for drains. This range is suitable for channels and drains, considering the typical surface conditions and vegetation encountered in drainage systems. This coefficient, also known as Manning's n, characterizes the roughness of the channel's interior. It influences the friction and resistance to flow within the channel, impacting the overall flow velocity and discharge.

3.7.1.3 Free Board

A free board of 2 feet has been incorporated for the main, branch, and sub-drains. The free board is the vertical distance between the water level and the top edge of the channel. This allowance provides a safety margin to prevent overflowing of the channel during high-flow events and helps mitigate potential flooding risks.

3.7.1.4 Z Values

A value of 2 for main drains and 1.5 for branch/sub-drains has been assigned to the Z parameter. This value represents the vertical distance between the hydraulic grade line and the channel's bottom. It is crucial for ensuring adequate flow capacity and avoiding backflow.

Incorporating these carefully chosen parameters into the hydraulic design calculations contributes to a well-engineered drainage system that efficiently manages water flow while considering factors such as local terrain, flow rates, and safety margins.

By judiciously selecting a drainage coefficient, roughness coefficient, free board, and appropriate Z values, the Jacobabad, Shikarpur, and Kashmore Surface Drainage Project is poised to effectively mitigate flooding risks and ensure optimal drainage performance in the target areas.

3.8 Hydraulic Structures Identified on the Route of Proposed Drains

With due diligence, the drain alignment has been refined incorporating Client's comments and site observations. The exercise for determining the number of structures through GIS and field surveys. In this regards, hydraulic engineer paid field visits. Following figure shows the locations with pictures during field investigations of the project area.

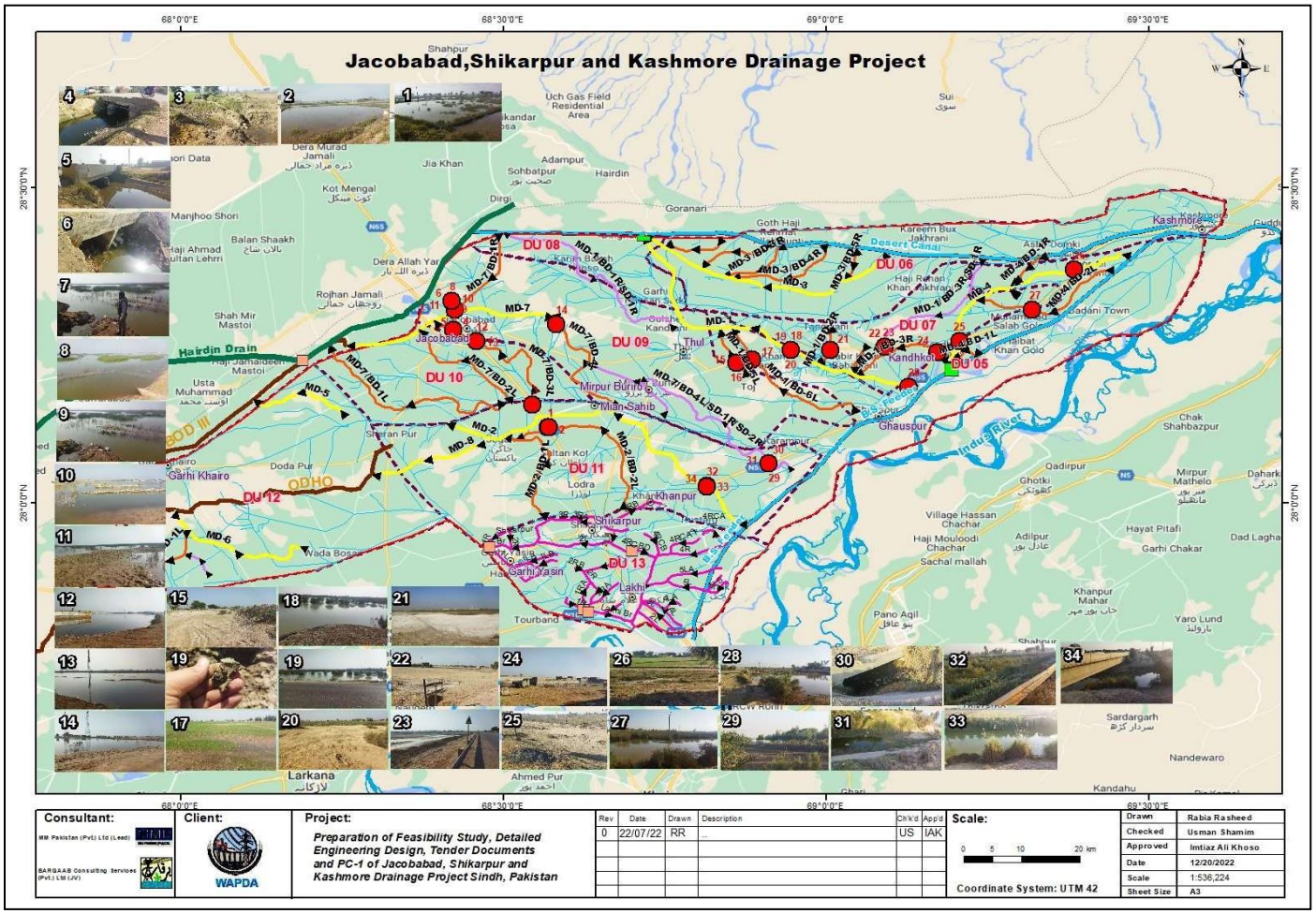


Figure 3.5: Field Survey Map with Locations and Pictures

The number of structures expected on proposed drains is shown in table below.

Table 3.5: Identified Structures on the Proposed Drains

Sr. No.	Structure Type	Tentative Quantity
1	Bridges	57
2	Road Culverts	178
3	Rail Crossing	03
4	Water Course Crossing	240
5	Drain Junction / Outfall	72
6	Water Course Aqueduct	104
7	Drain Inlet	1134
8	Pumping Stations	06

3.8.1 Hydraulic Design Guidelines

Locations, types, dimensions and levels of structures encountered in the drainage network have been selected following a set design criterion, which ensures safe conveyance, dependable stability, ease in construction, operation and reliability.

3.9 Design of New Structures

There are eleven main drains along with branch and sub-drains on which about 550 various types of structures are located. The purpose of drains is to minimize the water logging and increase the production. The structures have been designed against all types of the loadings that these will face during their life according to the national and international codes, standards and good engineering practices. This design criteria shall be used in the design of all structures. The supplemental design criteria applicable to specific structures will be established for any particular requirements/conditions.

3.9.1 Codes and Standards

Following codes of practice have been used to design the structures.

- AAASHTO LRFD Bridge Design Specifications, (2017)
- ASTDN Ep UTHQo QUJMH Lr Er GJy Hg 89 uy 71 Myu Hation sand testing materials
- UBC-97: Uniform building code 1997
- ACI 318-19 - Building Code Requirement for Structural Concrete and Commentary on Building Code Requirements for structural Concrete
- BCP – Building Code of Pakistan
- WPCOP – West Pakistan Code of Practice, Highway Bridges
- EM 1110-2-2104, Strength Design for Reinforced Concrete hydraulic structures.

3.9.2 Types of Structures

3.9.2.1 Culvert

There are 178 culverts with varying spans and cells. Number of cells vary from single to six with span from 5 to 10 feet. Minimum wall thickness 10 inch and maximum 12 inch. Thickness of top and bottom slabs varies from 12 to 16 inches.

3.9.2.2 Bridges

There are about 57 bridges including village, district and arterial bridges. Smaller spans and rectangular cast in situ concrete beams have been used in bridges. The larger prestressed girders have been avoided as these are heavy and need heavy trucks and cranes for conveying and installation at sites. The spans vary from 25 to 45 feet and the decks range from 18 to 45 feet. The bridges have been designed against all types of loads and codes mentioned above.

3.9.2.3 Water Crossings

The drainage project consists of about 240 crossings. The aqueduct of varying widths, depending on width of irrigation channel, have been used to convey water from one side of the drain to other side. The aqueduct comprises concrete open channels of multi-cells.

The walls of the aqueducts have been considered as invert T-sections to transmit the structure and water load to the abutments and piers. The length of the aqueducts varies from 25 to 40 feet each with one or multi spans.

3.9.2.4 Junctions

The junction structures have been used where a branch drain conveys water to the main drain or a sub-drain meets the branch drain. There are about 72 junction structures. The structures have been designed as pipes and culverts. Single and double cell culverts have been used for larger discharge.

3.9.2.5 Pumping Stations at Outfall Stations

There are six (6) pumping stations have been proposed that will dispose of drain water into the irrigation canal or in another existing drain system.

3.10 Construction Aspects

3.10.1 Construction Schedule

The proposed schedule of the proposed drains will take around five (05) years it is anticipated that construction will start on urgent basis.

3.10.2 Construction Camps

During construction of the Project about 14 acres of land will be acquired on temporary basis for the construction of field camps, labour camps, vehicle yards etc. Following Table describes the detailed about the proposed construction camps and Figure 3.6 shown the location of the construction camps.

Table 3.6: Detail of Proposed Construction Camps

Sr.	Drain	District	Location / Village	Road Location	Longitude	Latitude
1	Begari Drain 1	Kashmore	Near Manjhi Pull	Thul - Kandhkot Road	69.073756	28.246392
2	Begari Drain 1	Kashmore	Village Miran Khan Bajrani	Miran Khan Bajrani - Kandhkot Road	68.935005	28.187647
3	Begari Drain 2	Jacobabad	Village Garhi Syed	Mirpur Buriro - Shikarpur Road	68.720511	28.133728
4	Manjhipur Drain 1	Jacobabad	Village Piyaro Khan Khoso	Piyaro Khan - Manjhi Pur Village	68.753784	28.400982
5	Manjhipur Drain 2	Jacobabad	Village Karim Baksh Khoso	Karim Baksh Khoso - Dilmurad Road	68.613932	28.37771
6	Jacobabad Drain	Jacobabad	Huzoor Baksh Brohi Goth	Huzoor Baksh Brohi Goth - Jacobabad Road	68.524993	28.336511
7	Dad Pur Drain	Jacobabad	Moladad Village	Jacobabad - Garhi Khairo Road	68.374848	28.220374
8	Dad Pur Drain	Jacobabad	Village Shah Muhammad Brohi	Village Shah Muhammad Brohi - Jacobabad Road	68.224391	28.214197
9	Miranpur Drain	Jacobabad	Village Gul Hassan Brohi	Village Gul Hassan Brohi - Khanpur Road	68.155076	28.172177
10	Miranpur Drain	Jacobabad	Village Mazhar Khan Golo	Village Mazhar Khan Golo - Jacobabad Road	68.235946	28.150998
11	Dodapur Drain & Bhurgri Drain	Shikarpur	Village Ghulam Shah	Jacobabad - Rato Dero Road	68.316546	28.009471
12	Bhurgri Drain	Shahdadkot	Village Pir Gul Shah	Larkana - Garhi Khairo Road	68.072348	27.931825
13	Bhurgri Drain & Shahdadkot Drain	Shahdadkot	Village Umeed Ali Junejo	Shahdadkot - Garhi Khairo Road	67.95617	27.977979

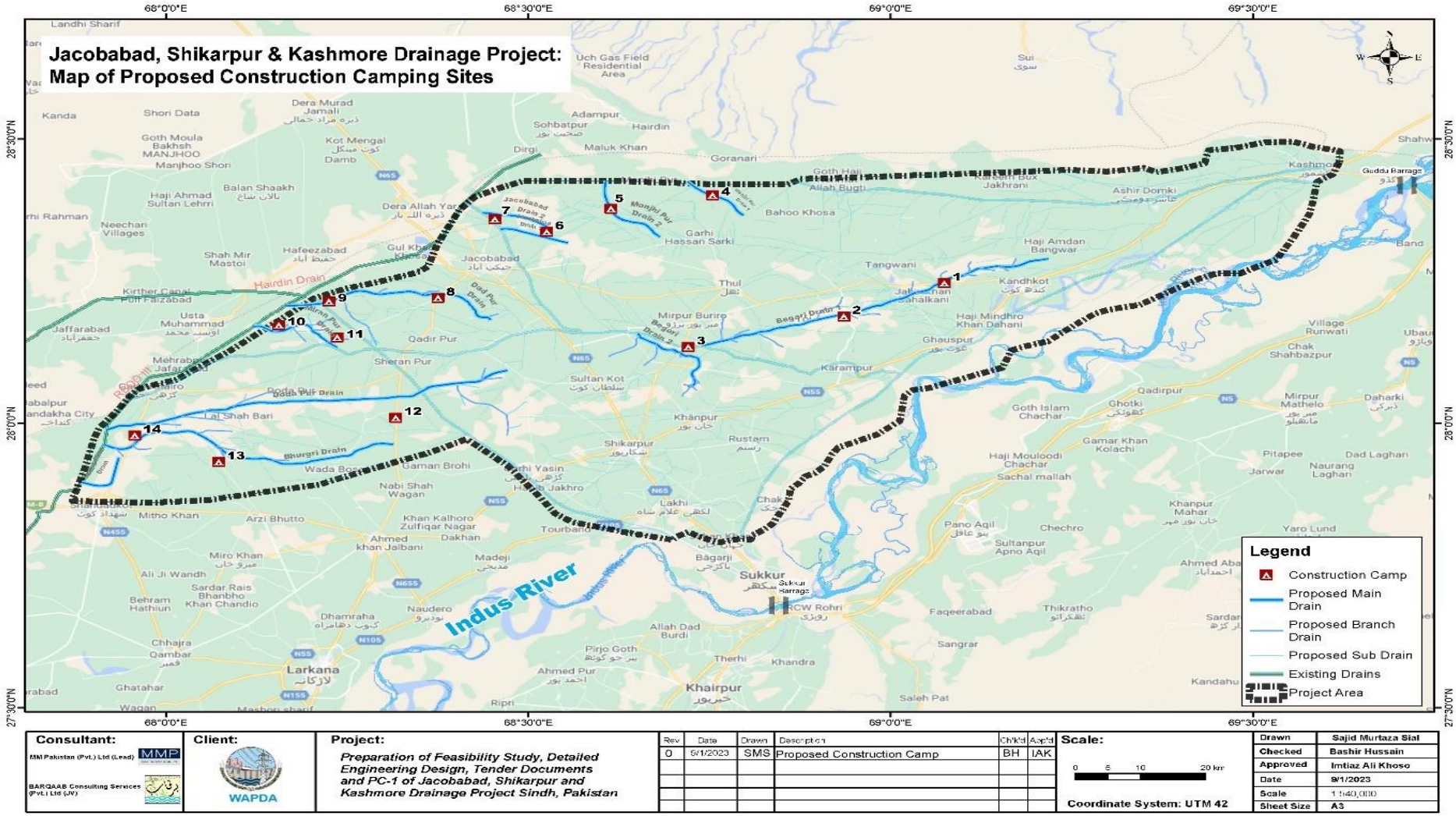


Figure 3.6: Proposed Construction Camp Sites

3.10.3 Workforce

The estimated workforce required for construction activities is shown in table below.

Table 3.7: Estimated Workforce Requirement for the Project

Sr. No.	Staff	No. of Staff Required
1	Site Engineer	26
2	Site Supervisor	32
3	Foreman	40
4	Assistant Foreman	40
5	Surveyors	6
6	Skilled Labour	150
7	Semi-Skilled Labour	250
8	Unskilled / Helpers	40
9	Drivers	20
Total		**604**

The total number of crew, skilled and unskilled labour to be employed will depend on the Contractor's activity schedule at the time when the contract is awarded. The contractor will be advised to hire maximum workforce from the local communities. Unskilled labour must be locals.

CHAPTER 4

ALTERNATIVES ANALYSIS

4 ALTERNATIVES ANALYSIS

4.1 Overview

The main purpose of Alternatives is to compare feasible alternatives to the proposed project components including without project situation. The potential environmental impacts of such alternatives and feasibility of mitigation of these impacts along with their suitability under local project conditions.

The potential environmental impacts of such alternatives and feasibility of mitigation of these impacts along with their suitability under local project conditions

The consideration of alternatives is a proactive method of environmental and social assessment as it enhances the project design by examining options and ruling out options, which are deemed to be environmentally or socially damaging, instead of only focusing on mitigations to reducing adverse impacts of a single design. This calls for a systematic comparison of feasible alternatives for the proposed project site, technology and operational alternatives. Different project alternatives were considered during the feasibility stage of this project.

4.2 No Project Option

Project area consist of two irrigation system i.e. Desert and Begari Canal System. Both canals are non-perennial canals. It has been noted that development of irrigation, road, railway system and flood protection bunds in 1960s has disturb the drainage patterns and the removal of excess storm water from the agricultural and residential areas become impossible. It is also noted that the majority of rainfall occurs in the month of July and August, which causes damage to the agriculture fields. Therefore, storm water along with excessive ground water should be cleared from the cropped area within 36 – 48 hours.

The no project alternative is assessed on the assumption that in the absence of the project, most of the project area become waterlogged after heavy rains, and it becomes very difficult to drain out the standing water from these fields. To achieve desired objectives, the Jacobabad drainage project is found to be an environmentally sound, socially acceptable and economically viable and no project option should not be considered.

4.3 Alternatives for Drainage System

4.3.1 Surface Drainage

Surface drainage is very useful in removing excess water from land in a controlled manner and as quickly as possible, to an artificial drainage system or natural water course. This should be done with no damage to environment.

In Jacobabad drainage project area, the depth to water rises during post monsoon and steadiness in canal supplies in comparison to pre monsoon seasons. The groundwater recharge is extremely nominal and does not significantly contribute to drainable surplus. For this Project area, surface drainage is majorly proposed to cater the drainage effluent based on irrigation recharge, rainfall runoff, losses and excessive ground water. It is however also recommended that horizontal / tile drainage and bio drainage must be used for better results and reclamation.

The surface drainage is applied on flat lands where slow infiltration, low permeability and when waterlogging occurs on the soil surface. It will result in lowering of the water-table which will improve crop rooting, input intake and plant health. Lowering of water table will result in decrease in surface

salinity through salts movement to lower layers with dissolving in water. Decrease in soil salinity will allow land that has been abandoned for agriculture to be brought back into crop production. It is envisaged that the surface drainage component will allow a considerable increase in cropping intensity, cropped area, and change in cropping pattern and crop yield. Overall, the surface drainage component will allow an increase in cropping intensity from a current 92% to 124% within-5 years of the land being drained.

Surface drainage systems are generally considered to be the most cost-effective option as compare to Sub-surface and vertical drainage. The materials typically used for surface drainage, such as soil moving equipment, pipes, culverts, and excavation tools, can be relatively inexpensive compared to other drainage methods. Vertical and sub-surface drainage systems, which involve the installation of tubewells & tile drainage, tend to be more expensive compared to surface drainage.

4.3.2 Sub-Surface Drainage System

Sub-surface drainage is employed when waterlogging occurs within the soil profile, i.e., below the surface. This can be due to a high-water table or impermeable layers with in the soil. This technique involves installing a network of perforated pipes or tiles below the ground surface. these pipes collect excess water and redirect it to an outlet, effectivity lowering the water table.

A disadvantage of sub-surface drainage is that it is often more costly to implement per unit area compared to surface drainage. Moreover, the excessive water evacuation is the main issue in the project area during monsoon time period and subsurface drainage is not effective in removing this excess water.

4.3.3 Vertical (Tubewell) Drainage System

Tubewells are drilled into the ground, and a pump is used to extract water from the saturated layers, effectively lowering the water table. Its particularly useful in areas where the water table is very high and there's a need to lower it significantly.

However, on the basis of ground water analysis, majority area is not in waterlogged condition so, there is no need of further expansion of vertical drainage.

4.3.4 Bio-Drainage

Biologically drainage typically refers to the use of plants or microbial processes to manage excess water in soil. plants with deep roots can help in draining excess water from soil, and certain microorganisms contribute to soil structure, making it more conducive to drainage.

The bio drainage system consists of fast-growing tree species, which absorb water from the capillary fringe located above the ground water table.

While bio-drainage can be an effective solution for managing waterlogged areas, its effectiveness and sustainability can vary depending on various factors. It's always best to consult with local agricultural or environmental experts before implementing a bio-drainage system.

4.4 Alternatives for Drainage Effluent

- RBOD-3
- Begari Canal
- Desert Canal.

4.5 Decision

It was found that proposed surface drainage option which is selected by the drainage engineer of this project is the most appropriate possible option because proposed route for the construction of drains where less houses, government infrastructures fall. No cultural, historical, religious building is there. Minimal disturbance to flora and fauna has been assessed on this route. Migratory birds will fly away from this route.

ENVIRONMENTAL BASELINE CONDITIONS

5 ENVIRONMENTAL BASELINE CONDITIONS

5.1 Baseline Study Methodology

Environmental baseline study of Jacobabad Drainage Project area falls under in three (3) districts, Jacobabad district, Shikarpur district and Kashmore district. This chapter deals with physical, biological and socio-economic resources of the project area.

The methodology to collect basic data involved activities like field surveys, scoping sessions with villagers, and visits to government of Sindh departments located in the boundary of project area for discussions.

5.1.1 Field Surveys for Collecting Primary Data

During the years 2022, 2023 and 2024 field surveys were conducted at intervals to collect primary data of the project area. The details of visits took place are as under:

- First environment related field visit was conducted on 12th September to 16th September 2022.
- Second field visit was conducted on 5th December to 9th December 2022.
- Third site visit was conducted on 13th February to 17th February 2023.
- Fourth field visit was conducted on 13th March to 17th March 2023.
- Fifth field visit was conducted on 27th March to 31st March 2023.
- Sixth field visit was conducted on 16th October to 21st October 2023.
- Seventh field visit was conducted on 29th January to 2nd February 2024.
- Eighth field visit was conducted on 9th February to 18th February 2024.

The survey team was consisted of; environment expert, drain expert, agriculture expert, juniors; environmentalist, sociologist, junior resettlement specialist and gender representative.

5.1.2 Collection of Secondary Data

Secondary data in the form of published information was collected and analyzed to be included in the report on ESIA. This data related to; national census report on population, topographic sheets issued by survey of Pakistan, GIS, Livestock, Agriculture, material received from Agriculture Department Larkana (Divisional Head Quarter).

5.1.3 Government Departments / Non-Governmental Organizations Visits

Field team visited government departments such as Forest Department, Wildlife Department, Irrigation Department, Revenue Department as well as Non-Governmental Organizations like as Al-Shifa Trust, Community Development Foundation, International Rescue Committee and Islamic Relief Pakistan.

5.2 Description of Physical Environment

5.2.1 Topography

The Indus plain, the course of which goes through Sindh province, is flat, with low gradient. The valley of the Indus and its banks have risen higher than the surrounding land as a result of the aggregational work of the river, the alluvial sands and clays of the soil tend to give way before floods, leading the river to change course frequently. The level surface of the plain is disturbed at Sukkur and Hyderabad, where

there are random outcroppings of limestone. The Indus delta has its apex near Thatta, below which distributaries of the river spread out to form the deltaic plain.

Project area of Jacobabad, Kashmore and Shikarpur contains two types of deposits, i.e. alluvium and piedmonts deposits. The Indus basin soils are mostly thick alluvium deposited by rivers and are of recent origin. Soils near river courses are the most recent and vary in texture from sand to silt loam and silty clay loams. They have a low organic content and are collectively known as the khaddar soils. Away from the river, toward the middle of the doabs, older alluvial soils (called bangar) are widely distributed. These soils are medium to fine in texture, have low organic content, and are highly productive under conditions of irrigation and fertilization. In some waterlogged areas, however, these soils are salinized. Strongly alkaline soils are localized in some small patches. In the submontane areas under subhumid conditions these soils are non-calcareous and have slightly higher organic content. In the delta the estuarine soils are excessively saline and barren.

The other deposits lying in the area is Piedmont deposits that, in geology is a landform created at the foot of the mountains by debris deposited by shifting streams. Such an alluvial region in a humid climate is known as a piedmont.

5.2.2 Surface Geology

Surface Geology of the project area has been established by superimposing the External boundary of the area on Geological map of Pakistan at scale 1:534,000 in ArcGIS software. This base Geological map was developed at scale of (1:1000,000) by “Government of Pakistan Ministry of Petroleum and Natural Resources, Geological Survey of Pakistan” in 1993.

The highlight of this surficial depositional sequence shows that these soils belong to the recent age in Geological time scale. The overall preview at glance shows the following depositional zones along and around the project area are designated as:

- **Qcm** (Loess deposits / Flood plain deposits of middle terrace)
- **Qmx** (Streambed and Meander Belt Deposits)
- **Qf** (Flood plain deposits)
- **Qm** (Meander Belt Deposits)
- **Qfx** (Flood plain deposits of low terrace)

Qcm (Loess Deposits / Flood Plain Deposits of Middle Terrace)

Loess, an unstratified, geologically recent deposit of silty or loamy material that is usually buff or yellowish brown in color and is chiefly deposited by the wind. Loess is a sedimentary deposit composed largely of silt-size grains that are loosely cemented by calcium carbonate.

Qmx (Streambed and Meander Belt Deposits)

The deposits which designated as Qmx comprises of Streambed and Meander Belt Deposits.

The Streambed deposits are usually deposited, eroded and deposited again several times. The principal meander belt deposits consist of a sequence of silt and fine sand grading downward to coarse sand and gravel.

Qf (Flood Plain Deposits)

Sediment that is deposited on floodplains and deltas by rivers and streams during seasonal flooding is called alluvial soil. Alluvium is loose, unconsolidated soil or sediment that has been eroded, reshaped by water in some form, and redeposited in a non-marine setting.

Braided stream deposits are found commonly where abundant sediment and high discharges were available during deposition. Braiding often results where incompetent streams form longitudinal bars by depositing coarse elements of bed load which trap finer elements.

The flood plains are flat tract of land bordering a river mainly in the lower reaches by sweeping of the meander belts downstream, thus widening the valley. The sides of which become some miles / kilometers apart. In the time of flood, when the river overflows its banks, sediments are deposited along and in the channel itself. The process elevates the river channel above the level of the flood plain.

Qm (Meander Belt Deposits)

Meander Belt deposits consist of sediments deposited inside the river bank and eroded from outside the river bank. A typical section may be subdivided into four generalized zones, each characterized by a particular class of following sedimentary structures:

- Small ripple (or small scale) crossbedding.
- Horizontal lamination.
- Giant ripple (or medium scale) crossbedding.
- Poor bedding.

The sequence deposited within the channel or the depositional (convex) bank area as the stream meandered laterally toward the erosional or caving (concave) bank. These Qm deposits runs parallel to the river Indus banks.

Qfx (Flood Plain Deposits of Low Terrace)

Tidal flats are areas, where sediments from river runoff, or inflow from tides, deposit mud or sand. If the energy of waves beating on these banks is low, then small-grained sediment or mud is deposited in the upper reaches of the area. In this instance, these areas are called mud flats.

The flood plains are mostly passing through in the series of widespread tributaries / Nullahs which are seasonal in nature. These tributaries mostly cut across the rail and roads alignment though out the project area and water pass through the bridges and culverts.

5.2.3 Soils

The soils of the Project area comprise piedmont plains and Indus alluvials. The piedmont plains has largely level to nearly level topography except some undulating sandy areas. The Indus alluvials consist of level areas, partially covered abandoned meandering channels and marsh lands (dhands). The soils of the piedmont plain are predominantly clayey (silty clay loam to silty clays/clays). Typha species is the dominant vegetation growing in these channels and can be identified on the imagery by their black tone. The soils are of greyish brown colour, massive to weakly structure in the upper subsoil and stratified below. They are moderately to strongly calcareous. Following figure shows the soil texture in the project area.

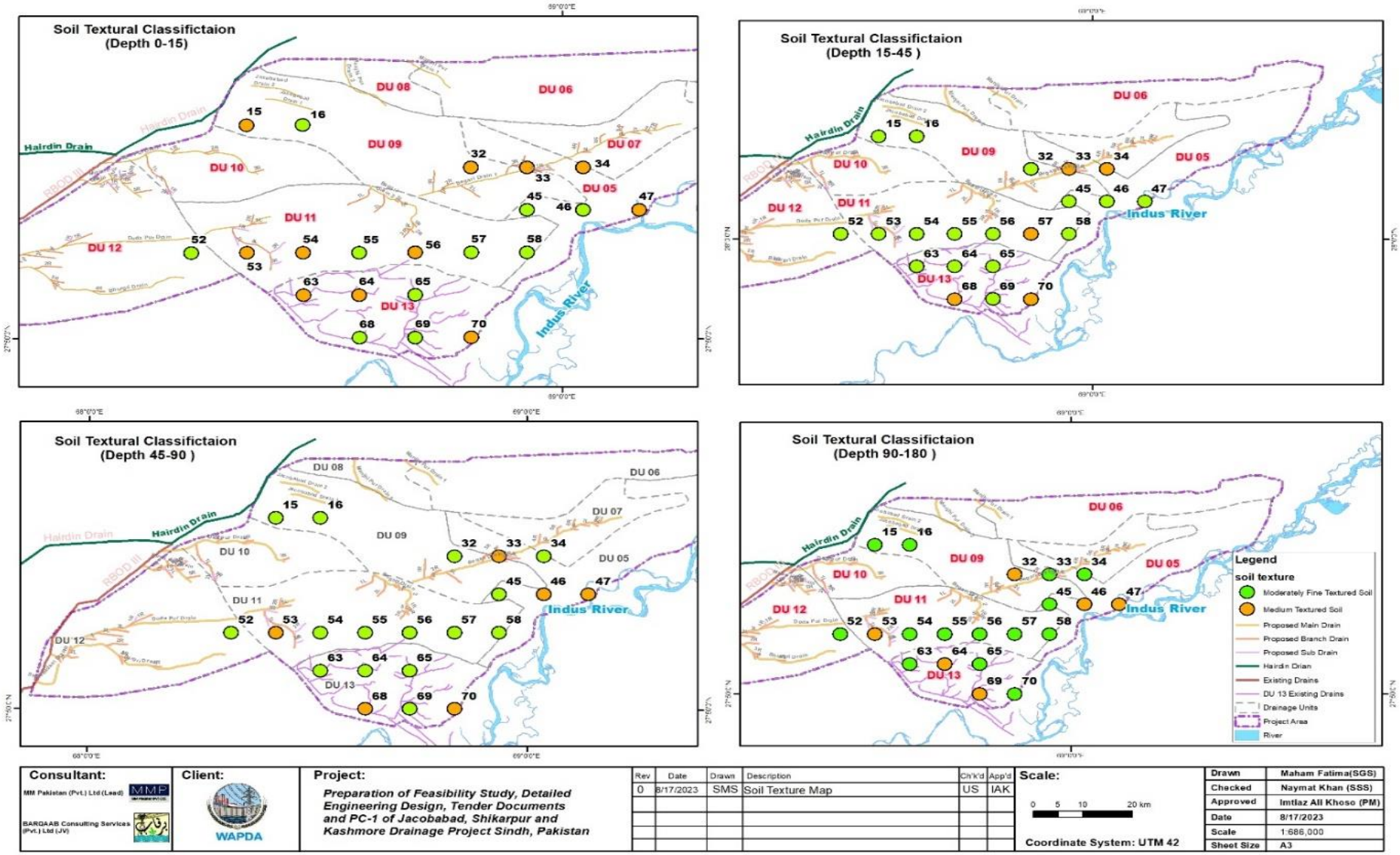


Figure 5.1: Shows Soil Texture Classification of the Project Area

5.2.4 Hydrology

The project area is equipped with two rain gauge stations located at Jacobabad and Rohri, installed by the Pakistan Meteorological Department (PMD). Both Jacobabad and Rohri fall within a geographical zone that encounters monsoonal influences, making them susceptible to varying patterns of rainfall. Collected data of Jacobabad spans over 54 years (1968- 2022) and 51 years (1971-2022) of Rohri respectively. The noteworthy years with the highest recorded rainfall, specifically 2012 for Jacobabad and 1992 for Rohri, serve as benchmarks for understanding the potential spectrum of precipitation that these areas could undergo. Recognizing the historical rainfall trends is of paramount importance for local authorities, agencies focusing on disaster management, and urban planners. Such data aids them in making informed decisions regarding infrastructure development, strategies to mitigate flooding, and the readiness of emergency responses.

Floods of 2022 in the month of August was caused by continuous rainfall for almost 11 days in which 123 mm is the highest. Total recorded rainfall for 11 days is 367.7 mm and total in the month of August is 451.7 mm. In the total month of August Rohri received 420 mm rainfall in which highest rainfall 90 mm.

In conclusion, the historical rainfall data pertaining to Jacobabad and Rohri accentuates the inconsistency and significance of particular years marked by substantial precipitation. This insight not only enlightens relevant stakeholders about the possibility of intense rainfall occurrences, but also underscores the critical necessity of flexible strategies to effectively address the challenges posed by such climatic events. Continual monitoring and analysis of precipitation patterns will be invaluable in devising resilient approaches to manage the repercussions of heavy rainfall in these regions.

5.2.5 Groundwater

Groundwater is the water located beneath the earth's surface in soil pore spaces and in the fractures of rock formations. A unit of rock or an unconsolidated deposit is called an aquifer when it can yield a usable quantity of water. The depth at which soil pore spaces or fractures and voids in rock become completely saturated with water is called the watertable. Groundwater is recharged from, and eventually flows to the surface naturally; natural discharge often occurs at springs and seeps, and can from oases wetlands. Also, groundwater is often withdrawn for agricultural, municipal and industrial use by constructing and operating extraction wells. Sustainable groundwater resources management will require available surface water allocation and aquifer management plans that clearly integrate groundwater and surface water systems. This will require more sensitive and accurate surface water availability, and aquifer water balance, to develop management plans which recognize the long timeframes of aquifer and surface water interaction. For proper groundwater management in the country, it is a pre-requisite to acknowledge the importance of groundwater and its role in the current scenario of overall water cycle in Pakistan. There is an urgent need to make agriculture more efficient. Water productivity in agriculture can be improved by reducing water losses through modernizing irrigation systems, better water management and by increasing crop productivity through the use of higher yielding, nutritious crop varieties. Important components of this strategy can be to:

- Improve our knowledge of groundwater and surface water connectivity, with significantly connected irrigation systems (as the IBIS is often called the biggest contiguous system in the world) to be managed as one integrated resource;
- Complete the return of currently over-allocated or overused irrigation systems to environmentally sustainable levels of recharge and extraction rates; and

- Improve understanding of sustainable extraction rates and regimes, and develop common approaches for achieving sustainability.

In Sindh province, a few canals, e.g. Begari Sindh Feeder, Desert Canal, Rice and Kalri are being supplied with much higher canal water, thus major parts of the command areas remained flooded or waterlogged, just at the onset of Rabi season. The farmers are unable to cultivate in Rabi, especially the wheat crop, resultantly, the cropping intensities are much less than the actual potential.

Non-beneficial evaporation in Sindh, due to waterlogging conditions prevailing over about 50% of the area is a major challenge in enhancing water productivity in the province. This can be taken up by provision of reduced irrigation supplies matching with demand and increased groundwater drainage (for irrigation or otherwise), to provide cushion for storage of irrigation leakages and excess rainfall. Thus, rainfall flooding as observed in 2011 on left of Indus River and unprecedented rainfall flood during August, 2022 in Right Bank of Indus River in Sindh could be avoided. This groundwater buffer can be very efficiently utilized by deep and shallow skimming wells, depending upon the thickness of fresh groundwater.

5.2.5.1 Causes of Waterlogging in the Project Area

In Sindh, the non-perennial canals are suffering the most from this twin menace of waterlogging and salinity. These non-perennial areas receive more than required supplies in the Kharif season, thus, the watertable rises significantly, which also acts as secondary menace for sowing of Rabi crops, particularly the wheat. At the onset of the Rabi season, fields are with standing water or more than the optimum moisture contents for seed germination, also salinity rises towards the surface due to bare land evaporation. Thus, many of the lands offer only one cropping. Begari Sindh Feeder and Desert Canal are the prominent examples of such a phenomenon, where the watertable fluctuates between 0-1 and 1-2 meters during Kharif and Rabi respectively. This annual cycle of rise and fall of watertable brings the salts to the upper soil strata.

Practical demonstration to the farmers regarding possibility of growing paddy with less water and thereby provide optimum moisture content for Rabi crops, especially the wheat crop is the need of the hour. This will help in changing the mind-set of the farmer regarding misconception of rice crop over irrigation.

Before moving towards farm level groundwater management, equity of surface water availability should be ensured, especially at farm gate. In watercourse commands, allocate less time at head and more towards tail reach, thus, creating a sense of equal delivery of irrigation water at farm gate;

As the project area comprises on nine drainage units i.e. (Drainage Unit-5 to 13), amongst these drainage units 5 & 6 drainage units has useable groundwater for agriculture.

5.2.5.2 Groundwater Depth during May & November-2023 (Pre & Post Monsoon)

The data of depth to watertable is combined which was collected during May & November-2023 (Pre & Post Monsoon- 2023). It is observed from the data collected during pre & post monsoon-2023, that watertable depth is ranging from 10 to 15 ft. The results of data shows that there is no water logging in the Project Area due to non-perineal irrigation system in the Jacobabad, Shikarpur & Kashmore Drainage Project. The Irrigation System supplying water in the Project Area during June to October, groundwater starts rising and it comes at surface level. In this season farmers are cultivating their rice crop and rice crop needs excessive irrigation water. Due to this excessive irrigation water the 75% Project Area is flooded/waterlogged.

After harvesting of rice crop farmers are cultivating wheat crop without irrigation. Wheat crop is using only existing soil moisture present in the field, in this way water table automatically begins to deplete due to stoppage irrigations supplies in the Project Area. Therefore, water table automatically depletes up to the depth of 10 to 15 ft. during pre & post monsoon. The surface drains are very useful for evacuating standing water & groundwater during waterlogging period i.e. July to October, when 75% Project Area is flooded/waterlogged.

5.2.5.3 Groundwater Results of Total Dissolved Solids (TDS) in Groundwater during May-November-2023

The combine groundwater samples results received from SMO-II, Hyderabad for total 198 locations after Laboratory analysis during May-November-2023 from the Project Area. These samples were collected in two phases for 236 locations. The results of 198 samples for Total Dissolved Solids (TDS) are ranging from 1300 to 3000 ppm. Some samples are ranging from 3000 to 5000 ppm, few samples are in the range of 5000 to 20000 ppm. The fresh water/normal water ranging from 0 to1000 ppm value of groundwater.

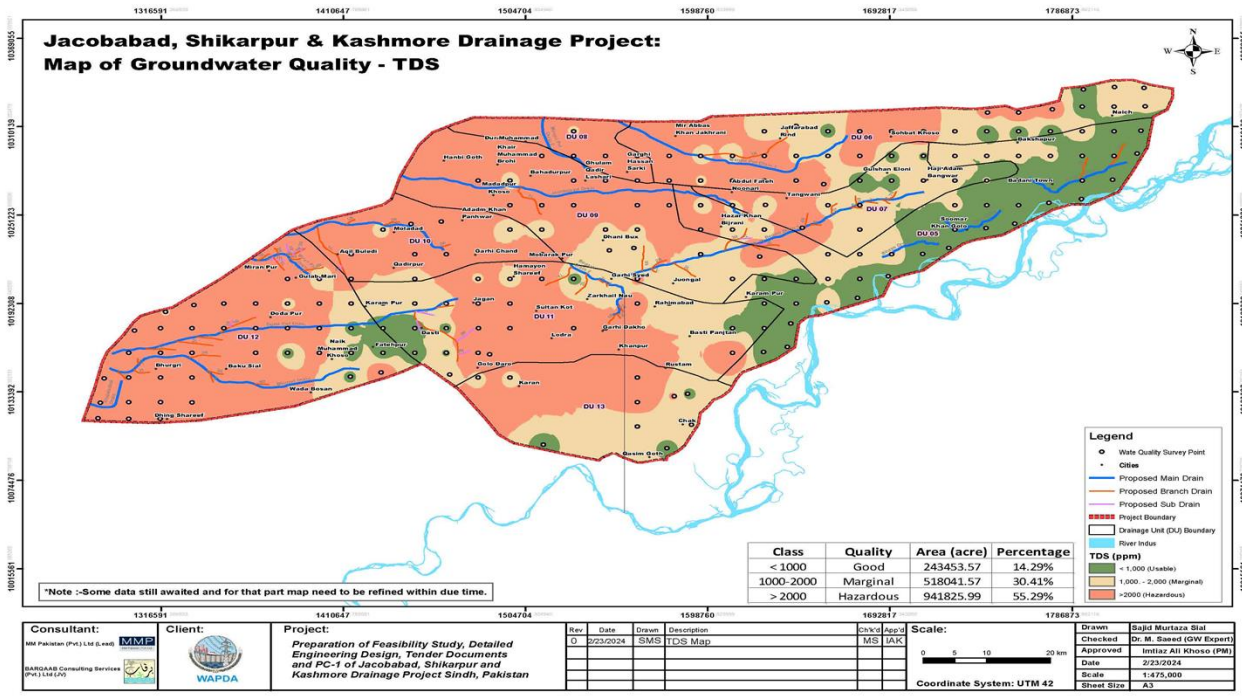


Figure 5.2: Map of Groundwater Quality (TDS), of JSK Drainage Project, during May-November 2023

5.2.5.4 Sodium Adsorption Ratio (SAR) in Groundwater during May-November-2023

The combine groundwater samples results received from SMO-II, Hyderabad for total 198 locations after Laboratory analysis during May-November-2023 from the Project Area. These samples were collected in two phases for 236 locations. The results of 198 samples for Sodium Adsorption Ratio (SAR) are ranging from 5 to 10. Some samples are ranging from 10 to 20, few samples are in the range of 20 to 25. The fresh water/normal water ranging from 0 to 10 value of groundwater.

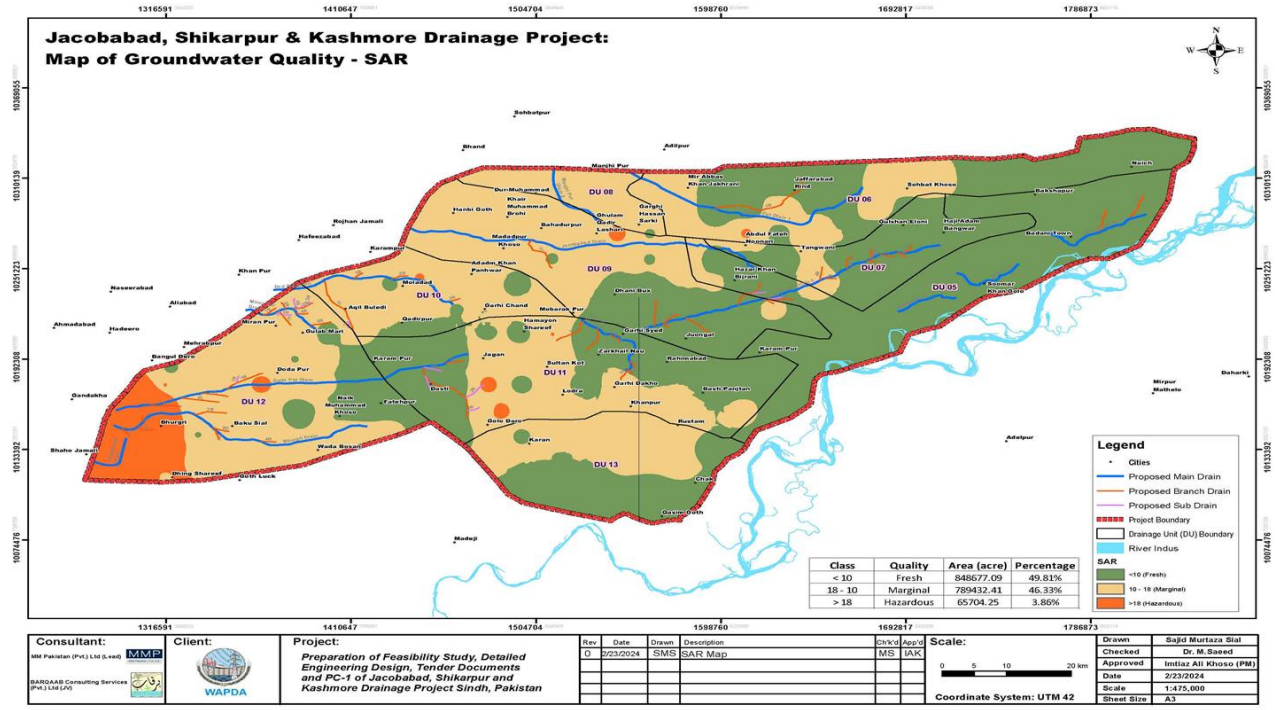


Figure 5.3: Map of Groundwater Quality (SAR), of JSK Drainage Project, during May-November 2023

5.2.5.5 pH of Shallow Ground Water during May-November-2023

The groundwater samples of 198 numbers were analyzed for pH during May-November-2023 in two phases. The trend of pH values are ranging in the normal range i.e. 7. As the normal value of pH is also 7. The maximum groundwater samples results are falling in the normal range.

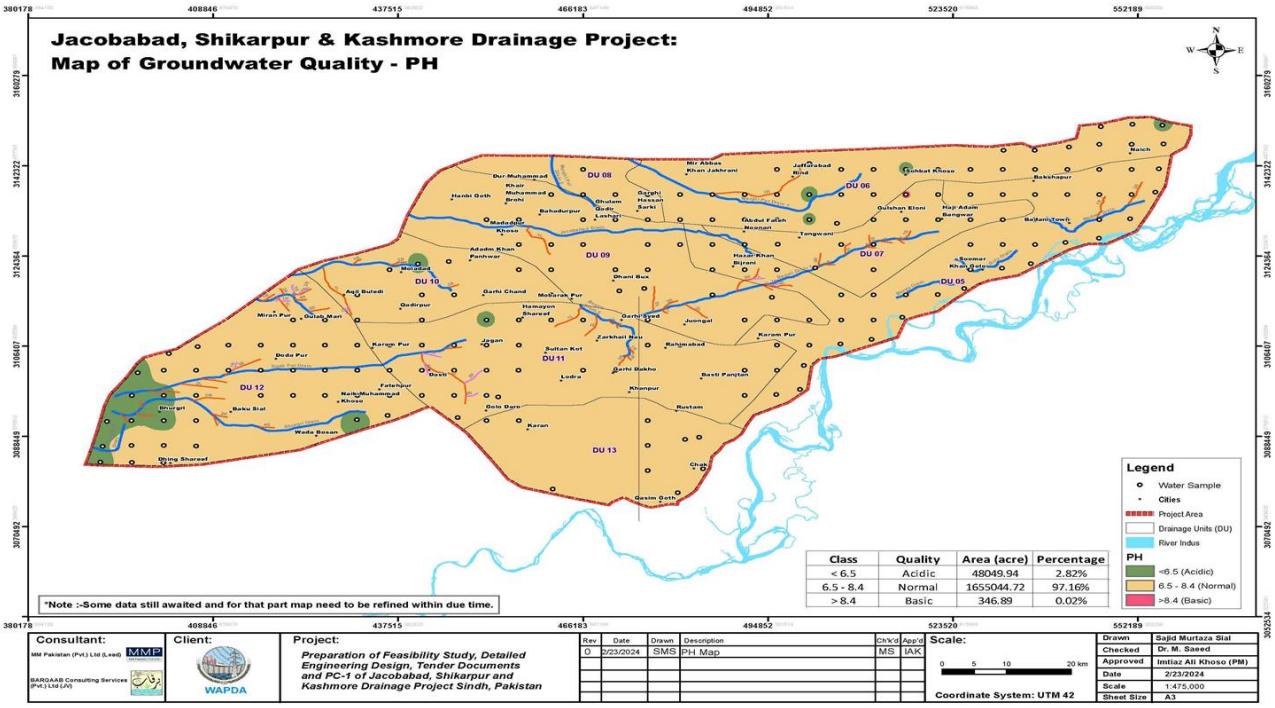


Figure 5.4: Map of Groundwater Quality (pH), of JSK Drainage Project, during May-November 2023

5.2.5.6 Groundwater Model for Calculating the Drainable Surplus

The groundwater model is used for calculating the drainable surplus for designing the proposed surface drainage system. To calculate the drainable surplus, excel worksheet model is used. In this model, data of canal supplies, rainfall runoff, evaporation from pond & land. The details of the drainable surplus are given in the following section.

5.2.5.7 Drainable Surplus for the Project Area

The drainable surplus was calculated by considering conveyance losses of flows through irrigation system like Begari Sindh Feeder irrigation network and Desert Canal irrigation network which irrigating to the project area. The rainfall considering unprecedented rainfall during August-2022. The rainfall runoff is calculated as 0.75 cusecs sq. mile and on safer side this factor is taken as 1 cusec/sq.mile. The groundwater drainable surplus is taken as 1.25 cusecs per square mile. This way total drainable surplus is as (1+1.25 = 2.25 cusecs/sq. mile. Therefore, the surface drains are designed for the drainable surplus as 2.25 cusecs/sq. mile.

5.2.5.8 Drinking Water Sample Quality Analysis of the Project Area, (Hand Pumps)

Drinking water quality was analysed in order to determine its suitability for drinking purposes. Sampling locations were carefully selected in order to represent the whole area. The quality of drinking water suffers from many factors, these include excessive amounts of microbes or chemicals derived from human and animal wastes, agricultural runoff, industrial chemicals, and even natural pollutants. Total fifteen (15) drinking water samples were collected from the entire project area. Location and coordinates are:

Sr. No	Location Coordinate	District
1.	Longitude 28° 29’ 21.7”- Latitude 69°30’65.6’’	Kashmore
2.	Longitude 28° 15’ 40.06”- Latitude 68°54’83.05’’	Shikarpur
3.	Longitude 28° 26’ 36.9”- Latitude 68°98’69.3’’	Kasmore
4.	Longitude 28° 38’ 81.9”- Latitude 68°72’86.9’’	Jacobabad
5.	Longitude 28° 03’ 25.4”- Latitude 68°61’47’’	Shikarpur
6.	Longitude 28° 22’ 99.6”- Latitude 68°99’94.2’’	Kashmore
7.	Longitude 28° 24’ 19.7”- Latitude 68°94’60.1’’	Kashmore
8.	Longitude 28° 19’ 24.3”- Latitude 69°13’70.7’’	Kashmore
9.	Longitude 28° 23’ 72.6”- Latitude 68°18’21.4’’	Kashmore
10.	Longitude 28° 27’ 80.3”- Latitude 68°42’42.9’’	Jacobabad
11.	Longitude 28° 28’43.7”- Latitude 68°69’22.1.’’	Jacobabad
12.	Longitude 28° 03’35.2”- Latitude 68°83’00.7’’	Shikarpur
13.	Longitude 28° 32’52.5”- Latitude 68°43’65.9’’	Jacobabad
14.	Longitude 28° 26’39.2”- Latitude 68°94’60.1’’	Kashmore
15.	Longitude 28° 24’39”- Latitude 68°95’04.2’’	Kashmore

Using manual sampling procedure, drinking water samples were taken in sterilized bottles and then transported in an ice box to the respective laboratory in Karachi for analysis. These samples were analysed from Sindh EPA duly approved Lab “Envi-Tech Al” based at Karachi for various water quality parameters such as Color, pH, TDS, Turbidity, Total Hardness as $CaCo_3$, Nitrite, Chloride, Fluoride, Aluminium, Nickel, Lead, Arsenic, Manganese, Zinc, Phenolic Compounds as Phenols, Sodium, Fecal Coliform, Escherichia Coli (E-Coli), etc.

Figure 5.5: Water Sample being Collected from Hand Pump Located at the Project Area

Result shows that water quality parameters fall within the prescribed standard values except four drinking water samples with respect to TDS are above prescribed limits of SEQS/NEQS/WHO. Total Dissolved Solids (TDS) are solids in water that can pass through a filter (usually with a pore size of 0.5 micrometres). TDS is a measure of the amount of material dissolved in water. This material can include carbonate, bicarbonate, chloride, sulphate, phosphate, nitrate, calcium, magnesium, sodium, organic ions, and other ions. TDS is used to estimate the quality of drinking water, because it represents the number of ions in the water. Water with high TDS often has a bad taste and/or high-water hardness, and could result in a laxative effect. However, pH level of the all 15 samples are acceptable limit. Furthermore, Microbiological report of drinking water analysis reflects that cited samples are free from Faecal contamination. Results of the all 32 parameters have been summarized in Table 5.1 and detailed results received from Lab have been annexed as Annexure 4 of this report.

Table 5.1: Test Results of 15 Drinking Water Samples

Sr.#	Parameters / Analyses Description	Unit	SEQS Limits	*WHO	All 15 Test Results with Site Co-ordinates														
					Sample 1	Sample 2	Sample 3	Sample 4	Sample 5	Sample 6	Sample 7	Sample 8	Sample 9	Sample 10	Sample 11	Sample 12	Sample 13	Sample 14	Sample 15
					8°1540.06"E 68°54'83.05"N	28°26'36.9"E 68°98'69.3"N	28°3'25.4"E 68°61'47"N	28°22'99.6"E 68°99'94.2"N	28°24'19.7"E 68°94'60.1"N	28°26'39.2"E 68°94'60.1"N	28°38'81.9"E 68°72'86.9"N	28°19'24.3"E 69°13'70.7"N	28°23'72.6"E 69°18'21.4"N	28°27'80.3"E 68°42'42.9"N	28°28'43.7"E 68°69'22.1"N	28°29'21.7"E 69°30'65.6"N	28°03'35.2"E 68°83'00.7"N	28°32'52.5"E 68°43'65.9"N	28°24'39"E 68°95'04.2"N
01	pH @ 25°C	-	6.5-8.5	6.5-8.5	7.65	7.76	7.85	7.64	7.66	7.59	7.37	7.69	7.30	7.42	7.23	7.58	7.34	7.09	7.55
02	Total Dissolved Solids (TDS)	mg/L	<1000	<1000	694	500	868	862	***1078**	482	***1015**	231	446	493	***1778**	840	471	777	***1055**
03	Total Hardness as CaCo3	mg/L	< 500	-	212	320	500	492	400	200	480	80	208	220	1080	400	188	396	960 -
04	Colour	TCU	≤15	≤15	19	10	14	10	15	14	14	12	07	10	08	10	10	08	16
05	Turbidity	NTU	≤5	≤5	11	<1	05	02	05	04	04	04	01	01	02	03	03	01	8
06	Nitrite	mg/L	≤3	3	0.003	0.002	0.033	0.022	0.031	0.011	0.054	0.041	0.033	0.022	0.088	0.027	0.027	0.089	0.045
07	Nitrate (NO3)	mg/L	≤0.50	50	0.1	0.1	0.3	0.3	0.4	0.2	0.4	0.6	0.2	0.3	1.0	0.3	0.2	1.5	0.3
08	Taste	-	Non-Objectionable	Non-Objectionable	Tasteless	Tasteless	Tasteless	Tasteless	Tasteless	Tasteless	Tasteless	Tasteless	Tasteless	Tasteless	Tasteless	Tasteless	Tasteless	Tasteless	Tasteless
09	Odour	-	Non-Objectionable	Non-Objectionable	Odorless	Odorless	Odorless	Odorless	Odorless	Odorless	Odorless	Odorless	Odorless	Odorless	Odorless	Odorless	Odorless	Odorless	Odorless
10	Chloride (Cl)	mg/L	≤250	250	399.87	99.96	199.93	193.93	599.81	159.95	499.84	119.96	199.93	179.94	599.81	399.87	179.94	329.89	79.97
11	Fluoride	mg/L	≤1.5	1.5	0.11	0.23	0.44	0.32	0.56	0.22	0.66	0.11	0.25	0.23	0.55	0.50	0.36	1.0	0.32
12	Aluminium	mg/L	≤0.2	0.2	<0.028	<0.028	<0.028	<0.028	<0.028	<0.028	<0.028	<0.028	<0.028	<0.028	<0.028	<0.028	<0.028	<0.028	<0.028
13	Nickel	mg/L	≤0.02	0.07	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008
14	Lead (Pb)	mg/L	≤0.05	0.01	<0.016	<0.016	<0.016	<0.016	<0.016	<0.016	<0.016	<0.016	<0.016	<0.016	<0.016	<0.016	<0.016	<0.016	<0.016
15	Barium (Ba)	mg/L	0.7	0.7	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
16	Antimony (Sb)	mg/L	≤0.005	0.02	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
17	Arsenic (As)	mg/L	≤0.05	0.01	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
18	Boron(B)	mg/L	0.3	0.5	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
19	Cadmium (Cd)	mg/L	0.01	0.003	<0.0028	<0.0028	<0.0028	<0.0028	<0.0028	<0.0028	<0.0028	<0.0028	<0.0028	<0.0028	<0.0028	<0.0028	<0.0028	<0.0028	<0.0028
20	Chromium (Cr)	mg/L	≤0.05	0.05	0.0078	0.0156	0.0299	0.0189	0.0146	0.0089	0.0289	0.0101	N.D.	0.0098	0.0129	0.0163	0.0069	0.0147	0.0100
21	Selenium (Se)	mg/L	0.01	0.01	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
22	Copper (Cu)	mg/L	2	2	0.1256	0.0299	0.0420	0.0360	0.0414	0.0123	0.0223	0.0075	0.0193	0.0125	0.0203	0.0111	0.0106	0.0169	0.0129
23	Cyanide (CN)	mg/L	≤0.05	0.07	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
24	Mercury (Hg)		≤0.001	0.006	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
25	Manganese (Mn)	mg/L	≤0.5	0.4	<0.0016	<0.0016	<0.0016	<0.0016	<0.0016	<0.0016	<0.0016	<0.0016	<0.0016	<0.0016	<0.0016	<0.0016	<0.0016	<0.0016	<0.0016
26	Zinc (Zn)	mg/L	≤5.0	3	0.0123	0.0101	0.0139	0.0111	0.0203	0.0066	0.0166	0.0098	0.0121	0.0101	0.0196	0.0102	0.099	0.0188	0.0110
27	Residual Chlorine	mg/L	0.2-0.5	5	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
28	Phenolic Compounds as Phenols	mg/L	-	0.002	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
29	Sodium	mg/L	-	200	145.0123	45.1230	85.1110	88.8652	305.0300	69.6578	269.3250	79.3695	69.1414	86.3005	386.1023	170.0013	77.3256	277.0202	37.0203
30	Fecal Coliform		-	0/100ml	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
31	E-Coli		-	-	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
32	Total Coliform		-	0/100ml	01	01	03	02	08	04	08	01	01	02	02	03	01	02	01

- *** Result with star is deviant from SEQS prescribed standards.**

5.2.6 Ecology

5.2.6.1 Lakes and Rivers

In most cases, lakes must be given special consideration, as there may not be an adequate outlet or flow volume from the lake, and contaminants may accumulate. This could cause substantial long-term problems to any beneficial uses of the lake water, such as aquatic habitat.

Generally, rivers continually cleanse themselves and can tolerate somewhat higher pollutant constituent loads than lakes. However, it is still essential that the quality of both the drainage water and the river water be evaluated to determine the safe level of constituents that can be placed in the river without affecting downstream beneficial uses.

5.2.6.2 Estuaries, Bays and Oceans

Estuaries, bays and oceans have somewhat different water quality requirements. Considerable exchange of water takes place in the estuarine, bay and ocean environments due to the changing tides and ocean currents. In addition, the introduction of saline drainage water into a salt-water environment generally reduces the impact of the discharge of the drainage water on the receiving water. However, each receiving water needs to be analysed and compared with the drainage effluent in order to protect beneficial uses of the receiving water. Nutrients in drainage waters may cause problems in estuaries. If possible, the oceans and seas should be the ultimate natural disposal location for saline drainage water.

5.2.6.3 Evaporation Ponds

Disposal of runoff and drainage waters into natural depressions has been practiced for centuries. The impounded waters are dissipated by evaporation, seepage and transpiration losses. Use of constructed disposal basins for saline agricultural drainage waters are also common worldwide where there are constraints on discharging into natural salt sinks such as the oceans and inland closed basins. Examples of such practices include the salinity control and reclamation projects (SCARP) along the Indus River in Pakistan; the irrigation projects along the Syr Darya and Amu Darya Rivers inKazakhstan and Uzbekistan.

5.2.6.4 Wetlands

There is no wetland of national or international importance located in the Project area. However, there are several small wetlands in the shape of saline water and fresh water fish ponds in the Project area and near the Project area which are used for following purposes:

- Agriculture
- Fisheries
- Storage reservoir
- Resting feeding and roosting ground for migratory and resident birds

These wetlands receive water from begari, Desert canals and Hairdin drains, runoff from crop fields, hill torrents and seepage from canals.

Water Flows Visiting Wetlands

- The wetlands habitats attract a wide variety of water fowls, swans, geese, ducks, grebes, herons and several species of waders.

- The number of water flows are visiting the wetlands in the study area and outside the study area. Following are the Wetland/Fish Ponds inside and outside the Project area:

Fish Ponds

There are many Fish ponds located at inside the Project area consisting hundreds of acres and ponds receive water from Begari, B.S Feeder and Desert Canals. Location of ponds are as under:

- Fish pond near Tangwani Village
- Fish pond near Mubarakpur
- Fish pond near Khan Garh Khosa Village

5.2.7 Climatic Conditions

Climate of the area has hot desert climate with extremely hot summers and mild winters. District Jacobabad is well known for consistently having among the highest temperature in South Asia, with a

mean summer temperature of 37 ºC (99 ºF), the highest recorded temperature is 52.8 ºC (127 ºF) and the lowest recorded temperature is -3.9 ºC (25.0 ºF). Rainfall is low and mainly occurs in the monsoon season (July – September). The average annual rainfall is 122.5 mm as per 1991-2020 period. District Shikarpur lies at about 69 m above sea level. Shikarpur's climate is a classified as desert with very little rainfall, the average annual temperature is 27.1ºC and average precipitation is 124 mm. District Kashmore annual rainfall is 94.53 mm / year.

5.2.8 Seismology

According to Seismic Map of Pakistan, district Shikarpur, Jacobabad and Kashmore falls in Zone (2 A) based on Peak Ground Acceleration values (PGA). This translates into PGA of 0.8-0.16 g.

The occurrence of Earthquakes in Sindh has been of the magnitude range 2.9 to 5.0 and 5.1 to 6.0 with higher magnitudes. Following figure shows seismic zoning map of the project area.

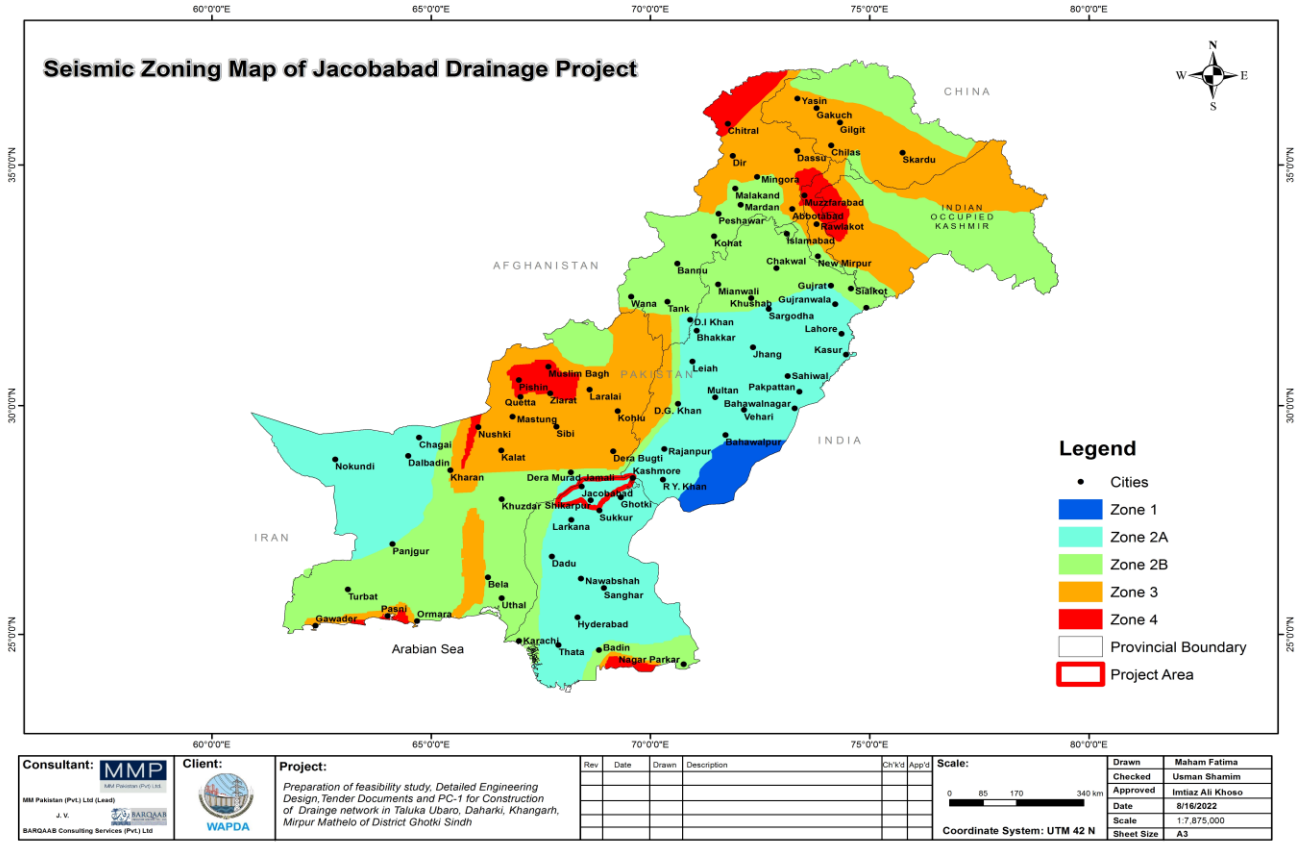


Figure 5.6: Seismic Zoning Map of the Project Area

5.2.9 Ambient Air Quality and Noise Quality Testing

Ambient air quality was analysed in order to establish the baseline conditions of the Project area and to provide benchmark for the monitoring of the physical and biological aspects of environment. Noise levels were also assed (in dBA) with the help of a noise meter to establish the baseline noise conditions in and around the Project area.

5.2.9.1 Ambient Air Testing

Ambient air testing refers to the measurement and analysis of various pollutants and gases present in the outdoor air surrounding a specific location. It is typically performed to evaluate air quality and assess

the potential health and environmental risks associated with air pollution. Key components of ambient air testing include:

Particulate Matter (PM): Measurement of airborne solid or liquid particles of various sizes (PM_{10}, $PM_{2.5}$, etc.). These particles can originate from sources like combustion, industrial processes, and natural sources.

Gaseous Pollutants: Monitoring of gases such as sulphur dioxide (SO_2), nitrogen oxides (NOx), carbon monoxide (CO), ozone (O_3), and others. These gases are often associated with combustion processes, industrial emissions, and vehicular traffic.

Toxic Substances: Detection of hazardous air pollutants (HAPs) and other toxic compounds like heavy metal (e.g., lead.) This substance can have severe health and environmental impacts.

5.2.9.2 Noise Testing

Noise testing involves the measurement and assessment of sound levels and noise pollution in a particular area. It is performed to evaluate the impact of noise on human health, quality of life, and the environment. Key aspects of noise testing include:

Sound Level Measurements: Quantifying the intensity of sound using decibels (dB) and assessing noise levels from various sources, including transportation (e.g., road traffic, aircraft, railways), industrial operations, construction sites, and recreational activities.

Regulatory Compliance: Ensuring that noise levels in specific areas comply with local regulations and guidelines, and taking measures to mitigate excessive noise when necessary.

Noise Reduction Measures: Recommending noise mitigation strategies and technologies to reduce the impact of noise pollution, such as sound barriers, quieter transportation methods, and urban planning modifications.

Both ambient air and noise testing play critical roles in safeguarding public health, enhancing environmental quality, and informing policy decisions to mitigate the adverse effects of pollution and noise on communities. Regulatory agencies and environmental organizations frequently conduct these tests to monitor and address environmental concerns.

National Environmental Services & Consultants Analytical Laboratory were awarded contract to conduct air and noise quality monitoring at 5 locations of the entire Project area. The air quality test was run continuously for 24 hours at each location. The noise level was also run at the same sites (The noise level shown by the laboratory is below permissible limits).

The monitoring values of Carbon monoxide (CO), Sulphur dioxide (SO_2), Nitrogen Oxide (NO), Particulate Matter (TSP, PM_{10} & $PM_{2.5}$), Ozone (O_3) & Lead (Pb) were compared with standards set by Sindh Environmental Quality Standards (SEQS).

The review of the results reveals that all the air quality test results fall well below the SEQS. It may be noted that the project area is mainly rural and most of it is barren without any significant activities hence the overall air quality will be similar or better than the results reflected in this table below. Problems will occur during the construction stage mainly that of dust for which mitigation measures have been suggested. It is also expected that level of harmful gases may increase due to vehicular and other heavy machinery exhaust but it will all be short lived and irreversible. Results of five air quality test locations are given below:

5.2.9.3 Air Quality Test Results

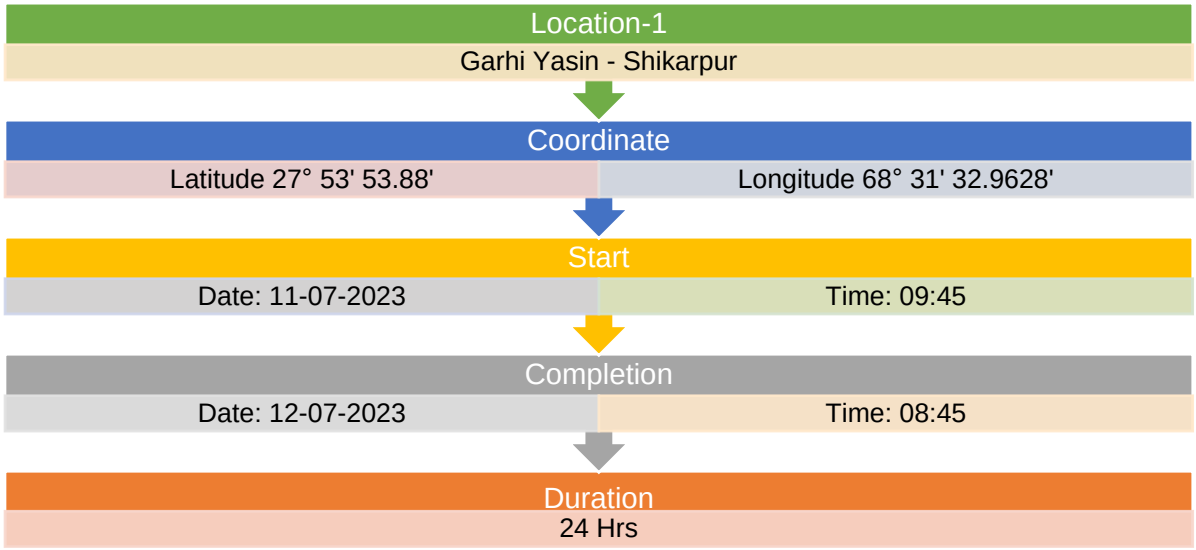


Table 5.2: Ambient Air Quality Test Results of Location-1

S. No.	Measuring Parameters	Unit	Obtained Concentration	SEQS Limit	WHO Limit
1	Nitrogen Oxide (NO)	(µg/m³)	13.91	40	-
2	Nitrogen Dioxide (NO_2)	(µg/m³)	26.57	80	25
3	Sulfur Dioxide (SO_2)	(µg/m³)	8.65	120	40
4	Carbon Monoxide (CO)	(mg/m³)	4.94	5	4
5	Suspended Particulate Matter (SPM)	(µg/m³)	150.13	500	-
6	Particulate Matter (PM_{10})	(µg/m³)	123.80	150	45
7	Particulate Matter ($PM_{2.5}$)	(µg/m³)	28.89	75	15
8	Ozone (O_3)	(µg/m³)	18	130	100/8hrs
9	Lead (Pb)	(µg/m³)	ND	1.5	-

Pictures of Location-1

Location-2	
Ali Sher Gola Kandhkot	
Coordinate	
Latitude, 28° 15' 24.3252'	Longitude, 69° 12' 46.566'
Start	
Date: 12-07-2023	Time: 10:30
Completion	
Date: 13-07-2023	Time: 09:30
Duration	
24 Hrs	

Table 5.3: Ambient Air Quality Test Results of Location-2

S. No.	Measuring Parameters	Unit	Obtained Concentration	SEQS Limit	WHO Limit
1	Nitrogen Oxide (NO)	(µg/m³)	13.73	40	-
2	Nitrogen Dioxide (NO_2)	(µg/m³)	23.80	80	25
3	Sulfur Dioxide (SO_2)	(µg/m³)	8.36	120	40
4	Carbon Monoxide (CO)	(mg/m³)	4.23	5	4
5	Suspended Particulate Matter (SPM)	(µg/m³)	145.1	500	-
6	Particulate Matter (PM_{10})	(µg/m³)	118.01	150	45
7	Particulate Matter ($PM_{2.5}$)	(µg/m³)	27.13	75	15
8	Ozone (O_3)	(µg/m³)	16	130	100/8hrs
9	Lead (Pb)	(µg/m³)	ND	1.5	-

Pictures of Location-2

Location-3	
Mero Khan Rato Daro Road - (GARHI KHERO)	
Coordinate	
Latitude, 27° 48' 01.1988'	Longitude, 68° 16' 27.3832'
Start	
Date: 13-07-2023	Time: 11:00
Completion	
Date: 14-07-2023	Time: 10:00
Duration	
24 Hrs	

Table 5.4: Ambient Air Quality Test Results of Location-3

S. No.	Measuring Parameters.	Unit	Obtained Concentration	SEQs Limit	WHO Limit
1	Nitrogen Oxide (NO)	(µg/m³)	15.94	40	-
2	Nitrogen Dioxide (NO_2)	(µg/m³)	25.22	80	25
3	Sulfur Dioxide (SO_2)	(µg/m³)	8.95	120	40
4	Carbon Monoxide (CO)	(mg/m³)	4.30	5	4
5	Suspended Particulate Matter (SPM)	(µg/m³)	146.06	500	-
6	Particulate Matter (PM_{10})	(µg/m³)	117.2	150	45
7	Particulate Matter ($PM_{2.5}$)	(µg/m³)	28.84	75	15
8	Ozone (O_3)	(µg/m³)	17	130	100/8hrs
9	Lead (Pb)	(µg/m³)	ND	1.5	-

Pictures of Location-3

Location-4	
Jacobabad Road – Garhi Khero	
Coordinate	
Latitude, 28° 03' 07.6212'	Longitude, 67° 59' 24.6588'
Start	
Date: 14-07-2023	Time: 11:00
Completion	
Date: 15-07-2023	Time: 10:00
Duration	
24 Hrs	

Table 5.5: Ambient Air Quality Test Results of Location-4

S. No.	Measuring Parameters	Unit	Obtained Concentration	SEQS Limit	WHO Limit
1	Nitrogen Oxide (NO)	(µg/m³)	13.31	40	-
2	Nitrogen Dioxide (NO_2)	(µg/m³)	25.35	80	25
3	Sulfur Dioxide (SO_2)	(µg/m³)	9.91	120	40
4	Carbon Monoxide (CO)	(mg/m³)	3.95	5	4
5	Suspended Particulate Matter (SPM)	(µg/m³)	147.86	500	-
6	Particulate Matter (PM_{10})	(µg/m³)	119.96	150	45
7	Particulate Matter ($PM_{2.5}$)	(µg/m³)	27.89	75	15
8	Ozone (O_3)	(µg/m³)	18	130	100/8hrs
9	Lead (Pb)	(µg/m³)	ND	1.5	-

Pictures of Location-4

Location-5	
Garhi Khairo Road - ShahdadKot	
Coordinate	
Latitude, 27° 51' 51.894'	Longitude, 67° 54' 51.624'
Start	
Date: 15-07-2023	Time: 11:10
Completion	
Date: 16-07-2023	Time: 10:10
Duration	
24 Hrs	

Table 5.6: Ambient Air Quality Test Results of Location-5

S. No.	Measuring Parameters.	Unit	Obtained Concentration	SEQS Limit	WHO Limit
1	Nitrogen Oxide (NO)	(µg/m³)	14.33	40	-
2	Nitrogen Dioxide (NO_2)	(µg/m³)	25.48	80	25
3	Sulfur Dioxide (SO_2)	(µg/m³)	8.68	120	40
4	Carbon Monoxide (CO)	(mg/m³)	3.94	5	4
5	Suspended Particulate Matter (SPM)	(µg/m³)	150.75	500	-
6	Particulate Matter (PM_{10})	(µg/m³)	121.86	150	45
7	Particulate Matter ($PM_{2.5}$)	(µg/m³)	28.89	75	15
8	Ozone (O_3)	(µg/m³)	17	130	100/8hrs
9	Lead (Pb)	(µg/m³)	ND	1.5	-

Pictures of Location-5

The average value of Noise for day and night time at each location is found to be within the prescribed limit of SEQS. Following, Figure 5.7 shows the location of air quality sampling areas and detailed results including monitoring methods, average value graphical representation of each parameter, received from the Lab have been annexed as Annexure 3 of this report.

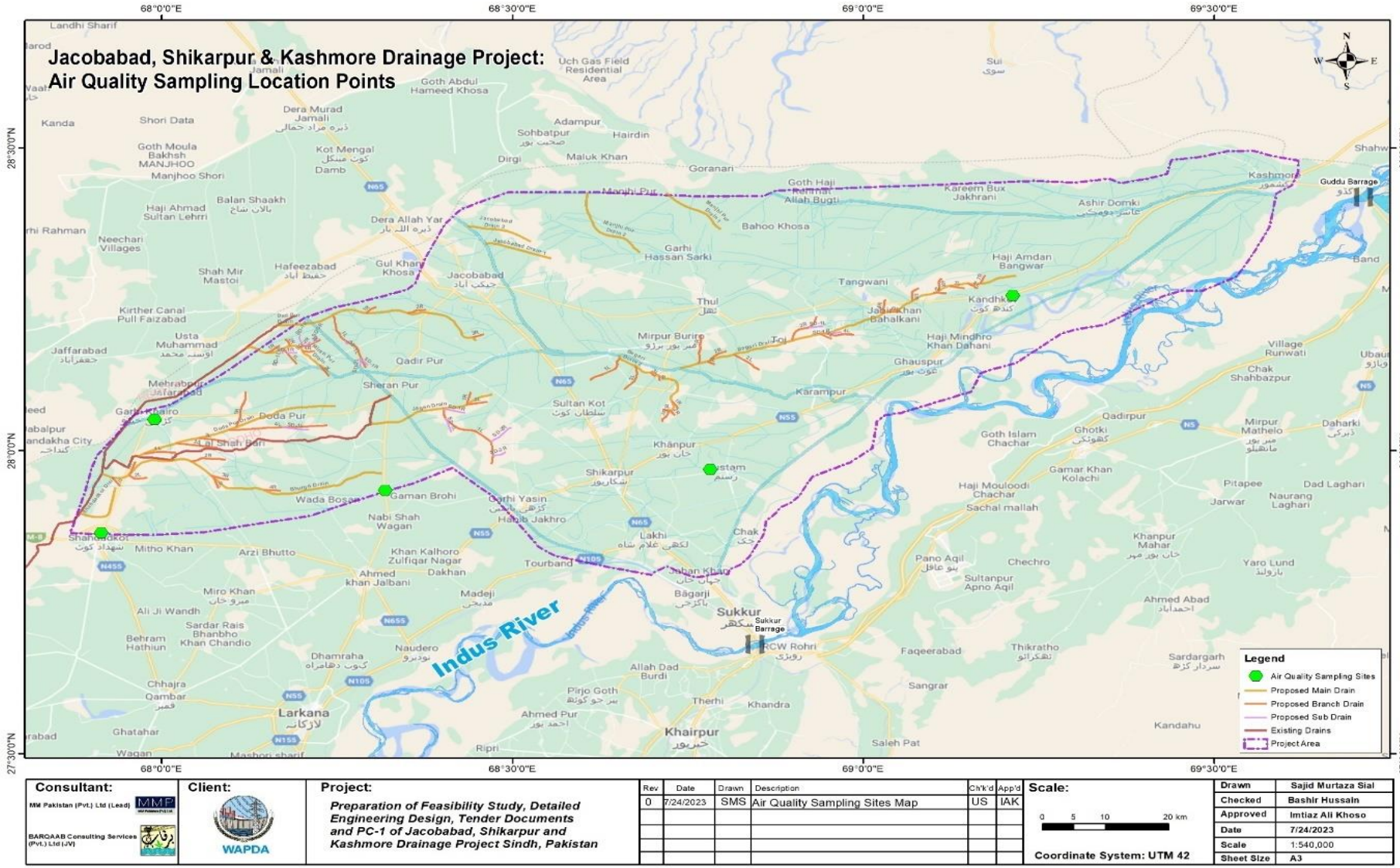


Figure 5.7: Locations of Air Quality Sampling

5.2.10 Agriculture and Land Utilization

5.2.10.1 Agriculture

Agriculture is the mainstay to the country's economic growth, food security, employment generation and poverty alleviation particularly. It contributes about 19 percent to the GDP and provides employment to around 38.5 percent of labor force. More than 65-70 percent of population depends on agriculture for its livelihood. Sindh province accounts for 18 percent of the country's land area, 16 percent of its total cropped area and contributes about 23 percent of national agriculture value added. Guddu Right Bank Basin is an integral part of Lower Indus Basin Plain and proposed Project area falls in this basin. Rice-wheat cropping system is being practiced in the project area. The agriculture productivity is well below optimal and yield per unit area for major crops such as wheat and rice are lower than the provincial average. Realizing the importance of agriculture, a drainage Project has been envisaged in the area to provide drainage facilities for catering waterlogging and salinity problem. The provision of drainage facilities will provide enabling environment for enhanced crop production. The project will enhance crop production through adopting appropriate cropping pattern with higher intensities and yields. The Project area is a level floodplain composed of River Indus alluvium with two principal soil groups; Indus alluvial and the Piedmont alluvial. Irrigation water is served to the project area through Desert and Begari canals on seasonal basis. The agriculture system is dependent on irrigation. The project CCA has been adopted as 617672 hectares for computing cropping patterns, intensities, crop productions and future agriculture development.

The average farm size is 8.8 acres (3.56 hectares) with 83% small farms having 41% of total area; medium size farms are 8% of total farms having 17% of total area; and large size farms are 9% having 42% of total farm area. Distribution of farms for owner, owner-cum-tenant, and tenant operated system is 78.6, 3.3, and 18.1 percent with farm area as 85.6, 3.3, and 11.1 percent, respectively. The fragmented farms are 23% while 77% exist as consolidated farms

The agriculture is predominant by rice and wheat as major crops with sugarcane, rapeseed, and mustards, jowar, bajra and gram as minor crops. Rice is dominant crop during Kharif with 48.7% intensity, followed by jowar, bajra, maize, and sugarcane etc. with negligible cropping intensities. Wheat is the major Rabi crop with cropping intensity of 17.3% followed by pulses 2.8%, gram 2.3%, vegetables 1.5%, rapeseed and mustard 1.3% and fodder 0.6% of CCA. Annual cropping intensity of Project area is 74.9% with Kharif as 49 % and Rabi as 25.9% against canals annual design intensity of 67%. The main reasons for low cropping intensities are late and irregular water supplies, waterlogging and salinity hazards etc. Begari and Desert Canals are seasonal and provide water from May to October and once in January.

Figure 5.8: Views of Agriculture in the Project Area

5.2.10.2 Land Utilization

Land use data is necessary to assess the existing agriculture development status and future potential of the project area. Land use statistics for districts of Jacobabad, Shikarpur and Kashmore published in Development Statistics of Sindh (2021) has been used as representative of project area and given in Table 5.7. The table indicates that out of total reported area of 812000 hectares, the cultivated area is only 333000 hectares (41 percent) and uncultivated area is 479000 hectares (59 percent). A vast area of 340000 hectares is available under the category of "culturable waste" which can possibly be brought under cultivation by adopting drainage and reclamation measures and there exists scope for future agriculture development depending on the availability of assured, adequate, and timely water supplies. Since the project area consists of 9 drainage units reported by RBOD Project Feasibility report, falling in the districts of Jacobabad, Shikarpur and Kashmore, GCA as 697912 hectares and CCA as 617672 hectares has been adopted for computing cropping pattern, intensities, crop production and future agriculture development.

Table 5.7: Land Utilization Statistics by Districts (Area in "000" Hectares)

District	Geographical Area	Reported Area	Cultivated area			Uncultivated area			
			Total	Current Fallow	Net Area Sown	Forest	Culturable Waste	Not Available for Cultivation	Total
1	2	3	4	5	6	7	8	9	10
Jacobabad	267	267	115	43	72	0	91	61	152
Shikarpur	284	284	108	15	93	26	126	24	176
Kashmore	261	261	110	35	75	15	123	13	151
Total	812	812	333	93	240	41	340	98	479

Source: Development Statistics of Sindh 2021 Government of Sindh, Karachi.

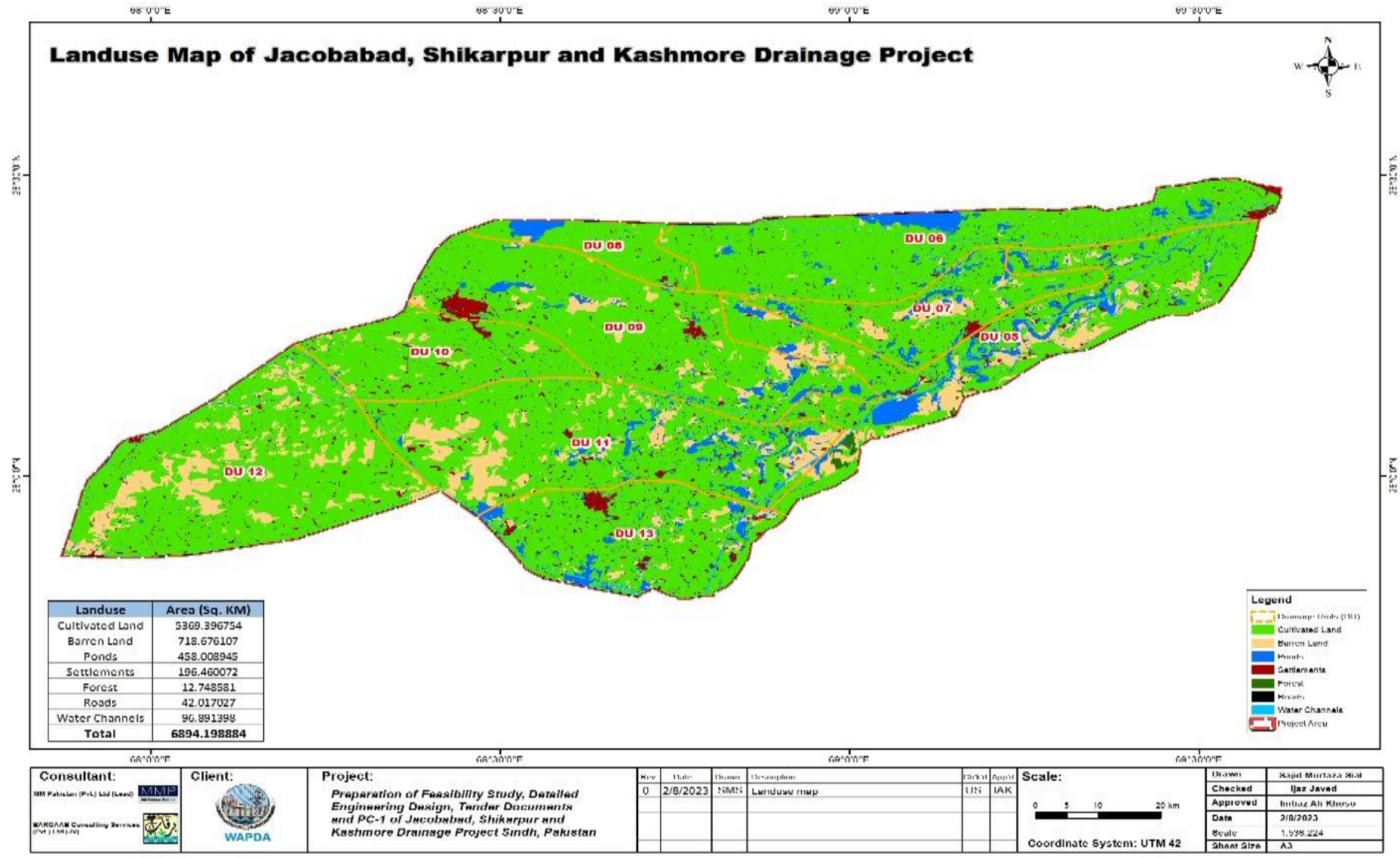


Figure 5.9: Land Use Map of the Project Area

5.2.10.3 Land Holdings

The farm size has a major impact on the agricultural development of the area because large farms have comparatively higher absorptive capacity for development than smaller farms. Therefore, the data collections and appraisal regarding farm size and their distribution is necessary to evolve a meaningful strategy which suits the socio-economic conditions of the area. The data regarding the farm structure for three districts falling in project area has been obtained from Agriculture Census Report (2010) and compiled for the project area and is presented in Table 5.8.

Table 5.8: Number and Area of Farms by Size of Farm in the Project Area

Area in acres

Size of Farm	Number of Farms		Farm Area		Cultivated Area		Cultivated Area as % of Farm Area	Average Size of Farm	
	Total	Percent	Total	Percent	Total	Percent		Farm Area	Cultivated Area
1	2	3	4	5	6	7	8	9	10
Small (under 12.5 acres)	73704	83	318759	41	303207	42	95	4.3	4.1
Medium (12.5 to under 25 acres)	7533	8	133179	17	125575	17	94	17.7	16.7
Large (25 acres and above)	7741	9	334236	42	297460	41	89	43.2	38.4
Total	**88978**	**100**	**786174**	**100**	**726242**	**100**	**92**	**8.8**	**8.2**

Source: Pakistan Agriculture Census 2010.

The farm size data is grouped in 10 categories ranging from under 1 acre to 150 acres and above. To make it simple and easy for interpretation, 3 categories namely “small” (under 12.5 acres), “medium” (12.5 to under 25 acres), and “large” (25 and above), farms have been compiled and described. By analyzing the statistics on percent basis, it is evident that small farms with 83 percent of total farms have 41 percent of total farm area with average farm size of 4.3 acres. For medium size category, farm number is 8 percent of total farms having 17 percent of total farms area with average farm size of 17.7 acres. Large size category has farm number share as 9 percent, and farm area share as 42 percent with average farm size of about 43 acres. Column 8 depicts cultivated area as % of farm area under each category and it is definitely less than 100%. These percentages are 95, 94 and 89 for small, medium and large size category, respectively. It shows that small and medium size categories put more efforts to bring farm area under cultivation to sustain their livelihoods. Columns 9 and 10 represent average farm area and cultivated areas, respectively against each category. The overall average farm size at project level is 8.8 acres (3.56 hectares).

5.2.10.4 Land Tenure

Based on Agriculture Census Data (2010), the distribution of farms and farm area by tenure system i.e., owner, owner-cum-tenant, and tenants for the project area are given in Table 5.9. The details regarding percent distribution of number of farms and farm area for different tenure systems i.e., owner, owner-cum-tenant, and tenants are shown in Table 5.10. The table reveals that number and area of owner operated farms are highest for all the three farm categories (small, medium, and large). Distribution of farms for owner, owner-cum-tenant, and tenant operated system is 78.6, 3.3, and 18.1 percent; and farm area for these three tenure systems is 85.6, 3.3, and 11.1 percent, respectively. There are number of economic and social problems associated with land tenure system such as: absentee landlords get

their share without making provision of efficient use of land; tenants are exploited by the landlords due to high rents and insecurity of the tenure; landlord gives small units of cultivation to tenants where modern implements of agriculture cannot be used etc. The table reveals that under the prevailing tenure system, majority of the farms are operated by owners themselves; thus, this will prove helpful for achieving the planned production targets.

Table 5.9: Tenure Classification of Farms and Farm Area by Size of Farm

Size of Farms	Number of Farms				Farm Area (Acres)			
	Total	Owner	Owner-cum-Tenant	Tenant	Total	Owner	Owner-cum-Tenant	Tenant
1	2	3	4	5	6	7	8	9
Small Farms (under 12.5 acres)	73704	56174	2470	15058	318760	246557	13884	58319
Medium Farms (12.5 to under 25 acres)	7533	6578	366	591	133179	116414	6390	10375
Large Farms (25 acres and above	7741	7186	83	471	334235	310031	5332	18872
Total	**88978**	**69938**	**2919**	**16120**	**786174**	**673002**	**25606**	**87566**

Source: Pakistan Agriculture Census, 2010.

Table 5.10: Tenure Classification of Farms and Farm Area by Size of Farm

(Percent)

Farm Category	Number of Farms				Farm Area (Acres)			
	Total	Owner	Owner-cum-Tenant	Tenant	Total	Owner	Owner-cum-Tenant	Tenant
1	2	3	4	5	6	7	8	9
Small Farms (under 12.5 acres)	100	76.2	3.4	20.4	100	77.3	4.4	18.3
Medium Farms (12.5 to under 25 acres)	,8100	87.3	4.9	7.8	100	87.4	4.8	7.8
Large Farms (25 acres and above	100	92.8	1.1	6.1	100	92.8	1.6	5.6
Total	100	78.6	3.3	18.1	100	85.6	3.3	11.1

Source: Pakistan Agriculture Census, 2010.

5.2.11 Climate Change

Climate change is a significant and lasting change in the statistical distribution of weather patterns over periods ranging from decades to millions of years. It results in more or fewer extreme weather events. Major factors believed to be causing climate change are:

- Variation in solar radiation
- Biotic processes
- Plate tectonics
- Volcanic eruptions
- Magnetic field strength
- Human activities leading to release of Green House Gases(GHGs) and causing global warming

In past 30 years or so, it it is the human activity generated GHGs which have triggered the accelerated climate change due to global warming. Some obvious and significant adverse impacts are listed below:

- Rise in sea level due to melting of polar ice caps.
- Threat to biodiversity.
- Loss of marine resources.
- Triggering of natural disasters.
- Damage to renewable energy resources.
- Damage to transport and communication.
- Losses in trade and finances.
- Increase in vulnerability to adverse impacts due to new hurdles in management of waste.
- Loss of fresh water resources.
- Loss of land resources.
- Loss of tourism.
- Loss of food resources and damage to agriculture.

5.2.11.1 Climate Change Effect on Agricultural Area of the Project

The main direct sources of GHG emissions in the agricultural sector are not only carbon dioxide (CO_2), but also nitrous oxide (N_2O), mostly by soils and through the application of fertilizers, and methane (CH_4), essentially from livestock and rice cultivation. These emissions are dependent on natural processes and agricultural practices, which makes them more difficult to control and measure. On the other hand, agriculture is a key sector that can lead to biological carbon capture and storage in biomass and soil, acting as “sinks”. Their management can play an essential role in managing climate change especially in the long term in two ways; by improving efficiency and by enhancing soil carbon sink.

The vulnerability of agriculture sector is very high to the climatic changes as variation in temperature and precipitation directly affects the agricultural production of the project area. Various studies have been conducted on the impacts of climate change on agriculture; such impacts are especially significant for Pakistan, where agriculture sector accounts for 19.3 percent of GDP and 38.5 percent of employment as reported in recent Pakistan Economic Survey. Agriculture sector includes crops, livestock, fisheries, agro-forestry and rangelands. Besides, agriculture is strongly linked with other sectors in terms of its inputs and outputs. Many agro-based industries, such as textile, leather and food processing, have direct or indirect links to agriculture and its products. The change in household income based on change in agro-based income also affects the household consumer demand for the products from the other remaining sectors. Thus, climate change directly or indirectly affects the overall economy through the agriculture sector. The local climate and weather changes in Sindh may affect both crop yields and returns to farmers of the project area. By the virtue of its geographical location and climate, Sindh has been able to grow some crops, such as mangoes, tomatoes, onion, wheat and other crops, one month earlier than Punjab, and farmers in Sindh have benefitted from this as market prices are generally high in the beginning of crop season. However, climate change and weather variability may change this pattern resulting in uncertainty and riskier returns to farmers. Due to diverse geography of Sindh, climate and weather variability are likely to create a great deal of uncertainty about agriculture sector and other economic sectors that depend on agriculture, which will have impacts on income,

livelihood and poverty. Thus, there is a need to identify policy measures that would facilitate climate change adaptation measures in Sindh to mitigate the negative impacts of climate change on the agriculture sector and to avail opportunities from any positive impacts arising from climate change.

Mitigation measures and adoptions are following:

- Agroforestry practices
- Plantation on agricultural land and banks of the proposed drains
- Watershed plantation
- Reforestation in riverain forests
- Vegetation improvement on rangelands

Adoption

- Control of forest
- Pest control
- Change in species and variations
- Preservation of watershed and rangelands
- Control of wastage
- Conservation of coastal zone.

The activities mentioned above, had to be carried out in the existing forests, watershed and rangelands areas, and would require large-scale plantations with indigenous as well as adopted exotic species to improve cover. There is need to rehabilitate, improve and develop the existing about more than 3000 acres of forest in the project to impede the impact of climate change.

5.2.11.2 Climate Change General Effects

Climate change poses serious risks to human security, food and water security particularly for nations dependent upon major irrigation systems such as Indus Basin. There is likely increase in the temperature and rainfall in the project area with more extreme events as the characteristics of the future weather. Higher temperatures could increase evaporation leading to drier soils. Moreover, due to shift in rainfall patterns there will be reduced water availability in the winter season. As a result of climate change, rainfall events which are the same size as the historic 1-in-100 year rainfall event are expected to occur more frequently in the future. In addition to the potential for more frequent flooding, this shift in the characteristics of rainfall events is also likely to:

- Increased runoff and associated pollutants.
- Increased soil erosion.
- Impact on vegetation cover which provides soil stability.
- Shifts in environmental flows and water quality are expected to impact on waterways and biodiversity.

Many studies have suggested and forecasted changes in Upper Indus Basin, reducing snowmelt, less events of rain, and high events of torrential rains causing soil erosion. These changes are certainly going to affect irrigation supplies fed by Indus Basin irrigation system which gives life to fertile land of Sindh province. A study was undertaken by Pakistan Council of Research in Water Resources (2021) to estimate potential water stress in irrigated areas by variations in three agro-met parameters viz.

precipitation and consumptive use of crops over a decade. During the study period, no significant change has been observed in overall irrigated land and coverage of four major crops. A significant variation in consumptive use of cotton and sugarcane crops was observed during summer months in all studied crop zones of province of Sindh and Punjab. Precipitation variability is high during late winter months, February-April. Increasing trend in precipitation during maturity months of cotton and wheat crops posed potential threat to the yield of these two key crops, and above all food security of the nation. High precipitation variability during monsoon/ Kharif period in sugarcane mix zone and Rice-Wheat zones including the project area, have not posed potential threat yet. Therefore, based upon the meteorological observations, the phenomenon of climate variability cannot be ruled out. Whereas the stress on canal water supplies is prevailing ever since the beginning of irrigation system. Fortunately, variations in precipitation and consumptive use of major crops are inclined with natural situation. Therefore, climate variability cannot be ruled out as it is causing several crop managements challenges.

Under the prevailing situation, transformation of traditional agriculture to climate smart agriculture is the option to mitigate climate change effects.

5.2.11.3 Heatwaves

District Jacobabad

- Historically, Jacobabad district has a Hot and Arid climate and is prone to severe heatwave seasons. However, most of the district is sparsely populated, which significantly lowers the chances of severe heatwave impacts.
- Heatwaves are forecastable hazards and actions can be taken well before occurrence of heatwaves. The most suitable action is issuance of warnings and alerts in public for precautions and safety. Suitable media for the purpose is social media and SMS.
- Scientific studies suggest that, frequency and intensity of heatwaves is increased due to climate change. Though climate change is global phenomena, however, its impacts can be minimized through local interventions. The most efficient and cost-effective solution is tree plantation. Tree plantation must be encouraged at different levels including government functionaries, NGOs, community and individual levels.
- Additionally, introduction of reduced Urban Heat Islands (UHI) through policies and implementation in infrastructure development will significantly reduce impacts of heatwaves.

District Shikarpur and District Kashmore

- The district has witnessed rapidly increased severity of heatwave in the past five years. The district is moderately populated, which significantly increases the chances of heatwave impacts.
- Heatwaves are forecastable hazards and actions can be taken well before occurrence of heatwaves. The most suitable action is issuance of warnings and alerts in public for precautions and safety. Suitable media for the purpose is social media and SMS.
- Scientific studies suggest that, frequency and intensity of heatwaves is increased due to climate change. Though climate change is global phenomena, however, its impacts can be minimized through local interventions. The most efficient and cost-effective solution is tree plantation. Tree plantation must be encouraged at different levels including government functionaries, NGOs, community and individual levels.

- Additionally, introduction of reduced Urban Heat Islands (UHI) through policies and implementation in infrastructure development will significantly reduce impacts of heatwaves.

5.2.11.4 Floods 2022

The floods were caused by heavier than usual and melting glaciers that monsoon rains followed a severe heatwave, all of which are linked to climate change. It is the world's deadliest flood since the 2017 South Asian floods and described as the worst in the country's history. In July, 2022 Sindh and Baluchistan received over 500% more rain than the 30-year average of about 39 mm. The province of Sindh received rainfall over 784% more in August than the average of about 43 mm. In an official notification on 21st August 2022, Sindh Government announced that there have been “heavy losses which include loss of human lives, livestock, the damages to the houses and standing crops”. Agriculture is one of the most affected sectors. On 25th of August 2022, Pakistan declared a state of emergency because of the flooding. By 29th August, around "one-third" of the country was under water, affecting 33 million people. These are the deadliest floods in Pakistan since 2010, when nearly 2,000 persons died due to floods, and the deadliest in the world since the 2017 South Asian floods. Figure 5.10 shows rainfall in 2022.

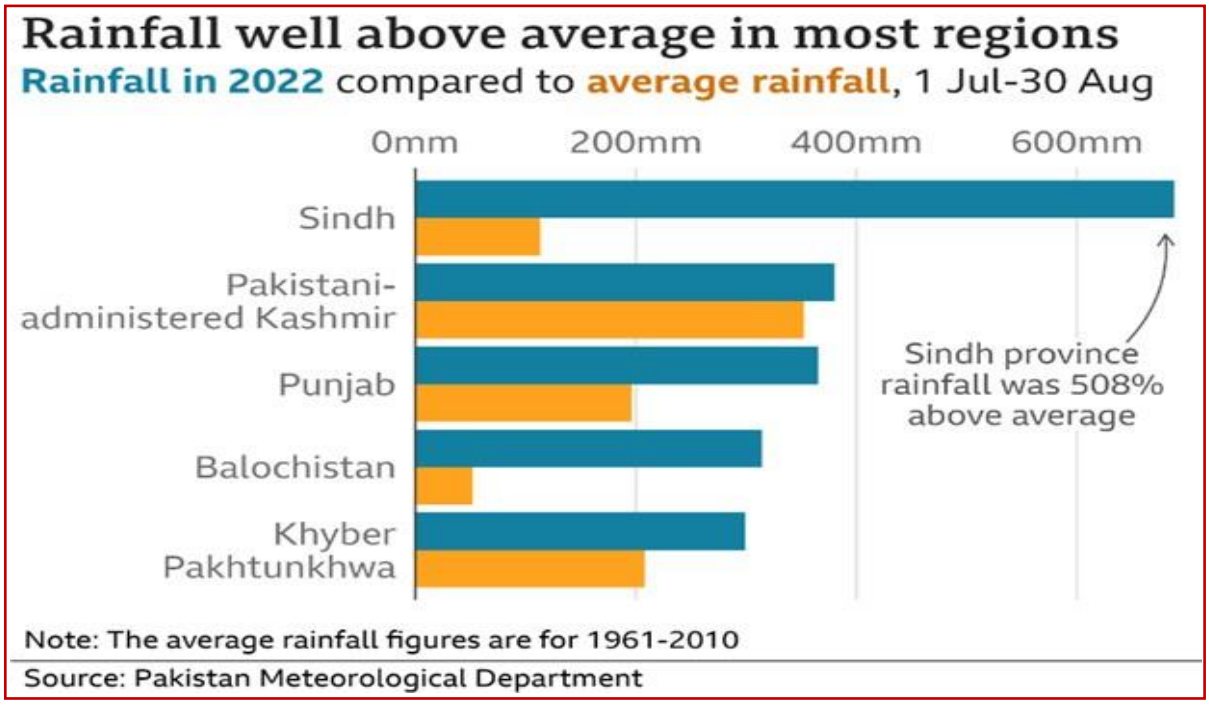


Figure 5.10: Chart Showing Average Rainfall during July and August 2022 in Pakistan (Yellow Bar Represents Average Values for 1961-2010, whereas Blue Bars are for the Year 2022)

The rise in sea surface temperatures is believed to increase monsoon rainfall. In addition, southern Pakistan experienced back-to-back heatwaves in May and June, which were record setting and themselves made more likely by climate change.

Pakistan contributes less than 1% of global greenhouse gas emissions, but is one of the places most vulnerable to climate change. A study by an international team of climate scientists says that global heating made the flooding up to 50% worse and future floods more likely. Deforestation in Pakistan has also been a factor worsening the floods.

5.3 Description of Biological Environment

Biological environment of an area comprises of flora, fauna, forest, wetlands, environmental sensitive areas and aquatic life.

5.3.1 Flora

Natural flora in the project area consist of trees, herbs, shrub, grass and sedge are found in the project area following Table shows list of Flora in the project area.

Table 5.11: List of Flora in the Project Area

S. No	Plant Species	Family	Local Name
Trees			
1	Acacia nilotica (Linn.) Delile.	Mimosaceae	Sindhi Babur
2	Azadirachta indica Adr. Juss.	Meliaceae	Neem
3	Bombax ceiba L.	Malvaceae	Sumbul
4	*Eucalyptus spp.*	Myrtaceae	sufedo
5	*Ficus benghalensis* L.	Moraceae	Ber
6	*Ficus religiosa* Linn.	Moraceae	Pepul
7	*Phoenix dactylifera* L.	Arecaceae	Khaji
8	*Salvadora persica* L.	Salvadoraceae	Khabbar
9	*Tamarix aphylla* (Linn.) Karst.	Tamaricaceae	Lao
Herbs			
10	Alhagi maurorum Medic.	Kandero	Fabaceae
11	*Eclipta prostrata*(Linn.) Mant.	Asteraceae	Daryahi Buti
12	*Euphorbia hirta* Forsk.	Euphorbiaceae	Kherawal
13	*Launaea procumbens*(Roxb.) Rammayya & Rajagopal.	Asteraceae	Bhattar
14	*Mukia maderaspatana* (Linn.) M.J. Roem.	Cucurbitaceae	Nandh Wal
15	*Phyla nodiflora* (L.) Greene.	Verbenaceae	Bukkan
16	*Solanum nigrum* Linn.	Solanaceae	Kanwal
17	*Solanum surattense* Burm.f.	Solanaceae	Kanderi
18	*Withania somnifera* (L.) Dunal	Solanaceae	……
Shrub			
19	*Phyllanthus reticulatus* Poir.	Euphorbiaceae	Kamooh
20	*Prosopis juliflora* (Sw.) DC.	Mimosaceae	Davi
21	*Tamarix indica* Willd.	Tamaricaceae	Lao
22	*Calotropis procera* (Willd.) R. Br.	Asclepiadaceae	Ak
Grass			
23	*Cynodon dactylon* (Linn.) Pers.	Poaceae	Chhabar
24	*Desmostachya bipinnata* (L.) Stapf.	Poaceae	Drabh
25	*Saccharum griffithii* Munro ex Boiss.	Poaceae	Kahan
26	*Phragmites karka* (Retz.) Trin	Poaceae	Naro
27	*Saccharum bengalensis* Retz.	Poaceae	Kanh, Booro
Sedge			
28	*Typha domingensis* Pers.	Typhaceae	Pan
29	*Typha elephantina* Roxb.	Typhaceae	Pan

Source: Secondary Data and Field Visits.

5.3.2 Floral Endangered Species

Under the pressure of colonization expansion in agriculture and impact of irrigation, the original flora of the area has become irreversibly endangered or extinct. The construction of the drains is not likely to cause any significant change in the existing balance of the ecosystem.

5.3.3 Fauna

Fauna consists of wild animals, birds, mammals, reptile, rodents and amphibian are listed below in the Table 5.12.

Table 5.12: List of Common Fauna in the Project Area

Sr. No.	English Name	Scientific Name	Rare (Yes or No)	IUCN Red List (Yes or No)
Wild Animals				
1	Deer	Gazella Benetti	x	x
2	Foxes	Valpes Bengalensis	x	x
3	Hares	Lagomorpha Lapus	x	x
4	Hog Deer	Hyelaphus Porcinus	x	x
5	Hyenas	Hyena Hyaenidac	x	x
6	Jackals	Canis Aureus	x	x
7	Pig	Sus Cristatus	x	x
8	Small Indian Mongoose	Herpestes Auropunctatus	x	x
9	Wolves	Canis Palfipes	x	x
Birds				
1	Bank Myna	Acridotheres ginginianus	x	x
2	Bay-backed Shrike	Lanius vittatus	x	x
3	Black Redstart	Phoenicurus ochruros	x	x
4	Black-winged Stilt	Himantopus himantopus	x	x
5	Blue Rock Pigeon	Columba livia	x	x
6	Cattle Egret	Bubulcus ibis	x	x
7	Common Chiffchaff	Phylloscopos collybita	x	x
8	Common Babbler	Turdoides caudatus	x	x
9	Common Myna	Acridotheres tristis	x	x
10	Common Sandpiper	Actitis hypoleucos	x	x
11	Crested Lark	Galerida cristata	x	x
12	Crow Pheasant	Centropus sinensis	x	x
13	Eurasian Kestrel	Falco tinnunculus	x	x
14	Grey Heron	Ardea cinerea	x	x
15	House Crow	Corvus splendens	x	x
16	House Sparrow	Passer domesticus	x	x
17	Indian Pond Heron	Ardeola grayii	x	x
18	Indian River Tern	Sterna aurantia	x	x
19	Indian Robin	Saxicoloides fulicata	x	x
20	Indian Roller	Coracias benghalensis	x	x
21	Indian sand Martin	Riparia paludicola	x	x
22	Indian Tree-Pie	Dendrocitta vagabunda	x	x
23	Large Egret	Egretta alba	x	x
24	Large Pied Wagtail	Motacilla maderaspatensis	x	x
25	Lesser Whitethroat	Sylvia curruca	x	x
26	Little Brown Dove	Streptopelia senegalensis	x	x
27	Little Cormorant	Phalacrocorax niger	x	x

Sr. No.	English Name	Scientific Name	Rare (Yes or No)	IUCN Red List (Yes or No)
28	Little Egret	Egretta garzetta	x	x
29	Little Green Bee-eater	Merops orientalis	x	x
30	Little Stint	Calidris minuta	x	x
31	Long-tailed Grass Warbler	Prinia burnesii	x	x
32	Marsh Harrier	Circus aeruginosus	x	x
33	Pied Bushchat	Saxicola caprata	x	x
34	Redshank	Tringa totanus	x	x
35	Red-vented Bulbul	Pycnonotus cafer	x	x
36	Red-wattled Lapwing	Hoplopterus indicus	x	x
37	Rose-ringed Parakeet	Psittacula krameri	x	x
38	White / Pied Wagtail	Motacilla alba	x	x
39	White-browed Fantail Flycatcher	Rhipidura aureola	x	x
40	White-cheeked Bulbul	Pycnonotus leucogenys	x	x
41	Yellow Wagtail	Motacilla flava	x	x
Mammals				
1	Five Stripped Palm Squirrel	Funambulus pennant	x	x
2	House Mouse	Mus musculus	x	x
3	Indian Gerbil	Tatera indica	x	x
4	Indian Grey Mongoose	Herpestes edwardsi	✓	x
5	Indus Dolphin/Bhulan	Platanista minor	x	✓
6	Small Indian Mongoose	Herpestes javanicus	x	x
7	Indian Desert Gerbil	Meriones hurrianae	x	x
8	Little Indian Field Mouse	Mus booduga	x	x
Reptile				
1	Common Lizard	Cnemidophorus Spp	x	x
2	Monitor Lizard	Varanus	x	x
3	Snake	Elapidae bungaris	x	x
4	Spring Tailed Lizard	Vromstyx	x	x
5	Brilliant Agama	Trapelus agilus isolepis	x	x
6	Indian Cobra	Naja naja naja	x	x
7	Indian Monitor	Varanus bengalensis	x	x
8	Saw Scaled Viper	Echis carinatus	x	x
9	Sindh Sand Gecko	Crossobamon orientalis	x	x
10	Indian Gardin Lizard	Calotes versicolor	x	x
11	Indian Softsheel Turtle	Aspideretes gangeticus	x	x
12	Indian Pound Turtle	Lissemys punctata	x	x
13	Checkered Keelback	Xenochrophis piscator	x	x
Rodents				
1	House Mouse	Mus Musculus	x	x
2	Five Stripped Palm Squirrel	Funambulus Pennanti	x	x
3	Indian Gerbil	Tatera indica	x	x
Amphibian				
1	Frog	Rama Trigrive	x	x
2	Toad	Bufo Bufo	x	x

Source: Secondary Data and Field Survey.

5.3.4 Fauna Endangered Species

Almost all the wildlife is under threat of extinction due to expanding agriculture and liberal shot gun licences. However, no new impact of the project is likely to be caused on the existing condition of the wildlife. Whoever some wild board crossing the road at night may become traffic hazards at night.

Pictures of Flora and Fauna found in the Project Area

Common Flora of the Project Area

Sindhi Babur (Acacia nilotica)

Sufedo (Eucalyptus globulus)

Khabar (Ficus lacor)

Ber (Ziziphus mauritiana)

Common Fauna of the Project Area

Deer (Cervidae)

Hog Deer (Axis porcinus)

Jackal (Disambiguation)

Wolve (Canis lupus)

Common Birds of the Project Area

House Sparrow (Passer domesticus)

White & Grey Heron (Ardea cinerea)

Common Mammals

House Mouse (Mus musculus)

Small Indian Mongoose (Herpestes edwardsii)

Common Reptiles of the Project Area

Lizards (Lacertilia)

Snakes (Serpentes)

5.4 Disruption of Socio-economic Environment

5.4.1 Socio-Economic Setup in Jacobabad, Shikarpur and Kashmore districts

5.4.1.1 Overview

Sindh is the second largest province of Pakistan. The neighbouring regions are Baluchistan to the west and north, Punjab in the north, Rajasthan (India) to the east and the Arabian Sea and Gujarat (India) to the south. The province forms the lower Indus basin and lies between 23º and 28º North latitudes and 66º and 71º East longitudes. It is about 579 km in length from north to south and nearly 442 km in its extreme breadth (281 km average). It spread over an area of 140,914 km². Jacobabad District is a part of Larkana Division.

5.4.1.2 Administrative Setup of three Districts

The administrative setup of the districts are similar to the other districts of Pakistan. District administration is headed by the Deputy Commissioner (DC) who is assisted by heads of other departments. The DC is responsible for the coordination of functions of all the departments in the district. The main district departments include: district administration body, judiciary, police, education, health, communication and works, agriculture, forestry, irrigation, telecommunication, livestock and fisheries. The head of district department is responsible for the performance of his department and is generally designated as the Deputy Director or District Officer. On the judicial side, the Deputy Director/Officer is assisted by an Additional District Magistrate and on the revenue side by an Assistant Deputy Commissioner.

5.4.1.3 Population, Health and Education Facilities in Three Districts

District of Jacobabad's population according to census survey 2017 is 1,006,297 which is almost 2.1% of Sindh's population of about 47.9 million. 70% of Jacobabad's population resides in rural areas and 30% resides in the urban areas. Jacobabad's population comprises of 515,480 males and 490,778 females with 51% and 49% of the district's population respectively. District of Jacobabad spans over an area of 2,771 sq. km which is 2.0% of Sindh's total area of 140,914 sq.km. The population density of the district is 363/sq.km. District Jacobabad comprises of 3 talukas, namely: -Ghari Khairo Taluka, -Jacobabad Taluka, and-Thul Taluka.

District of Shikarpur's population according to census survey 2017 is 1,231,481 which is almost 2.6% of Sindh's population of about 47.9 million. 75.4% of Shikarpur's population resides in rural areas and 24.6% resides in the urban areas. Shikarpur's population comprises of 634,985 males and 596,477 females with 51.6% and 48.4% of the district's population respectively. District of Shikarpur spans over an area of 2,577 sq. km which is 1.8% of Sindh's total area of 140,914 sq. km. The population density of the district is 478/sq.km.

District of Kashmore-Kandhkot's population according to census survey 2017 is 1,089,169 which is almost 2.3% of Sindh's population of about 47.9 million. 77% of Kashmore-Kandhkot's population resides in rural areas and 23% resides in the urban areas.

Kashmore-Kandhkot's population comprises of 564,843 males and 524,307 females with 52% and 48% of the district's population respectively. District of Kashmore-Kandhkot spans over an area of 2,551 sq. km which is 1.8% of Sindh's total area of 140,914 sq. km. The population density of the district is 427/sq. km. District Kashmore-Kandhkot comprises of 3 talukas, namely: Kandhkot Taluka, Kashmore Taluka, and Tangwani Taluka.

Health and Education Facilities of the three Districts have been presented in the Table 5.13.

Table 5.13: Population Health and Education Facilities in Three Districts

Description	Jacobabad	Shikarpur	Kashmore
Population			
Population	1,006,297	1,231,481	1,089,169
- Rural	709,170(70.0%)	928,232(75.4%)	835,556(77.0%)
- Urban	297,127(30.0%)	303,249(24.6%)	253,613 (23.0%)
Households	177,867	207,555	185,143
- Rural	125,341 (70.0%)	155,902 (75.4%)	140,872 (76.0%)
- Urban	52,526 (30.0%)	51,653 (25.0%)	44,271 (24.0%)
Health			
Basic Health Units	27	36	25
Rural Health Units	3	9	4
Dispensaries	45	102	45
Government	8	13	31
Semi Government	2	2	0
Local Bodies	23	15	13
Private	12	72	1
Education			
Schools	1,555	1,374	1,681
Boys School	200	337	237
Girls School	248	190	233
Mixed School	1,107	847	1,211
Teacher by Gender			
Male Teacher	82.2%	64.6%	70.7%
Female Teacher	17.8%	35.4%	29.3%

Source: Government of Pakistan, Pakistan Bureau of Statistics, Population Census, 2017.

5.4.1.4 Role of Women in the three Districts

The women particularly in the rural areas have fewer rights in all the aspects of their lives. The literacy data clearly corroborates this, and indicates that compared to men, the women are far behind in education, which is a key development indicator. Furthermore, this disparity is more generally prominent in the rural communities. The rural female literacy is quite low in all districts of the project area.

Women in most rural communities in the project area equally participate in livelihood activities along family lines. However, there exists a difference in mobility between Muslim and Non-Muslim women. Women from non-Muslim community work in the field right from the weeding to the harvesting. These women also receive money from farmers at the harvest; as such they are equal work sharers with men. While the Muslim women only work in the field at the harvest time. They do not frequency visit fields for work at any other time during the year. Almost in all of the project area, women role in decision-making is also negligible. They mostly remain subordinate to men throughout their lives regarding important decisions concerning them and the family. Unmarried girls are preferred to stay at home or work in fields. Usually, they are married at an early age. Exchange marriages are a common feature in the rural communities. Women's household role is taken for granted. Since their work inside the house and in the fields goes largely unpaid, they cannot assert economic independence and this affects their status to a large extent. Agriculture economy in the villages and cultural values discouraging women mixing with men hamper women's access to the markets. Therefore, men get control on all capital, monetary and productive resources.

The women of the project area have no any role in the decision making such as marriage of children, sale and purchase of property, sale and purchase of animals, decision regarding schooling of children and to attend social events. It was found during the field survey that the oldest male member of the family has the power of decision making and he determines the family.

Figure 5.11: Women Consultation in the Project Area

Note: *A detailed Socio-economic survey report with stratified sampling survey of the impacted areas for the project have been Annexed as Annexure 1 of this report.*

PUBLIC CONSULTATION AND PARTICIPATION

6 PUBLIC CONSULTATION AND PARTICIPATION

6.1 Overview of Consultation

The purpose of holding consultations is to share relevant information on the project interventions including potential environmental and social, (positive and negative) impacts with stakeholders. The consultation process consisted of dialogue with the stakeholders. Project Affected People (PAPs) and stakeholders are generally able to understand the implications of the project activities.

The present ESIA has been prepared by consultations with local communities, non-governmental organizations (NGOs) and concerned government departments/ organizations. This included Forest Department, Wildlife Department, Revenue Department and Fisheries Department. Their views and concerns have been taken into account in the study. This is also in compliance with the requirements of the World Bank (ESS 10 Stakeholder Engagement and Information Disclosure) and ADB Safeguard Policy Statement 2009. These documents give high priority to public consultation and participation in designing and implementation of a socially and environmentally compliant project.

6.2 Identification of Stakeholders

According to ADB "Stakeholders are those who have a direct interest in project development, and who will be involved in the consultative process". Therefore, the first step in developing a plan for consultation and participation is to identify the primary and secondary stakeholders.

6.2.1 Primary Stakeholders:

"Primary stakeholders include the people affected, the beneficiaries of the project, the host populations at any planned resettlement sites, and the implementing agency".

In this Drainage Project the primary private sector stakeholders are those who lost their lands, crops, trees, homes, etc.

In public sector, primary stakeholder is WAPDA through its implementing agency of the project.

6.2.2 Secondary Stakeholder:

"Secondary stakeholders are other individuals or groups with interest in the project, such as local or national government, policy makers, advocacy groups, elected officials, and NGOs".

In Jacobabad, Shikarpur and Kashmore drainage project, private sector secondary stakeholders are other individuals or groups with interest in the project such as: indirect affectees; local elected or community representatives including Jirgas and religious leaders; advocacy groups; and NGOs.

The following public sector entities also fall under this category:

- District Administration of three districts.
- Union Councils.
- Irrigation Department Government of Sindh.
- Forest Department.
- Wildlife Department.
- Pakistan Railways.
- Agriculture Department including Fishery.
- Local Govt. and Rural Development Departments.
- NGOs in the Project Area.

6.3 Consultation with Client and Officials of Sindh Government

Meetings with institutional stakeholders like government departments were held to discuss project interventions and their potential impacts on the local communities and environment. In these meetings, government officials were informed about the salient features of the project such as Project components, activities and main environmental impacts, Needs, priorities and reactions of the affected people. Environmental problems of the area, participation of the PAPs in the resettlement planning, grievances redress mechanism/ procedure, entitlement matrix development for the project affectees. evaluation criteria for the buildings/structures going to be affected, basis for determining the compensation rates of the land, houses, and other infrastructure, compensation framework for the project affectees, compensation criteria to be followed for the payment, role of the affectees in Project implementation and general socio-economic issues. Name of officers, designation, departments, contact numbers and discussions outcome are given below:

Honorable GM., Mr. Masood Ahmed Soomro discussed regarding the progress of the Project

Honorable GM., Mr. Masood Ahmed Soomro discussed regarding the environmental and social issues. He instructed to drainage engineer for avoiding the resettlement and cultural heritage sites from the RoW of the proposed drains.

WAPDA OFFICE SUKKUR	
Date	
Venue	Office of The Chief Engineer, WAPDA Sukkur.
Name of Officer	Mr. Azizullah Jamali
Designation	Project Director
Contact No.	0333-7070177
Discussion Outcome	He was briefed about the project activity showing through design & google maps during the field visit.

WAPDA OFFICE SUKKUR	
Date	17 February 2023.
Venue	WAPDA Guest House Sukkur.
Name of Officer	Mr. Faisal Ali Qureshi
Designation	Project Director (Ghotki Drainage Project)
Contact No.	-
Discussion Outcome	He was also briefed about the project activity showing through design maps during the field visit conducted on 13th February to 17th February 2023.

OFFICE OF THE CHIEF ENGINEER WAPDA SUKKUR	
Date	16th September 2022
Venue	Chief Engineer Office Sukkur.
Name of Officer	Sajjad Ahmed Abro
Designation	Director Technical
Contact No.	-
Discussion Outcome	Discussed the field visit activities and he was informed about the environmental baseline conditions of the project area.

IRRIGATION DEPARTMENT	
Date	20-12-2023
Venue	Office of The Chief Engineer, Gudo Barrage Sukkur.
Name of Officer	Mr. Mansoor Ali Memon
Designation	Chief Engineer
Contact No.	-
Discussion Outcome	Consultants' drainage engineer "Mr. Ijaz Javed" gave presentation to the Honorable chief engineer and his staff regarding the proposed drainage system. Chief engineer suggested following: 1. Areas which were badly affected during un-precedential rainfall of 2022 and 2012 should be included in the proposed drainage system. 2. Utilization of Deh maps for comprehensive understanding and precise alignment of the proposed drains All the suggestions raised by the chief engineer Guddu barrage have been addressed and included in our study.

Forest Department (District Shikarpur)	
Date	15 September 2022
Venue	Sukkur
Name of Officer	Mr. Zubair Ahmad Memon
Designation	District Forest Officer (DFO)
Contact No.	0331-2743153
Discussion Outcome	Environmental expert shared the details of the project and enquired the forest department stance. As per the forest officer in this region no forest area falls in the RoW of the proposed drains. However, 5925 mature trees would be cut. All trees are in the private land. He stressed to pay fair compensation to the tree owners.

Agriculture Department (District Shikarpur)	
Date	14 September 2022
Venue	Agriculture Office, Shikarpur
Name of Officers	Mr. Naveed Ali Shah Mr. Muzaffar Ali Abbasi.
Designation	Agriculture Officers.
Contact No.	0302-3650524, 0300-2352825
Discussion Outcome	Agriculture officers informed that "rain and flood destroyed the standing crops in the entire project area". Further commented that the shortage of water continues to be one of the most important threats to crop growers around the project area. In this meeting agriculture expert of the consultants shared the cost of agricultural improvement which have been proposed in the project cost and demanded the schemes for improving the agricultural development of the area.

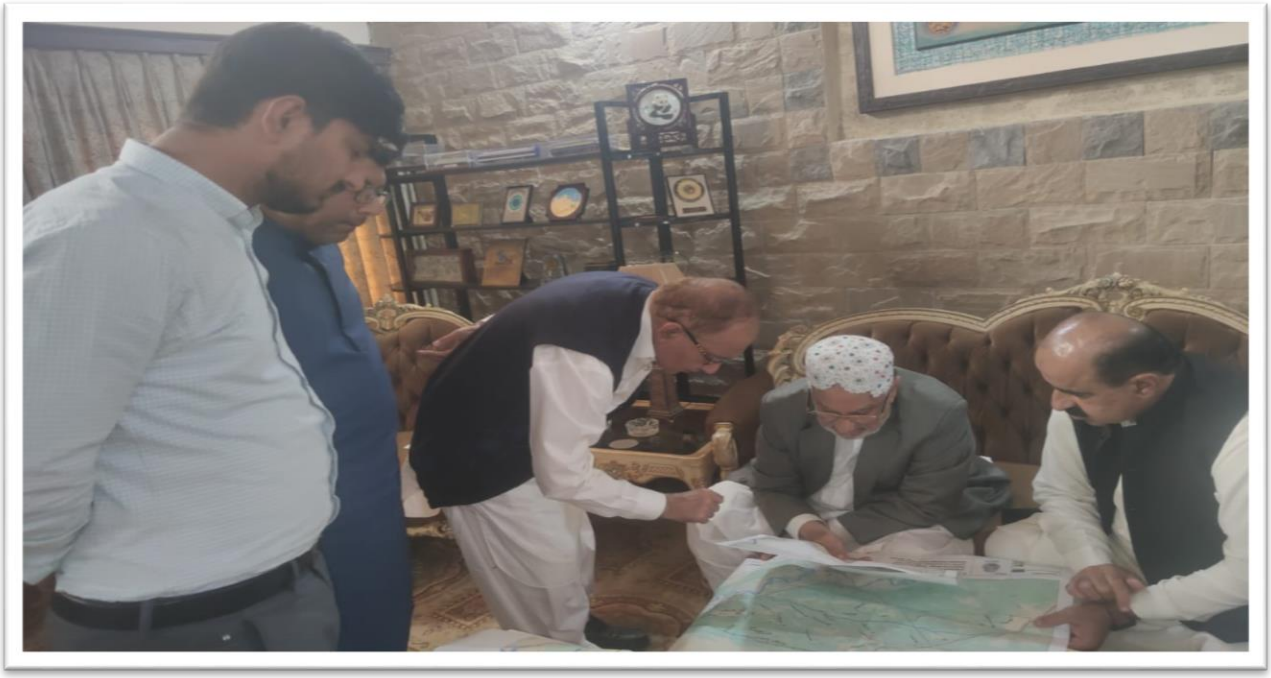
Wildlife Department (District Shikarpur)	
Date	14 September 2022
Venue	Shikarpur City
Name of Officer	Mr. Inayat Ullah Hakro
Designation	Head Clerk
Contact No.	0333-7131258
Discussion Outcome	Endangered species and Wildlife sanctuaries in the project area were discussed during the meeting. The Head Clerk provided the list of local wildlife animals.

Agriculture Department (District Kashmore)	
Date	13th September 2022
Venue	Agriculture Office, Kashmore
Name of Officer	Ali Gohar Mirani
Designation	Agriculture Officer (Focal Person)
Contact No.	0300-9316886
Discussion Outcome	Ali Gohar Mirani informed about the agriculture practices and marketing facilities in the project area. He told us that "agriculture belt of district Kashmore has come under

	rain/flood water and local characteristics of land and amount of water available for agriculture is strongly affecting the livelihood of the communities.	
Agriculture Department (District Shikarpur)		
Date	14 September 2022	
Venue	Agriculture Office	
Name of Officer	Mr. K. B Kalwar	
Designation	Agriculture Officer	
Contact No.	0333-7171473	
Discussion Outcome	Agriculture officer informed about the agriculture practices in the project area. Furthermore, he informed about the increasing of water logging and salinity in the project area.	
Revenue Department (District Kashmore)		
Date	13 September 2022	
Venue	Office of the Assistant Commissioner	
Name of Officer	Mr. Raza Ali Soomro	
Designation	Assistant Commissioner	
Contact No.	0333-7103769	
Discussion Outcome	He was briefed about the project area with proposed drains. Assistant Commissioner showed full support in this proposed project. He also provided rates of the land and other information regarding the project area.	
Wildlife Department (District Kashmore)		
Date	13 September 2022	
Venue	Wildlife Office, Kashmore	
Name of Officer	Mr. Abdul Jabbar	
Designation	Wildlife Focal Person	
Contact No.	0300-9316886	
Discussion Outcome	Mr. Abdul Jabar informed about the birds found in the District Kashmore.	
Agriculture Department (Divisional Headquarter Larkana)		
Date	15 September 2022	
Venue	Agriculture Office	
Name of Officer	Mr. Lal Dino Junejo Mr. Asad Ullah Solangi	
Designations	Director and Deputy Director.	
Contact No.	0300-3426824, 0302-3615390	
Discussion Outcome	Discussed present agriculture problems and future development prospects in the wake of climate change challenges in the project area.	

Revenue Department	
Date	15,16,17 December, 2023.
Venue	Office of the Deputy Commissioner, Jacobabad.
Name of Officers	Mr. Abu Bakar, Mr. Raza Ali Malik Mr. Zaffar Ali Jakhrani Mr. Aamir Bhutto
Designations	P/S Deputy Commissioner, Jacobabad, Mukhtiarkar Tehsil Jacobabad, Mukhtairkar Shikarpur Mukhtairkar Garhi Khairo
Contact No.	
Discussion Outcome	Discussed regarding the rate list of the land and infrastructure falling in the RoW of the proposed drains.

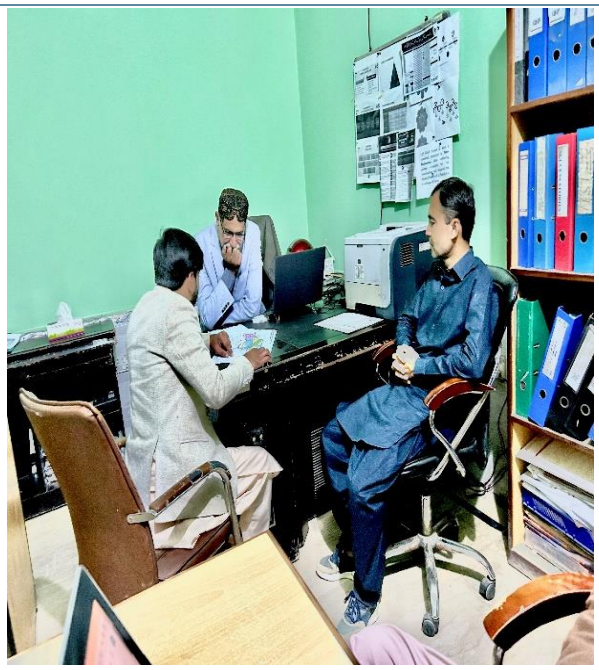
6.3.1 Photographs during Consultation with Government Officials



Consultation with Member National Assembly (MNA) Mr. Ghous Bux Khan Mahar regarding the Drain Project

6.3.2 Consultation with Non-Governmental Organizational (NGO) Officials

To enhance the community participation and affected persons' consultation, it is necessary to involve representative of various stakeholders particularly the NGOs involved in project tasks, committees and decision making at various stages. Environmental team conducted meetings with NGOs working at the project area.

AL- SHIFA TRUST (Providing Services): • Free of cost Installation of Hand pumps at villages • Cash Funding to needy persons.	
Date	14-2-2024
Venue	Al-Shifa-Trust, Jacobabad City.
Name of Official	**Mr. Ahmed Muheed**
Designation	Human Resource Officer
Contact No.	0347-8388316-
Discussion Outcome	Discussed about the project salient features such as project location, components, activities and man environmental impacts.
COMMUNITY DEVELOPMENT FOUNDATION (Providing Services): • Emergency response to immediate needs of flood affected population in District Jacobabad, Sindh Pakistan • Inclusive Humanitarian Response to meet urgent lifesaving needs of flood affected people	
Date	14-2-2024
Venue	Office of The Community Development Foundation Jacobabad City
Name of Officials	**Mr. Shabir Ahmed** (Program Manager) **Mr. Noman Ahmed** (Project Coordinator)
Designation	Program Manager
Contact No.	0300-9112179 0331-3174976
Discussion Outcome	Discussed about the project salient features such as project location, components, activities and main environmental issues.
INTERNATIONAL RESCUE COMMITTEE	
Date	15-2-2024
Venue	Office of The International Rescue, Committee Jacobabad
Name of Officials	**Sana Ullah Khan Kakar** Project Director **Haider Ali Lashari** Project Coordinator
Designation	Project Director
Contact No.	0333-8722648 0346-6734194
Discussion Outcome	Discussed about the project salient features such as project location, components, activities and main environmental issues.

ISLAMIC RELIEF PAKISTAN (NGO)	
Date	15-2-2024
Venue	Office of The Islamic Relief Pakistan
Name of Official	**Mr. Sulaiman**
Designation	**Project Manager**
Contact No.	0333-6546040
Discussion Outcome	Discussed about the project salient features such as project location, components, activities and main environmental issues.

6.4 Consultation with Affectees (Primary Stakeholders)

Extensive consultations were carried out through informal meetings in the project area, covering issues related to Environmental and Social aspects. The consultation exercise was conducted in Sindhi and Saraiki Languages. Environmental expert initiated the sessions by giving a brief, simple and non-technical description of the project providing an overview of all likely positive and negative impacts. List of participants with name, profession, CNIC and contact numbers are given in Table 6.1.

Table 6.1: List of Affectees for Proposed Main, Branch and Sub Drains

Sr. No.	Name of Affectees with Fathers	Profession	CNIC	Contact No.
Affectees of Manjhi Pur Drain 1 & Manjhi Pur Drain 2 (Village Mir Abbas Khan Jakhrani and Ghulam Qadir Lashari) Disposed of into Desert Canal District Jacobabad				
1.	Dr. Shoabab Dahani	Doctor		0302 3104981
2	Chakar S/o Khameso	Farmer	43502 0380827-5	0302-3159612
3	Qurban S/o Khameso	Farmer	43103 9562767	0307-3611312
4	Qaloo khan S/o Muhammad Salah	Farmer		0315 9352171
5	Sain Bux S/o Qabil	Farmer		0315 9352171
6	Sajad S/o Ghulam Qadir	Landlord (14 acre)		0302 1525607
7	Muhammad Ali S/o Mehboob	Farmer	43502 042602-1	0304 8011687
8	Muhammad Ali S/o Qadir Dad	Landlord (150 acre)	43103 4676466-1	0301 3972738
9	Darya Khan S/o Jahaanwar	Farmer		0306 374072
10	Ghulam Qadir S/o Dostain	Farmer	43103 9916002-5	0306 2894169
11	Imam din S/o Mandhra	Farmer		0306 2894169
12	Raza Muhammad S/o Muhammad Hashim	Farmer	43503 0380788-1	0300 4615702
13	Ameer Bux S/o Hadan	Farmer		0302 2160403
14	Ali Bux S/o Bag Ali	Farmer	43502 0452621-7	0302 2160403
15	Lakhmir S/o Sohbat Khan	Farmer	43105 2253292-3	0308 3898359
16	Muhbat S/o Bakht Ali	Farmer	43105 7160693-1	0307 1663789
17	Shabir Ahmed S/o Manzoor	Farmer	43105 2306110-9	0333 7289928
18	Sharbat Khan S/o Sohbat Khan	Farmer	43105 2285771-7	0307 3284515
19	Asghar Ali S/o Zulfiqar Ali	Landlord (15 acre)	43105 7015821-5	0300 3175429
20	Mashooq Ali S/o Haji Allah Dino	Landlord (70 acre)	43504 0402650-3	0312 821230
21	Naseer Ahmed S/o Ali khan	Farmer	43105 0539446-5	0306 3732017
22	Abdul Sattar S/o Mehrullah	Farmer	43105 8729573-5	0306 3486710
23	Ali Hasan S/o Abdul Rehman	Farmer	43105 2939932-3	0300 2701703
24	Faqir Muhammad S/o Rozi	Hari	43105 418285-3	0307 2061913
25	Akhtiar Ahmed S/o Muhammad Sadiq	Hari	43105 3857122-9	0308 3690023
26	Azlan Khan S/o Gous Bux	Hari	55103 0119333 9	0304 3574311
27	Arshad S/o Raheem Bux	Landlord (7 acre)	43102 6829955 1	0307 6993689

Sr. No.	Name of Affectees with Fathers	Profession	CNIC	Contact No.
28	Zafar Ali S/o Karam ullah	Farmer	43105 5457706-5	0310 3420338
29	Munsif Ali S/o Gul Bahaar	Farmer	43105 6164030-7	0305 8443708
30	Aleem S/o Raheem Bux	Landlord (7 acre)	43102 7626399 3	0307 6993689
31	Bahram S/o Habibullah	Landlord (40 acre	43102 2242323 5	0332 2856475
32	Muhammad Ayob	Retired Teacher	43102 2470432-7	0333 734514
33	Ejaz S/o Habibullah	Landlord (20 acre)	43102 1417952 9	0331 2378969
34	Imdad Hussain S/o Hidayatullah	Farmer		0333 7332377
35	Rashid Ali S/o Saindad	Farmer	43105 8228994-3	0310 1391282
36	Aziz ullah S/o Arbelo	Farmer	43105 8119434-9	0320 1826436
37	Shahnawaz S/o Shoban	Farmer	43101 5835764 9	0322 3565711
38	Shaman Ali S/o Ali Gul	Farmer	43101 2504407-9	0306 3610587
39	Mahwal S/o Pahlwan Burro	Office Boy	43105-4641131-5	03012609672
40	Lakh Mir S/o Jamwar Jafferi	Farmer	43502-0376213-7	03003922137
Affectees of Begari Drain-1 & Begari Drain-2 (Village Ghari Syed, Mubarikpur and Haji Ahmad Bhangwar) Disposed of into Begari Canal Districts Jacobabad, Shikarpur and Kashmore				
1	Shahnawaz S/o Imamdin	Farmer	43302 4033881 7	0302 2781537
2	Ghulam Qadir S/o Sukhio	Farmer		0302 27811537
3	Muhammad Zaman	Farmer		0308 7686350
4	Mumtaz Pahanwar	Farmer		0302 3158705
5	Momin Zaman			0308 7686350
6	Gous Bux	Farmer		0321 028043
7	Ali Nawaz	Landlord (20 acre)		0311 3515245
8	Muhammad Nawaz S/o Gulzar	Landlord (10 acre)		0306 3105915
9	Imtiaz Ali S/o Mir Niaz Ali	DFO		0300 5037138
10	Ghulam Nabi Soomro	Forest guard		0305 7633095
11	Ghulam Yaseen S/o Chowedha	Landlord (10 acre)	43302 5733801 5	0306 3392926
12	Khadim Hussain S/o Nadir	Farmer	43302 6485822 3	0308 3376595
13	Ali Hasan S/o Nadir	Farmer	43302 3232 44 9	0304 8445696
14	Nadeem Khan S/o Nabi Bux	Landlord (5 acre)	43302 4232143 3	
15	Muhammad Ashraf S/o Noor Hidayat	Farmer	43302 9196540 3	
16	Abid Ali S/o Hazoor Bux	Farmer	43302 5535779 9	
17	Ali Hasan S/o Naseer Muhammad	Landlord (10 acre)	43302 5120589 7	0300 3172110
18	Molo Khan S/o Muhabat Khan	Farmer		0300 3152468
19	Wazir Ahmed S/o Abdul Rehman	Farmer	43302 2578062 9	0303 9658847
20	Mirzain S/o Khush Muhammad	Landlord (5 acre)	43302 3720216 3	0307 8236802
21	Muhammad Azeem S/o Habibullah Shah	Farmer		0343 3875036
22	Kareem Bux S/o Gous Bux	Driver		0306 2132558
23	Ali Sher S/o Bahar Pahanwar	Landlord (5 acre)		0348 2533829
24	Ali Gul S/o Bahar	Landlord (5 acre)		0348 2533829
25	Mashooq Ali S/o Mahboob Ali Unnr	Farmer		0309 3504822
26	Hakim Ali S/o Shahzoar	Landlord (5 acre)	43302 9661516 7	
27	Sodho Kamaloni Jatoi	Landlord (100 acre)	43302 2753208 3	
28	Shahzado S/o Mir Muhammad	Landlord (5 acre)	43302 5671228 9	
30	Mahrab Shar S/o Ali Gohar Shar	Farmer	43302 6951478 1	
31	Mir Muhammad S/o Rasheed Bhayoo	Landlord (5 acre)	43302 7122247 7	0303 5525239
32	Gul Hasan Shar S/o Horaan Shar	Landlord (5 acre)	43402 0260692 7	0307 2467419
33	Banbhoar S/o Allah Yaar	Landlord (5 acre)	43302 6843017 1	0307 2467419
34	Bakhshal S/o Din Muhammad	Landlord (5 acre)	43302 9788345 7	

Sr. No.	Name of Affectees with Fathers	Profession	CNIC	Contact No.
35	Shoban S/o Ali Gohar	Landlord (5 acre)	43302 1219261 3	0307 2719232
36	Pir Bux Shar S/o Horaan	Landlord (5 acre)	43302 7431929 7	
37	Ghulam Abbas S/o Pahlwan	Farmer	43105-0687361-9	030038973619
38	Muhammad Salah S/o Nawab khan	Land Lord (80 acre)	43105-4329302-5	03012650875
39	Aman Ullah S/o Abdul Raazaq	Farmer	43302-13595502-3	0304-3383868
40	Allah Dino S/o Mehbob Ali	Farmer	43302-0961533-1	0309-3505010
41	Muhammad Punjal S/ Muhammad Waqas	Farmer	43302-3753467-1	0304-3383868
42	Abdul Ghaffar S/o M Ishaq	Land Owner (40 acre)	43302-51634879-1	0325-58416624
43	Abdul Gafoor S/o Mehbob	Farmer	43303-3896941-8	0326-352331-5
44	Abdul Raheem S/o Abdul Gafoor	Farmer	43302-0151865-5	Nil
45	M Mithal S/o Mahbob	Farmer	43302-241422-5	0305-228272-9
46	Raiz Ahmed S/o Mehbob	Farmer	43302-3245514-3	0305-228272-9
47	Muhammad Hayat S/o Manthar	Farmer	43302-8454248-1	0307-228272-9
48	Jeand Ali S/o Abdul Raazaq	Landlord (100 acre)	43302-5675305-9	0308-380894-6
49	Abdul Kareem S/o Abdul Gafoor	Farmer	43302-3861655-9	0308-380894-6
50	Ashiq Ali S/o Nazar Muhammad	Farmer	43302-1725704-7	0306-362956-1
51	Shah Bux S/o Gul Bahar	Farmer	43304-844160-7	0306-362956-1
52	Ali Gul S/o Lakhmeer	Farmer	43302-9021575-7	0301-284758-7
53	Meer Muhammad S/o Ali Gul	Farmer	43302-0344828-9	0303-059321-4
54	Mashooq Ali S/o Meer Muhammad	Farmer	43302-9718683-7	0304-812787-9
55	Nadir Ali S/o Hakim Ali	Farmer	42401-2477808-9	0306-382398-2
56	Hakim Ali S/o Muhammad khan	Farmer	42401-2477808-9	0306-382398-2
57	Muhammad khan S/o Hakim Ali	Farmer	53402-9560848-1	0300-284586-2
58	Muhammad Irfan S/o Lakhmeer	Farmer	43302-9909459-1	0304-576541-5
59	Manthar S/o Muhammad Murad	Farmer	43302-2638879-9	0302-364246-9
60	Muhammad Gul S/o Meer Muhammad	Farmer	43302-4899940-1	0306-334038-1
61	Wazir Khan S/o Kareem Bux	Farmer	43302-3957052-3	0306-337306-6
62	Qameer Din S/o Naik Muhammad	Farmer	43302-1825253-9	0345-381752-0
63	Abdul Hakeem S/ Muhammad Ibrahim	Farmer	43302-4768404-1	0308-3681982-1
64	Dilshad S/o Qabil	Farmer	43302-4150154-3	0326-259864-6
65	Wakeel S/o Qabil Pahwar	Farmer	43302-4151104-3	Nil
66	Nadir Ali S/o Hakim Ali	Farmer	42401-2477808-9	0306-382398-2
67	Hakim Ali S/o Muhammad Khan	Farmer	42401-6242969-3	0307-3740300
68	Muhammad Irfan S/o Lakhmeer	Farmer	43302-2638879-9	0304-576541-5
69	Muhammad Gul S/o Meer Muhammad	Farmer	43302-4899940-1	0306-334038-1
70	Wazir Khan S/ Kareem Bux	Farmer	43302-3957052-3	0306-337306-6
71	Qameer Din S/o Naik Muhammad	Farmer	43302-1825253-9	0345-381752-0
72	Abdul Hakeem S/o M Ibrahim	Farmer	43302-4768404-1	0308-368198-2
73	Dilshad S/o Qabil	Farmer	43302-4150154-3	0326-259864-6
74	Wakeel S/o Qabil Pahwar	Farmer	43302-4151104-3	Nil
75	Taj Muhammad S/o Jani	Farmer	43302-1687900-3	Nil
76	Ghulam Sarwar S/o Ali Muhammad	Farmer	43302-6701361-3	0302-317726-9
77	Manzoor Ali S/o M salah	Farmer	43302-0833088-5	0307-360637-5
78	Manzoor Ahmed S/o Khair Muhammad	Farmer	43302-2865115-5	0322-812273-6s
79	Allah Wasayo S/o Khair Muhammad	Farmer	43302-5103339-3	0327-2460538
80	Khair Muhammad S/o Allah Wasayo	Farmer	43302-3104507-5	0307-360637-5
81	Hazar khan S/o Khadim Hussain	Farmer	43302-7199026-7	Nil

Sr. No.	Name of Affectees with Fathers	Profession	CNIC	Contact No.
82	Sikandar S/o Malik	Farmer	43302-2459306-5	0326-937166-2
83	Imdad Allah S/o Sanwal	Farmer	43302-6206108-5	0306-304559-7
84	Muhammad Bux S/o Aman Ullah	Farmer	43302-5744686-9	0304-337556-7
85	Ghulam Nabi S/o Muhammad Umer	Farmer	43302-3308448-1	0306-329766-3
86	Badur Al Den	Farmer	43302-8787714-7	0308-200259-9
87	Allah Bux S/o Jinjor	Farmer	43302-558545-0	0309-359349-3
88	Sana Ullah S/o Ghous Bux	Farmer	43302-7121908-3	0308-328331-5
89	Abdul Rehman S/o Lal Muhammad	Farmer	43302-4213916-9	O304-030570-1
90	Noor Din S/o Lal Muhammad	Farmer	43302-3184277-5	Nil
91	Hazar Khan S/o Sanwal	Farmer	43302-0815864-3	0301-6393457-9
92	Sadar Al din S/o Ghuniyo	Farmer	43302-8130820-3	0303-378892-2
93	Atta Muhammad S/o Ghous Muhammad	Farmer	43302-3916268-5	Nil
94	Nizam AL Din S/o Lal Muhammad	Farmer	43302-0846860-1	Nil
95	Muhammad Bux S/o Aman Ullah	Farmer	43302-5744686-9	0304-337556-7
96	Nazeer Ahmed S/o Khamiso Khan	Farmer	43503-0376660-3	0301-239218-6
97	Ali Shah S/o Muhammad Azeem Shah	Farmer	43503-0496693-9	0307-761073-4
98	Muhammad Haneef Shah S/o Faisal Shah	Farmer	43503-0501290-3	0308-112889-0
99	Basheer Ahmed S/s Shah Moor	Farmer	43103-5681601-5	0301-397300-2
100	Ameer Bux S/o Shah Moor	Farmer	43502-0346128-9	0305-801101-6
101	Dildar Shah S/o Mehar Shah	Farmer	43103-1394428-9	0301-1394428-9
102	Muhammad Rafique S/o Muhammad Sadeeq	Farmer	43406-0472870-5	0340-214436-8
103	Mehboob Ali S/o Muhammad Arif	Farmer	43206-400610-1	0333-750720-8
104	Qurban Ali S/o Muhammad Umer	Farmer	43206-2084578-9	0307-863110-2
105	Irfan Ali S/o Qurban Ali	Farmer	43406-0489956-5	0325-261936-7
106	Rasool Bux S/o Muhammad Umer	Farmer	43206-2084556-3	0305-915974-6
107	Ghulam Mustafa S/o Muhammad Umer	Farmer	Nil	0304-752884-8
Affectees of Bhurgri Drain, Dad Pur Drain, Miran Pur Drain, Shahdad Kot Drain (at Village Miran Pur, Bhurgri and Shahu Jamali) Disposed of into RBOD-III Drain Districts Shikarpur, Larkana, Jacobabad and Shahdad Kot				
1	Aslam S/o Ali dost	Farmer		0302 2355317
2	Shabir Ahmed S/o Hazoor Bux	Land Lord (6 acre)	54400 2051927 9	0303 7672949
3	Asghar S/o Kundhar	Farmer	43101 3962027 9	0303 2723920
4	Wajid S/o Faiz Muhammad	Farmer		0303 0965610
5	Ghulam Shabir S/o Muhammad Akram	Farmer		0303 0965610
6	Bahadur S/o Haji Sawali	Landlord (25 acre)	43102 4851341 7	0324 3308069
7	Azad S/o Muhammad Bachal	Landlord (13 acre)	43102 8686691 7	0306 6552617
8	Abdul Hameed S/o Shaik	Landlord (7 acre)	43102 5673333 7	0306 6552617
9	Saleem S/o Nawab	Landlord (8 acres)	43102 9858433 1	0302 1389824
10	Qurban S/o Faujo	Farmer		0302 1389824
11	Raza Muhammad S/o Sukhio	Farmer	43102 8682493 3	0307 5707723
12	Nazaam ul Din S/o Raza Muhammad	Farmer	43102 8215197 7	0307 5707723
13	Ali Murad Mugari S/o Abdul Khaliq	Farmer	43102 6862955 9	0306 3392021
14	Eidan S/o Khawand Bux	Landlord (5 acre)	43102 5924415 7	0308 3881546
15	Gevand Bux S/o Eiden	Landlord (5 acre)	43102 4573089 9	0308 3881546
16	Juman Khan S/o Khawand Bux	Landlord (5 acre)	43102 3841627 7	
17	Ali Haider	Farmer	43102 6628652 9	
18	Muhammad Ali S/o Muhammad Umar	Farmer	43102 0467398 1	
19	Abdul Kareem S/o Muhammad Mureed	Landlord (6 acre)	43102 8244094 9	0304 3231770
20	Muhammad Iqbal	Farmer	43102 5633084 1	

Sr. No.	Name of Affectees with Fathers	Profession	CNIC	Contact No.
21	Gul Bahar	Farmer	43102 6762155 5	0303 0731615
22	Bahadur Khan	Farmer	43102 4102280 3	0324 3479198
23	Faqir Muhammad	Farmer	43102 8225995 9	0343 3505117
24	Shaman Ali	Farmer	43102 1469365 5	
25	Nawab	Farmer	43102 16313083	0303 3023908
26	Muhammad Ishaq	Farmer	43102 4094276 9	0303 3023908
27	Nadeem Ahmed	Farmer	43102 9008881-5	0303 3023908
28	Mehboob	Farmer	43102 2374507 9	0303 3023908
29	Khair bux S/o Saindad	Landlord (5 acre)		0324 3479198
30	Gani S/o Ajab	Farmer		0324 3479198
31	Rab Nawaz Chachar S/o Altaf	Farmer		0324 3479198
32	Noor Ali	Farmer		0324 3479198
33	Bahar	Farmer		0324 3479198
34	Gul Bahar	Farmer		0324 3479198
35	Mukhtiar	Farmer		0324 3479198
36	Kareem Bux	Farmer		0303 3023908
37	Shoukat	Farmer		0303 3023908
38	Dilber	Farmer		0303 3023908
39	Mian Bux S/o Murad Bux	Farmer	43206-3000668-7	Nil
40	Gul Hussan S/o Pir Bux	Farmer	43406-0401575-7	Nil
41	Arbab S/o Wahid Bux	Farmer	43206-2087377-1	Nil
42	Ustad Haji Fazal Muhammad S/o Nabi Bux	Rt. Headmaster Land (50 acre)	43101-2770715-3	03453964276 03033881485
Affectees of Jacobabad Drain (at Village Ghulam Qadir Lashari, Madad Pur and Bahadurpur) Disposed of into Hair din drain.				
1	Aurangzaib S/o Mir Baig	Patwari/Tapadar	43104 5503601 7	0341 3946757 0303 3752562
2	Nabi Dad S/o Mola Bux	Land Lord (1200 acre)	43304-8828972-5	0306-3173872
3	Ali Jaan S/o Lal Muhammad	Security Karachi	Nil	03097663887
4	Fatah Muhammad S/o Shakeel Khan	Farmer	43304 3772610-3	0345 3942729
5	Bohram Khan S/o Budho	Farmer	53203 0895465-9	0346 3157913
6	Ranjhan S/o Shakeel Khan	Farmer	43304 8070214-5	0346 8231162
7	Irfan Ali S/o Sikandar Ali	Farmer	43304 1372412-9	0309 3356514
8	Muhammad Sharif S/o Bohram Khan	Farmer	53503 0340827-1	0346 3157913
9	Huzoor Baksh S/o Juma Khan	Farmer	43102 4219388-1	0342 3967934
10	Gulshan S/o Mehdi	Farmer	43101 0170699-9	0340 3573136
11	Bilawal S/o Ramzan	Farmer	43304 9015303-1	0343 2748085
12	Altaf Khan S/o Muhammad Panah	Farmer	43102 4942615-3	0324 2983934
13	Hidayat ullah S/o Arz Muhammad	Farmer	43302 2359412-1	0307 3359694
14	Zakir Ali S/o Shaman Ali	Farmer	43103 3492862-9	0316 3326578
15	Gull Bano D/o Ali Gul (Ladies)	Farmer	43101 1472145-4	0306 3610587
16	Marvi D/o Ali Wahid (Ladies)	Farmer	43101 8318267-4	0306 3610587
17	Himat Ali S/o Muhammad Din	Farmer	43304 2193252-3	0348 3589172
18	Waqar Ali S/o Ranjhan	Farmer	43304 1094603-5	0302 3189807
19	Rasool Baksh S/o Haji Juma	Farmer	43102 3050027-1	0300 6175976
Affectees of Doda Pur Drain, (at Village Jagan, and Doda Pur) Disposed of into RBOD-3 Districts Jacobabad and Shikarpur				
1	Muhammad Mughal S/o Arbab	Landlord (16 acre)	43101 1560307 5	0342 9735129
2	Rais Din Muhammad S/o Pir Jan	Land (40 acre)	43101 0164747 7	0345 3962430

Sr. No.	Name of Affectees with Fathers	Profession	CNIC	Contact No.
3	Abdul Rasheed S/o Eiden	Farmer	43101 9804976 3	0326 3003521
4	Allah Jurio Mirani	Landlord (5 acre)	43201 1301010 9	0342 3817935
5	Ghulam Akbar S/o Shfi Muhammad	Farmer	45102 8713613 9	0300 3197023
6	Irshad Hussain S/o Huzoor Bux	Farmer	45102 9466395 7	0310 3705793
7	Muhammad Jan S/o Mushtaq	Farmer	43301 8883535 5	
8	Fida Hussain	Farmer		
9	Abdullah	Farmer		
10	Muhammad Ali S/o Mubshar	Farmer		
11	Younas S/o Muhammad Ali	Farmer		
12	Irfan Ali S/o Muhammad Yaseen	Farmer		
13	Lala Farooq S/o Haji Fazullah	Farmer		
14	Ashiq Hussain S/o Didar Ahmed	Farmer	43406-0437464-3	Nil
15	Shaman Ali S/o Ahandal Burghuri	Farmer	43206-7539292-5	0301-532077-6
16	Aftab Ali S/o Ali Jan	Farmer	43406-0432836-5	Nil
17	Fazal Hussain S/o Mawa khan	Farmer	43406-0360234-9	0333-752992-1
18	Alim khan Jamali S/o Muhammad Usman	Land Owner (150 Acre)	43101-0137544-3	0336-36374116-7
19	Muhammad Bachal S/O Alim khan	Land Owner (60 Acre)	43101-0137544-3	0333-796642-2
20	Ali Mardan S/o M Usman	Farmer	43101-0136594-3	0304-340009-6
21	Shahban Jamali S/o Dad Muhammad	Farmer	43101-0893836-9	0307-306241-4
22	Alahi Bux S/o Muhammad Soomar	Farmer	43101-3812151-9	0308-159944-0
23	Soomar Khan S/o Alahi Bux	Farmer	53403-1450480-1	0333-582102-1
24	Ghulam Sarwar S/o Haji Bagro	Farmer	43101-1835709-5	0300-750965-1
25	Allah Ditta S/o Foaj Ali Jamali	Farmer	43101-7919910-1	0326-702645-1
26	Foaj Ali S/o Ahmed Khan	Farmer	43101-3355030-5	0326-702645-1
27	Tanveer Hussain S/o Nisar Ali	Farmer	43101-6632747-3	0305-374309-1
28	Qurban Ali S/o Shaban	Farmer	43101-4617046-9	0319-85091-7
29	Aslam Ali S/o Didar Ali Jamali	Farmer	43203-1522158-`1	0303-292144-1
30	Irfan Ullah S/o Ghulam Sarwar	Farmer	53201-3451828-7	0300-385226-9
31	Asif Ali S/o Buland Khan	Farmer	43101-5211107-3	0306-050028-5
32	Buland Khan S/o Qutab Khan	Farmer	43101-8893917-7	0300-817348-5
Affectees of Drainage Unit-13 Lakhi Branch (Rehabilitation) District Shikarpur				
1	Rahmat Ullah S/o Abdul Aziz	Landlord (100 acre)	43102-9804794-5	03158333953
2	Raja Ashiq Habib S/o Habibullah	Farmer	43102-9265429-7	03173576878
3	Shahid Ali S/o Rahmatullah	Farmer	43010-28614910-9	03173576878
4	Qudratullah S/o Abdul Aziz	Farmer	43102-1545095-5	03188223694
5	Kingi S/o Bahawal	Farmer	43102-4299865-3	03266748782
6	Muhammad Mithal S/o Bhai khan	Farmer	43302-4369601-7	03021217147
7	Jan Muhammad S/o Abdul Nabi	Farmer (5 acre)	43105-1502108-1	030249535117
8	Muhammad Ramzan S/o Sadora	Farmer	43105-3827992-7	03007038113
9	Fareed S/o Muhammad Aslam	Farmer	43301-936199-5	03022523452
10	Rahib Ali S/o Jam Ali	Farmer	43301-15167101	0300-2716563
List of Affectees of Golo Drain Badani Drain and Bhayio Drain, (at Village Soomer Khan Golo, Badani and Habit Pacco)				
1	Abdul Jabar S/o Allah Buxsh	Farmer	43103-13974820-9	0300 9316886
2	Muhammad Yameen S/o Abdul Jabar	Farmer	43502-0367442-5	0300 3972990
3	Muhammad Hussain S/o Abdul Jabar	Farmer	43502-0471018-7	0300- 9316886
4	Mazhar ul din S/o Manzoor Hussain	Farmer	43103-1400551-5	0303 3554402
5	Amjad Ali S/o Mazhar ul Din	Farmer	03502 0448572-7	0303 3554402

Sr. No.	Name of Affectees with Fathers	Profession	CNIC	Contact No.
6	Mukhtaar Hussain S/o Allah Buxsh	Farmer	03502 0360577-1	0300 9316886
7	Muhammad Buxsh S/o Manzoor Hussain	Farmer	03103 6608680-7	0300 9372990-
8	Muhsan Ali S/o Manzoor Huusin	Farmer	03502 0404057 -2	0300 9316886
9	Dedaar Ali S/o Ghous Buxsh	Farmer	43103 2454637-9	0300 9316886
10	Waqar Ahmed S/o Dedaar Ali	Farmer	43503 0526293-7	0300 9316886
11	Kamran Allah Dino	Farmer	43502 0476707-1	0300 9316886
12	Karamullah S/o Sadoro	Farmer	43105 6204969-5	0308 1318300
13	Zafar Ali S/o Karamullah	Farmer	43105 5457706-5	0310 3420338
14	Shoaib Ahmed S/o Misri	Farmer	43105 1939956-1	0315 0295113
15	Sanaullah S/o Abdul Kareem	Farmer	43105 2800412-9	0311 8216090
16	Ashiq Ali S/o Abdullah	Farmer	43105 5549511-5	0323 1826436
17	Sarmad Ali S/o Abdul Khaliq	Farmer	43105 4879177-3	
18	Dost Muhmmad S/o Ramzan	Farmer	43105 110805-5	0325 3100433
19	Adiyo S/o Lakhmir	Farmer	43105 7723583-5	0308 1374179
20	Ali Hussain S/o Muhammad Shoban	Farmer	43105 1162565-5	0306 0390401
21	Ashiq Hussain S/o Aitbar Ali	Farmer	43105 4312249-3	0305 3166759
22	Ashiq Ali S/o Ahmed Ali	Farmer	43101 9910986-7	0322 3565711
24	Mazhar Ali S/o Mula Baksh	Farmer	43304 0432700-3	0301 1811798
25	Kashmir khan S/o Muhammad Ramzan	Farmer	43101 7715463-5	0305 3691230
Women Consultation				
1	Kareem Khatoon D/o Muhammad Chural	Housewife	43301 6781381 6	
2	Sitaran Khatoon W/o Gazanfar Jamali	Housewife	45504 4321294 4	
3	Kulsoom D/o Muhammad Chural	Housewife	43301 5950861 6	
4	Gul Bano W/o Muhammad Chural	Housewife	43301 90130171 6	
5	Mariyam W/o Akhtar Ali	Housewife	43301 5727936 0	
6	Tot Bibi W/o Sikandar Ali	Housewife	43301 30176350 3	
7	Gul Naz W/o Dildar Bhurgri	Housewife	43101 2583256 5	
8	Asma Mai W/o Waqar Pahnwar	Housewife	43101 0915086 0	
9	Rushna W/o Yasir Jamali	Housewife	43503 2105713 6	
10	Amna Bibi W/o Haleem Panhwar	Housewife	43101 8429378 5	
11	Malkan Khatoon W/o Khalid Jamali	Housewife	43503 4880042 0	
12	Maheen Khatoon W/o Javaid Buriro	Housewife	55504 0740118 2	
13	Maryam Khatoon W/o Noor Jamali	Housewife	03103 1587808 8	
14	Mariyam W/o Muhammad Ali Jamali	Housewife	45504 0740118 2	
15	Sadia W/o Zohaib Jamali	Housewife	03502 12266828	
16	Tanveer W/o Muhammad Imran Jamali	Housewife	03502 77179198	
17	Kanwal W/o Ahmad Jamali	Housewife	03502 2511222 6	
18	Rafia W/o Haseeb Jamali	Housewife	03502 5423359 7	
19	Rafia Khatoon W/o Muhammad Aamir Buriro	Housewife	03502 5423359 7	
20	Rumana W/o Shoukat Sirewal	Housewife	43304 8825436 6	
21	Nazina W/o Najeeb Bhatti	Housewife	43101 1030076 6	
22	Neeli W/o Muhammad Khadim Mahar	Housewife	43502 5549522 6	
24	Faiza W/o Afzal Buriro	Housewife	45504 3322127 5	
25	Zoya Marri W/o Adeel Buriro	Housewife	43101 2671417 6	
26	Almas Mai W/o Qavi Pahnwar	Housewife	43503 9429277 4	

6.4.1 Photographs during Consultation with Affectees of the Project Area

Consultation with Affectees at Route of Begari Drain-I

Consultation with Affectees at Route of Begari Drain-I

Informal Water Testing at RBOD-3

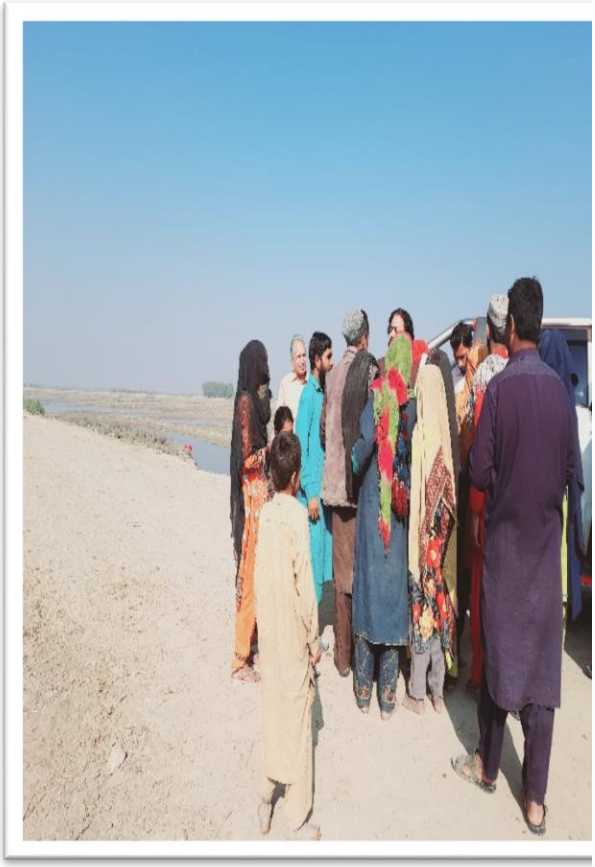
Consultation with Affectees at Route of Begari Drain-II

Consultation with Affectees at Route of Bhurgari Drain

Consultation with Affectees at Route of Bhurgari Drain

Consultation with Affectees at Route of Dad Pur Drain

Consultation with Affectees at Route of Jacobabad Drain-I

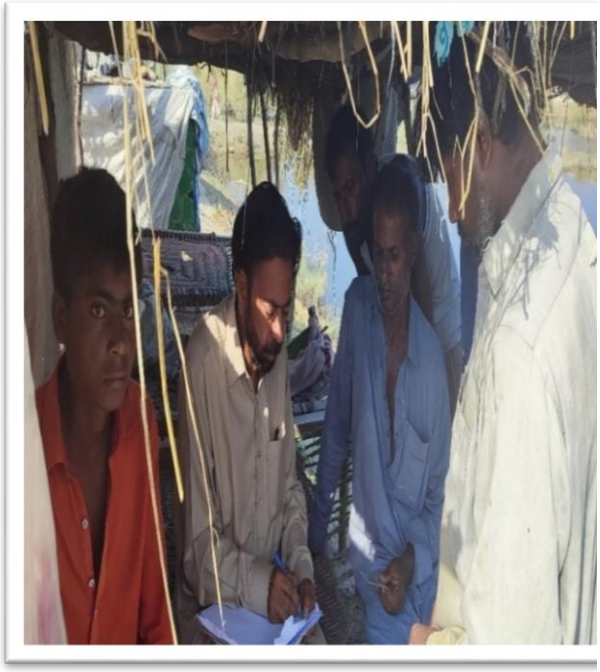


Consultation with Affectees at Route of Jacobabad Drain-I

Consultation with Affectees at Route of Jacobabad Drain-II

Consultation with Affectees at Route of Begari Drain-I

Consultation with Affectees at Route of Doda Pur Drain



Consultation with Affectees at Route of Manjhi Pur Drain-I

Consultation with Affectees at Route of Manjhi Pur Drain-II

A Group Photo of Consultants during Ground Truthing of the Proposed Drains

Drainage Expert is explaining the Route of Proposed Drains to the Project Manager

Consultats at Odho Drain

Consultation with Affectees at the Route of Bhurgari Drain

Consultation with Affectees at the Route of Shahdad Kot Drain

Consultation with Affectees at the Route of Manjhi Pur Drain-I

Consultation with Affectees at the Route of Manjhi Pur Drain-II

Consultation with Affectees at the Route of Miran Pur Drain

6.4.2 Public Feedback and Concerns from the Community during Consultations.

The overall feedback of the communities towards the Project was positive. Communities' main concerns during the scoping sessions / consultations were as under:

6.4.2.1 Compensation for irrigated lands, crops and other properties

The affected people of all villages located in the Project Area informed to the Consultants that their lands are very fertile and they obtain benefits not only from crops, but also grow forest trees, for fodder and fuel wood. The environment around the villages is partially neat and clean. They feel very comfortable while residing in the environment of these villages. They shall not provide their land of their own will, but if forced to sale, they should be adequately compensated with following conditions:

- Land compensation should be paid on current market rates before starting of the construction work.
- The compensation for crops and other affected assets should be according to the market rates.
- Special attractive compensation package should be given to the affectees.
- Compensation of trees should be on existing market rates keeping in view the type and age of trees.
- Compensation procedure and methodology should be fair and simple.

Consultants informed the affected people that compensation is regulated by rules and regulations. Deputy Commissioner is the Authority who decides the compensation on lands. Revenue Officials measure the land, decide the ownership title with the assistance of Jirga and classify the lands and district collector decides the rates of land for acquisition.

6.4.2.2 Employment during Construction and Operation Phases

Affectees of the Project Area were demanding the Job opportunities for local people during the construction and operation phases of the project area according to their qualification and skills.

The consultants responded to this question and informed the meeting that general practice is that the first preference for employment is given to the population affected by the project, if they meet the required academic qualifications and experience. The second right is that of residents of the district where the project is being constructed.

6.4.2.3 Education and Health Facilities Improvement

The project proponent WAPDA should invest in developing well-equipped education and health facilities in the area. They were informed by the Consultants that Pre-project improvement of education and health facilities is the responsibility of Sindh government. In case of difficulties, they may approach their MPA and MNA to take up their grievances with District Government.

6.4.2.4 General Public Concerns from the Community of the Project Area.

- Farmers are demanding free solar tube-wells to keep water table at suitable level
- Drains are a menace during rainy season.
- The farmers having land at the tail end do not get their due share of water.
- The construction activities should not restrict the mobility of the people, particularly the women.
- Contractor should not dump the construction materials in the private fields.
- Measures should be taken to minimize dust, smoke and noise pollution, and to control oil spillages from the construction machinery.
- The contractor should rehabilitate the damaged village roads / farm roads and watercourses, if any.
- Clean drinking water should be provided.
- Needs of Vocational training center for women in the Project area.
- Community was complaining about poor crop yields.

6.4.3 Response of Public Concerns and Sharing Information with Affectees of the Project

The title of land, crop etc. are to be finalized by district administration. The study shall show areas of various classes of land, no. of houses and no of trees to be inundated /affected by various components of the project. Actual estimation of these aspects shall be available when district government officials take the measurement and decide the title of properties with the assistance of Villagers/Jirga.

There is a presentation of all these facts to Sindh Environmental Protection Agency. (Sindh EPA), who is responsible to safeguard the interest of affected persons according to the law. Finally, there is public hearing meeting under the supervision of Sindh EPA at the nearest place where affected persons can attend. The meeting is arranged and all stakeholders are informed through public notice in the News Papers. Information on the project is also displayed for the general public at accessible official places.

EPA hears objections on the project documents from the affected persons, general public, local leaders, NGOs etc. During the meeting the EPA asks the client (WAPDA) and consultants to respond to the

objections raised on the project by various participants. The project is not approved by EPA unless genuine concerns of affected persons are removed in accordance with the law. However, All the concerns raised by the community elders have been placed in this report. Furthermore, mitigation of concerns have been provided in Chapter 7 (assessment of impacts and their mitigation measures) of this ESIA/ESMP Report.

6.4.4 Public Hearing

EPA – Sindh as part of their approval of ESIA will conduct public hearing at Jaccobabad District within 40 days of receiving the ESIA report. Public hearing will be conducted with the support of client and consultants. Local people and government Officials will be made aware of the meeting at least one month before the public hearing through advertisement in newspapers.

CHAPTER 7

ASSESSMENT OF ENVIRONMENTAL IMPACTS AND THEIR MITIGATIONS MEASURES

7 ASSESSMENT OF ENVIRONMENTAL IMPACTS AND THEIR MITIGATIONS MEASURES

7.1 Impact Assessment Methodology

Potential environmental impacts of the Project on various environmental features in the Project area are identified through the following measures:

- Consultations with executing and implementing agencies; relevant government agencies at national and provincial level; traditional and religious leaders of community, and national NGOs.
- Knowledge assimilation of international best practices on environmental assessment of surface drainage projects.
- Environmental quality baseline monitoring of air, noise, surface water, and soil.
- Detailed review and analysis of primary and secondary data available for all environmental parameters in project areas such as physical, biological and social resources.
- Review of engineering investigations, studies and designs.
- Review of satellite imageries followed by ground-trothing.
- Census survey to assess the extent of land acquisition and resettlement.

7.1.1 Impact Characterization

Categories	Characterization
Nature	**Direct: T**he environmental parameter is directly changed by the project. **Indirect: T**he environmental parameter changes as a result of change in another parameter
Duration of Impact	**Short-term:** Lasting only for the duration of the project such as noise from the construction activities**.** **Medium-term:** Lasting for a period of few months to a year after the project before naturally reverting to the originally condition such as loss of vegetation due to clearing of camp sites, contamination of soil or water by fuels or oil. **Long-term:** Lasting for a period much greater than medium term impact before naturally reverting to the originally condition such as loss of soil due to soil erosion.
Geographical extent	Local, regional (special dimension)
Reversibility of impact	**Reversible:** When a receptor resumes its pre -project condition **Irreversible:** When a receptor does not or cannot resume its pre-project condition
Likelihood of the impact	**Almost Certain:** Impact expected to occur under most circumstances **Likely:** Impact will probably occur under most circumstances **Possibly:** Impact may possibly occur at some time **Unlikely:** Impact could occur at some time **Rare:** Impact may occur but only under exceptional circumstances
Impact consequence severity	**Major:** when an activity causes irreversible damage to a unique environmental feature; causes a decline in abundance or change in distribution over more than one generation of an entire population of species of flora or fauna; has long -term effects (period of years) on socio-economic activities of significance on regional level. **Moderate:** When an activity causes long-term (period of years), reversible damage to a unique environmental feature; causes reversible damage or change in abundance or

Categories	Characterization
	distribution over on generation of a population of flora or fauna; has short -term effects (period of months) on socio-economic activities of significance on regional level. **Minor:** When an activity causes short-term (period of a few months) reversible damage to an environmental feature; slight reversible damage to a few species of flora or fauna within a population over a short period; has short term (period of months) effects on socio-economic activities of local significance. **Negligible:** when no measures damage to physical, socio-economic, or biological environment above the existing level of impact occurs.
Significance of impact	**High, Medium, or Low** Based on the consequence likelihood, reversibility, geographical extent, and duration; level of public concern; and conformance with legislative of statutory requirements.

7.2 Impacts during Project Design Phase

Designing a surface drain system to manage the impact of surface water runoff involves several key steps to ensure effective drainage and minimize flooding or erosion. Following are general outline of the design phase for a surface drain system:

I. **Site Analysis:** Thoroughly analyze the site to understand the topography, soil types, existing drainage patterns, and potential sources of surface water runoff. This information is crucial for designing an effective surface drain system.

II. **Determine Goals and Objectives:** Clearly define the goals and objectives of the drainage system, such as preventing flooding, protecting structures, or controlling erosion.

III. **Calculate Drainage Area:** Identify the area that contributes runoff to the surface drain system. This may involve mapping the entire site and determining the boundaries of each drainage sub-area.

IV. **Establish Design Criteria:** Establish design criteria based on local regulations, rainfall data, and the specific needs of the site. This includes determining the required drainage capacity and flow rates.

V. **Hydraulic Calculations:** Conduct hydraulic calculations to ensure that the drainage system can handle the peak flow rates during heavy rainfall events without causing flooding or damage.

VI. **Environmental Considerations:** Consider the environmental impact of the surface drain system design. Incorporate green infrastructure and sustainable practices to minimize ecological disruption. Evaluate the potential environmental impact of the surface drain project. Consider the effects on local ecosystems, water quality, and any potential disruption to flora and fauna.

VII. **Resettlement Considerations:** Avoid resettlement and cultural heritage sites from the RoW of the proposed drains.

VIII. **Regulatory Compliance:** Ensure that the design complies with local and regional regulations, including stormwater management ordinances and environmental permitting requirements.

IX. **Safety Considerations:** Prioritize safety in the design, taking into account factors such as potential erosion, stability of the drainage structures, and any risks to human life or property.

X. **Integration with Existing Infrastructure:** Coordinate with other ongoing or planned projects in the area to ensure that the surface drain system integrates seamlessly with existing infrastructure. This includes roads, utilities, and other drainage systems.

XI. **Maintenance Considerations:** Design the system with ease of maintenance in mind. Incorporate features such as access points, sediment traps, and erosion control measures that facilitate regular maintenance activities.

XII. **Climate Resilience:** Consider the long-term effects of climate change on precipitation patterns and extreme weather events. Design the surface drain system to be resilient and adaptable to changing climate conditions.

XIII. **Community Engagement:** Involve the local community in the design process, gathering input and addressing concerns. This can lead to a more successful and accepted drainage system.

The design phase of a surface drain project is a critical stage that significantly influences the success and effectiveness of the overall drainage system. Several key aspects need to be considered during this phase, and the decisions made can have a lasting impact on the project. Here are some factors to consider:

7.3 Impacts during Construction Phase

7.3.1 Impacts on Physical Environment

7.3.1.1 Impacts on Land

- Proposed drains will affect 8362 acres of land permanently. Out of this, 2341.207 acres of land are irrigated, 6020.785 acres of land are vegetation cover area/bare land/saline land/area under water. Approximately 16 acres of land is build-up area.
- Characterization of impacts are as below:

Nature	• Direct
Duration of impact	• Long-term
Geographical extent	• Local
Reversibility of impact	• Mostly irreversible
Likelihood of impact	• Likely
Impact consequence severity	• Moderate
Significance of impact	• Medium adverse impact

Mitigation Measures

The owners of land will be compensated according to the land acquisition rates of the districts. The payment should be made to the owners before the initiation of the execution of the project. In addition to this, land will be required for contractor's camp, labour camp, contractor offices, workshop, instalments and other infrastructure construction activities. This land will be taken on lease after the negotiation with the land owner.

7.3.1.2 Impact on Houses

- In the Project area, some 304 houses (pacca, semi pacca and kacha) are going to be affected due to project activities. Out of the total affected houses, 6.274%, 63.921% and 29.803% are Pacca (with bricks/blocks walls, concrete roof/corrugated sheet roofing), semi Pacca (with blocks/stones/ masonry and mud mortar and T-iron girder) and Katcha houses (with mud walls/mud mortar, sirky or tree wood batten roof) respectively.
- Characterization of impacts are as below:

Nature	• Direct
Duration of impact	• Short to medium term
Geographical extent	• Local
Reversibility of impact	• Reversible
Likelihood of impact	• Likely
Impact consequence severity	• Moderate
Significance of impact	• Medium adverse impact

Mitigation Measures

The compensation of houses will be paid according to Land acquisition act. During the project survey, almost all of the owners of the affected houses/households are interested to be resettled at various locations of the province and demanded suitable rates. The salvage material of the houses/infrastructures will be the property of the affectees without any payment. The owners will also be provided shifting and livelihood allowance before the execution activities of the project.

7.3.1.3 Impacts on Infrastructures

- In addition to houses due to construction of the project 57 bridges, 178 road culverts, 3 railway crossings 240 water courses will be damaged.
- Characterization of impacts are as below:

Nature	• Direct
Duration of impact	• Short to medium term
Geographical extent	• Local
Reversibility of impact	• Reversible
Likelihood of impact	• Likely
Impact consequence severity	• Minor
Significance of impact	• Low adverse impact

Mitigation Measures

All these structures will also be compensated as per ownership. The compensations will be paid to the owners of the infrastructures or will be rebuilt from the project funding. The compensations for the Government infrastructure / building will be paid to the concerned departments.

7.3.1.4 Impact of Spoil Disposal

- Project implementation will involve excavation of earth for construction of proposed drains. This may cause hazards for nearby population as well as wild animals. Kacha track will be blocked due to, spoil materials and caused social conflicts at the project area.
- Characterization of impacts are as below:

Nature	• Direct
Duration of impact	• Short to medium term
Geographical extent	• Local
Reversibility of impact	• Mostly irreversible
Likelihood of impact	• Likely
Impact consequence severity	• Minor
Significance of impact	• Low adverse impact

Mitigation Measures

Spoil materials volume will be managed for disposal in construction of drain embankments and to fill low-lying areas and desperations in the vicinity.

7.3.1.5 Impacts of Soil Erosion, Degradation and Geology

- Significant excavations are expected from the proposed drainage Project, which will lose the soil and make it more prone to the erosion. Occasional torrential rains always have the potential for soil erosion and degradation. Even in flat areas, soil erosion by surface runoff is a potential risk, in particular at the outlets of the field surface drainage systems. The banks of open ditches are especially sensitive to water erosion where they are not covered by protecting natural vegetation. In addition to soil losses caused by erosion, the sediments transported by surface water are deposited in the system of open drainage channels, thereby reducing their hydraulic capacity.
- Construction works may temporarily change the grading of the natural ground surfaces and due to instability of top-soil surface, soil erosion may also occur. Soil erosion and contamination may occur onroadside, at contractors' camps due to cutting/ filling operations, clearing of vegetation and land levelling activities can destabilize the surrounding land surface, particularly if the excavated area is left unfilled for long, which may lead to rainfall induced soil erosion. Unplanned disposal may create adverse environmental impacts such as an increase in dust pollution, a decrease in aesthetic value, erosion etc.
- The surface soil has the potential to be contaminated by construction material, vehicle movement and various construction activities. Spillage of fuel, lubricants, and chemicals has the potential to result in contamination of soil. The spillage can occur:
  - During transfer of fuel from one container to another or during refueling
  - Maintenance of equipment and vehicles
  - Due to leakage from equipment and containers

- Dropping of material near the asphalt plant
- Also, by accidental spills
- Improper disposal of excavated material may cause soil contamination due to wind and water borne erosion of loose material.
- Untreated sewage effluent from construction camps may cause damage to cultivated land and trees.

- Characterization of impacts are as below:

Nature	• Direct
Duration of impact	• Short to medium term
Geographical extent	• Local
Reversibility of impact	• Mostly irreversible
Likelihood of impact	• Likely
Impact consequence severity	• Minor
Significance of impact	• Medium adverse impact

Mitigation Measures

✓ The banks of the open ditches should be designed with an appropriate slope and be protected by natural vegetation.

✓ Spoil heaps and excavated slopes shall be compacted and protected to prevent erosion.

✓ Land clearance will be confined to the RoW.

✓ Avoid, wherever possible, clearing areas of highly erodible soils and steep slopes which are prone to water and wind erosion.

✓ Construction work will not be carried out during heavy monsoon rains.

✓ The excavated material should be disposed off properly and best management practices should be adopted during construction to control wind-borne erosion.

✓ Control of spillage and leakage of oils, lubricants and chemicals from camp sites and proper disposal of the used oils and lubricants.

✓ Oils, fuels and hazardous materials will be stored in appropriately bunded area with a capacity of 110% of the volume of largest container.

✓ Fuels lubricants and chemicals will be stored in covered areas, underlain with impervious lining.

✓ Appropriate spill control arrangements, including shovels, plastic bags, and absorbent material will be available near fuel and oil storage areas.

✓ Internationally accepted best engineering practice to minimize erosion risks be incorporated in contract documentation and monitored during construction.

✓ Sewage treatment facilities be established for the construction camps.

- ✓ Construction activities be limited to designated areas.
- ✓ Minimization of soil and land taken for construction measures.
- ✓ Fair / negotiated compensation should be promptly paid for damaging property, crop, trees etc. falling within 250 ft Right Of Way
- ✓ Fertile top soil to be disturbed must be stock piled separately for future use during development of green areas/belts.
- ✓ Best practice construction methodology will be used in line with local regulations and international guidelines.
- ✓ Further, to avoid soil contamination, construction materials will be appropriately stored and must be handled properly to prevent leaks and spills that could contaminate surface soils or leach into the groundwater.
- ✓ Soil erosion can be minimized by regular rehabilitation of areas not in use for Project activities. Rehabilitation will include immediate re–vegetation of slopes using fast–growing indigenous species and different functional groups of plants i.e., shrubs and grasses for keeping soil in place.
- ✓ Roads and access routes will include suitable road engineering techniques such as road edge buffer re–planting.
- ✓ To minimize the potential for soil erosion, upon completion of all disturbed areas would be contoured and re–vegetated.
- ✓ Soil conservation measures must be considered while designing and maintaining of surface drainage outlets in order to ensure the safe discharge of drainage water flowing from the field systems.
- ✓ Restriction of machinery and vehicles to designated areas.
- ✓ Spill prevention trays will be provided and used at refuelling locations.
- ✓ Oils, fuels and hazardous materials will be stored in appropriately bunded area with a capacity of 110% of the volume of largest container.
- ✓ Fuels lubricants and chemicals will be stored in covered areas, underlain with impervious lining.
- ✓ Appropriate spill control arrangements, including shovels, plastic bags, and absorbent material will be available near fuel and oil storage areas.
- ✓ Fertile top soil to be disturbed must be stock piled separately for future use during development of green areas/belts.
- ✓ Best practice construction methodology will be used in line with local regulations and international guidelines.
- ✓ Further, to avoid soil contamination, construction materials will be appropriately stored and must be handled properly to prevent leaks and spills that could contaminate surface soils or leach into the groundwater.
- ✓ Soil erosion can be minimized by regular rehabilitation of areas not in use for Project activities. Rehabilitation will include immediate re–vegetation of slopes using fast–growing

indigenous species and different functional groups of plants i.e., shrubs and grasses for keeping soil in place.

✓ Roads and access routes will include suitable road engineering techniques such as road edge buffer re–planting.

✓ To minimize the potential for soil erosion, upon completion of all disturbed areas would be contoured and re–vegetated.

7.3.1.6 Impacts on Surface Water and Groundwater Contamination

Proposed drainage network will cross a number of field channels, major and minor distributaries and canals and while construction of canal aqueducts, drain syphons and watercourses, improper disposal of solid waste or washout from concrete batching plants may contaminate the present sources of water. Following actions are likely to result in impacts on surface water quality:

- Land leveling and clearances
- Excavation of drains
- Closure of saline (drainage) tubewells
- Increase or changes in the capacity of drain inlets

The project activities that can contaminate the surface water and ground water. These include:

- Wastes generated from construction camps includes sewage or black water, grey water (from kitchen, laundry, and showers), kitchen wastes, combustible wastes, non-combustible wastes (such as glass and plastic) and recyclable wastes. Inappropriate disposal of this waste may cause contamination of water bodies. Waste effluent disposal
- Spillage / leakage of fuels, oils and chemicals
- Disposal of construction waste
- Solid waste disposal from construction camps
- Excavators and other construction machinery operation near water bodies such as, water courses can contaminate the surface water
- The project locations which are near the settlements, the consequence of these impacts will be severe.
- Characterization of impacts are as below:

Nature	• Direct
Duration of impact	• Short to medium term
Geographical extent	• Local
Reversibility of impact	• Mostly irreversible
Likelihood of impact	• Likely
Impact consequence severity	• Minor
Significance of impact	• Low adverse impact

Mitigation Measures

- ✓ Impact of construction phase should be minimized by avoiding undue wastage of water through conservation techniques and selection of adequate water supply sources to ensure that the project water does not affect the local use.
- ✓ Particular work sites and access roads will be carefully selected so that surface runoff may not discharges to surface waters.
- ✓ Proper management of camp sites through providing septic tanks with pre-treatment facility for effluents should be provided to avoid surface and ground water contamination and camp sites be selected depending on the water table depth.
- ✓ The rehabilitation activities should be carried out during closure periods of the drains.
- ✓ Contamination of surface as well as ground water may be caused due to spillage of oil, lubricant, fuel, chemical and concrete or by solid waste and effluent from camp sites. It would be managed by good management and maintenance techniques to prevent contamination.
- ✓ Inundation of adjoining lands by storm or flood water should be avoided through providing safe water ways for surface run off.
- ✓ Construction activities be limited to designated areas so that, the impact on water quality will be negligible
- ✓ The groundwater quality analysis at each of the camp sites will be conducted before mobilization of construction crew.

7.3.1.7 Impact on Existing Fish Ponds in the Project Area

- Approximately 48 acres of land having Fish Pond will be lost due to the construction of the project. Table 7.1 is presenting the detail of Fish Ponds.

Table 7.1: Detail of Fish Ponds falling within the RoW of the Project Area

Sr. No.	Name of Drain	Area in Acres)	No. of Affectees	Location of the Fish ponds (Longitude to Latitude)
1.	Proposed Begari drain 1 and its associated branch & sub drains	21	8	1. 68.744921-28.137934 2. 68.825410 – 28.161739 3. 68.910449 – 28.185679 4. 68.792350 – 28.159640 5. 68.802466 – 28.163767 6. 68.843687 – 28.138542 7. 68.916955 – 28.202584 8. 69.169352 – 28.282188
2.	Proposed Begari drain 2 and its associated branch & sub drains	7	3	1. 68.723415 – 28.118611 2. 68.702384 – 28.127941 3. 68.735195 – 28.103997
3.	Proposed Dadpur drain and its associated branch & sub drains	5	5	1. 68.189000 – 28.207650 2. 68.281203 – 28.230272 3. 68.360930 -28.225737 4. 68.383114 – 28.227138 5. 68.409465 – 28.218887
4.	Bhurgari drain and its associated branch & sub drains	7	3	1. 67.923154 – 27.958120 2. 68.106362 – 27.938212 3. 68.064726 – 27.987180

Sr. No.	Name of Drain	Area in Acres)	No. of Affectees	Location of the Fish ponds (Longitude to Latitude)
5.	Miranpur drain and its associated branch & sub drains	1	1	1. 68.165080 – 28.172071
6.	Dodapur drain and its associated branch & sub drains	1	1	1. 68.174521 – 28.038928
7.	Shahdadkot drain	5	3	1. 67.925590 – 27.901034 2. 67.929374 – 27.919479 3. 67.929786 – 27.920842
8.	Jacobabad drain 1	1	1	1. 68.524730 – 28.326888

Fish Ponds having large volume of fish and of particular importance for migratory birds in the project area which affect fisheries as well as natural environmental factors such as migratory birds etc.

- Characterization of impacts are as below:

Nature	• Direct
Duration of impact	• Short to medium term
Geographical extent	• Local
Reversibility of impact	• Reversible
Likelihood of impact	• Likely
Impact consequence severity	• Moderate
Significance of impact	• Medium adverse impact

Mitigation Measures

Compensation of the assets which will be falling in the RoW will be paid. However, contactor is responsible for any loss of wetlands and fish farms near the RoW.

7.3.1.8 Impacts of Air Quality, Noise and Vibration

- Air quality deteriorate during the construction phase due to dust generation from construction activities such as movement of vehicles, construction machinery, site clearing and earth excavation.
- Potential sources of dust are construction material stockpiling and loading, transportation and unloading, areas cleared for construction of main and branch drains, preparation of camp sites and access tracks for operations, off road vehicular traffic on unpaved roads during construction, open storage of solid materials, exposed soil surfaces and excavation of drains. Generation of dust from these activities can cause serious health impacts for laborers.
- Air quality of the area may degenerate during construction as a result of the drainage project interventions. Construction machinery, diesel generators and project vehicles will release exhaust emissions containing carbon monoxide (CO), sulfur dioxide (SO_2), oxides of nitrogen (NO_X), and particulate matter (PM). These emissions can deteriorate the ambient air quality at the project site and along the haulage roads leading to the sites.
- Diesel fuels are mainly used by the construction vehicles and equipment caused Green House Gases (GHG) emissions.

- Enhanced noise level due to increased traffic as well as working of construction machinery and equipment.
- The movement of heavy machinery (excavators, Loader, Bulldozer and Trucks) during construction of project structure including digging of the drains will treat noise and vibration for local residents of the nearby settlements.
- Vibration levels will also increase due to heavy machinery and equipment and caused harmful to construction workers.
- Characterization of impacts are as below:

Nature	• Direct
Duration of impact	• Short to medium term
Geographical extent	• Local
Reversibility of impact	• Mostly irreversible
Likelihood of impact	• Likely
Impact consequence severity	• Minor
Significance of impact	• Medium adverse impact

Mitigation Measures

The contractor should be made aware of Sindh Environmental Protection Act 2014 prescribing air pollution control measures. The contractor shall take all necessary measures to limit pollution from dust and any windblown materials during construction, including water sprinkling on regular basis during dry climatic conditions. However, all the noise impacts, associated with construction stage are short term and temporary, which usually, come to end with the completion of construction activities. The adopted mitigation measures in this regard will focus on the following:

- ✓ Regular water sprinkling on the unpaved roads to avoid dust.
- ✓ Maintenance and tuning of vehicles/construction machinery used for transportation of construction material to avoid air pollution.
- ✓ Strict compliance of the SEQS/NEQS for vehicular emissions.
- ✓ Monitoring of ambient air against SEQS/NEQS should be carried out. Where SEQS are exceeded at generators or batching plant, control technologies shall be required to reduce emissions to within acceptable levels.
- ✓ Reduced speed limit of vehicles in the construction area.
- ✓ Avoiding use of pneumatic drills and other noisy appliances during days of rest or after normal working hours.
- ✓ Noise and vibration should be mitigated by using noise and vibration controlling techniques such as silencers and sound insulation materials.
- ✓ All project plant (including generators & batching plant) and vehicles must be serviced as permanufacturer's guidelines to reduce gaseous emissions.

- ✓ Incineration of any solids which may release toxic chemicals on combustions, such as plastics, shallbe prohibited.
- ✓ Burn pits shall be visually monitored and the quantity of burning waste and incineration temperaturecontrolled to minimize smoke emissions.
- ✓ Covering the stockpile with tarpaulin or thick plastic sheet to prevent dust.
- ✓ The contractor shall be required to minimize double handling of material during earthworks operations. This shall also be in the interest of the contractor as this shall reduce his costs.
- ✓ The training programme for excavator operators shall include the need to reduce drop height whenloading trucks in order to reduce dust emissions (& noise)
- ✓ Access roads shall be adequately compacted and/or regularly sprinkled with water as a dustsuppression measure.
- ✓ Clearing of vegetation for site clearance will be kept to a minimum.
- ✓ Vegetation clearance for camps and access roads will be kept to the minimum required.
- ✓ Clearing of vegetation beyond the RoW shall be avoided.
- ✓ Existing tracks shall be favored for haulage of material.
- ✓ During construction the preparation of new access tracks will be minimized. Where improvement ofexisting tracks or development of short lengths of new tracks is unavoidable the width of the access tracks.
- ✓ The contractor will monitor the noise levels regularly at the nearby villages and other sensitivereceptors to ensure that these do not exceed SEQS/NEQS.
- ✓ The Community Liaison Officer shall notify affected people and communities prior to undertakingespecially noisy work activities.

7.3.1.9 Impact of Dust Emission

- Construction material, loading, unloading areas cleared for construction of main branch and sub drains, preparation of camp sites and access kacha tracks for operations, open storage of solid materials, exposed soil surface etc.
- Characterization of impacts are as below:

Nature	• Direct
Duration of impact	• Short to medium term
Geographical extent	• Local
Reversibility of impact	• Mostly irreversible
Likelihood of impact	• Likely
Impact consequence severity	• Minor
Significance of impact	• Medium adverse impact

Mitigation Measures

- ✓ The contractor shall be required to minimize double handling of material during earthworks operations.
- ✓ Water sprinkling at batching plants shall be required as a dust supervision method. Wet scrubbers for batching plants can also be used.
- ✓ Access roads shall be adequately compacted and/or regularly sprinkled with water as a dust suppression measure.
- ✓ Clouring of vegetation for site clearance will be kept to a minimum.
- ✓ Clearing of vegetation beyond the RoW shall be avoided.

7.3.1.10 Impact of Accidental Damage to Utilities during Excavation

- Excavation operations without consulting the existing utility maps may result in accidental damage to existing utilities like water supply, natural gas, telephone etc. causing inconvenience to the public.
- Characterization of impacts are as below:

Nature	• Direct
Duration of impact	• Short to medium term
Geographical extent	• Local
Reversibility of impact	• Mostly irreversible
Likelihood of impact	• Likely
Impact consequence severity	• Minor
Significance of impact	• Medium adverse impact

Mitigation Measures

A good coordination between different utility departments shall be maintained to get the details of existing underground utilities before starting the construction of proposed drains. The contractor will also be provided with those utility maps. TMA will supervise the construction activities to avoid any accidental damage to the lines. Provision shall be made in the cost estimate for restoration/ replacement of damaged utilities and relocation to minimise the negative impact.

7.3.1.11 Impact of Traffic Disruption due to Excavations

- Excavation of proposed drains may disrupt the traffic flow. Movement of the vehicles carrying construction materials may disturb the existing traffic. This may cause inconvenience to public.
- Characterization of impacts are as below:

Nature	• Direct
Duration of impact	• Short to medium term
Geographical extent	• Local
Reversibility of impact	• Mostly irreversible
Likelihood of impact	• Likely
Impact consequence severity	• Minor
Significance of impact	• Medium adverse impact

Mitigation Measures

The construction activities shall be phased out to confine the disruption of traffic. Traffic diversion/ re-routing plans, if found necessary, shall be prepared with the help of traffic police for smooth traffic flow. The vehicles carrying the construction materials will not be allowed to enter into the cities during rush hours. Their movement will be done during the late-night hours. Continuous and coordinated monitoring of traffic shall be required to minimize the impact.

7.3.2 Impacts on Biological Environment

7.3.2.1 Impacts on Flora

- The major or primary impact on flora will be tree cutting carried out during construction of proposed drains. Forest trees falling within the RoW of drains will have to be cut during construction. About 5925 trees are falling within the RoW of the drains. Detail of trees falling within the RoW are presented in Table 7.2.

Table 7.2: Trees are Falling within the RoW which will be Cut Down

Sr. No.	Name of proposed drain	No. of Trees			Name of Trees	
		Small	Medium	Large	Scientific Name	Local Name
1.	Proposed Begari drain 1 and its associated branch & sub drains	123	569	293	Acacia nilotica Eucalyptus Tamarix aphylla Ziziphus Prosopis cineraria Azadira chta indica Capparis aphyla	Sindhi babur Sufada Lai Ber Kandi Lim or neem Kirrar
2.	Proposed Begari drain 2 and its associated branch & sub drains	16	312	162		
3.	Proposed Dadpur drain and its associated branch & sub drains	111	601	148		
4.	Bhurgari drain and its associated branch & sub drains	40	311	129		
5.	Miranpur drain and its associated branch & sub drains	23	167	30		
6	Dodapur drain and its associated branch & sub drains	64	1306	320		
7.	Jacobabad drain 1.	90	78	52		
8.	Jacobabad drain 1.	65	80	95		
9.	Manjhipur drain 1.	8	77	105		
10.	Manjhipur drain 2.	103	213	124		
11.	Shahdadkot drain 1.	13	58	39		
Total		**656**	**3772**	**1497**		
Grand Total		**5925**				

- During construction /rehabilitation of drains, existing flora will be damaged in the process of land clearance.
- Clearing of vegetation may also be required for the construction of access roads, embankments, cut and fill activities, material dumping and lay down areas, resulting in a direct negativeimpact on the natural vegetation of the project area.
- During the construction activities the contractor's workers may damage the vegetation and trees (for use as firewood to fulfill the construction camps kitchen requirements).
- Characterization of impacts are as below:

Nature	• Direct
Duration of impact	• Short to medium term
Geographical extent	• Local
Reversibility of impact	• Reversible
Likelihood of impact	• Likely
Impact consequence severity	• Minor
Significance of impact	• Medium adverse impact

Mitigation Measures

- ✓ The cutting of trees shall be minimized – a tree management plan shall be prepared during implementation of the project. Every tree removed will be compensated with the planting of 05 saplings to ensure at least 02 mature trees.
- ✓ An inventory of trees to be cut shall be maintained by the contractor.
- ✓ Compensatory tree plantation plan will be in place and implemented before cutting the trees. This will be prepared as part of the site-specific ESMP by the Contractor. The local species will be preferred during replantation. The plantation of native and fast-growing species in consultation with the local forest department and communities is recommended.
- ✓ Compensation of damaged of flora could be by way of systematic plantations along the RoW of drains.
- ✓ Selective and careful pruning of trees shall be made where possible to reduce need of tree removal.
- ✓ The selection of potential camp sites to avoid areas of dense vegetation.
- ✓ The area required for camp sites, borrow sites (if required), and dumping sites will be kept to the minimum required.
- ✓ Clearing of vegetation will be kept to a minimum and will not extend beyond the area required for works
- ✓ Construction workers should be encouraged to use alternative sources of cooking fuel.
- ✓ Dumping of construction material must avoid in vegetation areas.
- ✓ Uprooting of plants should be strictly kept limited according to the requirements of project activities.

- ✓ More trees will be planted along the bank of the proposed length of drains and other sub drains and in the reclaimed waterlogged and salt affected land.
- ✓ Proponent will make a provision of compensatory plantation at the ration of 1:3 with the help of local forest department.

7.3.2.2 Impacts on Fauna

Impacts on Wild Animals

- Wild animals may be disturbed due to movement of vehicles, labrours, construction camps, operation of batching plants.
- Construction of drains and rehabilitation of DU 13 can cause of disturbance to wild animals.
- Characterization of impacts are as below:

Nature	• Direct
Duration of impact	• Short to medium term
Geographical extent	• Local
Reversibility of impact	• Mostly irreversible
Likelihood of impact	• Likely
Impact consequence severity	• Minor
Significance of impact	• Low adverse impact

Mitigation Plan

- ✓ The Construction camp sites to be related in an area non-sensitive to wildlife so as to minimize any impacts of its operation.
- ✓ Hunting, poaching and harassing of wild animals will be strictly prohibited and contractor will be required to warn its labour accordingly.

Impacts on Birds

- As the supply of drainage effluents to the ponds and other wetlands and low-lying swamps areas will be cut-off, the number of waterfowls and other birds, visiting these places will decrease.
- Characterization of impacts are as below:

Nature	• Direct
Duration of impact	• Short to medium term
Geographical extent	• Local
Reversibility of impact	• Mostly irreversible
Likelihood of impact	• Likely
Impact consequence severity	• Minor
Significance of impact	• Low adverse impact

Mitigation Plan

✓ The number of birds will increase because of recovered land and cropped area. The migratory waterfowls and other birds can shift to neighboring wetlands.

Impact on Mammal Communities

- Due to construction activity, small mammals may suffer and migrate to other areas and loss of habitats.
- Characterization of impacts are as below:

Nature	•Direct
Duration of impact	•Short to medium term
Geographical extent	•Local
Reversibility of impact	•Mostly irreversible
Likelihood of impact	•Likely
Impact consequence severity	•Minor
Significance of impact	•Medium adverse impact

Mitigation Plan

✓ The number of mammals will increase due to reclamation of waterlogged and swamp areas.

✓ Evaporation ponds located in the project area is sufficient to provide habitats for mammals.

✓ They are small and are located here and there, their value as wetland is limited, with the completion of the project.

Impact on Reptile Communities

- During the construction phase, there will be physically adverse impact on reptiles of the area, due to activities involving, excavation of drains, construction of access roads, movement of labour.
- Characterization of impacts are as below:

Nature	• Direct
Duration of impact	• Short to medium term
Geographical extent	• Local
Reversibility of impact	• Mostly irreversible
Likelihood of impact	• Likely
Impact consequence severity	• Minor
Significance of impact	• Medium adverse impact

Mitigation Plan

Some of them are expected to migrate to thinly occupied areas.

Impact on Fish

- Construction often involves digging, grading, and excavation, which can lead to increased sediment runoff into nearby water bodies. Excessive sedimentation can smother fish habitats, reduce water clarity, and negatively affect fish health by clogging their gills.
- Construction can introduce pollutants like oil, chemicals, and heavy metals into waterways through runoff from construction sites. These pollutants can be toxic to fish and disrupt the aquatic food chain.
- Construction projects, can lead to the destruction or alteration of critical fish habitats such as wetlands, spawning areas, and nursery grounds. This can result in a loss of biodiversity and reduced fish populations.
- Changes in water flow patterns caused by construction can alter water temperature, which can impact fish species that are sensitive to temperature changes.
- Construction activities generate noise and vibrations that can disturb fish and disrupt their behavior.
- Construction of culverts can create physical barriers that impede fish migration. This can disrupt their natural life cycles, making it difficult for them to access spawning and feeding grounds.
- Construction of the Project can inadvertently introduce invasive species into aquatic ecosystems through the transportation of construction equipment and materials. Invasive species can outcompete native fish and disrupt the balance of the ecosystem.
- Characterization of impacts are as below:

Nature	• Direct
Duration of impact	• Short to medium term
Geographical extent	• Local
Reversibility of impact	• Mostly irreversible
Likelihood of impact	• Likely
Impact consequence severity	• Minor
Significance of impact	• Medium adverse impact

Mitigation Plan

✓ To mitigate these impacts on fish during construction, various best practices and regulations are often put in place, including erosion and sediment control measures, water quality monitoring, fish habitat restoration, and the use of fish-friendly construction techniques like fish-friendly culverts and bridges. Additionally, permits and regulations are typically enforced

to ensure that construction activities comply with environmental laws and minimize harm to aquatic ecosystems.

7.3.3 Impacts on Social Environment

7.3.3.1 Impacts on Human Health

- Though, very unlikely, there could be health hazards from potential explosions/fire, electric shocks, accidents etc. to staff and the general public.
- Characterization of impacts are as below:

Nature	• Direct
Duration of impact	• Short to medium term
Geographical extent	• Local
Reversibility of impact	• Mostly irreversible
Likelihood of impact	• Likely
Impact consequence severity	• Minor
Significance of impact	• Low adverse impact

Mitigation Plan

- ✓ Careful designs and construction using appropriate technologies to minimize hazards.
- ✓ Safety awareness raising among construction staff and public
- ✓ Provision of potable water supply and sanitation facilities for construction camps of contractors.

7.3.3.2 Impacts on Population

- Possible inconvenience to the communities and cattle herds caused by temporary restrictions on movements during construction of drains.
- Impact due to dust, noise and vibration during construction.
- Impact on agricultural income due to permanent acquisition of land under the drains and damage to crops during construction.
- Characterization of impacts are as below:

Nature	• Direct
Duration of impact	• Short to medium term
Geographical extent	• Local
Reversibility of impact	• Mostly irreversible
Likelihood of impact	• Likely
Impact consequence severity	• Minor
Significance of impact	• Low adverse impact

Mitigation Measures

✓ Adopting of adequate measures during construction to minimize any adverse impacts.

✓ Good construction management.

7.3.3.3 Impacts on Commercial Activities

- Fish ponds are commercial activity noted in the RoW. Approximately 48 acres of Fish ponds will be resettled
- Characterization of impacts are as below:

Nature	• Direct
Duration of impact	• Short to medium term
Geographical extent	• Local
Reversibility of impact	• Mostly irreversible
Likelihood of impact	• Likely
Impact consequence severity	• Minor
Significance of impact	• Medium adverse impact

Mitigation Plan

No mitigation measures are required.

7.3.3.4 Impacts on Services, Utilities and Government Infrastructure

- No real impact on utilities, however, government infrastructure including 3 railway line crossings, 57 bridges, 178 culverts, 240 watercourses will be affected.
- Characterization of impacts are as below:

Nature	• Direct
Duration of impact	• Short to medium term
Geographical extent	• Local
Reversibility of impact	• Mostly irreversible
Likelihood of impact	• Likely
Impact consequence severity	• Minor
Significance of impact	• Medium adverse impact

Mitigation Plan

✓ During construction period, steps will be taken to avoid disrupting these services for un-necessarily prolonged periods with prior permission of and information to the concerned authorities and the communities.

✓ Any damage to the infrastructure resulting from project activity will require complete restoration by the contractor.

7.3.3.5 Impacts on Economic Activities

- The project can have some negative impacts on the economic activities of the area. For example, some affected farmers would be prevented from farming on the portion of their farms that fall within the proposed drains Right of Way (RoW) during the construction period, even though they would be adequately compensated for this.
- Characterization of impacts are as below:

Nature	• Direct
Duration of impact	• Short to medium term
Geographical extent	• Local
Reversibility of impact	• Mostly irreversible
Likelihood of impact	• Likely
Impact consequence severity	• Minor
Significance of impact	• Medium adverse impact

Mitigation Plan

After completion of the project, farmers may be allowed to go back to use the land for farming purposes with due safety precautions.

7.3.3.6 Impacts on Health and Safety of Workers

- Impact could occur due to dust, noise, vibration, construction machineries etc. during construction.
- Characterization of impacts are as below:

Nature	• Direct
Duration of impact	• Short to medium term
Geographical extent	• Local
Reversibility of impact	• Mostly irreversible
Likelihood of impact	• Likely
Impact consequence severity	• Minor
Significance of impact	• Low adverse impact

Mitigation Plan

At the time of induction, contractor shall provide safety training along with equipment to all site personnel. If necessary, this training will be repeated at regular intervals. Workers shall also be provided with: hard hats; gloves; long work boots; ear muffles; safe clothing; safety belts; and safety glasses, first aid and medical kit; must be placed at workplace.

7.3.3.7 Impacts on Cultural Heritage

- There are no graveyards, mosques, shrines or sites of archaeological importance in the RoW of drains (Until Mid-term Report, ground trothing is in under progress).

Mitigation Plan

✓ No mitigation measures are required.

7.3.3.8 Resettlement Impacts

- Approximately 6,653.7 acres of land will be acquired.
- 304 houses, will be resettled.
- About 5925 (Mature Trees) will be cut down.
- Characterization of impacts are as below:

Nature	• Direct
Duration of impact	• Short to medium term
Geographical extent	• Local
Reversibility of impact	• Mostly irreversible
Likelihood of impact	• Likely
Impact consequence severity	• Moderate
Significance of impact	• Medium adverse impact

Mitigation Plan

Compensation will be paid to the land and trees owners.

7.4 Impacts during Operation Phase

7.4.1 Impacts on Physical Environment

7.4.1.1 Impact of Sump / Pumping Station Area

The water from the drainage sump (Six-06 pumping stations have been proposed) can be used to increase the available irrigation water supply if its quality permits. This water can be added to the B.S. Feeder, Begari Canal and Desert Canal. Water will be lifted from ground through pumping stations. Some researchers believe that mixing or blending does not increase water supply if saline water contains excessive amount of salts (Grattan and Rhoades, 1990). The salts might cause exceedance of the threshold tolerance of the crop during emergence /establishment of the crop, thereby rendering otherwise good quality irrigation water useless.

The sump discharge is not constant during the year. The variation in the sump discharge rate may create a water management problem.

The quality of sump water is crucial, especially if it contains contaminants or pollutants. Improperly managed sump water can contribute to water pollution, affecting both surface and groundwater quality.

Contaminated sump water poses a risk to public health. If the water contains pathogens or harmful substances, it can lead to the spread of diseases if not properly handled or treated.

Sump water discharge, if not controlled, can contribute to soil erosion. The force of the water and the volume discharged can lead to the erosion of soil in the surrounding areas, impacting agricultural land or natural habitats.

Mitigation Plan

Effluent discharge of the drains should be fallen out in RBOD-3 (if possible) otherwise, cyclic use of water is recommended (in the cycle use, the drainage effluent can be used in conjunction with the canal water but separately. The canal water should be applied to establish seeding and during other sensitive crop growth stages while the poor-quality water can be used during other periods).

Sump discharge may be overcome by building a surface reservoir. the sump water may be stored in it and from here it can be pumped and used as required. the reservoir will add flexibility in the water supply which may be helpful to meet the varying crop water needs.

To mitigate the potential negative impacts of sump water, it's important to implement proper sump water management practices. This may include using sump pumps, implementing water treatment measures, and ensuring that sump water discharge complies with environmental regulations. Additionally, regular monitoring and maintenance of sump systems are crucial to preventing adverse effects on the environment and public health.

7.4.1.2 Impact of Acidification

Acidification of surface water in a drain can have significant environmental and ecological consequences. Surface water acidification typically occurs when the pH of the water decreases due to the addition of acidic substances. This can happen as a result of various human activities and natural processes. some of the effects of acidification on surface drains are: Harm to Aquatic Life (Acidification can harm aquatic organisms, including fish, insects, and other invertebrates. Many aquatic species have a narrow range of pH tolerance, and when the pH of the water decreases, it can disrupt their physiological processes. Fish eggs and juvenile fish are particularly sensitive to changes in pH, and acidified water can lead to reduced fish populations. Disruption of Food Chains (Acidification can disrupt food chains in aquatic ecosystems. As primary producers, such as algae and aquatic plants, are affected by acidification, it can have cascading effects on the entire ecosystem. Reduced primary production can impact herbivores and predators that rely on these resources). Decreased Biodiversity (Acidification can lead to a decrease in the overall biodiversity of an ecosystem. Sensitive species may be unable to survive or reproduce in acidic conditions, leading to a shift in species composition and potentially a decrease in species diversity). Damage to Infrastructure (Acidic water can corrode and damage infrastructure such as drainage pipes and culverts. This can result in increased maintenance and repair costs for drainage systems). Release of Toxic Metals (Acidification can cause the release of toxic metals (e.g., aluminium, lead, and mercury) from soils and sediments into the water. These metals can be harmful to aquatic life and pose risks to human health if the contaminated water is used for drinking or irrigation). Impact on Water Quality (Acidic water can affect the overall water quality of the drain. It can increase the concentration of dissolved substances, change the solubility of minerals, and alter nutrient cycling, all of which can have a range of negative effects on water quality). Impact on Agriculture (Acidified surface water can also negatively affect agriculture if it is used for irrigation. Acidic water can decrease soil pH, which can harm crops and reduce agricultural productivity).

Mitigation Measures

Sources of acidification in surface drains can vary, including natural processes like the leaching of acidic substances from rocks and human activities like the discharge of acidic industrial effluents or acid rain.

Preventing and mitigating surface water acidification often involve addressing these underlying causes, such as reducing emissions of acidic pollutants and managing land use practices to minimize the release of acid-forming substances into water bodies. Additionally, monitoring and regular assessment of water quality in surface drains are essential for early detection and appropriate management of acidification issues.

7.4.1.3 Impact of Salinization

According to previous studies by NESPAK in the project area, salt affected area is about 28 percent and salts are carried out of the higher areas to low areas through drainage of excess water causing there by severe soil salinization in the lower areas. Thus, the presence of high content of salts, retards the plant growth and causes the reduction in crop yields. The rise of the groundwater table near ground surface in saline ground water (SGW) areas and consequently soil salinization continued to be the cause of serious environmental problems in the project area.

Mitigation Measures

- ✓ To mitigate the effects of salinization on surface drainage, it is important to implement appropriate land management practices, such as improved irrigation techniques, salt-tolerant crops, and soil amendments. Additionally, effective drainage systems that can efficiently remove excess salts from the root zone are crucial in salt-affected areas. Managing salinization requires a combination of soil and water management strategies to maintain healthy soil and ensure effective surface drainage.
- ✓ Improving irrigation Practices can help to reduce Soil Salinity. Allowing excess water to drain away from the soil. This can be achieved by using drip irrigation or other method that deliver water directly to the roots of plants reducing evaporation and leaching.
- ✓ Enhancing Drainage can also help to reduce soil salinity by allowing excess water to drain away from the soil. This can be achieved by installing drainage pipes or Construction canal to divert water away from Soil.
- ✓ Planting Salt-Tolerant can also help to reduce soil Salinity. These crops are able to tolerate high level of Salt in the Soil. Reducing the need for irrigation and fertilizer

7.4.1.4 Impact on Hydrology

- Drainage system can significantly alter the natural hydrological regime of wetlands, marshes and other ecosystems. Change in water levels, flows and sediment transport can disrupt habitats leading to loss of biodiversity and ecological imbalance.
- Drainage system of the Project can expedite the movement of water off the land surface, leading to increased runoff. This can result in higher volumes of water flowing into river and other water bodies, potentially causing erosion.
- Drainage system can modify the Natural flow patterns of water on the surface. By channeling water through ditches or canals, the natural distribution of water across a landscape may be altered, affecting the timing, quantity and quality of water reaching downstream areas.
- Poor planning or infrastructure can sometimes exacerbate flood risks downstream. High volume of water discharged from drainage system into river or water bodies can overwhelm their capacity, leading to localized flooding.

Mitigation Plan

The impacts of drainage system on surface hydrology can vary depending on the scale of system, the type of land use, climate conditions and the design and maintenance of the drainage infrastructure. sustainable planning and management practices are crucial to mitigate negative impact s and promote responsible water management.

7.4.1.5 Impact on Ground Water Table Depth

Surface Drainage System is very essential in the Jacobabad, Shikarpur and Kashmore Districts. As the farmers are cultivating rice crop in these districts. To cultivate the rice crop farmers are trying to bring the water table depth at about surface level in the area. After cultivating the rice crop, they are irrigating their crops known as puncho irrigation (using extra water for irrigation of rice crop). This extra water also fills the depressions surroundings their crops. In the absence of surface drains that water is standing for whole season of rice crop.

If the surface drains are available in the area, these drains are helpful to evacuate the standing water in the depressions. In the same way if unusual rainfall (unprecedented rainfall) occurred in the area, these surface drains are very essential to evacuate the rainfall storm water.

It is observed from water table depth data which was collected during May-2023 & November-2023 that water table depth is ranging from 10 to 15 ft. below. It means there is no water logging in the area. The reason behind such depth of water table is due to non-perineal irrigation system in the Jacobabad, Shikarpur & Kashmore Drainage Project.

The Irrigation System supplying water during June to October in the Project Area. In this season farmers are cultivating their rice crop. After harvesting of rice crop farmers are cultivating wheat crop without irrigation. Wheat crop is using only previous crop soil moisture, in this way water table automatically begins to deplete due to closure of irrigation system in the area. Therefore, water table automatically depletes up to the depth of 10 to 15 ft. Therefore, drainage is not required for groundwater. However, for depleting groundwater, if necessary, the capacity of groundwater water drainage is kept in the surface drains. The seepage line will also develop and these seepage line will drain the groundwater and the surface drainage is also required for evacuating standing water i.e. of rainfall storm water and depression filled with water during rice crop season. Therefore, surface drainage net- work is proposed for evacuating the surplus surface water standing in the Project Area for making cultivation easy for the farmers and boosting agriculture economy of the country.

Mitigation Plan

Only evaporation is taking place from that standing water and it does not infiltrate or percolate in the soil, because soil is clayey and it does not allow water to penetrate in the soil.

7.4.2 Impacts on Biological Environment

7.4.2.1 Impact of Eutrophication

Eutrophication is a phenomenon that has detrimental impacts on aquatic ecosystems. It refers to the excessive enrichment of nutrients, particularly nitrogen and phosphorus, in water bodies, leading to accelerated growth of algae and aquatic plants. The increased nutrient load often stems from human activities such as agriculture, urbanization, and industrial processes. As these nutrients enter water bodies, they fuel the growth of algae, resulting in harmful algal blooms, oxygen depletion, and degradation of water quality. Eutrophication poses serious environmental and ecological challenges,

affecting biodiversity, fisheries, recreational activities, and even human health. Following are expected impacts of the process:

- One of the most noticeable impacts of eutrophication is the degradation of water quality. Excessive nutrients can lead to an overgrowth of algae and aquatic plants, forming greenish or murky waters. This can make the water unsightly and unpleasant for recreational activities.
- Eutrophication can also give rise to harmful algal blooms (HABs). Some species of algae produce toxins that are harmful to humans and aquatic life. These blooms can occur on a large scale, affecting entire ecosystems and even threatening the health of animals and humans that come into contact with them.
- Eutrophication can lead to oxygen depletion in water bodies. The excessive growth of algae and plants consumes oxygen during the decay process, creating areas with low dissolved oxygen levels. This can result in hypoxia, a condition where oxygen levels are insufficient to support aquatic organisms, leading to fish kills and other detrimental effects on the ecosystem.
- The increased activity of algae and other aquatic plants during eutrophication can alter the pH levels and acidity of water bodies. Algal blooms can release substances that increase acidity, potentially harming sensitive organisms such as fish and invertebrates that rely on specific pH conditions for survival.
- Endangered and sensitive species are particularly vulnerable to the impacts of eutrophication. The changes in water quality and habitat conditions caused by excessive nutrient enrichment can negatively affect their survival and reproductive success. These species may struggle to adapt or compete in nutrient-rich environments, leading to population declines and potential extinction.

Mitigation Plan

There are various mitigation measures available to address this issue.

Implementing nutrient management practices is crucial in reducing the excessive nutrient inputs that fuel eutrophication. This includes controlling the use of fertilizers in agriculture, improving wastewater treatment processes, and promoting responsible nutrient management in aquaculture operations.

Restoring ecosystems affected by eutrophication can help to rebalance nutrient levels and promote the recovery of native species. This can involve techniques such as wetland restoration, reforestation, and the use of biomanipulation strategies to control algal blooms by manipulating the predator-prey relationships within ecosystems.

Effective policies and regulations play a crucial role in managing and preventing eutrophication. Governments and regulatory bodies can establish nutrient control standards, promote sustainable agricultural practices, and enforce strict wastewater treatment regulations. Additionally, supporting research and monitoring programs can provide valuable data to inform policy decisions and measure the success of implemented measures.

7.4.2.2 Impact on Wildlife

The scarce terrestrial wildlife in the proposed drain areas will need to cross the drains/canals/ distributaries for accessing alternate habitats, dispersal or seasonal migration

Mitigation Measures

During operation phase, there will be impediments to movement of wildlife animals However, wildlife may soon relocate themselves. Others may learn to use crossing points, for this purpose hydraulic structures, like bridges, are provided for the movement of wildlife during operation phase.

7.4.2.3 Impact of Pesticides, Fertilizer Heavy Metals in Water to Flow through the Proposed Drain

The discharge of pesticides, fertilizers, and heavy metals into water bodies through surface runoff or drainage systems can have significant environmental impacts. These contaminants may originate from agricultural activities, urban areas, or industrial discharges.

Pesticides:

- **Eco toxicity:** Pesticides, especially if not properly managed, can be toxic to aquatic organisms. They may harm fish, invertebrates, and other aquatic life, disrupting the balance of the ecosystem.
- **Bioaccumulation:** Pesticides can accumulate in the tissues of aquatic organisms, leading to bio magnification in the food chain, posing risks to higher trophic levels, including humans.

Fertilizers:

- **Nutrient Enrichment:** Excessive nutrients from fertilizers, such as nitrogen and phosphorus, can lead to eutrophication in water bodies. This can cause algal blooms, oxygen depletion, and disruptions in aquatic ecosystems.
- **Harmful Algal Blooms (HABs):** Nutrient-rich runoff can trigger the growth of harmful algae, which can produce toxins harmful to aquatic life and human health.

Heavy Metals:

- **Toxicity:** Heavy metals like lead, mercury, cadmium, and arsenic can be highly toxic to aquatic organisms. They can accumulate in tissues and sediments, posing long-term risks to the health of aquatic ecosystems.
- **Bioavailability:** Some heavy metals can become more bioavailable in certain environmental conditions, increasing their potential to cause harm to aquatic life.
- **Drinking Water Contamination:** Contaminants from agricultural runoff can infiltrate groundwater or directly impact surface water sources, posing risks to the quality of drinking water. Contaminants may enter the food chain, affecting the safety of fish and other aquatic organisms consumed by humans.

Use of Agro-Chemicals and Pesticides

With the operation of irrigation system, use of fertilizers and pesticides will start and increase with time to boost up agricultural production. The Provincial Agriculture Extension Services should play their role in providing timely agronomic advice to the farmers to ensure the appropriate and economic use of these chemicals. The fertilizer and pesticides applications are linked to soil nutrient status, crop growth stage, and irrigation water applications. For enhanced agricultural productivity the affluent farmers will use higher inputs of pesticides, without considering environmental and health impacts thus making provision of efficient agricultural extension services by the Agriculture Department, essential.

Mitigation Measures

- ✓ Implementing best management practices, such as vegetative buffers, cover crops, and controlled drainage, to reduce runoff and the transport of contaminants.
- ✓ Adopting sustainable agricultural practices that minimize the use of pesticides and fertilizers and promote soil health.
- ✓ Implementing water treatment technologies to remove or reduce contaminants before water is discharged into natural water bodies.
- ✓ Enforcing and strengthening regulations related to the use of pesticides and fertilizers to prevent excessive contamination of water bodies.
- ✓ Regular monitoring of water quality and the enforcement of reporting requirements for industries to ensure compliance with environmental standards.
- ✓ It is crucial to adopt an integrated and holistic approach to manage the impacts of pesticides, fertilizers, and heavy metals in water to protect both aquatic ecosystems and human health. Sustainable practices and regulatory measures can contribute to minimizing these impacts and promoting a healthier environment.

7.4.3 Impacts on Social Environment

7.4.3.1 Loss of Agricultural Land

The loss of agricultural land, required to establish the proposed surface drainage system in the project area is one of the major negative impacts of the project. Permanent land acquisition of various categories of land, (i.e., waste culturable, agricultural, residential and barren land) for the proposed surface drains and on temporary basis (for access road, Contractor Camp, batching plant, work base area, waste disposal site and borrow area) will be involved. Total land required for this proposed project will be 6700 (Acres).

Mitigation Measures

- ✓ Adequate budget will be provided in the project cost for the compensation to the affected people as per Land Acquisition Act, 1894 and Resettlement & Rehabilitation Policy 2020.
- ✓ Drains alignment to follow barren areas to minimize relocation and compensation of properties
- ✓ The design of alternative access to affected properties and the management of temporary works and traffic diversion can also reduce the magnitude of impacts on property and welfare.

7.5 Environmental and Social Screening Matrix

As part of the environmental impact assessment process, an environmental and social screening matrix has been developed-tailored specially to the proposed drain project, focusing the potential environmental impacts during the construction and operation phases. The matrix examined the interaction of project activities with various components of the environment. The impacts were classified as physical, biological and socio-economic, and then each of these categories further divided into different aspects. Characterized in the matrix as follows:

- High adverse impact

- Moderate adverse impact
- Low adverse impact
- No adverse impact

Environmental and Social Screening Matrix are defined in Table 7.3.

Table 7.3: Environmental and Social Screening Matrix (Unmitigated) - Construction Phase

Environmental Component	Environmental Impacts	Adverse Impact			
		High	Moderate	Low	No Impact
Physical Environment					
Land acquisition	Loss of land / ownership / damage to structure and means of livelihood.	☑			
	Change in land uses			☑	
	workshop facilities in the project area will spread oil and chemicals			☑	
	Quality of air will be deteriorated due to camp site and machinery yard		☑		
Excavation	Disposal sites of excavated material may have potential for soil degradation	☑			
	Reduction in fertility			☑	
Geology, Land and Soils	Soil erosion during excavation of drains			☑	
	Land pollution due to fuel, chemicals and lubricants		☑		
	Construction camps can cause damage of cultivated land trees, due to sewage disposal			☑	
Climate, Air and Noise	Chances of some dust particles and uses of toxic chemicals can cause air pollution		☑		
	Burning of wood as fuel for cooking contributes to particulate and nitrogen dioxide concentrations				☑
	Exhaust emission from vehicles, compressors, installation equipment's also can cause air pollution		☑		
	The construction stage would be accompanied by increased traffic as well as working of construction machinery and equipment installation activities all of which will add to the ambient noise level at the project area				☑
Water Resources	Pollution of nullahs / water channel by construction works and materials				☑
	Pollution of existing irrigation water quality				☑
	Dust pollution during construction of drains		☑		
Indus River	Impact on Indus River (Just passes from the project area.				☑
RBOD	Impact on RBOD			☑	
Hamal Lake, Manchar Lake	Drainage effluent may impact on Hamal and Manchar Lakes (25 km and 155 km away from project area boundaries).				☑
Balochistan Drainage System	Construction may impact on Hairdin Carrier Drain System, Khairthar Drainage System, Drainage Units: DU-1 (Hairdin System), DU-2 Dera Murad Jamali Area, DU-3 Balam Drainage Unit DU-4 Pat Feeder Extension Area, DU- 19 Usta Muhammad				☑

Environmental Component	Environmental Impacts	Adverse Impact			
		High	Moderate	Low	No Impact
Biological Environment					
Flora and Fauna	Loss and degradation of natural plants		☑		
	Threats to animals by noise, vibration			☑	
	Hunting associated with project staff and workers			☑	
Social Environment					
Land Compensation	Social conflict	☑			
Agriculture	Loss of land, decreased crops yields		☑		
	Decreased agricultural crops			☑	
Irrigation	Damage to water channel and existing canal				☑
Cultural Issues	Cultural conflicts,				☑
IUCN List Sites/ Ramsar declared sites	Environmental degradation				☑
Gender Issues	Purdah issue due to entry of outsiders in the project area			☑	
Aesthetic Values	Social conflicts				☑
Public Nuisance	Damage to health			☑	
Block Access Routes	Social conflicts		☑		
Public/Private Infrastructure	Compensation issues			☑	
Safety, Health and Social Situation	Risks by usage of explosive materials for workers and local people			☑	
	Safety of construction workers, local population and their livestock		☑		
	Social disturbance due to construction workers			☑	
	Noise pollution by heavy machines and vehicles			☑	
	HIV and other diseases brought by construction workers			☑	

Table 7.4: Environmental and Social Screening Matrix (Unmitigated) - Operation Phase

Environmental Component	Environmental Impacts	Adverse Impact			
		High	Moderate	Low	No Impact
Physical Environment					
Impact of Acidification	Harm to Aquatic Life			☑	
	Disruption of Food Chains in aquatic ecosystems			☑	
	Decrease Biodiversity			☑	
	Damage to Infrastructure			☑	
	Impact on Water Quality		☑		
Impact of Salinization	Reduced Infiltration			☑	
	Increase Erosion of Top Soil			☑	
	Water Quality Issues		☑		

Environmental Component	Environmental Impacts	Adverse Impact			
		High	Moderate	Low	No Impact
Loss of Agriculture Land	Loss of 6700 acres on permanently basis	☑			
Climate, Air and Noise	Chances of some dust particles and uses of toxic chemicals can cause air pollution			☑	
	Burning of wood as fuel for cooking contributes to particulate and nitrogen dioxide concentrations			☑	
	Exhaust emission from vehicles, compressors, installation equipment's also can cause air pollution			☑	
Water Resources	Pollution of nullahs / water channel by construction works and materials				☑
	Pollution of existing irrigation water quality			☑	
	Dust pollution during vehicle movements				☑
Indus River	Impact on Indus River (Just passes from the project area.				☑
RBOD	Impact on RBOD			☑	
Hamal Lake, Manchar Lake	Drainage effluent may impact on Hamal and Manchar Lakes (25 km and 155 km away from project area boundaries).				☑
Balochistan Drainage System	Construction may impact on Hairdin Carrier Drain System, Khairthar Drainage System, Drainage Units: DU-1 (Hairdin System), DU-2 Dera Murad Jamali Area, DU-3 Balam Drainage Unit DU-4 Pat Feeder Extension Area, DU- 19 Usta Muhammad				☑
Biological Environment					
Flora and Fauna	Loss and degradation of natural plants				☑
	Threats to animals by noise, vibration				☑
	Hunting associated with project staff and workers				☑
Social Environment					
Land Compensation	Social conflict				☑
Agriculture	Loss of land	☑			
	Decreased agricultural crops				☑
Irrigation	Damage to water channel and existing canal				☑
Cultural Issues	Cultural conflicts,				☑
IUCN List Sites/ Ramsar declared sites /	Environmental degradation				☑
Gender Issues	Purdah issue due to entry of outsiders in the project area				☑
Aesthetic Values	Social conflicts				☑
Public Nuisance	Damage to health			☑	
Block Access Routes	Social conflicts			☑	
Public/Private Infrastructure	Compensation issues		☑		
Safety, Health and Social Situation	Risks by usage of explosive materials for workers and local people			☑	
	Safety of construction workers, local population and their livestock				☑
	Noise pollution by machines and vehicles			☑	

7.6 Positive Impacts of Jacobabad Drainage Project

- Approximately 93,683 hectares of land will come under cultivation due to the implementation of the project.
- Production of Rice & Wheat will be increased up to 33 & 57% respectively.
- The surface drainage environmental assessment study indicated that drainage in general has positive effect, if properly operated and maintained.
- Reduction in seasonal swamp area prone to flooding will result in increased crop area, yields and production.
- Provision and rehabilitation of drainage unit 13 will reduce soil salinity, and improve land capability.
- Improved socio-economic conditions of the people consequent to better-irrigated agriculture will result in attracting more people to work in the project area. The present tendency of urban drift will also decrease.
- Decrease mosquito breeding and other water borne pathogens causing malarial fever and other diseases.
- With the increased income and improvement in status, a greater number of children will go to schools.
- The establishment of agro based business activities will demand skilled and unskilled labour in the Project area.
- In the project area, environmentally sensitive or protected areas are not present.
- No threatened or endangered flora and fauna species are present in the area of the development.

7.6.1 Employment Opportunities

The Project will have significant positive impacts on the local economy due to creation of lot of job opportunities to the local community. The Project construction activities will require many unskilled laborers and skilled staff for more than 05 years. In this respect the Project will be commenced training people from the project area to facilitate employment during project implementation. Employment in the project construction will act as an added source of income in the income and livelihood restoration processes of PAPs. The construction supervision consultants will monitor the implementation of this contract condition through monthly statements submitted by the Contractor.

Jacobabad Drainage Project Consultants & Contractors will ensure that local has access to work opportunities created by the project. People willing to work cannot be discriminated based on race, religion, caste, residence or place of birth. However, people from the affected families with relevant qualifications would get preferences for employments in the project.

All persons above the age of 18 years would be eligible to work in the project.

The project will not discriminate between locals and non-locals for employment in the project.

Women and members of vulnerable groups will get preference for employment and/or training for alternative employment.

Project will support affected households to open businesses as alternative sources for livelihoods.

Local residents will also be benefitted from expanded opportunities for seasonal employment elsewhere to earn supplemental incomes.

CHAPTER 8

ENVIRONMENTAL SOCIAL MANAGEMENT PLAN

8 ENVIRONMENTAL SOCIAL MANAGEMENT PLAN

8.1 Introduction

Environmental Social Management Plan is a delivery mechanism to implement the mitigation measures for the identified adverse impacts on the affected people and their socio-economic life. It is a tool to confirm that the impacts have not exceeded the stipulated environmental quality objectives for the project. In addition to the adverse impacts, some other impacts also occur during construction and operation phases. During construction, damages may occur to plant life, animals and their habitats, soils, water flow patterns, water pollution, etc. Construction activities also generate solid wastes, construction spoils, noise and air pollution. Some construction activities are prone to risk and are likely to create health and safety issues. The addressing of these issues is imperative to obligate the contractor to follow good engineering practices in order to avoid any risks to the health and safety of the workers.

8.1.1 Objectives of the ESMP

Environmental and Social Management Plan (ESMP) is prepared for all the identified environmental impacts during pre-construction, construction and operational stages due to implementation of various Project activities in accordance with national best practices and World Bank guidelines. The objectives of the ESMP are to achieve the followings:

- Deriving mitigation measures for each identified impact and risk,
- Estimating budget requirements for implementation mitigation and monitoring measures,
- Identifying responsibilities of various agencies involved in the Project for implementation and monitoring of mitigation measures.
- Auditing of the implementation activities to ensure that mitigation measures are implemented appropriately
- To facilitate the implementation of the mitigation measures and commitments made in the ESIA during approval.
- Assign responsibilities for the project proponent, contractor and the construction supervision consultants (CSC).
- Define a monitoring mechanism and identify monitoring parameters, to ensure complete implementation of the mitigation measures.
- Define details of management procedures to deal with any adverse outcome.
- Identification of anticipated significant adverse environmental impacts.

8.1.2 Establishment of Environmental Social Unit (ESU)

It is responsibility of WAPDA to establish its own Environmental Social Unit for implementing the ESMP Prepared for the Project. The composition of the Project ESU is given below:

Table 8.1: Detail of Environmental Social Unit

Post	Nos.	Remarks
Project Director/Project Management Officer (Client)	01	Head of ESU
Consultant Environmental Expert	01	Engineer or scientist having experience of dealing with environment related issues.
Consultant Junior Environmentalist	01	Environmental scientist having experience of dealing with environment related issues
Consultant Junior Sociologist	01	Social scientist having experience of dealing with social/resettlement related issues
NGO	01	Representative, one of NGOs working in the region
Local Community	01	Any MNA /MPA or influential person of the district.

8.1.3 Components of the ESMP

The ESMP consists of the following:

- Organizational Structure and Responsibilities
- Mitigation measures implementation plan
- Environmental and Social Monitoring
- Change management
- Environmental and social trainings
- Environmental and Social Management Costs
- Site Specific Environmental Management Plans

8.1.4 Monitoring and Evaluation

WAPDA will establish a Project Management Unit (PMU) for comprehensive monitoring and evaluation system to ensure compliance of project activities with agreed procedures and standards. The environmental component of the project monitoring and evaluation will be the responsibility of WAPDA Environmental Cell (WEC). It will look after Compliance Monitoring by checking key indicators of environmental impacts caused by the Project. These will include but no limited to irrigation water volumes, and water quality, drainage water flows, soil salinity, water-logging, soil erosion, groundwater fluctuations and quality, drinking water quality and public health. In terms of capacity building and sustainability, the Project should support WEC and provincial EPA in designing and implementing sustainable monitoring programmes.

8.1.4.1 Organizational Structure and Responsibilities

This section provides an organizational structure for environmental social management during the proposed activity and defines the roles and responsibilities of the various organizations. The responsibilities of different organization are given below:

Project Management Officer (PMO)

The PMO responsibilities:

- While executing the contract and undertaking the construction, all environmental regulations and requirements promulgated by SEPA and Pakistan Environmental Protection Agency

(PEPA), with respect to the work site and adjacent areas are fully respected and implemented.

- PMO will be responsible, through Environmental Social Units to ensure implementation of ESMP.
- PMO will ensure that Contractor and Construction Supervision Consultants appoint dedicated Environmental and Social Officers (ESOs) and Environmental and Social Supervisor (ESS), respectively. PMO will also ensure that all environmental personnel are responsible to implement the social and environmental policies and the ESMP requirements.
- PMO through ESU will also coordinate with relevant Government Departments and stakeholders on concerned socio-environmental issues.
- PMO through ESU will inspect and monitor residual impacts of the rehabilitation work and observe documentation of the impacts during the construction phase.
- PMO through ESU will also inspect the significance of impact in case of unanticipated change in the project.

The Construction Supervision Consultants will assist and advise PMO in the supervision and the implementation of ESMP.

Environmental Social Unit Responsibilities

- ESU will be responsible to monitor the environmental and social performance of the project, and in particular, adequate implementation of ESMP. ESU will function in coordination with the Construction Supervision Consultants and will receive reports from them on behalf of PMO.
- ESU will prepare and submit periodical progress and monitoring reports to all stakeholders as per their schedules. In this task they will seek assistance/ guidance from Construction Supervision Consultants as and when required.
- ESU will closely liaise with ESS and ESOs of the supervision consultants and contractor, respectively; the structure of ESU is also in Figure 8.1.
- Ensure that all the mitigation measures for the adverse impacts have been implemented properly and timely.
- Assist the contractor on social conflicts at the work site.
- Ensure that the utility services affected by the construction works are relocated / rehabilitated.
- Ensure that all the safety and health measures are followed by contractor.

Contractor Responsibilities

- The contractor is required to implement the mitigation measure as included in the ESMP and the contract documents. The contractor shall carry out the following environmental works in addition to the good engineering practices.
- The contractor will prepare a site-specific environmental plan in the light of ESIA and ESMP as required under the specifications of the contract documents.

- Ensure that all the mitigation measures are carried out to the specifications of the Client (PMO).
- Ensure that Sindh Environmental Protection Agency rules, regulations, Pakistan Environmental Protection Agency and other prevailing rules and regulations of Pakistan and international conventions signed by Pakistan are complied with during carrying out of the works.
- Coordinate with the various government agencies to resolve the issues hindering the project works.
- Ensure that first aid facilities are provided on site.
- Submit monthly and quarterly reports of implementation works carried out on the instructions of the Client/PMO or any other agency indicated by the Client (PMO).
- Submit a report on the major accidents on site to the Client/PMO and relevant government agencies immediately on occurrence of such accidents.
- The contractor will prepare a Health and Safety Plan in the light of ESIA and EMMP as required under the specifications of the contract documents.

In case of contractor fails to implement any part of ESMP, the PMO will reserve the right to get it done at the cost of the contractor. The cost of any such work will be determined by the Construction Supervision Consultants (CSC) and will be adjusted from amount due to the contractor.

The contractor will appoint adequate number of dedicated ESOs at site who will ensure ESMP implementation at the site and will liaise with ESS/ ESU for this purpose.

Construction Supervision Consultants Responsibilities

The construction supervision consultants (CSC) will supervise the implementation of the ESMP by the contractor and assist PMO to monitor the implementation. The consultant will also assist the sponsor and the contractor in training the site staff. The responsibilities of the consultants are:

- Supervise the implementation works of the ESMP by the contractor.
- Ensure that all the works carried out are in accordance with SEPA, PEPA Act 2014/1997 rules and regulations, and NEQS.
- Ensure that health and safety measures are addressed on worksite and in labour camps.
- Impart training to the contractor and other persons related to environmental control.
- The Supervision Consultant will appoint a dedicated ESS at the site, who will supervise the ESMP implementation at the site, and liaise with ESOs and ESU for this purpose.

Institutional Organogram

The existing organogram of the project management unit in WAPDA is shown below:

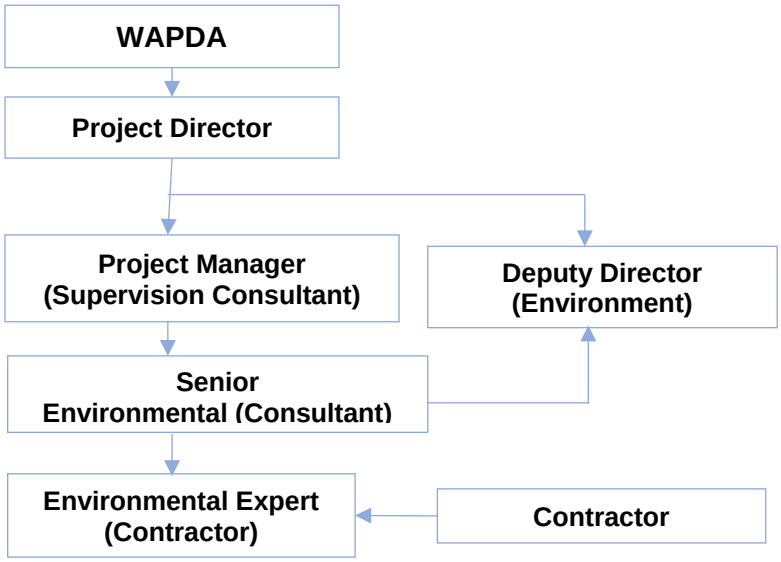


Figure 8.1: Existing Organogram Chart of the Project Management

8.2 Environmental and Social Monitoring

8.2.1 Activity Monitoring

The objectives of the activity (compliance) monitoring will be to:

- Systematically observe the civil and mechanical works conducted by, and the site facilities established by, the Contractor
- Verify that the activities undertaken are in compliance with the ESMP and other conditions identified by ESS and the Supervision Consultants.
- Document and communicate the observations to the concerned persons in PMO so that the corrective action, if required, can be taken timely.
- Maintain a record of all incidents of the environmental and social significance, related actions and corrective measures.
- Prepare periodic reports of the environmental and social performance of the project.
- Develop an environmental issue tracking system for an effective monitoring and ensuring that all environmental and social concerns are identified and addressed in a timely manner.

8.3 Effects Monitoring

The effects monitoring has the following objectives:

- To verify that the impacts of the proposed project are within acceptable limits (as anticipated in ESIA), thus establishing credibility.
- To minimize the magnitude of effects, control the timing, location and level of the project activities/mitigation measures.
- To notify PMO and other regulatory agencies in case of adverse impacts or sudden changes in the anticipated impacts so that the corrective measures can be taken such as modification of mitigation measures and/or inclusion of additional mitigations.

- To facilitate research and development by documenting the effects of the proposed project that can be used to validate impact- predication techniques and provide a basis for more accurate impact prediction related to future projects.

8.4 Post-Project Monitoring

The effects monitoring will also include the post-project monitoring, to determine the level of residual impacts of the project on physical, biological and socio-economic receptors of the project area. This monitoring may be carried out within one month of the end of project activities.

Table 8.2: Effects Monitoring Plan

Sr. No.	Description	Monitoring Location	Monitoring Parameters	Frequency of Measurements
Construction Phase				
1	Ambient air quality	Drains, hatching plant site, labor camp site and borrow areas.	NOx, SOx, CO, Ozone, Lead and Particulate Matters (PM10) and (PM2.5).	Quarterly
2	Quality of surface water used for construction activities.	At source of surface water used.	pH, EC, SAR and RSC	Quarterly
3	Emission of dust, smoke and potential air pollutants from the construction machinery.	Construction sites, Campsite, access roads, borrow areas.	Dust, smoke, gases	Throughout construction phase
4	Visual check for exhaust emissions from the vehicles.	Construction sites, campsite, access roads, borrow areas.	Visible emissions	During routine monitoring.
5	Visual check for vegetation loss	Construction site, campsite, access roads, borrow area.	Type and number of tree species uprooted.	At the beginning of construction activities.
6	Noise	Construction site, campsite, access roads, communities within 500 m of construction site.	Noise measurement	Once a week throughout the construction phase.
7	Soil erosion	Construction site, campsite, access roads, borrow area.	Visual observations for street or rill/gully erosion.	During routine monitoring of entire project activities especially after rains.
8	Resource utilization	Project site.	Quantity of material used to include water and fuel	Daily during construction phase.
9	Solid Waste Generation	On camp site and Construction site.	Any sign of soil or water contamination; any un-disposed waste	Daily during whole Construction phase.
10	Wastewater generation	Campsite, offices and construction sites.	Waste water generation rate, integrity and maintenance of the septic tanks and soaking pits, any sign of soil or water contamination	To be determined through water management techniques.
11	Oil wastes/ spills	Oil storage area, vehicle-washing lines; any other spill area.	Facilities to control the accidental oil spill as per oil spill contingency plan; any sign of soil or water contamination	Daily during construction phase
12	Socio - economic issues	All project locations, settlements	Local people recruited for all manual labor and other	During construction phase

Sr. No.	Description	Monitoring Location	Monitoring Parameters	Frequency of Measurements
			jobs for which local skill are available; grievances of and	
13	Monitoring of cumulative impacts	All project sites, particularly near dam and project command area	All environmental and social parameters such as soil erosion, soil/water contamination, noise, air contamination, vehicular traffic, local resource utilization, and other impacts on communities.	Throughout the construction period
Operation Phase				
1.	Restoration	At all project locations (construction sites, camp sites, offices, tracks and others)	Restoration and rehabilitation as per Restoration Plan	At the end of the construction phase
2	Surface Water quantity and Quality	Drain site, at the same locations where design and construction phase monitoring was done	Flows, pH, conductivity, TSS, TDS, BOO and COD.	Once in pre and post monsoon season for 2 years. Flows on a regular basis.
3	Ground water Quality	Water sources used for construction purpose and dug wells within 1 km from wastewater mud ponds (if any). At the same location where construction phase monitoring was done.	Physical- chemical parameters, heavy metals and toxic organic compounds.	Once in pre and post monsoon season for 2 years,
4	Soil Erosion	At project sites and along the aligned borrow areas; at location prone to soil erosion.	Visual observation.	After site restoration.
5	Habitat Disturbance	Within the project boundaries.	Visual Observation.	At the end of the construction phase.
6	Tree planation in watershed area.	According to the tree plantation plan.	Survival rate of tree saplings.	Once/ twice in a year for three years.

8.4.1 External Monitoring

The M&E Consultants will carry out the external monitoring of the entire project, and their scope of work will include the monitoring and evaluation of the ESMP implementation (including Mitigation Plans, Effects Monitoring Plan, Social, and cumulative impacts).

8.5 Communication and Documentation

An effective mechanism for recording, storing and communicating environmental and social information during the project is an essential requirement of an ESMP. The key features of such a mechanism are:

- Recording and maintaining all information generated during the monitoring in a predetermined format.
- Communicating the information to a central location.
- Storing raw information in a central database.

- Processing the information to produce periodic reports.

A description of the various components of the communication and documentation system is given below.

8.5.1 Data Recording and Maintenance

The forms to be used for recording information during the environmental and social monitoring will be developed by the ESO, under the supervision of ESC. These forms will follow a standard format, which will correspond to the database into which all the information gathered will be placed. All common fields will have identical formats in the database and on the forms. Check boxes will be used as much as possible for ease in filling out the forms and to facilitate data entry.

All forms will be numbered and a tracking system will be developed for each. Whenever a form is released for use in the field, its number will be recorded. The field staff will be required to account for each form after completion. In this manner, it will be ensured that all forms are returned to the office.

8.5.2 Meetings

The following environmental meetings will take place during the project:

- Project initiation meetings (once for each of the contractors).
- Fortnightly meetings

The purpose of the project initiation meetings will be to discuss the ESMP, and ensure full understanding and commitment from concerned parties for its implementation.

A periodic meeting will be held at site during the construction phase. The purpose of the meetings will be to discuss the conduct of the operation, non-compliances noted by the ESO or Contractors' ESMs, and any environmental / social issues identified in the field. The remedial measures will also be discussed and agreed during these meetings. The meeting will be recorded in the form of an environmental and social report (ESR) prepared by the ESO.

8.5.3 Reports

The Environmental Social Supervisor will produce periodic reports based on the information collected. These will include reports for:

- Project initiation meetings with each contractor,
- Fortnightly meetings,
- Non-compliances,
- Effects monitoring.

These reports will be shared with the contractors, Project Director, Manager Construction. The reports will also be made available for review, to the external monitoring teams, and to any other stakeholders who visit the site.

At the end of the construction phase, a final report will also be prepared.

8.5.4 Photographic Record

The photographic record will be maintained to record the conditions of the project area before start, during and after the construction. The following information will be recorded:

- Shot number
- Camera
- Name of photograph
- Location
- Date
- Time
- Feature of photograph
- Other observations.

8.5.5 Public Disclosure

WAPDA will disclose this ESIA and ESMP to all the stakeholders before the commencement of the proposed project. The ESIA report will be made available to the stakeholders at the sites designated by the EPA, in accordance with the provincial/national legislation (SEPA 2014/PEPA 1997). In addition, the executive summary of the ESIA will be translated into Sindhi language, and made available to the affected communities (and also kept at the project sites). This will ensure that the local communities are aware of the project, its key impacts, the mitigation measures and the implementation mechanism. In addition, the Executive Summary will be disclosed through the WAPDA's official website.

8.6 Grievance Redressal Mechanism

An attempt has been made during the present ESA to identify all potential impacts of the proposed project, to identify all PAPs, to provide mitigation measures to address the potential impacts, and to chart out a mechanism to implement these mitigation measures (including payment of compensation).

However, during the project implementation, the stakeholders (mostly the communities in the vicinity of the project sites/transmission line routes) may still have some grievances 2 Frequency of meetings may be adjusted per the situation with respect to the project activities, their impacts, compensation and other mitigation measures. The key reasons of these grievances are listed below:

- PAPs not enlisted,
- Losses (such as damaged crops) not identified correctly,
- Compensation inadequate or inappropriate,
- Dispute about ownership,
- Delay in disbursement of compensation,
- Improper distribution of compensation in case of joint ownership.

In order to address the above eventualities, the Grievance Redressal Mechanism (GRM) has been devised. The main objective of the GRM will be to provide a mechanism to mediate conflict and cut down on lengthy litigation. It will also facilitate people who might have objections or concerns regarding the project activities, provide a public forum to raise their objections and through conflict resolution, address these issues adequately. The main functions of the GRM will be as follows:

- Provide a mechanism to the PAPs to address the problems arising as a result of project activities,

- Record the grievance of the PAPs, categorize and prioritize the grievances that need to be resolved,
- Determine and implement the mitigation actions to address the grievances,
- Report to the aggrieved parties about the developments regarding their grievances and the decision of the project authorities.

Under the GRM, the ESS will maintain the Social Complaint Register (SCR) at the sites to document all complaints received from the local communities or any other stakeholder. The information recorded in the Register will include date of the complaint, particulars of the complainant, description of the grievance, actions to be taken, the person responsible to take the action, follow up requirements and the target date for the implementation of the mitigation measure. The register will also record the actual measures taken to mitigate these concerns.

As soon as a complaint is received, the ESS will discuss it with the CSC, and determine the remedial action. If required, consultations will also be undertaken with the contractor's site managers and WAPDA's PD. Once the remedial action is decided, implementation responsibility as well as schedule will be determined.

The proposed remedial action will be documented in the SCR, with complete details (by whom and by when). The proposed remedial action will be shared with the complainant. Similarly, the actual action taken will also be documented in the Register and shared with the complainant. The complainant's views on the remedial action taken will also be documented in the Register.

The SCR will be reviewed during the fortnightly meetings at the site during the project, and the action items discussed. The progress on the remedial actions will also be reviewed during the meetings.

The Register will also be shared with the PD WAPDA and CSC, on regular basis, for information and further action, if any.

In order to address any unresolved grievances at a higher level of the organization, a Grievance Redressal Committee (GRC) will be constituted. The Committee will be headed by the PD, with ESS and its other members. A suitable person from the relevant community will also be a member of this committee. Any un- resolved issue will be sent to the Committee for determining the remedial action.

The GRM's roles, responsibilities and implementation mechanism are explained in following Table 8.3.

Table 8.3: Grievance Redressal Mechanism Plan

Stage	Action	Action by	By when	Monitoring by	Notes
Mobilization at site	Placement of Social complaint Register (SCR) at the site office	ESU	At the time of site mobilization	ESS	The SCR will have separate columns for: I) date of complaint; ii) description of complaint; iii) particulars of complaint; iv) details of action required/decided; v) person's responsible to take action; vi) person's responsible to monitor the action; vii) details of action taken (when, by whom, where); viii) comments

Stage	Action	Action by	By when	Monitoring by	Notes
					of the complainants after the action taken. A separate SCR will be placed at each drain included in the proposed project, and any other project site offices.
Complaint raised by any complainant	The complaint is recorded in the SCR	ESU	-	ESS	The relevant columns of the SCR are filled.
Identification of remedial action	A meeting is held between ESS, and if required with PM and Site In charge. The redial action is identified. The PD and CSC are informed regarding the grievance and the remedial action identified.	ESS	Within 2 days of the new complaint	CSC	The relevant columns of the SCR are filled.
Implementation of remedial action	The remedial action is implemented	Contractors or WAPDA, depending upon the nature of the remedial measures	To be decided for each remedial action	ESS	The relevant columns of the SCR are filled.
Feed back to the complainant	Information is provided to the complainant regarding the remedial action taken. The comments / observations of the complaints are obtained and documented.	ESU	Within 1 week of the action taken	ESS	The relevant columns of the SCR are filled.
Fortnightly site meetings	The SCR will be discussed.	ESS	Fortnightly	PM	The discussion will be documented in the minutes of meeting
On monthly basis	The summary of SCR will be sent to PD and CSC	ESS	Monthly	PM	-

8.7 Change Management

It is possible that changes in project design are required when the project is implemented. This section describes the mechanism to handle the changes that might affect the project environmental and/or social impacts. The changes in the project design may be of different orders and levels as given below.

The first order change is one that leads to a significant deviation from the project scope of work such as change in location or design of the project. The change will need communication to EPA for approval of change.

The second order change is one that is not significantly different from those described in the ESIA such as:

- Increase or decrease in project technical personnel.
- Changes in the documentation and communication, stakeholder's consultation program.

The third order change is one that is of little consequence to the ESIA findings, such as re - aligning a particular section of road to avoid cutting a tree.

The second and third order changes will not require the approval of EPA, Sindh.

8.7.1 Changes in ESMP

The possible categories of changes have been discussed above. The changes in the project design or result of the environmental monitoring may necessitate changes in the ESMP. In this regard, the following actions will be taken:

- Consultation among PMO, Contractor and consultant's representatives
- Based on the changes made a change report will be produced collectively which will include the additional ESMP clauses.
- A copy of the report will be sent to the head offices of PMO, the Contractor and the Consultants.
- All relevant project personnel will be informed of the additions/deletions/changes. These will be reported in the Consultants monthly environmental reports.
- Mid-term review of the ESMP to review changes that might affect the project environmental impact.

8.8 Environmental & Social Trainings

The environmental and social trainings will help to ensure that the requirements of the ESIA and ESMP are clearly understood and followed by all project personnel throughout the project period. The primary responsibility of providing training to all project personnel. The trainings will be given to different professional groups separately such as manager level group, skilled personnel group, and unskilled labors. The scope of the training will cover general environment awareness and the requirements of the ESIA and ESMP, with special emphasis on sensitizing the project staff to the environmental and social aspects of the area. An indicative training plan, which will be finalized before the commencement of the project, is given in Table 8.4.

Table 8.4: Training Plan

Staff	Trainer	Contents	Schedule
Selected field staff of PMO	ESU Specialists; ESS	Environmental and social aspects, particularly sensitivities of the project; Key finding of the ESIA Social and cultural values of the area; Leadership dynamics.	Before construction activities
All site personnel Contractor; Managerial staff engineers. Environment, social, health and safety staff. Consultants: Managerial staff and engineers	ESS	Environmental and social aspects, particularly the sensitivities of the project; Wildlife and vegetation related sensitivities of the project; Key finding of the ESIA, Mitigation measures; Contingency plan; Community issues; Social and cultural values of the area	Before and durin construction stage

Staff	Trainer	Contents	Schedule
Construction crew	ESS;	ESMP; Waste disposal; HSES plan	Before and during construction stage
Drivers	ESS	HSES plan; Road safety; Road restrictions; Vehicle restrictions; Defensive driving; Waste disposal; Social and cultural values of the area.	Before and during the construction
Mechanics	ESS	Waste disposal; HSE plan; Vehicle restriction	Before and during the construction
Camp Staff	ESS	HSE plan; Camp operation Waste disposal Natural resource conservation Housekeeping	Before and during the construction
Restoration team	ESS	Waste disposal; Site restoration; Leveling and dewatering of burrow area	Before the start of the restoration activity
Relevant Guidelines, Standards and Legislation	Sindh environmental protection act 2014 Pakistan Environmental Protection Act, 1997 National Environmental Standards, 2000 and 2010 World Bank Environmental and Social Guidelines, (ESS, 2 Labor and working Condition)		

8.9 Environmental and Social Management Costs

The primary component of the environmental and social management cost pertains to the personnel dedicated for ESMP implementation. The other component relates to the construction of drains and rehabilitation of the drains, water channels and watercourses there may be some adverse impact on the physical, biological and socio-economic environment. All of these impacts need to be compensated/ mitigated/ rehabilitated properly. For mitigation of the adverse impacts, following Table 8.5 shows the cost will be involved.

Table 8.5: Environmental Social Management Plan Implementation Cost

Description		Cost (Million Rupee)
Environmental and Social Management Plan (ESMP)		
1	Environmental and Social Personnel (Salaries during construction)	48.00
2	External Monitoring (Outsource)	3.00
3	Training (Outsource)	1.50
4	Environmental Audit (Outsource)	1.00
5	Ambient Air Quality Monitoring (Quarterly)	2.40
6	Water Quality Testing (Quarterly)	6.40
7	PPEs (Safety Hard Helmets, Safety Shoes, Safety Goggles, Face Mask, Hand Gloves, Protective Clothing etc.)	5.00
8	First Aid Boxes, Medicine and Fire Extinguishers	5.00
9	**Total (PKRs. Millions)**	**72.30**
10	Contingencies @ 10% of Total	7.23
11	**Grand Total (PKR Millions)**	**79.53**
12	**Grand Total in Million US Dollar (Rate 279.15 March 08, 2024)**	**0.285**

8.10 Mitigation and Monitoring Plan

The mitigation and monitoring plan is the key component of ESMP. This plan describes the implementation mechanism of the mitigation actions to address the project impacts. It also assigns responsibility to various project entities for implementing these measures. The plan consists of the following:

- A listing of the mitigation measures to address the potential environmental and social impacts associated with various project activities/facilities.
- The person(s)/entities responsible for implementing/monitoring the mitigation measures.
- The parameters to be monitored for the effective implementation of measures.
- A time frame/frequency for the implementation of measures to ensure that the objectives of mitigation plan are fully met.

The summary of mitigation plans for the activities likely to have direct impacts on the environment and communities are presented in Table 8.6.

Table 8.6: Environmental Impacts, Mitigation and Monitoring Plan

Environmental Parameter	Impacts	Mitigation Measures / Actions	Monitoring Mechanism	Monitoring Frequency	Institutional Responsibilities	
					Executor	Supervision
Design Phase						
Land Acquisition	8362 acres of land will be required for implementation of the project. WAPDA will have to acquire land on permanent basis. While land involved for contractor camp, batching plant, work base area and waste disposal sites will be acquired on lease basis.	Preference to barren areas for drainage network alignments to minimize relocation and compensation of properties. Preparation of Involuntary Land Acquisition and Resettlement Plan (LARP).	Compliance as per mitigation measure. Complaint record about land acquisition and compensation.	During Design Phase	Design Engineer	Consultant
Alignment of proposed drains	Public infrastructure to be damaged.	Avoid graveyards, and other properties such as cables, water pipes, during alignment of drains. Damage to infrastructure will be compensated at market rate.	Compliance as per mitigation measure. Complaint record about damaged infrastructure compensation.	During Design Phase	Design Engineer	Consultant
Construction Phase						
Physical Environment						
Establishment and operation of labor camps, material and equipment yards and approach roads.	Change in land use and land form; contamination of soil and water; soil erosion; resource consumption; additional load on local facilities/utilities such as schools, hospitals, electricity and water supply	Sites for camps and other site facilities are approved by the supervision consultants/ PMO. If private land is used lease cost will be paid to land owner.	Written approval. Location of camps/other facilities marked on the map.	Before camp/camp/another facilities establishment.	Contractor	PMO/ CSC
		Baseline conditions are recorded before establishing camps and other site facilities.	Availability of baseline description; photographs	Before camp/camp/another facilities establishment.	Contractor	PMO/ CSC
		No involuntary land acquisition as rehabilitation activities is in the existing RoW. Photographic record to be maintained before establishing the camps/other facilities.	Photographs; a statement signed by ESU that no private land is used.	Before camp/camp/another facilities establishment.	Contractor	PMO/ CSC
		Camp size is as per standard specifications.	Approved camp layout plan.	Before camp/other facilities establishment.	Contractor	PMO/ CSC

Environmental Parameter	Impacts	Mitigation Measures / Actions	Monitoring Mechanism	Monitoring Frequency	Institutional Responsibilities	
					Executor	Supervision
		Washing areas are demarcated and water from washing areas and kitchen is released in sumps.	System in place; photographs	Weekly.	Contractor	PMO/ CSC
		Septic tanks of appropriate design used for sewage treatment and outlets are released into sumps.	Approved drawings; system in place	Before camp/other facilities establishment. ESO; ESS.	Contractor	PMO/ CSC
		The outlets released into sumps must not make a pond of stagnant water.	Presence/absence of stagnant water; photographs.	Weekly. ESO; ESS	Contractor	PMO/ CSC
		Latrines, septic tanks, and sumps are built at a safe distance from water body, stream, or dry streambed, and sump bottom is above the groundwater level.	Approved layout; physical verification.	Before camp/other facilities establishment.	Contractor	PMO/ CSC
		Sumps are in absorbent soil, down slope and away from the camp, downstream from the camp water source and above the high watermark of any nearby water body.	Approved layout; physical verification.	Before camp/other facilities establishment. ESO; ESS; ESU.	Contractor	PMO/ CSC
		Effective drainage is in place at the site.	System in place; photographs	Before the start of work, and then once a month.	Contractor	PMO/ CSC
		To avoid the chemical and oil spills in storm water run-off, materials be stored properly.	System in place; photographs	Weekly.	Contractor	PMO/ CSC
		In case of emergency spills, standard operating procedures be developed and followed.	System available at site; compliance with the system	Before the start of work; then as required.	Contractor	PMO/ CSC
		Fuel wood not be used in the camp.	Compliance; availability and arrangement of alternate fuel.	Weekly.	Contractor	PMO/ CSC
		Fuel and water consumptions be recorded.	System in place; records available.	Weekly.	Contractor	PMO/ CSC

Environmental Parameter	Impacts	Mitigation Measures / Actions	Monitoring Mechanism	Monitoring Frequency	Institutional Responsibilities	
					Executor	Supervision
		For solid wastes, the waste disposal plan be followed. No waste be left in the open.	System in place; any sign on un-disposed wastes.	Daily.	Contractor	PMO/ CSC
		Contractor to ensure that the local facilities/utilities are used in a manner not to negatively affect the local communities.	Compliance; complaints from relevant department or local communities	Weekly.	Contractor	PMO/ CSC
Access tracks	Soil erosion; Blockage of natural drainage; dust emission; loss of natural vegetation; safety hazard for communities; damage to public infrastructure;	The moving machinery should remain within the project boundary.	Demarcations on map and at the site; compliance	Daily.	Contractor	PMO/ CSC
		All sections of the access tracks that are prone to dust emission and where sensitive receptor are located within 500 m should be identified and marked on the map of the project area, and water sprinkled regularly.	Demarcations on map and at the site; compliance; photographs	Daily.	Contractor	PMO/ CSC
		Construction corridors along the access roads are marked on map and in the field.	Demarcations on the maps and in the field; photographs.	Before the start of work; then as required.	Contractor	PMO/ CSC
		Access roads do not block the natural drainage and culverts are constructed where necessary.	Compliance; photographs	Before the start of work; then as required.	Contractor	PMO/ CSC
		Adherence to the speed limit of 40 km/hr. at the access roads.	Compliance; evidence of training provided to drivers.	On random basis.	Contractor	PMO/ CSC
		Vegetation clearing is minimized and no trees are felled without prior permission of ESS. Compensatory tree plantation be carried out if any trees are felled.	Compliance; photographs.	Before the start of work; then as required.	Contractor	PMO/ CSC
		The Contractor will be responsible for preparation and seeking approval of the Traffic Management Plan (TMP)	Approved TMP; any evidence of interference	When required (particularly before commencing the works.	Contractor	PMO/ CSC
		The contractor will report any significant violation of EMP.	Any sign of violation and cumulative impacts.	Weekly.	Contractor	PMO/ CSC

Environmental Parameter	Impacts	Mitigation Measures / Actions	Monitoring Mechanism	Monitoring Frequency	Institutional Responsibilities	
					Executor	Supervision
Soils	Construction of the proposed drains and associated other structures (construction contractor camps etc.) may trigger soil erosion particularly in bad weather conditions, due to uneven slopes, drilling, compaction, improper cutting and siting and fill storage depots, improper handling of spoils, improper disposal of construction materials as well as soil pollution by leaks of combustibles and lubricants, disposal of wastewater etc. construction of structures will imply the use of heavy earth moving equipment. These machines will need routes (for example to borrow pits etc.). Which are not limited to the drains or road width but will also affect neighboring areas, including cultivated land. This can lead to soil compensation which will affect soil suitability for agricultural production.	Good engineering practices such as appropriate siting of borrow pits and fill storage depots, keeping spoil/borrow materials covered, construction of protection structures for embankment slopes, proper cutting of slopes, plantation of trees and shrubs. Proper disposal and storage of materials and chemicals (in impervious lined pits), correct handling of chemicals and construction materials, checking for leaks and spill of oil and chemical products, proper waste management, proper training of workers for storage and handling of materials on construction sites and construction contractor camps. Restriction of machinery and vehicles to designated areas.	Photographs; visual observations	Once a month.	Contractor	PMO/CSC
Agriculture and irrigation	Construction of the drains and associated structures and works (land clearance, excavation, soil fill depots, etc.) may hindered access to fields and markets, disturb agricultural activities and affect cropping in the surroundings of the construction sites. During construction phase, a large labour force will be	Restriction of machinery and vehicles to designated areas. Tribal heads to be consulted about employment of local labour	Photographs	Once a year	Contractor	PMO / CSC

Environmental Parameter	Impacts	Mitigation Measures / Actions	Monitoring Mechanism	Monitoring Frequency	Institutional Responsibilities	
					Executor	Supervision
	required. this may result in a shift of local labour from agriculture to construction.					
Extraction of earthen material.	Soil erosion; Loss of fertile soil; Obstruction in natural drainage	The contractor has to extract the material from the specified borrow areas. no agricultural land be used as borrow area.	Photographs; demarcation on maps. Leveling Revegetation	Before using, borrow area.	Contractor	PMO/ CSC
		Ensure that: Excavation is as per ESS instructions. Top six inches soil removed and stored separately. Land excavated up to 3 feet as compared to adjacent fields. The field slopes maintained Top soil spread back. Ensure compensation and revegetation	Photographs; Visual observations	Once a week when borrow area is active.	Contractor	PMO/ CSC
			Presence of surface drainage; any visible sign of soil erosion.	Once before start of using borrow area; after each rain.	Contractor	PMO/ CSC
			Demarcation on maps	Daily.	Contractor	PMO/ CSC
			Presence of any visible sign of soil erosion.	Once a week.	Contractor	PMO/ CSC
		Ensure barrow areas leveled and top soil restored.	Photographs	After completion of works.	Contractor	PMO/ CSC
Waste generation and disposal	Soil and water contamination; Obstruction in natural drainage; Obstruction of community paths; Aesthetic problem	Site selected for waste disposal is marked before starting the work (waste disposed on the proposed disposal sites)	Photographs; demarcation on maps and in the field.	At the start of the works.	Contractor	PMO/ CSC
		Waste disposal plan is developed and approved.	Approved waste disposal plan.	At the start of the works.	Contractor	PMO/ CSC
		Waste generated from different locations be disposed of according to the Plan.	Compliance record;	Daily.	Contractor	PMO/ CSC
		Photographs of selected area are taken prior and after waste disposal.	Photographic record	Once before start of works, and then as and when required.	Contractor	PMO/ CSC
		Trucks used for the transportation of waste construction material are air and watertight.	Compliance	Once before start of works, and then as and when required.	Contractor	PMO/ CSC

Environmental Parameter	Impacts	Mitigation Measures / Actions	Monitoring Mechanism	Monitoring Frequency	Institutional Responsibilities	
					Executor	Supervision
		The Contractor obligations defined in contract document and Social Framework Agreement are followed.	Compliance	Once a month.	Contractor	PMO/ CSC
		Movement of waste lifting machinery and vehicles is limited to the work area.	Demarcation on maps and in the field.	Daily.	Contractor	PMO/ CSC
		Waste material is properly disposed of that does not affect the natural drainage.	Compliance	Weekly.	Contractor	PMO/ CSC
		Dumping area levelled properly after disposal of waste material.	Compliance; photographs	Weekly.	Contractor	PMO/ CSC
		Material suitable for recycling stored separately in three bin system and sold; Combustible waste burnt at burn pit; Non-combustible, non-recyclable garbage sent to the designated landfill site; Medical waste if any transported to any hospital incineration plant; Solid residue from the septic tanks transported to municipal sewage facilities Contaminated soil sent to burn pit or landfill	System in place	Weekly.	Contractor	PMO/ CSC
Traffic Jaam	Accidents as a result of poor driving practices	Upgrade all Project related roads to appropriate standards for safety Signpost hazards in high-risk areas Educate all nearby villages on road safety All vehicles must be maintained to manufacturer's standards including regular maintenance of tires, breaks and lights.	Monthly traffic related accidents	Pre-construction/ Construction	Contractor	PMO / CSC
Construction activities;	Soil and water contamination; safety hazard; damage to crops; air contamination; noise	Maintenance of vehicle and other equipment takes place only in designated areas underlined with	Compliance; system in place; photographs.	Weekly/as required.	Contractor	PMO/ CSC

Environmental Parameter	Impacts	Mitigation Measures / Actions	Monitoring Mechanism	Monitoring Frequency	Institutional Responsibilities	
					Executor	Supervision
handling of fuels, lubricants and chemicals	emissions; damage to natural vegetation, habitat and wildlife.	concrete slabs and a system to collect runoff into mud pit.				
		Ensure that no contaminated effluent is released in to the environment.	Compliance; system in place; photographs of any violation.	Daily.	Contractor	PMO/ CSC
		Ensure machinery wash and other potentially contaminated effluents are released in mud pit.	Compliance; system in place; photographs of any violation.	Daily.	Contractor	PMO/ CSC
		Ensure that fuels, oils, and other hazardous substances are handled and stored according to standard safety practices such as secondary containment. Fuel tanks should be labeled and stored in impervious lining and dykes etc.	Approved HSE plan; compliance; photographs.	At the start of works (for the HSE plan), then daily (for compliance).	Contractor	PMO/ CSC
		Ensure spills are avoided during fuel and oil transfer operations. Appropriate arrangements, such as concrete base or drip pans, should be used to avoid spills.	Approved HSE plan; compliance; photographs.	At the start of works (for the HSE plan), then daily (for compliance).	Contractor	PMO/ CSC
		Oil and chemical storage are daily checked for leakage.	Compliance.	Daily.	Contractor	PMO/ CSC
		Shovels, plastic bags, sand bags and absorbent materials, are kept available near fuel and oil storage areas.	Compliance.	Daily.	Contractor	PMO/ CSC
		Vehicle refueling is planned on need basis to minimize travel and chance spills.	Compliance.	Daily.	Contractor	PMO/ CSC
		Vehicles/equipment are checked regularly for any fuel, oil, or battery fluid leakage.	Compliance.	Daily.	Contractor	PMO/ CSC
		Leak /spill record is maintained for each vehicle and such vehicles are operated after proper repair.	Availability of record.	Weekly.	Contractor	PMO/ CSC

Environmental Parameter	Impacts	Mitigation Measures / Actions	Monitoring Mechanism	Monitoring Frequency	Institutional Responsibilities	
					Executor	Supervision
		Soil contaminated by moderate spills or leaks (up to 200 liters) is controlled using shovels, sand and mud. The contaminated soil will be removed from the site and disposed off at landfill or burn pit as required. Major spills (exceeding 200 liters) will be handled and controlled by specialized contractor.	Availability of record; system in place; photographs of any spills.	As required.	Contractor	PMO/ CSC
		If the agriculture land/crops are damaged by the construction activities, proper compensation will be paid to the owner by the Contractor.	Compliance; photographs of any damage; any complaints from communities.	Weekly/as required.	Contractor	PMO/ CSC
		If any archeological or religious sites (such as graves) are found, these will be protected, in consultation with PMO, the relevant communities and the concerned Departments.	Compliance; photographs of any archeological or religious sites found during construction.	As required.	Contractor	PMO/ CSC
		Dust emissions due to vehicular traffic are minimized by reduced speed, vehicular traffic minimized through good traffic management and water sprinkling.	Compliance; photographs; complaints from communities.	Daily.	Contractor	PMO/ CSC
		Dust emissions at the rehabilitation sites are minimized by implementing good housekeeping and sound management practices.	Compliance; photographs; complaints from communities.	Daily.	Contractor	PMO/ CSC
		Use strict standards for maintenance of construction machinery and sprinkling of water, dust and smoke.	Compliance; photographs; complaints from communities.	Daily.	Contractor	PMO/ CSC
		All equipment, generators and vehicles used during the construction are properly tuned and maintained in good working condition.	Compliance; photographs; maintenance record.	Daily.	Contractor	PMO/ CSC
		Use appropriate and machinery in good working condition, keeping noise levels within NEQS.	Compliance; complaints from communities.	Weekly.	Contractor	PMO/ CSC

Environmental Parameter	Impacts	Mitigation Measures / Actions	Monitoring Mechanism	Monitoring Frequency	Institutional Responsibilities	
					Executor	Supervision
		Ensure prohibition of use of vehicle horns anywhere inside the fenced areas or on the access roads is strictly observed.	Compliance; complaints from communities.	Randomly.	Contractor	PMO/ CSC
		Ensure that drivers are discouraged from keeping vehicles running in parking lots.	Compliance.	Randomly.	Contractor	PMO/ CSC
		At unavoidable noisy places, the workers should be provided ear plugs and other protective devices.	Compliance; availability of PPE.	Randomly.	Contractor	PMO/ CSC
		Fuel consumption will be recorded.	Availability of record.	Randomly.	Contractor	PMO/ CSC
		During construction activities, minimum vegetation is lost. If any tree is uprooted, ensure that the Contractor has planted at least 4 for one tree lost.	Compliance; photographs of pre-construction conditions.	Once at the start of work, then as required.	Contractor	PMO/ CSC
		Ensure that endangered trees species (if any) are not cut.	Compliance; photographs of pre-construction conditions	Once at the start of work, then as required.	Contractor	PMO/ CSC
		After completion construction the vegetation of the area should be restored through indigenous species.	Compliance; photographs of restored conditions.	After works completion.	Contractor	PMO/ CSC
		Waste/food waste is disposed in such a way that animals are not attracted.	Compliance; photographs of any violations.	Daily.	Contractor	PMO/ CSC
		Natural habitats be maintained to the maximum extent.	Compliance; photographs of pre-construction and during-works conditions	Once at the start of work, then as required.	Contractor	PMO/ CSC
		Any endangered species should be documented and activities be carried out to reduce negative impacts.	Compliance; availability of record.	As required.	Contractor	PMO/ CSC
		Contractor's staff be strictly prohibited from buying any wild animals/birds.	Compliance; evidence of trainings provided to staff.	Randomly.	Contractor	PMO/ CSC

Environmental Parameter	Impacts	Mitigation Measures / Actions	Monitoring Mechanism	Monitoring Frequency	Institutional Responsibilities	
					Executor	Supervision
		Ensure there is no open defecating in the vicinity of camps / construction site.	Compliance; evidence of any violations.	Daily.	Contractor	PMO/ CSC
		Ensure that discharging firearms is not allowed.	Compliance; evidence of trainings provided to staff.	Randomly.	Contractor	PMO/ CSC
		Safe driving be observed to avoid accidental killing of reptiles / small animals crossing the roads.	Compliance; evidence of trainings provided to staff.	Randomly.	Contractor	PMO/ CSC
		Damage to the natural topography and landscape is minimum.	Compliance; photographs of pre-construction conditions	Weekly.	Contractor	PMO/ CSC
		No-hunting, no-trapping, no-harassing and no-fishing policy be strictly observed.	Compliance; evidence of trainings provided to staff.	Randomly.	Contractor	PMO/ CSC
		General awareness of the crew be enhanced regarding the wildlife and natural vegetation, through environmental training, and sign boards.	Compliance; evidence of trainings provided to staff.	Randomly.	Contractor	PMO/ CSC
		Planning, designing and execution of the project be carried out through adopting proper mitigation measures to conserve aquatic life. Ensure that no oil/lubricant or other toxic materials are released into the river.	Compliance	Randomly.	Contractor	PMO/ CSC
Installation and operation of batching plant	Soil, air and water contamination; safety hazard for communities.	No private land be used for installation of the batching plant. In case of private land is used, the compensation be paid to land owner.	Demarcation on map; photographs; a statement signed by ESU that no private land is used.	Before establishing the batching plant.	Contractor	PMO/ CSC
		Location of batching plant be at least 500 meters away from the settlement.	Compliance; community complaints.	Before establishing the batching plant.	Contractor	PMO/ CSC
		Batching material be stocked on specified area in compliance with specifications of installation of batching plant.	Compliance; locations marked on map and at the site; photographs.	Before establishing the batching plant, then randomly	Contractor	PMO/ CSC

Environmental Parameter	Impacts	Mitigation Measures / Actions	Monitoring Mechanism	Monitoring Frequency	Institutional Responsibilities	
					Executor	Supervision
		Batching plant be installed with emission-control mechanism, and the system remains operative/effective during the batching plant operation.	Compliance; photographs.	Before establishing the batching plant, then daily.	Contractor	PMO/ CSC
		Batching plant not contaminates the soil and water, or block natural drainage.	Compliance; photographs.	Before establishing the batching plant, then daily.	Contractor	PMO/ CSC
Air Quality	Gaseous vehicular emissions and fugitive dust emission from construction machinery movement, construction and upgrading of roads and excavation of borrow areas will affect air quality Dust emissions /Particular Matter emissions due to exaction and concreate mixing process during construction phase.	Ensure equipment and vehicles are properly tuned and maintained to minimize exhaust emissions. Compliance of vehicles and equipment with Sindh EPA SEQS. Dust meters to check whether the dust exceeds permissible limits and use of ventilation. Sprinkling of water to reduce dust on access roads and tracks, and in construction zones and material storage areas. Use of tarpaulins on haul trucks carrying earth, sand, aggregate and other materials to contain dust.	Compliance as per mitigation measures Monitoring of ambient air against SEQS.	Weekly	Contractor	PMO / CSC / EPA.
Noise and Vibration	Use of heavy machinery equipment and construction activities may cause in high noise levels which will affect the nearby residents and workers.	Construction machinery and equipment should be tuned and maintained. Limit movement of construction machinery to day time to minimize noise disturbance. Installing noise barriers as a wall or earth wall, where construction site is near a settled area. Contractor should define adequate work operating procedures to reduce noise. PPEs should be provided to labour force and work should be done in shifts. Hours of work to be limited near settlements to reduce disruptions to local residents.	Compliance as per mitigation measures The contractor will monitor the noise levels regularly at the nearby villages and other sensitive receptors to ensure that these do not exceed SEQS.	Weekly	Contractor	PMO / CSC / EPA.

Environmental Parameter	Impacts	Mitigation Measures / Actions	Monitoring Mechanism	Monitoring Frequency	Institutional Responsibilities	
					Executor	Supervision
Water Quality	Construction activities, sewerages from construction sites and work camps may affect the surface water quality. The construction works will modify groundcover and topography changing the surface water drainage patterns of the area. These changes in hydrological regime lead to increased rate of runoff, increase in sediment and contaminant loading, increased flooding.	Minimize the generation of sediment, oil and grease, excess nutrients, organic matter, litter, debris and any form of waste (particularly petroleum and chemical wastes). These substances must not enter waterways or storm water systems. Monitor the water quality in the runoff from the site or areas affected by excavation. Do not discharge cement and water curing used for cement concrete directly into water courses and drainage inlets.	Compliance as per mitigation measures The contractor will monitor the water quality regularly.	Monthly	Contractor	PMO/CSC
Biological Environment						
Vegetation and habitat	Local flora is important to provide shelters for the birds so that, clearance of vegetation may impact shelter, feeding, breeding, physical destruction and severing of habitat areas. Lack of awareness may lead to environmentally destructive practices Unnecessary damage to vegetation and habitat due to excessive clearance. Damage to flora has wide range of adverse environmental impacts. Impact on migratory birds, its habitat and its active nests.	Clear only the vegetation that needs to be cleared in accordance with the engineering plans and design i.e.; use appropriate type and minimum size of machine to avoid disturbance to adjacent vegetation. Make selective and careful pruning of trees where possible to reduce need of tree removal Not burn off cleared vegetation -where feasible, chip or mulch and reuse it for the rehabilitation of affected areas, temporary access tracks or land escaping.	Compliance as per mitigation measures	Monthly	Contractor	PMO/CSC
Wildlife	The location of construction activities can result in the loss of wild life habitat and habitat quality, illegal poaching Potential impacts on Wildlife.	Prohibit hunting, fencing to exclude wildlife, prohibit carrying and use of firearms.	Compliance as per mitigation measures; Photographs	Monthly	Contractor	PMO / CSC

Environmental Parameter	Impacts	Mitigation Measures / Actions	Monitoring Mechanism	Monitoring Frequency	Institutional Responsibilities	
					Executor	Supervision
Socio-economic Environment						
Land acquisition	Involuntary resettlement; loss of assets and income opportunities; damage to crops.	All the activities construction of drains and rehabilitation activities are going to be carried out in the existing RoW, 8362 acres of land will be acquired and about 30 acres of land may be required for workshop, labour camp etc. and will be taken on lease and temporary basis.	Demarcation on maps; photographs; a statement signed by PMO that no private land is involved.	Before start of works.	Contractor	PMO/ CSC
		In case private land acquisition has to be undertaken, a RAP will be prepared, in accordance with the SEPA guidelines and RPF agreed under the project.	Availability of RAP.	Before start of works.	Contractor	PMO/ CSC
Social issues	Local conflicts; privacy of women.	Ensure that conflicts with tribal leaders and local communities be avoided.	Any sign of conflicts; community complaints.	Randomly.	Contractor	PMO/ CSC
		Ensure that individuals holding titles to private property used in the project (if any) be compensated as per DC rates and all payments are recorded.	Availability of records; community complaints.	Randomly.	Contractor	PMO/ CSC
		Focus group meetings be conducted to identify any water related or other issues.	Evidence/records of meetings; community complaints.	Randomly.	Contractor	PMO/ CSC
		Ensure that PMO representatives visit the site monthly and gather complaints from Social / Environment Complaints Management Register and provide feedback to the concerned on the compliance status.	Evidence/records of visits; community complaints.	Randomly.	Contractor	PMO/ CSC
		Project staff interaction with local community be minimum.	Compliance; community complaints.	Randomly. ESO; ESS; ESU.	Contractor	PMO/ CSC
		Guidelines be prepared and implemented to sensitize laborers to local norms and customs to minimize cultural tensions.	Compliance; evidence of training provided to staff.	Randomly.	Contractor	PMO/ CSC
Public health and safety issues	Safety hazard for local population;	The contractor will develop and implement a Health, Safety, Environment and Social (HSE) plan.	Plan in place and operational.	Once at the start of works, then randomly.	Contractor	PMO/ CSC

Environmental Parameter	Impacts	Mitigation Measures / Actions	Monitoring Mechanism	Monitoring Frequency	Institutional Responsibilities	
					Executor	Supervision
	health hazard for local population and project staff.	Due precautions be taken by the Contractor, to ensure the safety of his staff and labor and, in collaboration with and to the requirement of the local authorities.	HSE plan in place; accident record.	Once at the start of works, then randomly.	Contractor	PMO/ CSC
		Ensure that medical staff headed by qualified medical doctor, first aid equipment and stores, sick bay and suitable ambulance service are available at the camps, housing, and on the site at all times throughout the period of the contract and that suitable arrangements are made for the prevention of epidemics and for all necessary welfare and hygiene requirements.	System and staff in place; community complaints	Once at the start of works, then randomly.	Contractor	PMO/ CSC
		Leave no machinery unattended in the project area.	Compliance as per mitigation measures	Randomly.	Contractor	PMO/ CSC
		Materials, gears and equipment (including Personal Protective Equipment (PPE) needed to carry out the job safely be provided to the workers.	Ambulance and system in place	Once at the start of works, then randomly.	Contractor	PMO/ CSC
		Ensure that employees have access to running potable water at their place of work and shadow area is provided for rest.	HSE plan in place; availability of PPE.	Once at the start of works, then randomly.	Contractor	PMO/ CSC
		Use of horns be prohibited, except when necessary.	System in place.	Once at the start of works, then randomly.	Contractor	PMO/ CSC
		Entry points into construction sites be staffed 24 hours a day.	Compliance as per mitigation measures	Randomly.	Contractor	PMO/ CSC
		Safe driving practices be adopted, particularly while passing close to settlements. This includes a speed limit of 40 km per hour if passing within 100 m of settlements.	Compliance as per mitigation measures	Randomly.	Contractor	PMO/ CSC

Environmental Parameter	Impacts	Mitigation Measures / Actions	Monitoring Mechanism	Monitoring Frequency	Institutional Responsibilities	
					Executor	Supervision
		Safe driving practices be adopted, particularly while passing close to settlements. This includes a speed limit of 40 km per hour if passing within 100 m of settlements.	Compliance; evidence of training provided to drivers.	Randomly.	Contractor	PMO/ CSC
		Do screening of labor at the time of recruitment. Undertake periodic awareness campaigns for HIV/AIDS for the project staff.	Availability of record; evidence of training provided to staff.	Once at the start of works, then randomly.	Contractor	PMO/ CSC
		Risk assessment of the spread of HIV/AIDS be undertaken in the project.	Availability of record;	At the start of works.	Contractor	PMO/ CSC
Employment opportunities	Local dissent associated with influx of workers from other parts of the country	Maximum employment be provided to the local people.	Availability of record; community complaints.	Randomly.	Contractor	PMO/ CSC
		Maintain inter-tribal balance when giving employment to the local population. Give preference to the people directly affected by the project.	Availability of record; community complaints.	Randomly.	Contractor	PMO/ CSC
Aesthetic/ scenic quality.	The construction activities could affect the aesthetic / scenic value of the area.	Carry out complete restoration of the construction sites. Remove all waste, debris, unused construction material, and spoil from the worksites.	Compliance as per mitigation measures; photographs.	After completion of works.	Contractor	PMO/ CSC
Roads, bridges and traffic	Potential noise, vibration, air quality and soil impacts Significant increase in traffic due to construction which will increase the risk of accidents to road users. Road works are likely to cause disruption to local traffic through delays at construction sites and detour routes.	Strictly follow the Project s Traffic Management Plan. Provide signs at strategic locations of the roads, complying with the schedules of signs contained in the Pakistan Traffic Regulations. Prepare and submit additional traffic plan, if any of traffic routes are not covered in the Project traffic management plan.	Road accident proformas; community complaints.	Randomly.	Contractor	PMO/ CSC
Operation phase (Physical, Biological and Socio-economic Environment)						
Impact of acidification	Acidification can harm aquatic organisms, including fish, insects, and other invertebrates.	Sources of acidification in surface drains can vary, including natural processes like the leaching of acidic substances from rocks and human activities like the	Compliance as per mitigation measures Available of Record , visually observation	Randomly	WAPDA	WAPDA

Environmental Parameter	Impacts	Mitigation Measures / Actions	Monitoring Mechanism	Monitoring Frequency	Institutional Responsibilities	
					Executor	Supervision
	Fish eggs and juvenile fish are particularly sensitive to changes in pH, and acidified water can lead to reduced fish populations. Acidification can disrupt food chains in aquatic ecosystems. Acidification can lead to a decrease in the overall biodiversity of an ecosystem. – Acidic water can corrode and damage infrastructure such as drainage pipes and culverts. Acidification can cause the release of toxic metals (e.g., aluminium, lead, and mercury) Acidic water can affect the overall water quality of the drain. Acidic water can decrease soil pH, which can harm crops and reduce agricultural productivity).	discharge of acidic industrial effluents or acid rain. Preventing and mitigating surface water acidification often involve addressing these underlying causes, such as reducing emissions of acidic pollutants and managing land use practices to minimize the release of acid-forming substances into water bodies. Additionally, monitoring and regular assessment of water quality in surface drains are essential for early detection and appropriate management of acidification issues.				
Impact of salinization	The presence of high content of salts, retards the plant growth and causes the reduction in crop yields. The rise of the groundwater table near ground surface in saline ground water (SGW) areas and consequently soil salinization continued to be the cause of serious environmental problems in the project area.	To mitigate the effects of salinization on surface drainage, it is important to implement appropriate land management practices, such as improved irrigation techniques, salt-tolerant crops, and soil amendments. Additionally, effective drainage systems that can efficiently remove excess salts from the root zone are crucial in salt-affected areas. Managing salinization requires a combination of soil and water management strategies to maintain healthy soil and ensure effective surface drainage. Improving irrigation Practices can help to reduce Soil Salinity. Allowing excess water to drain away from the soil. This can be achieved by using drip irrigation	Compliance as per mitigation measures Available of Record , visually observation	Randomly	WAPDA	WAPDA

Environmental Parameter	Impacts	Mitigation Measures / Actions	Monitoring Mechanism	Monitoring Frequency	Institutional Responsibilities	
					Executor	Supervision
		or other method that deliver water directly to the roots of plants reducing evaporation and leaching. Enhancing Drainage can also help to reduce soil salinity by allowing excess water to drain away from the soil. This can be achieved by installing drainage pipes or Construction canal to divert water away from Soil. Planting Salt-Tolerant can also help to reduce soil Salinity. These crops are able to tolerate high level of Salt in the Soil. Reducing the need for irrigation and fertilizer				
Impact on hydrology	Drainage system can significantly alter the natural hydrological regime of wetlands, marshes and other ecosystems. Change in water levels, flows and sediment transport can disrupt habitats leading to loss of biodiversity and ecological imbalance. Drainage system of the Project can expedite the movement of water off the land surface, leading to increased runoff. This can result in higher volumes of water flowing into river and other water bodies, potentially causing erosion. Drainage system can modify the Natural flow patterns of water on the surface. By channeling water through ditches or canals, the natural distribution of water across a landscape may be altered, affecting the timing,	The impacts of drainage system on surface hydrology can vary depending on the scale of system, the type of land use, climate conditions and the design and maintenance of the drainage infrastructure. sustainable planning and management practices are crucial to mitigate negative impact s and promote responsible water management.	Compliance as per mitigation measures Availability of Record	Randomly	WAPDA	WAPDA

Environmental Parameter	Impacts	Mitigation Measures / Actions	Monitoring Mechanism	Monitoring Frequency	Institutional Responsibilities	
					Executor	Supervision
	quantity and quality of water reaching downstream areas. Poor planning or infrastructure can sometimes exacerbate flood risks downstream. High volume of water discharged from drainage system into river or water bodies can overwhelm their capacity, leading to localized flooding.					
Air quality	Increase vehicular emission and affect air quality of the area.	Fit vehicles with appropriate exhaust systems and emission control devices. Operate the vehicles in a fuel-efficient manner. Impose Service all vehicles regularly to minimize emissions.	Compliance as per mitigation measures Monitoring of ambient air against SEQS.	Randomly	WAPDA and Sindh EPA	WAPDA and Sindh EPA
Impact on wildlife	Potential impacts on Wildlife	Wild animal having migrated to nearby safe areas will have the opportunity to return to their habitats after project construction activity is over/during operation phase	Compliance as per mitigation measures; Photographs	Randomly	WAPDA, Sindh EPA and Provincial Wildlife Department	WAPDA, Sindh EPA and Provincial Wildlife Department
Loss of land houses	Permanent loss of 8362 acres cultivated and uncultivated land. Loss of 304 houses,	Adequate budget will be provided in the project cost for the compensation to the affected people as per Land Acquisition Act, 1894 and Resettlement & Rehabilitation Policy 2020. Drains alignment to follow barren areas to minimize relocation and compensation of properties.	Compliance as per mitigation measures; Social Survey	Randomly	WAPDA and NGOs	WAPDA and NGOs

8.11 Indicative Site Specific Environmental Social Management Plans

8.11.1 Emergency Response and Contingency Plan

Whenever the human activities supported with heavy machinery are increased in any area, the probability of accidents such as oil spills, accidental habitat destruction, and water or air pollution is also increased. To avoid such accidents and to minimize the consequent environmental impacts, emergency response plan is developed and employed, for which the following mechanism is proposed:

- Obtain an early warning of the emergency conditions so as to avoid adverse impacts on the environment.
- Safeguard personnel to prevent injuries or loss of life.
- Minimize the impact of such event on the environment and facilities by mitigating the hazards.

The contingency plan to deal with emergencies caused by spill of chemicals and oil is shown in Table 8.7. Similar type of plans for other possible emergencies will be developed by the Contractor with the assistance of Construction Supervision Consultant before start of actual construction works.

Table 8.7: Environmental Contingency Plan to Tackle Oil and Chemical Spill

Step	Activities
Alert I Mobilize	Alert emergency coordinator and team
Initial Action	I. Start log of event II. Rescue the personnel III. Notify PMO in Sukkur IV. Notify relevant authorities
On-going Actions	Start log of event Determine appropriate strategy based on the severity of the incident. If there is a containment breach, use earth-moving equipment to construct ditch or berm to contain spill. Use pump/ absorbent to recover the product and reuse.
Stand Down	Once the incident has ended the emergency team and authorities will stand down and commence the full investigation.
Waste Disposal	Incinerate the collected spilled material and contaminated soil etc. in the incinerator or in the bum pit.

8.11.2 Emergency Response Mechanism

In the event of any emergency the Environmental project office shall take the following actions:

- Shall attend the site of the traffic incident; assess the situation and issue directions to the concerned parties and to the Fire Team in case of fire.
- Evaluate the scale of the incident and decide whether additional resources are required to deal with it.
- Liaise with site supervision staff for withdrawing any working permits.
- Liaise with site supervision staff for the mobilization of any plant and equipment necessary for dealing with the emergency.
- Limit access to the area with barriers, or other means to prevent unauthorized excess.
- Co-ordinate the re-instatement measures following stabilization of incident.

- Prepare a full report on the accident.

Prompt and appropriate action for defined events such as serious traffic accident, vehicle hit, illness/injury, fatality, snake bite etc.

8.11.3 Solid and Liquid Waste Disposal Plan

It describes the waste disposal plan for solid and liquid wastes generated during the construction and restoration periods. The expected types of wastes to be generated will be:

- Fuel, oils, and chemicals;
- Sewage;
- Campsite waste;
- Workshop waste;
- Medical waste;
- Demolition waste; and
- Packing waste; and
- Excess construction material.

The waste disposal plan outline is summarized in Table 8.8. Before start of the construction phase, the Contractor will prepare a detailed solid and liquid waste disposal plan, and get it approved from ESS.

Table 8.8: Solid and Liquid Waste Disposal

Types of Waste	Description	Disposal Method
Disposal of waste water during construction	Hazard to the natural drainage and a source of pollution	Dumping and leveling of waste only on site as agreed in SFA such as along the embankments. Soil will be properly disposed of in a manner that does not disturb the natural drainage
Fuel, oils, lubricants and chemicals	Contamination of soil or water	Soil contaminated by minor spills/ leakages (defined as leaks from the vehicles, machinery, equipment, or storage containers such that the areas and depth of soil contaminated is less than I square ft and 3 inches respectively) will be scraped and sent to the burn pit where it will be burned along with other combustible wastes. Moderate spills defined as spills of volume less than or equal to 200 liters will be contained and controlled using shovels, sand, and native soil. These materials and equipment will be made available at campsite and construction site during operation
		Major spills of volume exceeding 200 litters will require the initiation of Emergency Response Procedures. These spills will be handled and controlled by spills removal experts by employing specialized measures and treatments.
Sewage and gray Wastewater	Waste water from kitchen and washing areas sewage	Sewage and gray water to be disposed of using septic tanks and soaking pits, residue to be buried in lined pits.
Solid waste; generated from camps and residential areas	Animal, fruit or vegetable residue, domestic garbage	Recyclable waste like papers, metals, glass to be given away for recycling; non-recyclable, combustible waste to be burned in burn pit and non-combustible waste to be buried in designated landfill to be built by the Contractor as per design approved by ESS.
Medical waste	Syringes, glass bottles, bandages, blood sampling tubes, expired drugs, dressing etc.	To be incinerated at nearby hospital incinerator, if any, or an equivalent facility.

Types of Waste	Description	Disposal Method
Vehicles and workshop waste including fluid waste	Used oil, ferrous I nonferrous materials, batteries, oil	Handing over to the certified recycling Contractor.
Demolition waste	Concrete, bricks and other building materials	Reusable material to be given away for use. Remaining waste to be spread at a proper/ designated place.
Packing waste material	Paper, plastic, textiles, cardboard, rubber, wood, glass, tin, cans, aluminum cans	Combustible waste to be burned in burn pit, recyclable waste to be handed over to recycling Contractors.
Excess construction material	Sand, aggregate, cement, bricks, paints and other construction material.	To be sold back or given to the supplier or other users.

8.11.4 Traffic Management Plan

The construction activities may result in disturbance near the construction work sites, which will create inconvenience for the local people. The following arrangements are proposed to avoid this situation and facilitate smooth traffic flow:

Public Transportation

It is planned that the existing traffic facilities for public transportation should remain as such because of construction activities.

8.11.4.1 Transportation of Labour and Machinery

The vehicles and machinery to be used at site will be operated keeping in view the standard safety measures as mentioned in the Environmental Management Plan and this plan. During construction there will be a need to operate heavy machinery on site.

8.11.4.2 Material Transportation and Access Routes

The following routes/detours have been proposed for transportation of construction material to and throughout the site. Below figures details routes throughout the sites.

8.11.4.3 Contractor's Obligations regarding Traffic control

The following steps are suggested for proper management of traffic on routes to be used for material transport within the project area:

- The Contractor will display sign boards and banners about traffic diversion at places on detour routes.
- He will display a traffic man at appropriate places particularly near settlements to control traffic if required.
- Obey speed limits as prescribed in Environmental Management Plan
- Ensure regular inspection of vehicle leakage for oil and fuel, fix the problem.
- The Contractor will arrange a rescue team and first-aid facility in case of any accident.
- The Contractor will keep the smoke emission of the vehicles within NEQS.
- Water will be sprinkled on earthen routes to control dust emissions.
- No private property without permission of the owner will be used for transportation.
- Restriction on playing radio/tapes at high volumes and on use of noise producing machinery during night near settlements.

- Water Service of vehicle regularly to clean mud to avoid damage to vehicles and road.

8.11.4.4 Visitors to Site

A security cabin and security personnel will be positioned at the site entrance. Access to the construction site is controlled and manned by a trained security guard at the site entrance. Visitors to site must sign in and out at security.

8.11.4.5 Route Signage and Messages

Appropriate signage will be erected along the chosen traffic route. Signage will be erected as required to comply with relevant road works regulations and best practice.

Guidance messages will be installed on site to aware drivers and public to be familiar with site movement and traffic rules. These messages will be regarding;

- Keep slow
- Diversion ahead

8.11.4.6 Speed limits

- Narrow road/route
- Population here
- Crossing of animals
- Other various messages

Figure 8.2: Sample Signs for Traffic Management

8.11.5 Pollution Control Plan

Air Quality Control Plan

The Air Quality Control Plan is provided with the control measures to be used to minimize air emissions from all construction activities. In each specific control (i.e. dust management, gaseous pollutants management, and odor management), the plan provides control measures for emissions from equipment in accordance with best practices and the manufacturer's instructions.

The project construction involves large scale activities including movement of different types of traffic, operation of mixing plants and the presence of a large number of workers in the area. Due to all these activities, it is expected that the air quality of the project area will deteriorate. The pollution in air in the form of dust, vehicles exhaust, particulate matter, aerosols, smoke and gases will increase in addition to noise pollution. The deterioration in the local micro climate and atmosphere during construction phase will be of temporary nature and will end with the completion of the project.

Concrete Mixture Trucks

- Closely monitor emission of dust from the concrete mixing plant at the main construction area and if visually assessed that dust levels are impacting upon these settlements, mitigating measures should be adopted.
- Prevent release of alkaline cement dust from silos during filling to harm ecology and annoy neighbors by reducing fall distance between silos and containers.

Generators

- Use generators with fuel economy and in-built technology of low emissions
- Use clean fuels in generators and make record of fuel use for efficient performance
- Maintain regularly to prevent noise, emissions and leakages
- Container will be provided at generator liquid exit
- Plate form with hard base will be provided
- Buffer wall will be constructed to control release of noise and vibration
- Tests from the laboratory will be performed as per EMP

Vehicles

- To control the emissions due to vehicular movement and exhaust, following measures will be taken;
- Use fuel efficient and maintained vehicles with low emissions
- Regularly sprinkle water (only where is vehicular or machinery movement) to reduce generation of dust, especially near settlements
- Fit vehicles with appropriate exhaust systems and emission control devices, in compliance with the NEQS. Maintain these devices in good working condition.
- Service all vehicles regularly to minimize emissions and in accordance with the manufacturers maintenance procedures
- Limit the idling time of vehicles to not more than 2 minutes

- Ensue appropriate exhaust systems and emission control devices.
- Machinery causing excess pollution (e.g. visible smoke) will be banned from construction sites
- A separate washout area with settling tank will be provided as specified in concrete mixing plant
- Tests from the laboratory will be performed as per ESMP.

Construction Machinery

- Use fuel efficient and maintained vehicles with low emissions
- Fit machinery with appropriate exhaust systems and emission control devices.
- Machinery causing excess pollution (e.g. visible smoke or emissions above NEQS) will be banned from construction sites
- Service all equipment regularly to minimize emissions
- Maintain equipment (e.g. tuning of engines) to reduce exhaust emissions
- Tests from the laboratory will be performed as per EMP

Following construction machinery will be used;

- Tracked Excavators
- Excavators
- Bulldozer
- Dum Trucks
- Concrete Mixing Trucks
- Road Rollers
- Boring Rig
- Dewatering Pumps
- Horizontal Boring Machine
- Electric Welding Generators
- Grinders

Kitchens

Following mitigation measures will be ensured

- No consultation workers camps will be permitted in the project area.
- Provide fuel to the construction camps for preparation tea etc. in order to discourage them to use fuel wood or other biomass (depending upon real conditions and availability).
- Make available alternative fuels like natural gas or kerosene to the workforce to prevent them using biomass for cooking (depending upon real conditions and availability).

- Conduct awareness campaigns and trainings to educate workers on preserving the biodiversity of the project.
- Provide a sheltered and ventilated kitchen area which is separated from working place.
- Do not burn materials which may result in release of toxic or hazardous substances.

Loose Material

- Cover vehicles carrying loose & dusty materials
- Cover material placed at site
- Control speed as per traffic plan specially on earthern routes
- Make wet construction materials (where appropriate) prior to loading and transport
- Provide masks to workers working at site

Excavation and Demolition Activities

- Carryout excavation in a way to minimize emissions
- Make the soil wet where appropriate before excavation
- Avoid earthworks on windy days
- Provide mask and other appropriate PPEs to workers

Road Works

- No worker will be allowed to work without PPEs
- No worker will be allowed to work downwind the bitumen smoke
- Only skilled people in this regard will work at this site

Personal Protective Equipment

Emissions cause eye irritation, skin diseases and other health problems, therefore no worker will be allowed to work without wearing mask, glasses, goggles, other appropriate PPEs depending upon the job requirements.

Dust Management

Dust will be controlled through water sprinkling at earthen routes, work sites and restriction of speed limits during movement.

Oduor Management

Though there is no major odor problem, but to control the minor impacts following measures will be taken:

- Sufficient ventilation of work areas where there is chance of gases accumulation
- Appropriate PPEs will be provided to workers

Emissions Monitoring

Some of main monitoring parameters will be recorded as per following Table 8.9.

Table 8.9: Monitoring Parameters

Parameter	Method/Standard	Responsibility	Frequency
Smoke	Visual	Contractor	Daily
Dust	Visual	Contractor	Daily
CO/CO_2	NEQS	Contractor	As per contract
SO_x/NO_x	NEQS	Contractor	As per contract

8.11.6 Tree Plantation Plan

The project activities involve movement of light and heavy vehicles, construction of labor camps, establishment of vehicles parking places and workshops, fixing of material storage sites and batching plants etc.

The damage to these bushy plants may have some environmental issues to be addressed. The Contractor of the project will be bound through contract to save the each and every plant wherever possible. He will also be responsible to have a check on the labor to avoid cutting of any trees for using as firewood etc.

However, if there is any damaged to the plants will be responsibility of the Contractor to replant at least five times the number of trees cut/ damaged for clearance of site at the time of establishment of the auxiliary services and during construction. All trees to be replanted should be preferably of native species as they have more chances of survival. The Contractor will also be responsible for taking care and replacement of dead plants throughout the project duration. In case of more plants are damaged a tree plantation plan will be prepared by the contractor and submitted to the Engineer for approval prior to implementation.

8.11.7 Restoration and Rehabilitation Plan

After completion of the construction, work all the disturbed sites will be rehabilitated in to conditions prior to the commencement of the project. The area will be planted with indigenous vegetation and all the temporary access roads will be broken in the strategic places so that it can no longer be used. All the concrete will be broken and dispose off according to the waste disposal plan provided in Table 8.8. The fencing will be removed; the barrow area leveled and the top soil will be restored separately at the time of construction.

The following procedures will be followed:

- All concrete structures will be broken up and debris will be taken away to the landfill site
- All fencing and access gate will be removed
- All pits, except the waste mud pit will be backfilled
- The waste mud pit will be fenced using chain links and guard will be posted at the site. This arrangement will last until the entire contents of the pit are completely dry. Once dry, the residual material will be removed and taken to the landfill site. The pit will fill and fence will be removed
- Re-vegetation measures will be taken to restore the area to its original conditions.

8.11.8 Health, Safety, Environment Plan

Corporate Health and Safety Policy

The Contractor is committed to preventing the accidental loss of any of its resources, including employees and physical assets.

In fulfilling this commitment to protect both people and property, management will provide and maintain a safe and healthy work environment, in accordance with industry standards and in compliance with legislative requirements, and will strive to eliminate any foreseeable hazards which may result in property damage, accidents, or personal injury/illness.

We recognize that the responsibility for health and safety are shared. All employees will be equally responsible for minimizing accidents within our facilities and on our work sites. Safe work practices and job procedures will be clearly defined in the company's Health, Safety, Environment Plan for all employees to follow.

Accidental loss can be controlled through good management in combination with active employee involvement. Safety is the direct responsibility of all managers, supervisors, employees, and contractors.

Health, Safety, Environment Responsibility

The following are the individual responsibilities for safety and health of key personnel within the organization:

Project Manager

- Ensuring that employees, sub-contractors and visitors are aware of safety procedures.
- Establishing that all equipment, plant and substances used are suitable for the task and are kept in good working condition; this include, the regular maintenance and servicing of equipment.
- Providing adequate training, information, instruction and supervision to ensure that work is conducted safely.
- Taking immediate and appropriate steps to investigate and rectify any risks to safety and health arising from the work activities.
- Bringing to the attention of the Contractor and the Employer any health and safety issues that require their attention.
- Ensuring that all accidents and "near misses" are properly recorded and reported and that an investigation is carried out to determine the root causes.
- Maintaining safe access at the workplace at all times.
- Be the Chairman of the Project's Safety and Health Committee and ensure that all matters relating to safety and health brought out in the meetings are carried out and enforced appropriately.

Construction Manager

- Knowing and understanding the Contractor's Safety Policy and the responsibility for safety allocated to each level of staff within the project.

- Coordinating safety activities between the Contractor and sub-contractors.
- Determining at the planning stage:
    - The most appropriate order and method of working;
    - The provision of adequate lighting;
    - The allocation of responsibilities with sub-contractors and others;
    - Hazards which might arise from overhead or underground power lines and other situations which might lead to unnecessary improvisations on site;
    - Facilities for welfare and sanitation;
    - Basic fire precautions.
- Providing written instructions to establish working methods to explain the sequence of operations, outlining potential hazards at each stage and indicating precautions to be adopted. Provide written safe working statements for plant and equipment as well as operators.
- Checking over working methods and precautions with the Project Manager before starting work.
- Ensuring that work, once started is carried out as planned and in accordance with the Health, Safety, Environment Plan, relevant laws, regulations, and codes of practice.
- Setting good personal example.
- Seeing that proper care is taken of casualties and know where to obtain medical help and ambulance service in the event of a serious injury.
- Accompanying relevant government authorities on site visits and complies with their recommendations.
- Releasing supervisors and operators where necessary, for on- or off-site safety training.

Health, Safety, Environment Officer

- Advising site management on the following:
    - Prevention of injury to personnel and damage to plant and equipment.
    - Further improvement in existing sound working methods.
    - Legal requirements affecting safety, health and welfare of the workers.
    - Provision and use of protective clothing and equipment.
    - Potential hazards on new contract before work start and on the site safety organization.
    - Methods of safe working arising from new developments/activity.
    - Changes in legislation and safe codes of practices.
    - Other related health and safety issues occurred in the project.

- Carrying out hazard identification and assessment, in association with the Construction Manager, Supervisor to decide on the best safe methods of working are in operation; that all regulations are being observed.
- Determining the cause of any accident or dangerous occurrence and recommends means of preventing recurrence.
- Supervising the recording and analysis of information on injuries, damage and loss, analyze accident trends and review overall safety performances.
- Provide training input for all levels of employees on safety issues.
- Promoting awareness of injury prevention and damage control to all levels of employees.
- Keeping contact with official and professional bodies relating to occupational health and safety in Pakistan.
- Conduct the health and safety programs such as weekly training, weekly toolbox talks, weekly machinery inspection, weekly walkabout etc.
- Ensure the welfare of the workers to be taken care of such as sleeping facilities, drinking water facilities, food supply and etc.
- Keeping up to date with recommended codes of practices and new safety literature, circulate information applicable to each level of employees.
- Acting as secretary for the Project Health, Safety, Environment Committee Meeting.

Construction Supervisor

- Organizing work sites so that work is carried out to the required safety standard with minimum risk to men, equipment and materials.
- Understand the requirement of the Safety Plan in accordance with the applicable legislation currently in force in Pakistan and other relevant legislation and how it applies to the project.
- Ensuring that all materials and equipment sent to site are safe and fully efficient, are guarded and equipped with safety devices and are tested in accordance with the safety plan.
- Making certain that all plant operators and maintenance personnel are only employed for that which they have been thoroughly trained.
- Checking that all repairs and maintenance work carried out on site is done in a proper manner and that emergency repairs are dealt with properly as soon as possible. Call the attention of site management if there is a need for dangerous plant to be put out of service.
- Checking that hired plants are safe to work.
- Giving all Foremen and leading hands precise instructions on their responsibilities for proper working methods; see that they do not require or permit men to take unnecessary risk.
- Arranging delivery and stacking of materials to avoid risks by double handling; positioning plant effectively, ensuring that the electricity supply is installed and maintained without endangering men and equipment.
- Planning and maintaining a tidy work site.

- Implementing arrangements with sub-contractors and other contractors on site to avoid any confusion about areas of responsibility.
- Making sure suitable protective clothing is available and used.
- Liaising with the District Fire Brigade Office Sukkur. Prior approval shall be taken from the department.
- Setting good personal example.

Foreman

- Understand the requirement of the Health, Safety, Environment Plan and regulations applicable to the work on which their gangs are engaged and insist that those regulations be observed.
- Incorporating safety instructions in routine orders and seeing that they are being obeyed.
- Restraining workers from taking unnecessary risks.
- Ensuring that new employees to be trained on the workplace safety precautions.
- Transmitting safety knowledge and Contractor's message to his fellow workers.
- Discouraging horseplay and reprimanding those who consistently fail to consider their own well being and that of others around them.
- Reporting defects in plant or equipment.
- Setting good personal example.

Workers

- Using the correct tools and equipment for the job; use safety equipment and protective clothing supplied, e.g. roof ladders, safety helmets, belts, goggles etc. according to job performed and the hazards identified.
- Keeping tools in good working conditions.
- Reporting to supervisor defects in plant or equipment.
- Developing a personal concern for safety– for themselves and for others, particularly newcomers and young people.
- Avoiding improvising which entails unnecessary risk.
- Advice and warning new workers of known hazards.
- Refraining from horseplay and the abuse of welfare facilities.
- Suggesting ways to eliminating hazards.

8.11.8.1 Electrical Safety

Accidental contact with electrical components can have deadly consequences. Always refer to the manufacturer's recommended operating practices prior to using new electrical appliances, tools and equipment. Following guidelines shall be used to reduce the risk of personal injury.

- All electrical tools and appliances shall be double insulated or have a three-prong plug-in.

- Only qualified and authorized electricians should be allowed to service and repair electrical appliances, tools and equipment.
- Prior to operating electrically powered tools and equipment, it shall be ensured that work is carried out on a dry surface.
- Tools with damaged cords, grounds and housing units shall be tagged “Out of Service” and sent for repair.
- Missing or damaged ground plugs of any appliance, tool or piece of equipment shall be repaired prior to use.
- Damaged extension cords shall be tagged “Out of Service”, repaired or replaced as warranted.
- Always stand to the side of a service box when resetting a breaker.
- Disconnect power tools from power source before making adjustments. Defective equipment needs to be tagged “Out of Service” and removed.
- Tools with electrical arcing brushes should be removed when you feel any tingling during use.

8.11.8.2 Fire and Fire Extinguishers

Fires can start anywhere and at any time. This is why it is important to know the type of fire extinguisher to use and how to use it

Always keep fire extinguishers visible with easy access. Fire extinguishers shall be properly maintained. Where temperature is a factor, that care is taken in selecting the right extinguisher

Workers shall receive training before using fire extinguishing equipment.

Types of Fires

- Class A: Wood, paper, rags, rubbish and other ordinary combustible materials.
    - Recommended Extinguishers: Water from a hose, pump type water can, pressurized extinguisher, or soda acid.
    - Fighting the Fire: Soak the fire completely – even the smoking embers.
- Class B: Flammable liquids, oil and grease.
    - Recommended Extinguishers: ABC units, dry chemical, foam and carbon dioxide.
    - Fighting the Fire: Start at the base of the fire and use a swinging motion from side to side, always keeping the fire in front of you.
- Class C: Electrical equipment.
    - Recommended extinguishers: Carbon dioxide and dry chemical (ABC units).
    - Fighting the Fire: Use short bursts on the fire. When the electrical current is shut off on a Class C fire, it can become a Class A fire if materials around the electrical fire are ignited.

Fire Protection Requirements

- All entrances and exits shall be kept clear of obstructions such as vehicles, equipment and general clutter at all times.
- Appropriate shielding of flammable surfaces shall be used when performing hot work.
- Remember that grinders are capable of throwing red hot particles approximately 30 feet.
- Work area should be kept free of unnecessary combustible materials.
- Proper degreasing agents shall be used. Gasoline or other “flammable liquids” should not be used for degreasing or cleaning.
- All fire doors shall be kept closed when the work is finished.

Fire Fighting Equipment

- All workers should know the location of the firefighting equipment in their area.
- Fire extinguishers shall be checked monthly.
- An empty extinguisher shall not be returned to its fire station. It shall be clearly marked “MT” with chalk and exchange it for a charged unit.
- All fire extinguishers will be inspected on an annual basis by a certified company.
- All workers shall receive training before using fire extinguishing equipment.

Trenching/Excavation

Soil conditions and stability can vary greatly from one area to another. Factors that can affect soil stability include, but are not limited to: previously disturbed soil, drying of walls and sub-surface weeping.

Hard Compact

Hard compact is defined as:

- Hard to hand excavate,
- An excavating bucket can leave well defined teeth marks in the soil,
- The soil has been verified as hard compact by a Professional Engineer,
- A soil testing kit indicates that it is hard compact.

Soils Other than Hard Compact

- Require a 45 degree or greater cutback from the vertical side wall in all soil conditions above 1.2 meters in height.
- Require the use of shoring, or
- Require the use of an engineered trench box.

Spoil Piles

- They should be set back a minimum of 1.0 m from the trench/excavation edge.
- If placed too close to the trench or excavation edge, they can exert excess downward pressure causing wall failure.

- Excavated loose material should be scaled back away from the edge of the trench.

Welding Cutting and Burning

Work involving welding, cutting and burning can create fires and breathing hazards for workers on any job. The following should be considered prior to the start of work.

- Always ensure that adequate ventilation is supplied since hazardous fumes can be created during welding, cutting or burning.
- Where other workers may also be exposed to the hazards created by welding, cutting and burning, they shall be alerted to these hazards and protected by the use of “screens”.
- Never start work without proper authorization.
- Always have firefighting equipment on hand before starting.
- Check the work area for combustible material and possible flammable vapours.
- A welder should never work alone. A fire or sparks watch should be maintained.
- Protect cables and hoses from slag or sparks.
- Never weld or cut lines, drums, tanks, etc. that have been in service without making sure that all have been purged or other necessary precautions are in place.
- Never enter, weld or cut in a confined space without proper air quality testing and a qualified safety lookout in place.
- When working overhead, use fire resistant materials (blankets, tarps) to control or contain slag and sparks.
- Cutting and welding should not be performed where sparks and cutting slag will fall on cylinders. Move all cylinders away to one side.

Open all cylinder valves slowly. The wrench used for opening the cylinder valves should remain on the valve spindle.

Solvent and Flammable Liquids

Cleaning solvents are used in day-to-day construction work to clean tools and equipment. Special care shall be taken to protect the worker from hazards which may be created from the use of these liquids. Wherever possible, solvents should be non-flammable and nontoxic.

The foreman shall be aware of all solvents/flammables that are used on the job, and be sure that all workers who use these materials have been instructed in their proper use and any hazard they pose. The following practices will apply when solvents/flammables are used:

- Use nonflammable solvents for general cleaning.
- When flammable liquids are used, make sure that no hot work is permitted in the area.
- Store flammables and solvents in special storage areas.
- Check toxic hazards of all solvents before use.
- Provide adequate ventilation where all solvents and flammables are being used.
- Use goggles or face shields to protect the face and eyes from splashes or sprays.

- Use rubber gloves to protect the hands.
- Wear protective clothing to prevent contamination of worker's clothes.
- When breathing hazards exist, use the appropriate respiratory protection.
- Never leave solvents in open tubs or vats. Return them to storage drums or tanks.
- Ensure that proper containers are used for transportation, storage and the field use of solvents/flammables.
- Where solvents are controlled products, ensure that all employees using or in the vicinity of use or storage are trained in the Workplace Hazardous Materials Information System (WHMIS).
- Ensure all WHMIS requirements are being met.

CHAPTER 9

RESETTLEMENT ASPECTS

9 RESETTLEMENT ASPECTS

9.1 General

Population resettlement aspects of the Project are important components of Environmental Social Impact Assessment. The project components, which will cause a change in the land use pattern and other natural resources. It will have multifaceted effects on the housing, community and public structures, social networks, productive assets, income sources, cultural identities, potentials for quality and quantity of the assets and resources.

As per national and international donors safeguard policies the preparation of Resettlement Action Plan (RAP) becomes obligatory on the Project proponent if displacement of more than 200 persons is involved.

The RAP provides details of public/private properties and infrastructure expected to be damaged and requiring compensation or reconstruction. RAP also covers entitlement framework, compensation assessment and disbursement procedure, grievance redressal mechanism, pre and post project monitoring requirements and the resettlement budget for the project.

It is investigated during the field visits and details design of the RoW of the proposed drains that there are 304 houses, government infrastructure, displacement of human population and social impacts are noted therefore, RAP is required and should be prepared and recommended by the environmental consultants. however, following the TORs of the Project some limited resettlement aspects are mentioned in the study.

The resettlement aspects have been prepared for undertaking the assessment of the project affectees, identification of categories of impacts, number of affected persons with inventory of affected assets and other losses, entitlement of compensation, and other mitigations.

9.2 Need for the Resettlement Planning

It is widely accepted by the donors that unmitigated involuntary resettlement under development projects often gives rise to severe economic, social, and environmental risks. The 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, 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.

The Resettlement Action Plan (RAP) will prepare **(if required)** as per the statutory requirements of Government of Sindh Resettlement & Rehabilitation Policy, 2022 which provide guidance in resettlement planning, implementation, and monitoring/evaluation and the World Bank Environmental and Social Framework (ESF) 2018 includes Environmental and Social Standards (ESSs) to address and mitigate these impoverishment risks.

During preparation of the RAP, the potential positive and negative social impacts created by the construction of the Jacobabad, Shikarpur and Kashmore Drainage Project are identified through field surveys, consultation meetings and discussions with PAPs, Government officials and experts. A socio-economic study will carry out to identify potential impacts and affected households and properties located along the route.

The RAP sets out objectives, principles, eligibility criteria and public participation mechanisms to compensate land and other assets, identifies compensation beneficiaries, and provides the results of the consultations which accompanied its preparation. The RAP is based on a comprehensive diagnosis of the socioeconomic context and social analysis within which the PAPs operate. The plan focuses on culturally sensitive socio-legal milieu and administrative systems for land administration and ownership, entitlement provisions, modes of compensation and conflict resolution mechanisms.

The RAP will be endorsed by the Project Executing Agency, prior to initiation of the relevant civil works, and will be publicly disclosed in a manner accessible to the project-affected persons (PAPs).

9.3 Resettlement Policy Framework

9.3.1 Policy Application and Entitlements

This policy will be applicable to all government approved projects, public sector, private sector, joint ventures etc. that involve land acquisition and/or involuntary resettlement of people who may be physically and/or economically displaced due to the development project across Sindh. Policy will also be applicable to resettlement and relocation in the event of climate related events/natural disasters (e.g., floods, earthquakes) and to relocate people from disaster/hazard prone locations and forced displacement during AEDs to free public land / rows. It will be effective immediately following the approval by the Sindh Government and will be notified through the Gazette of Sindh (Extraordinary). Sindh Government will decide about retroactive application of this policy for forced displacements due to AEDs which have happened in the past before the effective date of this policy on a case-by-case basis.

The policy measures are also applicable to all projects financed by multilateral and bilateral development partners. In case of any policy gaps with any International Financial Institutions (IFIs), project-specific additional measures will be adopted under relevant project legal and project agreements. The R&R Policy may be reviewed and updated from time to time as may be necessary.

9.3.2 Entitlement

The proposed project will provide compensation to all affected people eligible for compensation based on nature or category of their losses including physical assets or income affected within a set and communicated cut-off-date. Full replacement cost as compensation is the basic principle guiding the allocation of entitlements, i.e., the project will replace in kind or cash what is lost in terms of land, structures, livelihood, community facilities and services, with special provisions for the improvement of livelihoods of vulnerable displaced persons, sharing of project benefits and unanticipated impacts.

The entitlement matrix for the proposed project will be specific to the types of impacts, losses and eligible persons in the project, while the provisions made in this RPF include a wider range of possible cases, which may rise under the projects. Each individual PAP will be eligible for a combination of entitlements specific to his/her particular loss and property relations to the lost assets. The entitlement matrix in Table 9.1 summarizes the provisions for eligibility and entitlements.

9.3.3 Entitlement Matrix

An entitlement matrix derived from the R&R Policy framework is provided in Table 9.1 for general guidance. This may be tailored to according to the context and needs, and based on the nature of impacts, types of displacements, and mitigation measures. While resettlement is the preferred approach from a sustainable

development perspective, cash compensation, based on entitlements, can also be provided if preferred by eligible persons and/or required by the government due to contextual reasons (e.g., non-availability of resettlement sites and/or land and/or resources for developing new resettlement sites that are or can easily be well connected to sources of livelihood and provided requisite services). The decision to provide resettlement or cash compensation may be done on a case-by-case basis.

Table 9.1: Entitlement Matrix

Type of Loss	Unit of Entitlement	Entitlement	Additional Services
1. Loss of Agricultural Land			
1.1 Permanent loss of and/or permanent access restriction to	(a)Legal owner(s) as per the revenue/land records or customary rights	(i) Land-for-land of the same or better quality for those losing entire agricultural holdings to ensure that economic viability and livelihoods are not negatively affected; or	Land-for-land, project to find alternative land in the area
agricultural land (including uncultivated, grazing, or other lands used for agricultural purposes and subsistence) falling under project RoW		(i) Cash compensation at replacement cost, plus 15% compulsory acquisition surcharge (CAS) – free of taxes, registration, and transfer costs (iii) For cases where small parcels of land are required, a negotiated approach shall be preferred overuse of eminent domain to speed up the land-take process.	Locality / district in consultation and agreement with the affected landowners.
	(b) Leaseholders of government land	(i) Compensation for land for legally recognized leaseholders only or land-for- land swap where possible (ii) Cash compensation equal to market value of gross harvest /agricultural outputs for remaining lease years up to maximum of two years.	
	(c) Sharecroppers / Tenants	(i) Cash compensation equal to market value of gross harvest/agricultural outputs from the land, proportion to shares for one year	
	(d) Agricultural workers losing their contracts	(i) Cash compensation for loss of work, at official daily wage rate, for the remaining part of agricultural season up to a maximum of three months.	
	(e) Informal users of the land/ agricultural workers without contracts	(i) Cash compensation for loss of crops for one year (inclusive of winter and summer) (ii) Provision for additional assistance under vulnerable groups	
1.2 Temporary impact on cultivable or other types of land, typically for 3-4 months (or more in case of large projects)	Titled owners and other categories (re b to e above)	(i) No compensation to titled owners provided land is rehabilitated/restored to its former state; however, owners are entitled to compensation for loss of crops/trees etc. (if any), plus cash compensation for loss of income for the duration. (ii) For leaseholders, tenants / sharecroppers, agricultural workers, and informal settlers, cash compensation for any crop losses, and cash compensation for income losses during the period	Project to rehabilitate land to its original status
Implementation Guidelines			
1. Land owners and users will be informed of the details of land acquisition and compensation processes and payment procedures 2. Replacement cost refers to the method of valuation that help determine the amount sufficient to replace lost assets and cover transaction costs. For land, replacement cost is referred to pre-project value of the land of similar type/quality, plus transaction costs (e.g., administration charges, title or registration fees etc.). The valuation method for determining replacement cost should be documented and included in relevant resettlement planning document.			

Type of Loss	Unit of Entitlement	Entitlement	Additional Services
3. Identified owners will be assisted by the project to prepare legal documents in support of their ownership for compensation purposes. 4. Project implementing agency/NGOs shall encourage the entitled persons (EPs) for purchasing land or invest the compensation money in productive income generation activities.			
2. Loss of Homestead, Commercial, and Urban/Industrial Land			
2.1 Loss of residential/ homestead, commercial, urban/industrial land due to project interventions	(a)Legal owner(s) as per the revenue /land records or customary right	(i) Land for land through provision of a private plot comparable in value and location to plot lost; or cash compensation at replacement cost, plus 15% compulsory acquisition surcharge (CAS) – free of taxes, registration, and transfer costs. (ii) A residential plot in the resettlement site for those opting for project- sponsored resettlement. (iii) For urban/commercial, see 5.1.	Legal owners will be assisted by project NGO to prepare legal papers necessary to claim compensation
	(b) Renter / Leaseholders	Six months' rent or a value proportion to the duration of the remaining lease, including any deposit, they may lose	
	(c) Informal settlers/occupants of land without title / landless agricultural workers, agricultural tenants without tenancy agreements, and agricultural tenants whose tenancy agreements do not cover the right to reside on the landowners' land	Provision for accommodation in available alternative land/resettlement site or self-relocation allowances equivalent to: For urban areas (per household) i. Provision for space for accommodation - amount may be provided equivalent to the replacement cost OR a plot at the resettlement site [recommended plot size at resettlement site is 60 sq yards], if the project involves a resettlement site, (ii) replacement cost of a 60 sq yard plot in the area that they were residing, if the project does not involve a resettlement site. For rural areas (per household) i. Provision for space for accommodation – amount may be provided equivalent to the replacement cost OR a plot at the resettlement site [recommended plot size at resettlement site is 120 sq yards in rural areas] if the project involves a resettlement site, (ii) replacement cost of a 120 sq yard plot of the land they were occupying if the project does not involve a resettlement site.	
Implementation Guidelines: 1. Affected landowners will be informed of the details of land acquisition and compensation processes and payment procedures 2. Replacement cost will be determined following the principles mentioned earlier. 3. Project NGO to encourage and motivate the entitled persons to purchase alternative residential or commercial/industrial land with compensation money or invest in productive and income generating activities.			
3. Loss of Residential Structures with Titles to Land			
3.1 Loss of residential structures/houses	Legal owner(s) as per the revenue /land record or other legal papers	(i) For Pukka and Semi-Pukka Houses: Cash compensation at replacement cost for affected structures by type of construction, and other fixed assets without depreciation cost; owners will be allowed to take the salvageable free of cost plus transfer grant. (ii) For Katcha and Temporary structures (e.g. shacks, jhuggi, huts etc.): Transfer and reconstruction grant calculated based on the C&W approved rates of structure for rebuilding residential structure on plots at resettlement site	Project will provide other resettlement benefits through the project -NGO, including assistance in relocation and reconstruction

Type of Loss	Unit of Entitlement	Entitlement	Additional Services
		or elsewhere based on self-relocation option: for urban and rural areas (per family), provision of construction for accommodation – amount may be provided equivalent to C&W rates for construction of 540 sqft. (iii) Special assistance of one-time payment equivalent to one minimum wage for female-headed, disabled, elderly and the very poor (those under BPL).	
3.2 Partial loss of residential structures, including boundary walls / minor structures	Legal owner(s) as per the revenue /land record or other legal papers	(i) Cash compensation at replacement cost for the affected part of the structure. (ii) Additional cash compensation to assist in the restoration of the remaining structure	
3.3 Loss of housing or accommodation by tenants/ occupants	Tenants and others with rental agreements/ contracts	(i) Affected tenants will receive cash compensation of a value proportionate to the remaining tenancy period or three months, whichever is higher.	
Implementation Guidelines: 1. Applicable to all structures located on affected area at cut-off dates. 2. Affected structure owners/tenants etc. will be informed about the impacts and notified of the compensation value/rates etc. 3. Compensation will be paid prior to dismantling and removal of the structures as per civil works requirements 4. Replacement cost, based on C&W rates, must reflect current material costs, labor etc.; the valuation report by structure types to be annexed in the resettlement planning document.			
4. Loss of Residential Structures without Titles to Land			
4.1 Loss of residential structures/houses by owners without title to land (e.g. informal settlers/landless agricultural workers/ agricultural tenants without tenancy agreements/ agricultural tenants whose tenancy agreements do not cover the right to reside on the landowners' land etc.)	Socially recognized owner(s) of structures on RoW identified during census/ surveys	(i) For Pukka and Semi-Pukka Houses: Cash compensation at replacement cost for affected structures by type of construction, without depreciation cost; owners will be allowed to take the salvageable free of cost plus transfer grant (ii) For Katcha and Temporary Structures (e.g. shacks, jhuggis, huts etc.): Transfer and reconstruction grant calculated based on the C&W approved rates of structure for rebuilding residential structure on plots at resettlement site or elsewhere based on self-relocation option: for urban and rural areas (per family), provision for construction for accommodation – amount may be provided equivalent to C&W rates for construction of 540 sq./ft. (iii) Special assistance of one-time payment equivalent to four month minimum wage for female-headed, disabled, elderly and the very poor (those under BPL).	Project will provide other resettlement benefits through the project -NGO, including assistance in relocation and reconstruction
Implementation Guidelines: 1. Applicable to all informal residential structures located in affected during the census/surveys (i.e., cut-off dates) 2. Affected structure owners/tenants etc. will be informed about the impacts and notified of the compensation value/rates etc. 3. Compensation will be paid prior to dismantling and removal of the structures as per civil works requirements 4. Replacement cost, based on C&W rates, must reflect current material costs, labor etc.; the valuation report by structure types to be annexed in the resettlement planning document.			
5. Loss of Commercial and Urban/Industrial Structure with Titles to Land			
5.1 Loss of commercial, urban/industrial	Legal Owner(s) of the structures as per legal records	(i) For Pukka and Semi-Pukka structures: Cash compensation at replacement cost for affected structures by type of construction, and other fixed	Project will assist owners to find alternative area for

Type of Loss	Unit of Entitlement	Entitlement	Additional Services
structures due to project RoW		assets without depreciation costs plus transfer grant (ii) Owners will be allowed to take the salvageable free of cost. (ii) For Katcha and Temporary Structures: Transfer and reconstruction grant calculated based on the C&W approved rates of structure for rebuilding structure at resettlement site or elsewhere based on self-relocation option.	relocation, rebuilding and reconstruction
5.2 Loss of rental space or accommodation by tenants / occupants	Tenants and others with rental agreements/ contracts	Affected tenants will receive cash compensation of a value proportionate to the remaining tenancy period or six months, whichever is higher.	
Implementation Guidelines: 1. Applicable to all structures located in the affected area at cut-off dates. 2. Affected structure owners/tenants etc. will be informed about the impacts and notified of the compensation value/rates etc. 3. Compensation will be paid prior to dismantling and removal of the structures as per civil works requirements			
6. Loss of commercial/urban space for businesses without Titles to Land			
6.1 Loss of commercial/ urban space without titles (e.g., shops, stalls) – both temporary or permanent	Owner(s) of structures/ businesses identified @cut-off date during census/surveys	For owners of businesses: (i) cash compensation equal to one-year income, provided the loss is permanent; (ii) in case of temporary losses, cash compensation equal to the period of interruption of the business up to a maximum of 6 months or covering the period of income loss based on construction activity	Eligible to other benefits, including livelihood/ training program
6.2 Loss of employment	Workers/ employees of affected businesses identified at cut-off date during census/surveys.	For workers/employees, indemnity or protection of lost wages for the period of interruption up to a period of three months, based on local wage rates)	
6.3 Mobile informal sector microenterprises (e.g., kiosk, carts, vendors, hawkers etc.) & loss of public space – for example, by cobblers, hair cutter etc. used for businesses.	Owner(s) of kiosks, carts and other businesses identified at cut-off date during census/surveys	(i) Movable structures are unlikely to be affected; however, if affected, shall be considered case by case for cash compensation commensurate to the loss. (ii) Each affected street vendors will be compensated for loss of businesses for three months (or duration of the civil work, whichever is higher) at the wage rates in the locality determined by the local bodies/administration. (iii) Any additional losses identified shall be treated case by case.	
Implementation Guidelines: 1. Applicable to all types of informal businesses located in affected area during the census/surveys (i.e., cut- off dates). 2. In case of disputes, the local Grievance Redress Committee (GRC) will verify and determine eligibility for compensation and other benefits. 3. Compensation will be paid during civil works period, depending on the work schedule. 4. Project will provide compensation and other resettlement benefits with assistance from the Project- NGO/field staff.			
7. Loss of Common Property Resources (CPRs)			
Loss of CPRs such as pumps, wells, ponds, village grazing land, school/religious structures used by community	Local Committee/legal owners or legally recognized entity by revenue administration	(i) Cash compensation at replacement cost for land and structures by type of construction, and other fixed assets without depreciation costs plus transfer grant (ii) Salvageable materials will be allowed free of cost	Project-NGO will conduct consultation meeting with concerned committee for new relocation and reconstruction

Type of Loss	Unit of Entitlement	Entitlement	Additional Services
Implementation Guidelines: 1. Applicable to all types of CPRs located on RoW at cut-off dates notification. 2. Project-NGO will engage with concerned communities regarding relocation sites and choices. 3. Compensation for CPRs will be paid prior to dismantling and removal of the structures as per civil works requirements 4. The concerned community will be responsible for reconstruction of the CPR with help and supervision from the project and local administration			
8. Loss of Crops and Trees			
8.1 Loss of standing crops on affected area	Project-affected persons (including squatters) owning standing crops on public land	(i) Crop compensation in cash at full market rate for one harvest season (either winter or summer) by default for impacts caused by project activities. (ii) All other types of crop losses will be compensated at market rate based on actual losses.	
8.2 Loss of trees on RoW	Project-affected persons (including squatters) owning trees on public land	(i) For fruit trees, compensation based on lost production for the entire period needed to re-establish a tree of equal productivity. (ii) For timber/wood trees, compensation will be at market value of trees' wood content	
Implementation Guidelines: 1. Applicable to all types of trees and crops in affected area at cut-off dates notification. 2. For fruit trees that are not yet mature and fruit-bearing, compensation will be based on the gross expenses needed to reproduce the tree to the same age it was cut. 3. Timber trees will be valued based on market value of their dry wood volume. The wood of the fallen tree will remain with the owner, and its value will not be deducted from compensation.			
9. Loss of Income/Livelihood			
Loss of income and livelihood	Project-affected persons with impact on livelihood/income, including those physically displaced	(i) For land and non-land based livelihood, 3 to 6 months of livelihood support, based on official minimum wage per month, as transition to restoration of income. (ii) Temporary or permanent employment during construction and operation of the project that caused displacement	
Implementation Guidelines: 1. Applicable to all project affected person (including women and other vulnerable groups), who experienced loss of income and livelihood. 2. The economic activity data must be analyzed by gender, age group, education, skills, income, households' size, and preferences and options 3. The resettlement planning document must clearly identify the scale of impact by categories such as severe, minor impacts etc. with recommended provisions for multiple income restoration programs 4. A separate NGO to be hired to design/plan and implement Income Restoration and Enhancement Program.			
10. Assistance to Vulnerable Groups			
Vulnerability impact and support	Socially marginalized groups such as (not limited to) households below poverty line, female -headed households, elderly, persons with disabilities, landless agricultural labor, agricultural tenants without tenancy agreements, and the very poor	(i) Lump sum one-time livelihood assistance equivalent to three-months minimum wage in local standards. (ii) Temporary or permanent employment in construction activities where feasible (iii) Provision for any additional support during relocation and resettlement.	Eligible to other benefits, including livelihood/ training program

Type of Loss	Unit of Entitlement	Entitlement	Additional Services
Implementation Guidelines: 1. Applicable to project affected person, more particularly women and other vulnerable groups, who may experience severe impact due to their pre-project socio-economic status. 2. The resettlement planning instrument must further refine the concept of vulnerability in more inclusive way in view of the project context. 3. In consultation with vulnerable groups, the project will design a social preparation strategy for the vulnerable groups prior to relocation and resettlement.			
11. Unforeseen Adverse Impacts and Losses			
Households/persons affected by any unforeseen impact during project implementation	Entitlement will be determined in view of the R&R Policy framework	The unforeseen impacts will be identified through due diligence and surveys. The entitlement will be reviewed by Project PMO and approved by the concerned department / agency.	As appropriate
Implementation Guidelines: 1. The unforeseen impact and affected persons will be identified with due care as per the policy framework, andsubmitted to PMO for review and approval, including the quantity of losses, ownerships, and the proposed entitlements.			

9.3.4 Vulnerability

During inventory of project affected persons within the beneficiary communities, vulnerable persons will be identified in order for special assistance or measures to be put in place for them. Generally, vulnerable persons will cover:

- The aged (above 70 years);
- Physically and mentally challenged;
- Widows;
- Orphaned children (less than 18 years) and
- Bedridden or seriously sick persons.

9.3.5 Cut-off Date

The cut-off date is the date when section 4 of LAA is issued. With the issuance of section 4, buying and selling of land in the notified area comes to a stop till land is acquired. However due to lengthy process of land acquisition and timeline between different sections of LAA (section 4 to land award) the date of census of PAPs is usually considered as the cut-off-date for funded projects. Any person moving into the land located within the specific location of the project after this cut-off date will not be eligible for compensation, relocation and livelihood restoration and rehabilitation entitlements.

9.3.6 Environmental and Resettlement Costs

In the process of investigations, construction, operation and maintenance of any drainage project, the physical, biological and socio-economic impacts like land acquisition, loss or damage to houses, trees, infrastructure, crops, labour camps, contractor's camps, widening of roads and rehabilitation of construction and waste material disposal areas, etc. are envisaged. All of these impacts need to be compensated/ mitigated/ rehabilitated properly. For mitigation of the adverse impacts on various parameters, cost will be involved. In order to meet the cost of environmental management, rehabilitation of affected areas, crops,

infrastructures and land acquisition etc. is estimated in the light of the guidelines, objectives and policies made by Pakistan/Sindh Environmental Protection Agency and World Bank.

9.3.7 Land Acquisition

The land being affected and acquired for different project components consists of the irrigated agricultural, saline and banjar land, which is generally private land, and will be fully compensated. The exact ownership of affected land will be established by the relevant Revenue Department and compensated as per their land record. The total cost of the land acquisition amounts to PKR 9,499.014 million and is presented in Table 9.2.

9.3.8 Contractor Camp and Installations

The contractor camps and installations etc. need to be established near to the excavation sites on rent/lease basis. For this purpose, 28 Acres land will be acquired on lease basis.

9.3.9 House Compensation

304 houses will be resettled due to, the implementation of the Project. The compensation of these houses is based on the prevailed market rate basis. The houses compensation cost amounts to PKR 363.034 million and is presented in Table 9.2.

9.3.10 Firewood Trees

In the Project affected area, there are 5925 forest/firewood trees consisting of Girth size of tree from 2ft to 6ft and above. There are no fruit trees found in the RoW of the proposed drains. The compensation cost of these trees amounts to Rs.91.01 million and re-plantation cost of cut trees in 1:5 ratios is estimated as PKR 14.81 million and is presented in Table 9.2. The salvaged material of the cut trees will be the property of the respective owners. The herbs/shrubs have also been compensated and values are 5.3 million.

9.3.11 Public Structure

Government owned infrastructures are valued and the compensation costs of these infrastructures is worked out as PKR 0.46 million and the cost details are presented in Table 9.2.

9.3.12 Resettlement / Transition Period Allowance

Each Project affected family is entitled for relocation allowance, and vulnerable allowance will be paid to vulnerable people in the Project area. The total amount is estimated as PKR 23.85 million and is presented in Table 9.2.

9.3.13 Cost of Vulnerable Allowance

The Project has identified 15 vulnerable people, whose income is falling below the poverty line. These vulnerable will be paid onetime cash allowance of Rs.96,000 per person that is equal to three months wage rate. The total amount is estimated as PKR 1.44 million.

9.3.14 Implementation of ESMP

It covers the pay of environmental and social personnel salaries, ambient air monitoring, water sampling etc. It amounts to Rs. 72.3 million is presented in Table 9.2. Rate list of land have been annexed as Annexure 5 of this report.

Table 9.2: Summary of Land Acquisition/Resettlement/ Environmental and Social Cost

S.No	Components	Cost in Million (Rupees)
A - Land Acquisition		
i.	Irrigated and Saline Land	9499.014
Sub Total – A		**9499.014**
B - Resettlement Cost		
i.	Residential House	363.034
ii.	Fish Ponds	72.00
iii.	Public infrastructure (Electric poles etc.)	0.46
iv.	Relocation Grant	7.6
v.	Firewood Trees	96.39
vi.	Compensatory plantation of cut down firewood trees.	14.81
vii.	Vulnerability allowance	1.44
Sub Total - B		**555.734**
C - Environmental and Social Cost		
i.	Environmental and Social Personnel's (Salaries during construction)	48.00
ii.	External Monitoring (Outsource)	3.00
iii.	Training (Outsource)	1.5
iv.	Environmental Audit (Outsource)	1.00
v.	Ambient Air Quality Monitoring (Quarterly)	2.4
vi.	Water Quality Testing (Quarterly)	6.4
vii.	**PPEs** (Safety Hard Helmets, Safety Shoes, Safety Goggles, Face Mask, Hand Gloves, Protective Clothing, Safety Harness etc.)	5.00
viii.	First Aid Boxes, Medicine and Fire Extinguisher	5.00
Sub Total - C		**72.3**
Sub Total of A+B+C		**10127.048**
10% Contingency Cost		**1012.704**
Grand Total		**11,139.752**
Grand Total in Million US Dollar (Rate 279.15 March 08, 2024)		**39.906**

Table 9.3: Detailed Table for Land Acquisition/Resettlement/Environmental and Social Cost

Sr. No.	Description	Unit	Quantity	Price Per Unit in PKR	Total Amount in PKR Million	Remarks
	1	2	3	4		
Detailed Table for Land Acquisition/Resettlement/ Environmental and Social Cost						
A	**Irrigated Agriculture Land**					
i.	Badani Drain & its Associated Branch & Sub Drains	Acre	124.244	2000000	248.488	
ii.	Begari Drain 1 & its Associated Branch & Sub Drains	Acre	389.97	2000000	779.94	Land Compensation is based on the Deputy Commissioner Approved Rates.
iii.	Begari Drain 2 & its Associated Branch & Sub Drains	Acre	137.876	2000000	275.752	
iv.	Bhayo Drain	Acre	53.228	2000000	106.456	
v.	Bhurgari Drain & its Associated Branch & Sub Drains	Acre	281.129	2000000	562.258	
vi.	Dadpur Drain & its Associated Branch & Sub Drains	Acre	215.505	2000000	431.01	
vii.	Dodapur Drain & its Associated Branch & Sub Drains	Acre	427.47	2000000	854.94	
viii.	Golo Drain	Acre	65.720	2000000	131.44	
ix.	Miranpur Drain 1 & its Associated Branch & Sub Drains	Acre	128.66	2000000	257.32	
x.	Jacobabad Drain & its Associated Branch & Sub Drains	Acre	335.665	2000000	671.33	
xi.	Manjhipur Drain	Acre	54.762	2000000	109.524	
xii.	Manjhipur Drain 2	Acre	77.764	2000000	155.528	
xiii.	Shahdadkot Drain	Acre	49.212	2000000	98.424	
Sub Total A					**4682.41**	
B	**Saline/Banjar Land**					
i.	Badani Drain & its Associated Branch & Sub Drains	Acre	319.485	800000	255.588	
ii.	Begari Drain 1 & its Associated Branch & Sub Drains	Acre	1002.790	800000	802.232	Land Compensation is based on the Deputy Commissioner Approved Rates.
iii.	Begari Drain 2 & its Associated Branch & Sub Drains	Acre	354.539	800000	283.631	
iv.	Bhayo Drain	Acre	136.875	800000	109.5	
v.	Bhurgari Drain & its Associated Branch & Sub Drains	Acre	722.905	800000	578.324	
vi.	Dadpur Drain & its Associated Branch & Sub Drains	Acre	554.663	800000	443.730	

Sr. No.	Description	Unit	Quantity	Price Per Unit in PKR	Total Amount in PKR Million	Remarks
	1	2	3	4		
vii.	Dodapur Drain & its Associated Branch & Sub Drains	Acre	1099.228	800000	879.382	
viii.	Golo Drain	Acre	168.996	800000	135.196	
ix.	Miranpur Drain & its Associated Branch & Sub Drains	Acre	330.84	800000	264.672	
x.	Jacobabad Drain & its Associated Branch & Sub Drains	Acre	863.14	800000	690.512	
xi.	Manjhipur Drain 1	Acre	140.817	800000	112.653	
xii.	Manjhipur Drain 2	Acre	199.96	800000	159.968	
xiii.	Shahdadkot Drain	Acre	126.547	800000	101.237	
	Sub Total B				**4816.625**	
C	**Residential Area**					
i	Pacca Houses Double Storey	No	12	2500000	30.0	
ii	Pacca Houses Single Storey	No.	24	2000000	48.0	
iii	Semi Pacca Houses	No.	192	1200000	230.4	
iv	Kacha Houses	No.	76	700000	53.2	
v	Bandi associated with houses	Acre	4.781	300000	1.434	
	Sub Total C				**363.034**	
D	**I) Firewood Tree Compensation**					
	a) Sindhi Babur					
i	Trees up-to 2ft. girth	No.	136	3000	0.408	
ii	Trees above 2.1 to 4ft girth	No.	647	6000	3.88	
iii	Trees above 4.1 to 6ft girth	No.	524	10000	5.24	
	b) Sufada					
i	**Trees up-to 2ft. girth**	No.	505	3000	1.51	
ii	Trees above 2.1 to 4ft girth	No.	1109	6000	66.54	
iii	Trees above 4.1 to 6ft girth	No.	322	10000	3.22	
	c) Lai					
i	Trees up-to 2ft. girth	No.	167	3000	0.50	
ii	Trees above 2.1 to 4ft girth	No.	203	6000	1.21	
iii	Trees above 4.1 to 6ft girth	No.	222	10000	2.22	
	d) Ber					
i	Trees up-to 2ft. girth	No.	137	3000	0.41	
ii	Trees above 2.1 to 4ft girth	No.	180	6000	1.08	
iii	Trees above 4.1 to 6ft girth	No.	157	10000	1.57	
	e) Kandi					
i	Trees up-to 2ft. girth	No.	62	3000	0.18	
ii	Trees above 2.1 to 4ft girth	No.	130	6000	0.78	
iii	Trees above 2.1 to 4ft girth	No.	45	10000	0.45	
	e) Lim					

Sr. No.	Description	Unit	Quantity	Price Per Unit in PKR	Total Amount in PKR Million	Remarks
	1	2	3	4		
i	Trees up-to 2ft. girth	No.	24	3000	0.07	
ii	Trees above 2.1 to 4ft girth	No.	71	6000	0.42	
iii	Trees above 2.1 to 4ft girth	No.	23	10000	0.23	
	f) Kirrar					
i	Trees up-to 2ft. girth	No.	302	3000	0.90	
ii	Trees above 2.1 to 4ft girth	No.	34	6000	0.20	
iii	Trees above 2.1 to 4ft girth	No.	-	-	-	
Sub Total D					**91.01**	
E	**Herbs/Shrubs**					
i	Kanderi	One Tractor Trolley Load=	30	45000	1.35	
ii	Davi	One Tractor Trolley Load=	16	30000	0.48	
iii	Lai	One Tractor Trolley Load=	42	30000	1.26	
iv	Pure Babul	One Tractor Trolley Load=	**33**	48000	1.58	
v	khabber	One Tractor Trolley Load	13	55000	0.71	
Sub Total E					**5.38**	
F	**Compensation for Public Structure**					
i	Electric Poles	No	23	20000	0.46	
Sub Total F					**0.46**	
G	**Fish Ponds**					
i	Ponds	Acres	48	1500000	72.00	
Sub Total G					**72.00**	
H	**Transition Period Allowance**					
i	Relocation Grant for houses	No.	304	25000	7.6	
ii	Vulnerability allowance	No.	15	96000	1.44	
iii	Re-planation of trees	L/S	29,625	500	14.81	
Sub Total H					**23.85**	
I	**Implementation of ESMP**					
i	Environmental and Social Personnel (Salaries)	Person/ month	120	400000 (Billing Rates)	48.0	60 months for Environmental Expert and 60 months for Social Expert
iii	External Monitoring (Outsource)	Person/ Month	6	500000	3.00	
iv	Training (Outsource)	Person/ month	3	500000	1.5	
v	Environmental Audit (Outsource)	Person/ month	2	5000000	1.00	
vi	Ambient Air Quality Monitoring (Quarterly)	L/S	48	50000	2. 4	
vii	Water Quality Testing (Quarterly)	L/S	640	100000	6.4	

Sr. No.	Description	Unit	Quantity	Price Per Unit in PKR	Total Amount in PKR Million	Remarks
	1	2	3	4		
ix	PPEs (Safety Helmets, Safety Shoes, Goggles, Face mask, Protective Clothing, Safety Harness, Safety Hand Gloves etc.)	L/S	-	-	5.0	
x	First Aid Boxes, Medicine and Fire Extinguishers	L/S	-	-	5.0	
Sub Total I					**72.3**	
Sub Total of A+B+C+D+E+F+G+H+I					**10127.048**	
10% Contingency Cost					**1012.704**	
Grand Total					**11,139.752**	
Grand Total in Million US Dollar (Rate 279.15 March 08, 2024)					**39.906**	

9.3.15 Total Cost Estimate of JSK Drainage Project

The cost estimate of the Project includes land acquisition of 8362 acres, earth work of proposed surface drains and existing surface drain of (DU-13), Shikarpur area. The cost of field investigations like soil & water sampling from the field and their analysis, geo-tech. investigations for the construction of proposed structures which are crossing to the surface drains, strip survey cost for the proposed surface drain for proper design and the cost of environmental study is also included in the cost estimate. The cost of proposed structures to be constructed during implementation of the Project, Improvements of agriculture cost, purchase of new pumping stations and O&M cost of the Project is also included in the cost estimate of the project.

Table 9.4: Total Cost for JSK Drainage Project

Sr. No.	Description	Implementation Period (Rs. Million)
1	Land Acquisition / Resettlement / Environmental and Social Cost	11,139.752
2	Earth Work of Proposed Drains	4370.92
3	Earth Work of Existing Drains	203.98
4	Purchase of New Pumps	789.4
5	Expenditures on Existing Pumping Stations	77.72
6	Strip Survey of Proposed Surface Drains	12.24
7	Proposed Structures Cost	8382.03
8	Geo-tech Investigations	13.79
9	Environmental Study Cost	51.5
10	Soil & Water Testing Cost	11.38
11	Agriculture Improvements Cost	3922.5
12	**Sub Total-1**	**28,975.212**
13	O&M Cost (5%)	1,448.761
14	**Sub Total-2**	**30,423.973**
15	Miscellaneous (5%)	1,521.199
16	**Total Cost-I**	**31,945.172**
16	Average Inflation @15% of Total Cost	4,791.776
17	**Grand Total (Million Rs)**	**36,736.948**
18	**Grand Total in Million US Dollar (Rate 279.15 March 08, 2024)**	**131.603**

9.3.16 Livelihood Development Plan

The important activity in the rehabilitation of the project affected people is the Livelihood Development Plan (LDP) and income restoration with the objective to develop measures in terms of income sources and employment. The main steps to be considered in the restoration of income are the analysis of existing activities, identification of alternate income restoration programmemes, trial testing of multiple income generating projects, provision of necessary training and skill enhancement.

The construction of Proposed Jacobabad, Shikarpur and Kashmore Drainage Project will generate important positive economic and social benefits for the whole community and will be increased employment opportunities to the local people. The project, however, necessitates compensatory measures for all the project affected people

9.3.16.1 Objectives

The broad objectives of the Livelihoods Development Plan (LDP) envisaged are as follows:

a) Improve, or at least restore, incomes and living standards of the affected people.

b) Develop short term and long-term strategies for the better livelihood of affected people.

c) Establish linkage to the local and national socio-economic uplift and employment generation programmes.

A development plan shall set out an overall strategy for the proper planning and sustainable development of the project area indicating the development objectives for the area in question. The development plan performs an important task in setting out the framework within which the development needs of the economy and society in general can be responded to for maintaining, and where possible, improving the environment.

9.3.16.2 Affected Population

During the project field surveys, it was assessed that a total of 2,736 people from 304 houses / households will be affected directly by the project. The livelihood development plan covers the impacts on households that will be affected by the project works, or are going to be impacted by construction activities.

9.3.16.3 Plan Strategy

The development of livelihood of the affected people for any project is not only restoring incomes but also restoring and developing capacity in relation to human, social, financial, natural and physical resources. The LDP is designed to restore these resources both at the household and at community level. Due to limited local resources, it is essential that the external resources like technical assistance, financial assistance and new physical resources are involved in order to have an effective LDP. Diversification into non-agricultural occupations through vocational training for the young educated people, and support to local micro-enterprises will create local jobs. LDP also pays attention to avoiding that the majority of relocated households with higher formal education levels move out of the area. It provides to these household's opportunities to stay in the project area.

There is a possibility that the resettled households may not be able to recreate similar type of land use systems because they will move to new locations or other area where conditions may be different. They

will have to adjust their farming practices accordingly. The LDP vision is to help households and provide adequate facilities for restoring cultivation on modern lines using the latest agricultural technologies. They will be encouraged for a marked development of home gardens and supporting development of small and large livestock integrated with agriculture.

In addition to the development of the above community development measures, the project will play a significant role in the development of the area. This will include improvement of roads, electrification, health facilities, education facilities, water supply etc. In the implementation process, an early start of LDP is the key to its success. Technical assistance needs to be combined with capacity building for local staff of different departments. In the area, although it looks somewhat difficult, gender main streaming should be a key strategy for promoting gender equity, and for ensuring that women's needs are explicitly addressed in the decision-making process for the development activities.

The programme has been designed to contribute positively to poverty reduction within the affected area by providing employment opportunities for the affected people during construction/operation, new crop and fruit varieties will be introduced, and skill development training programme will be initiated. During the construction of the project, the employment level of the local people and their income level will receive potential improvements, consequently resulting in better and improved social life.

9.3.16.4 Pilot Agricultural Extension Programme

During the execution of the project, the adverse impacts on agricultural production need to be mitigated through crop, animal and fruit production at least to the pre-project levels by adapting environmentally friendly techniques. New crop, fruit and vegetable varieties and appropriate technology would be introduced through diversified pilot programmes. The training and agricultural improved methodology would be delivered to the interested groups, paying special attention to the needs of a large farming group. Environment protection is to be promoted through the development of biological resources and better management policies. The existing water distribution system and diversion structures need to be improved for better irrigation water availability. The agriculture, horticulture, floriculture departments need to be involved for training and capacity building for the farmers. Technology should be introduced in the project area for the promotion of cultivated fodder and vegetation.

9.3.16.5 Non-Governmental Organization

Non-Governmental Organization (NGO) present and working in the project area, will organize and provide technical services to the households including individual advice and orientation courses, credit facilitation, access to vocational training and employment on the project, and facilitation of enterprise development. The NGO will also help in the project relocation/rehabilitation process and Grievance Redressal Mechanism during the project implementation. The local NGO will be hired during construction of the project for facilitating the project execution.

9.3.16.6 Recreational Park

A recreational park will be established near the project area, where all the modern facilities will be available, especially children play ground, restaurant and boating facilities. The upper areas are already very attractive and famous for the tourists and a large number of national and international tourists visit the area especially

during summer and winter. Creation of a recreational park will further enhance the beauty of the area and consequently result in socio-economic improvement of the project area people.

9.3.16.7 Skill Enhancement/Capacity Building

In the area two vocational schools should be established in the Project area, one for male and one for female where surrounding population will get training for different technical skills to enhance their income through handicrafts. This will help for socio-economic uplift of the locals, as the area is behind other parts of the province.

CHAPTER 10

CONCLUSION AND RECOMMENDATIONS

10 CONCLUSION AND RECOMMENDATIONS

10.1 Conclusion

The study was carried out to assess the environmental and social impacts of the proposed surface drains. The assessment was done keeping in view provincial and federal legislation as well as international guidelines

Baseline environmental and socio-economic information was collected from a variety of sources including reports of previous studies, published literature, field visits, interviews, consultations/discussions held with different stakeholders like concerned officers of relevant government departments, area elites, NGOs and especially the project affected people. The information collected was used to compose profiles of the physical, biological, and socio-economic environments likely to be affected by the Project.

Adverse Impacts

- Loss of agricultural land.
- Land fragmentation.
- Increased soil erosion and degradation.
- Degradation in air quality.
- High noise & vibration level during construction.
- Dust emissions during construction.
- Cutting of trees and other vegetation.
- Loss of habitat and biodiversity.
- Disruption to public life during construction.

The proposed project activities were reviewed and an assessment made of the potential impact of these activities on physical, biological and socio-economic environments as described in Chapter 7 of the report. Where appropriate, mitigation measures were recommended to keep the adverse environmental impact within acceptable limits.

The conclusion drawn are:

- Approximately 93,683 hectares of land will come under cultivation due to the implementation of the project.
- Production of Rice & Wheat will be increased up to 33 & 57% respectively.
- The surface drainage environmental assessment study indicated that drainage in general has positive effect, if properly operated and maintained.
- Reduction in seasonal swamp area prone to flooding will result in increased crop area, yields and production.
- Provision and rehabilitation of drainage unit 13 will reduce soil salinity, and improve land capability.

- Improved socio-economic conditions of the people consequent to better-irrigated agriculture will result in attracting more people to work in the project area. The present tendency of urban drift will also decrease.
- Decrease mosquito breeding and other water borne pathogens causing malarial fever and other diseases.
- With the increased income and improvement in status, more number of children will go to schools.
- The establishment of agro based business activities will demand skilled and unskilled labour in the Project area.
- The construction of infrastructure will require employment of technical and non-technical people. Therefore, the implementation of the proposed project will increase employment opportunities in the Project area.

It is concluded that the proposed Jacobabad, Shikarpur and Kashmore Drainage Project is acceptable with reference to Environment.

10.2 Recommendations

10.2.1 Recommendations for Consultant

The Consultants will ensure that implementation of the Environmental Social Management Plan is achieved so as to minimize the negative impacts of the project during its implementation, therefore, proper monitoring would be necessitated. In addition, the environment department will frequently monitor that the management plan is working as prescribed.

10.2.2 Recommendations for Contractor

The following conditions should be included, in addition to general conditions provided for environmental protection in the tender document as essential clauses:

10.2.2.1 Clause regarding Disposal of Waste Construction Material

The contractor shall in consultation with and with the approval of Resident Engineer (RE) of the Project, select and abide by the selection, a site for disposal of waste construction material. Contravention to this clause may tantamount to non-compliance to contract and the Contractor will be responsible for removing the material dumped on a wrong site, at his own expense and pay a fine for his negligence.

10.2.2.2 Clause regarding Rehabilitation of Construction Sites

The Contractor shall carry out construction work exactly on the same site and according to the same design as provided in the Tender Documents. Also, the camps site, the material depot, the machinery and equipment yard, link roads, borrow areas shall, after the completion of construction, be restored and rehabilitated and brought to at least the same condition, in which these were handed over to the contract. A set of photographs and a video tape film shall be prepared to show the pre-construction sites and post construction rehabilitated sites. For any contravention of this clause the final payments and the securities deposited shall not be released.

10.2.2.3 Clause regarding Discharge Spill or Dumping on Any Building, House, Graveyard, Archaeological Site (Established or Newly Found), Unstable Slopes, Uncompacted Embankment or Leaking into Construction Area

The Contractor shall be contractually bound to not to allow or cause discharge spill or dumping on any building house, graveyard, archaeological site (established or newly found) unstable slopes, uncompacted embankment or leakage into the construction area. Any such failure shall be duly noted by RE during site inspections and contractor shall immediately remedy the situation failing which the payment of the contractor shall be with-held and the damage so caused shall be debited to contractor's account under the contractual provisions.

10.2.2.4 Clause regarding Protection of Construction Work from Floods

The Contractor shall throughout the construction work, manage to keep an eye on the flood position of the river and shall remain in touch with Flood Control Centre and remain equipped with means and equipment for taking protective measures to protect the works under construction. WAPDA shall not be responsible for any damage caused by floods and any works washed away shall be reconstructed by the Contractor at his own cost within the tenure of the contract.

10.2.2.5 Clause regarding Control on Air Quality by not Allowing Machinery to Cause of Dust, Smoke and Noise Pollution

The Contractor shall not cause deterioration of air quality by using old or ill maintained machinery which raise excessive dust, produce excessive smoke or cause excessive noise pollution. The Contractor shall follow strict standards of maintenance of machinery, provide qualified and trained drivers and operations for the vehicles. The Contractor shall also sprinkle water on kacha roads to be used as link roads. The Contractor shall provide protective masks to his work force. Failure to do so shall be taken as serious contravention of the contract and shall cause the payment to be deferred till correction of the situation.

10.2.2.6 Clause regarding Use of Outdated Machinery

The Contractor shall obtain a certificate from Vehicle Examiner working under the RE but paid by the Contractor, that all the machinery employed is either new or in first class fitness condition so as not to cause smoke or oil leakages. RE will not allow the use any outdated machinery.

10.2.2.7 Clause to Protect the Biological Resources

The Contract will ensure that:

Unnecessary and out of bound activities/movements are not done outside the campus allotted to him for setting-up the labour camp, material depots and machinery yard.

a) No fire arms are carried by any of the employees or labour.

b) All Forest, Wildlife and Fisheries Laws are fully respected and abided by the Contractor and his work force.

c) The Biodiversity is respected and saved on its terrestrial, aquatic and aerial habitats.

d) Necessary sign boards are displayed to make labour, visitors and members of public to remind them of their obligations towards Biota.

e) Inspections by Wildlife, Forest and Fisheries Officers are facilitated in camps to facilitate a proper implementation of relevant Laws.

f) Communities are given awareness and are involved in proper protection of the Biota inside and around the Project site.

g) Any contravention to any of the above sub-clause will be considered as breach of contract and lead to disqualification of the Contractor.

10.2.2.8 Clause regarding Socio-economic and Cultural Values and Physical Cultural

The Contractor shall be bound to:

a) Ensure that no damage or disruption is caused to the social infrastructure or public services being provided to the people e.g., education, health, electricity supply, drinking water supply facilities for public gathering or religious congregations.

b) Ensure that existing ownership of land around the Project is respected.

c) Ensure that if some construction material has to procure from or through a member of local community, it must be by a proper Social Framework Agreement with social communities.

d) Ensure that no damage or adverse effect is caused to archaeological (present or chance find) sites, graveyards and burial places.

10.2.2.9 Clause regarding Public Safety, Health and Safety at Construction Site, including Measures against HIV/AIDS and Life Insurance

The Contractor shall:

a) Arrange to run a proper campaign the labour camp, to make people aware of the causes, mode of transmission and consequences of HIV/AIDS and other infections diseases particularly Hepatitis and Malaria

b) Strengthen the existing BHU for the benefit of the labour as well as the surrounding villages.

10.2.2.10 Clause regarding Employment of Locals in the Construction Work

a) The Contractor as an obligation of the Contract will employ, subject to availability and work ability, maximum number of local labour for construction work.

Note: *The above clauses have been suggested from technical point of view, these may be got vetted by qualified law officer before incorporating them into the Tender Document or the Contract Document.*

ANNEXURES

Annexure-1: Detailed Socio-Economic Survey

Annexure-2: Disaster Risk Assessment Management Plan

Annexure-3: Survey Air & Noise Quality Monitoring Report Received from “National Environmental Services and Consultants

Annexure-4: Water Quality Analysis Received from “Envi Tech AL”

Annexure-5: Rate Lists Received from Government Department

ANNEXURE 1

DETAILED SOCIO-ECONOMIC SURVEY

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ABBREVIATIONS

Abbreviations	Term
BHU	Basic Health Unit
CD	Civil Dispensary
UC	Union Council
DC	Deputy Commissioner
DU	Drainage Unit
EPA	Environmental Protection Agency
GD	Computer Generated Imagery
ha	Hectare
km	Kilometre
Km²	Kilometre Square
MNA	Member of National Assembly
MPA	Member Provincial Assembly
NGOs	Non-Government Organizations
SESCO	Sukkur Electric Supply Company
USF	Upper Sindh Frontier
UC	Union Council
MICS	Multiple Indicator Cluster Surveys
RHCs	Rural Health Centres
LHV	Lady Health Visitor
O.T	Occupational Theatre
ICU	Intensive Care Unit
ANC	Ante Natal Care
PNC	Pakistan Nursing Council
OPV	Oral Polio Vaccine
IPV	Inactive Polio Vaccine
GMO	Genetically Modified Organism
BCG	Bacillus Catamite- Guerin
MPI	Multi-Dimensional Poverty Index
DHS	Distribution Household Population
MCHC	Mother and Child Health Centre
HHs	Households
Sr. No.	Serial Number
No.	Number
SCARPs	Salinity Control and Reclamation Projects
SEMIS	Sindh Education Management Information System
WAPDA	Water And Power Development Authority

ANNEXURE – 1: DETAILED SOCIO-ECONOMIC SURVEY

Executive Summary

1) Scio-Economic Baseline Information

- **General**

The socio-economic baseline information consists of three parts. The first part relates to the existing socio-economic conditions in the entire districts Jacobabad, Shikarpur and Kashmore, based on the published data and field surveys. Second part is based on the stratified sampling field surveys conducted by the Consultants, especially for the project-impacted areas.

Table ES 1: Population Health and Education Facilities in Three Districts

Description	Jacobabad	Shikarpur	Kashmore
Population			
Population	1,006,297	1,231,481	1,089,169
- Rural	709,170(70.0%)	928,232(75.4%)	835,556(77.0%)
- Urban	297,127(30.0%)	303,249(24.6%)	253,613 (23.0%)
Households	177,867	207,555	185,143
- Rural	125,341 (70.0%)	155,902 (75.4%)	140,872 (76.0%)
- Urban	52,526 (30.0%)	51,653 (25.0%)	44,271 (24.0%)
Health			
Basic Health Units	27	36	25
Rural Health Units	3	9	4
Dispensaries	45	102	45
Government	8	13	31
Semi Government	2	2	0
Local Bodies	23	15	13
Private	12	72	1
Education			
Schools	1,555	1,374	1,681
Boys School	200	337	237
Girls School	248	190	233
Mixed School	1,107	847	1,211
Teacher by Gender			
Male Teacher	82.2%	64.6%	70.7%
Female Teacher	17.8%	35.4%	29.3%

2) Scio-Economic Baseline Field Survey

- **General**

The major focus of this study is on understanding and describing the socio-economic conditions in the project impacted areas, the consultants interviewed 24 from Jacobabad district, 18 household from Shikarpur district and 16 households from Kashmore district. Survey results have been described as:

- **Family Structure in Impacted Areas**

  ✓ Average age of head of households is 48 in Area Jacobabad,Area Shikarpur is 50 and Area Kashmore is 50. Average number of wives is 1, minimum 1 and maximum 2 Nos. The average number of children is 8 in the area Jacobabad, area Shikarpur is 7 and 7 is area Kashmore, respectively, minimum 1 and maximum 11 are in the three areas. Average household size is 8.65 varying from 2 to 14.

  ✓ According to the survey 51.3% in Jacobabad, 51.7% in Shikarpur and 50.9% in Kashmore, population is below 18 years of age indicating the need for robust programmes for education, skill development and job opportunities.

- **Sources of Drinking Water and Electricity**

  ✓ 100% respondents of the project area are using hand pump water for drinking purpose. In area Jacobabad Shikarpur and Kashmore, 70% of respondents Informed that they are using Sukkur Electric Supply Company (SESCO) supply.

- **Professions of Impacted Population**

  ✓ The Major profession is Agriculture and Livestock in the villages, i.e. 75%, Employment in shops and other business within district and entire Pakistan is about 11.36%, work as contractor, construction works is 2.27%. About 3.03% work as government servants and teachers. The workforce employed as drivers and transport workers is 1.51%. The proportion of workers gone abroad is 0.75%.

- **Human Disease and Places for Treatment**

  ✓ The focus of the field questionnaire was to assess water borne diseases. About 5.78 % of cases reported are of Gastro entreaties, Skin diseases account for 3.0% of cases. Hepatitis are under 19.40%, Malaria cases reported 53.85%. Other diseases account for 17.87% of total cases. The consultant's view that other diseases are upper respiratory infection, hypertension, diabetes, etc. The majority of patients go to Jacobabad, Shikarpur and Kandhkot for local treatment and for specialized treatment; the respondents go to Sukkur and Karachi.

- **Landless Households and Average Size of Land Holdings**

  ✓ The landless households were counted as 48.14% in area Jacobabad, in area Shikarpur and kashmore is 25.92%. Overall, average size of land holding is 13.16 acres.

- **Inventory of Livestock**

  ✓ The data on livestock has been collected from 58 respondents. The total number of livestock including poultry has been counted as 551. The percent population of goats are 23.41, cows 12.15, buffaloes 10, donkeys and mules 1.45, sheep's 5.26 and horses 0.

- **Composition of income of Surveyed Household and Expenditures**

  ✓ The major source of cash income is earn from agriculture crops, which is 70% of total income. Salaries from government services account for 4% and vegetable products is three (3) of total income. Cash income from livestock sector is about 13% and remittance from wages are 6.38% of total income. Three percent (3%) of fuel wood is also source of total income.

- ✓ The expenditures consist of two components i.e. consumption of home produced commodities and purchased commodities. Purchased items comprise of 82% of total expenditures. The total share of food items has been calculated to be 48%. The high expenditure on food leaves very little space for spending on education and health.

1 Socio-Economic Baseline Information

1.1 General

The socio-economic baseline information pinpoints the existing socio economic conditions of the project Impacted areas, likely adverse impacts and their mitigation. The baseline survey consists of three parts. The first part relates to the existing socio economic conditions in the entire districts Jacobabad, Shikarpur and Kashmore. Based on the published data and field surveys. Second part is based on the stratified sampling field surveys collected by the Consultants, especially for the project-impacted areas and third part is included in conducted scoping sessions and meetings with primary and secondary stakeholders.

1.2 Socio-Economic Setup in Jacobabad District

1.2.1 Overview

Sindh is the second largest province of Pakistan. The neighbouring regions are Baluchistan to the west and north, Punjab in the north, Rajasthan (India) to the east and the Arabian Sea and Gujarat (India) to the south. The province forms the lower Indus basin and lies between 23º and 28º North latitudes and 66º and 71º East longitudes. It is about 579 km in length from north to south and nearly 442 km in its extreme breadth (281 km average). Jacobabad District is a part of Larkana Division.

Jacobabad serving as both the capital city of Jacobabad District and the administrative centre of Jacobabad Taluka, an administrative subdivision of the district. The city itself is subdivided into eight Union Councils. Sitting far to the northwest of the province, near the provincial boundaries of Sindh and Baluchistan, Jacobabad became a city on the site of an existing village (Khangarh), and is crossed by the Pakistan Railways and many main roads of the province. It is the 43rd most populous city in Pakistan.

1.2.2 History

Sindh was annexed to British rule in 1843 when the British Army, under Sir Charles Napier, invaded Sindh, after the Talpurs had disbanded their own army. Sir Charles Napier was appointed Governor of the province by the British Queen; he divided Sindh into 3 collectorates: Karachi, Hyderabad, and Shikarpur. The Shikarpur Collectorate consisted of present day Sukkur, Upper Sindh Frontier Province (which included Jacobabad, named Khangarh at the time) and Larkana districts except for the talukas of Sehwan, Dadu, and Johi. When John Jacob was sent to Khangarh (in Upper Sindh Frontier Province) to establish control of the frontier, he made the city (now Jacobabad) his headquarters. He was only allowed into Mir Talpur's territories which extended to the Balochi state of Burdica in the East, and Kalat, another sovereign Balochi state, in the North. John Jacob established a cantonment within the narrow belt belonging to the Mirs, and brought peace to the area, which allowed infrastructure development to begin. Land growers, attracted by the stability offered by the British cantonment, started to arrive, and were followed by businesspersons and artisans, resulting in the establishment of a thriving town on the site of the village of Khangarh. This town was named after its founder, John Jacob, and was called Jacobabad. General John Jacob died in December 1858 at Jacobabad and was buried in the Christian cemetery located in the West of town.

1.2.3 Administrative Setup

The administrative setup of the district Jacobabad is similar to the other districts of Pakistan. District administration is headed by the Deputy Commissioner (DC) who is assisted by heads of other departments. The DC is responsible for the coordination of functions of all the departments in the district. The main district departments include: district administration body, judiciary, police, education, health, communication and works, agriculture, forestry, irrigation, telecommunication, livestock and fisheries. The head of district department is responsible for the performance of his department and is generally designated as the Deputy Director or District Officer. On the judicial side, the Deputy Director/Officer is assisted by an Additional District Magistrate and on the revenue side by an Assistant Deputy Commissioner.

1.2.4 Location

Jacobabad district is located in the Division of Larkano, Sindh, Pakistan. The location of Jacobabad proper can be explained as 44 km North West of Sukkur. It is situated between 68.26 longitude and 28.17' latitude. This District was sometime also called Upper Sindh Frontier (U.S.F) District. In addition to its common folks also call it only (the northern) and some other time as (Siro) or the upper part.

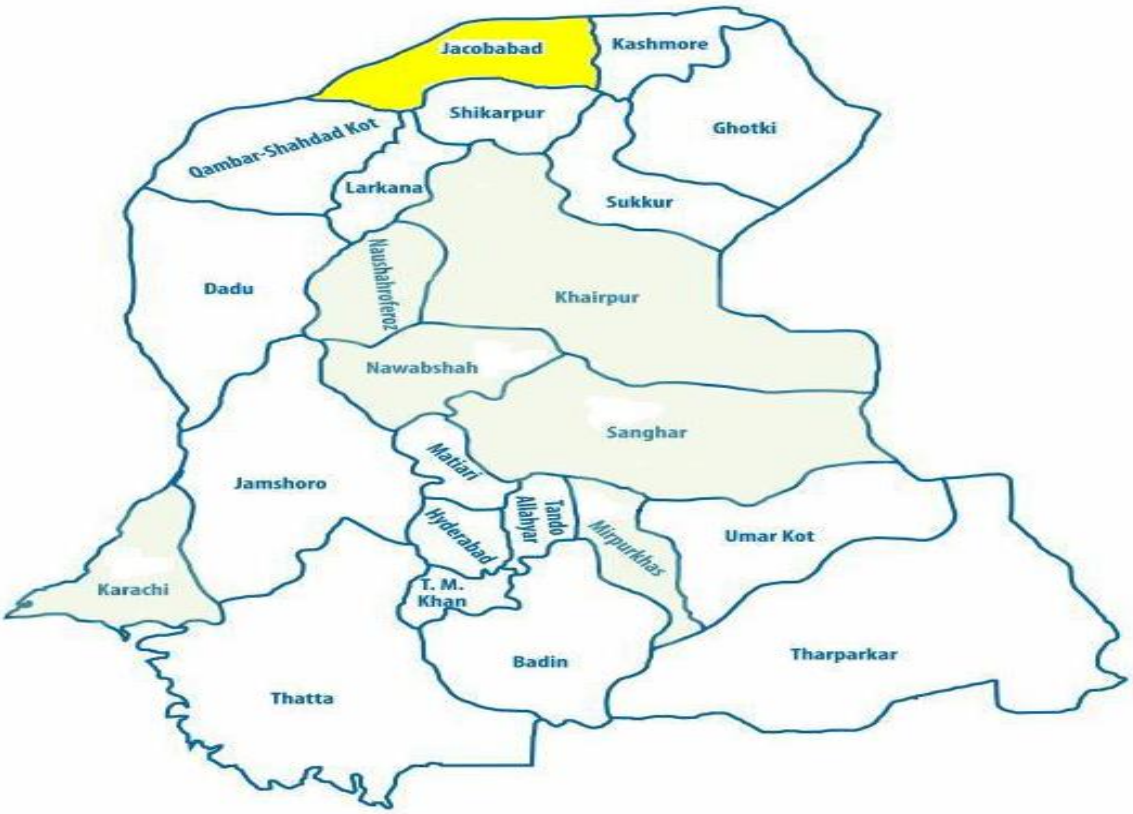


Figure 1-1: Location of District Jacobabad in the Province Map

1.2.5 Cultural Features

1.2.5.1 Jamia Mosque, Hyderpur Wagho

More than a century old Jamia Mosque in village Hyderpur Wagho (via village Ahmed Mian Soomro) is situated in the outskirts of Jacobabad town, (behind Shahbaz Air Base). The mosque was built by Haji

Ghulam Hyder Khan Wagho, son of Qaisar Khan Wagho. As mentioned on the commemorative stone, its work was started in 1318 Hijri and was completed in a year.

1.2.5.2 Odho Haveli

Odho Haveli was constructed by Sardar Lal Mohammad Khan Odho in the beginning of the 20th century in the village Tajo Dero, Taluka Garhi Khairo, District Jacobabad.

1.2.5.3 Jamia Mosque Usto Bhaledinoabad

Haji Karimdino Usto, a pious philanthropist from this village, also built a few more mosques in the suburbs. The one at village Jahan Shah (UC Qadirpur), near Kheer Thar canal was completely destroyed during the recent floods. It was already a fragile structure when the devastating floods hit it and got its surviving structures to the ground. While yet another mosque which was built during almost the same time, in village Dadh Darri, UC Nawrra (near Pir Padhro and Chang Chachar Railway Station) is very much intact.

1.2.6 Demographic Profile

1.2.6.1 Population

District of Jacobabad's population is about 1,006,297 which is almost 2.1% of Sindh's population of about 47.9 million. With 177,867 households, the average household size in the district of Jacobabad is 5.66 as per the Census of 2017 compared to average household size of 5.58 in Sindh. According to MICS 2018-19, mean household size of Jacobabad is 6.9 as compared to mean household size of 6.5 in Sindh. 70% of Jacobabad's population resides in rural areas and 30% resides in the urban areas.

Jacobabad's population comprises of 515,480 males and 490,778 females with 51% and 49% of the district's population respectively. District of Jacobabad spans over an area of 2,771 sq. km which is 2.0% of Sindh's total area of 140,914 sq. km. The population density of the district is 363/sq. km.

Table 1-1: Population by Gender

Gender	Total	Rural	Urban
Male	515,480	363,684	151,796
Female	490,778	345,486	145,292
Transgender	39	0	39
Total	**1,006,297**	**709,170**	**297,127**

Table 1-2: Population and Households by Taluka

Talukas	Population (#)	Population (%)	Households (#)	Households (%)
Ghari Khairo	**158,360**		**28,373**	
Rural	145,728	92.0	25,975	92.0
Urban	12,632	8.0	2,398	8.0
Jacobabad	**382,513**		**64,980**	
Rural	191,437	50.0	31,785	49.0
Urban	191,076	50.0	33,195	51.0
Thul	**465,424**		**84,514**	
Rural	372,005	80.0	67,581	80.0
Urban	93,419	20.0	16,933	20.0

Source: Government of Pakistan, Pakistan Bureau of Statistics, Population Census, 2017.

1.2.7 Social Profile

1.2.7.1 Housing

Housing characteristics including household size, ownership status, roofing, walls and assets provide a holistic description of the overall well-being of the household. Description of household characteristics provide a snapshot for the government to improve target housing conditions as per district-wise deprivations.

In District Jacobabad, 75.9% of population owns houses while 24.1% don't own their houses (13.6% rented) compared to 77.7% of the population in Sindh province who own their houses. According to MICS 2018-19, the average number of persons per room in Jacobabad is 5.8 compared 4.1 persons per room in Sindh. Similarly, the mean household size of District Jacobabad is 6.9 compared to mean household size of 6.5 in Sindh.

33.6% of households in Jacobabad have Pacca roofing compared to 70.7% households in province that have Pacca roofing. Similarly, 31.7% households in Jacobabad have Pacca walls compared to 70.7% households in the province that have Pacca walls.

Table 1-3: Housing by Ownership

Description	Own %	Rent %	Other/Missing %
Sindh	77.7	14.9	7.3
Jacobabad	75.9	13.6	10.5

Table 1-4: Mean Number of Persons per Room

Description	1	2-3,	4-5,	6-7,	8-9,	10+
Sindh	0.6	12.5	30.1	27.4	15.5	13.9
Jacobabad	0.6	10.7	25.5	27.0	18.9	17.3

Source: Government of Sindh, Bureau of Statistics, Multiple Indicator Cluster Survey 2018-19.

1.2.8 Utilities

Access to basic facilities like clean drinking water, toilets and sanitation services provide a holistic supply-side service provision coverage in a district.

In District Jacobabad, 97.2% of households have improved sources of drinking water compared to 96.0% households in Sindh having improved sources of drinking water. In terms of access to sanitation services, 34.0% of households in Jacobabad have access to improved sanitation services compared to 65.9% of households in Sindh with access to improved sanitation services. The prevalence of open defecation in Jacobabad is 47.6% compared to 24.0% in Sindh.

To ascertain whether environment-friendly practices are adopted at household level for cooking, heating and lighting, it is essential to gauge the prevalence of reliance on clean fuels. In District Jacobabad, 19.6% of the households rely primarily on clean fuels for cooking compared to 50.2% of households relying on clean fuel for cooking in Sindh. 30.0% of households in District Jacobabad rely primarily on clean fuels for space heating compared to 30.2% of households in Sindh.

Table 1-5: Source of Drinking Water

	Basic service %	Limited service %	Unimproved %	Surface water %
Sindh	90.3	5.7	2.1	1.9
Jacobabad	90.6	6.6	2.1	0.7

1.2.9 Health

District Jacobabad has a total of 15 Government, Departmental, Private and Local Bodies Hospitals with a capacity of 432 beds out of 648 Hospitals in Sindh with a capacity of 30,126 beds. Jacobabad has a total of 27 Basic Health Units (BHUs) with a capacity of 54 beds out of 800 BHUs in Sindh with a capacity of 1615 beds. Jacobabad has a total of 3 Rural Health Centers (RHCs) with a capacity of 24 beds out of 133 RHCs in Sindh with a capacity of 1703 beds in Sindh.

District Jacobabad has a total of 45 Dispensaries with a capacity of 25 beds out of 2996 Dispensaries with a capacity of 715 beds in Sindh. District Jacobabad has a total of 7 TB Clinics with no beds out of 228 TB Clinics with total capacity of 42 beds in Sindh. Jacobabad has 6 Mother & Child Health Centers (MCHCs) with 13 beds out of 227 MCHCs with a total of 181 beds. Similarly, Jacobabad has 2 Maternity Homes out of 42 Maternity Homes in the province.

Number of indoor patients served in District Jacobabad are 13,834 out of 744,618 indoor patients in the province. Similarly, number of outdoor patients served in District Jacobabad are 1,253,881 out of 43,718,506 outdoor patients in Sindh.

Table 1-6: Health Facilities

Description	Medical Centers	Beds
Basic Health Units (BHUs)	**27**	**54**
Rural Health Centers (RHCs)	**3**	**24**
Dispensaries	**45**	**25**
• Government	8	0
• Semi Government	2	10
• Local Bodies	23	0
• Private	12	15
TB Clinics	**7**	**0**
• Government	6	0
• Private	1	0
Mother and Child Health Centers (MCHC)	**6**	**13**
• Government/Semi-Government	5	0
• Local Bodies	0	0
• Private	1	0
Maternity Homes (Government)	**2**	**NA**

1.2.9.1 Population Served

Patients Per Bed 1,947

Patients Per Doctor 4,700

Patients Per Nurse 97,000

Indoor Patients			Outdoor Patients		
Male **5,953** (43.0%)	Female **7,881** (57.0%)	**Total 13,834**	Male **529,561** (42.0%)	Female **724,320** (58.0%)	**Total 1,253,881**

Source: Government of Sindh, Bureau of Statistics, Health Profile of Sindh, 2017

1.2.9.2 Hospitals

Hospitals 15 Beds 432

Table 1-7: Hospitals Detail in the District

Description	Hospitals	Beds
Civil	1	166
Teaching	-	-
Major	-	-
Specialized	-	-
Taluka	2	60
Departmental	2	62
Private	10	144
Local Bodies	-	-

The patients per bed in District Jacobabad are 1,947 compared to 1,455 patients per bed in Sindh. The patients per doctor in Jacobabad are 4,700 compared to 3,159 patients per doctor in Sindh. Patients per nurse in Jacobabad are 97,000 compared to 12,411 patients per nurse in Sindh. Total Number of Government Medical, Nursing & Para-Medical Staff is 372 in District Jacobabad out of 18,429 Government Staff in Sindh. The total number of Semi-Government Medical, Nursing & Para-Medical Staff is 43 out of 2,985 Semi-Government Staff in Sindh. The total number of Local Bodies Medical, Nursing & Para-Medical Staff in District Jacobabad is 51 out of 4,119 in Sindh. There are 105 reported Private/Missionary Staff in Jacobabad out of 15,051 in Sindh.

Table 1-8: Numbers of Medical Nursing & Para-Medical Staff

Description	Government	Semi-Government	Local Bodies	Private
Physician	3	0	0	0
Surgeons	3	0	0	0
Gynecologist	2	0	0	0
Pediatricians	2	0	0	0
Doctors/GMO	137	22	10	48
Dentists	6	0	0	0
Nurse	11	0	0	0
LHV	21	0	0	0
ECG. Technician	6	0	0	0

Description	Government	Semi-Government	Local Bodies	Private
O.T. Assistant	6	0	0	0
Midwives	33	0	1	2
Medical Technician	47	0	0	0
Dispenser/Dresser	55	21	40	37
Lab Technician	6	0	0	0
Lab Assistant	8	0	0	18
X-ray Technician	8	0	0	0
O.T. Technician	3	0	0	0
Dental Technician	10	0	0	0
X-ray Assistant	1	0	0	0
Ultra sound Assistant	1	0	0	0
Blood Bank Technician	3	0	0	0
ICU Technician	0	0	0	0

Source: Government of Sindh, Bureau of Statistics, Health Profile of Sindh, 2017.

1.2.9.3 Maternal and Child Healthcare

The place of delivery in District Jacobabad is 46.9% in public health facility and 14.3% in private health facility which translates into 61.2% institutional deliveries. For the province, the average of institutional deliveries is 70.1%. In terms of home deliveries, Jacobabad has 38.8% of those compared to 29.0% in Sindh. In terms of assistance during delivery, District Jacobabad has 87.1% of deliveries with skilled birth attendants compared to 82.7% of deliveries with skilled birth attendants in Sindh.

In terms of ante-natal care coverage, 70.0% of women (15-49 years) were attended at least once by skilled health personnel in Jacobabad as compared to 76.7% in Sindh. The median months of pregnancy during first ANC visit is 2 months in Jacobabad as compared to 3 months in Sindh.

In District Jacobabad, women (15-49 years) who received at least two Tetanus Toxoid vaccine doses during the pregnancy of the most recent live birth is 32.4% compared to 48.3% in Sindh.

In District Jacobabad, 41.4% of women reported having health checks following birth at home or facility compared to 56.5% in Sindh.

In District Jacobabad, the prevalence of pre-mature births is 8.6% compared to 7.5% in Sindh.

1.2.9.4 Public Facility

Jacobabad Sindh 46.9% 31.9%

1.2.9.5 Private Facility

Jacobabad Sindh

14.3% 38.2%

1.2.9.6 Home

Jacobabad Sindh

38.8% 29.0%

1.2.9.7 Others

Jacobabad	Sindh
0.0%	0.8%

Table 1-9: Assistance in Delivery

Description	Sindh %	Jacobabad %
Doctor	67.4	74.5
Nurse/ Midwife	6.3	2.4
Lady Health volunteer (LHV)	1.0	1.0
Community Midwife	8.1	9.2
Traditional Birth Attendant	12.3	11.9
Family Member/Neighbour/Friend	3.4	0.5
Others	1.0	0.5
No Attendant	0.6	0

Table 1-10: Antenatal Care

Description	Medical Doctor %	Nurse/ Midwife %	LHV %	Community Midwife %	Traditional Birth Attendant %	Other %	No Natal Care %
Sindh	71.0	3.7	0.4	1.7	1.5	0.1	21.7
Jacobabad	69.5	0.0	0.0	0.5	0.0	0.0	30.0

70.0 Percent of women who were attended at least once by skilled health personnel.

Table 1-11: Neonatal Care

Description	Percentage of women who received at least 2 tetanus toxoid containing vaccine doses during the pregnancy of the most recent live birth %	2 doses, the last within prior 3 years %	3 doses, the last within prior 5 years %	4 doses, the last within prior 10 years %	5 or more doses during lifetime %	Protected against tetanus %
Sindh	48.3	6.8	0.7	0.2	0.1	56.1
Jacobabad	32.4	12.4	0.5	0.0	0.0	45.3

Source: Government of Sindh, Bureau of Statistics, Multiple Indicator Cluster Survey 2018-19.

Table 1-12: Postnatal Care

Description	Health check following birth while in facility or at home %	Same day %	1 day following birth %	2 days following birth %	PNC visit for mothers		No post-natal care visit %	Missing/DK %
					3-6 days following birth %	After the first week following birth %		
Sindh	56.5	18.2	3.7	2.9	6.1	3.0	65.4	0.8
Jacobabad	41.1	17.4	1.0	0.5	0.5	0.9	79.8	0.0

1.2.9.8 Pre-Mature Birth

In terms of age-specific fertility for adolescents (15-19 years), District Jacobabad has a rate of 71 per 1000 women compared to 49.5 per 1000 women in Sindh. For total fertility rate of women (15-49 years), District Jacobabad 4.9 per woman compared to 3.7 per woman in Sindh.

In terms of nutritional status of children, in District Jacobabad, 62.1% of the children under 5 years are stunted (moderate or severe) compared to 50.2% in Sindh. 48.3% of children are underweight compared to 40.7% in Sindh. Similarly, 14.6% are wasted compared to 14.8% in Sindh.

Jacobabad 8.6%	Sindh 7.5%
Total Fertility Rate (women aged 15-49 years)	4.9
Adolescent Birth Rate (fertility rate for women age 15-19 years)	71 Per Thousand Women

Source: Government of Sindh, Bureau of Statistics, Multiple Indicator Cluster Survey 2018-19.

1.2.9.9 Early Child Bearing

(Percentage of men/women aged 20-24 years who had a live birth before the age of 18)

Male		Female	
Jacobabad	7.5%	Jacobabad	22.8%
Sindh	2.8%	Sindh	11.6%

1.2.9.10 Children Nutrition

	Stunting	Wasting	Overweight	Underweight
Jacobabad	62.10%	14.60%	3.50%	48.30%
Sindh	50.20%	14.80%	3.70%	40.70%

Table 1-13: Mortality Rates

Description	Neonatal Mortality Rate	Infant Mortality Rate	Under-five Mortality Rate
Sindh	24	39	46
Jacobabad	26	44	57

Source: Government of Sindh, Bureau of Statistics, Multiple Indicator Cluster Survey 2018-19.

Table 1-14: Immunization Coverage

Description	Sindh	Jacobabad
At Birth	82.4	74.4
OPV 1	80.1	62.1
OPV 2	69.9	56.6
OPV 3	61.2	55.3
OPV 3 & IPV 2	48.6	25.1

Neo-natal, infant and under-5 mortality rate in Jacobabad is 26, 44 & 57 per 1000 live births in Jacobabad compared to 24, 39 & 46 in Sindh respectively.

Full vaccination coverage for basic antigens for children (12-23 months) in Jacobabad is 27.5% compared to 43.8% in Sindh.

Table 1-15: Vaccination Details

Description	Sindh	Jacobabad
BCG	82.4	59.5
PENTA 1	75.1	47.7
PENTA 2	68.1	38.1
PENTA 3	57.6	31.2
PCV 1	72.2	49
PCV 2	65.5	35.2
PCV 3	55.4	31.2
MEASLES 1	62.7	38.4
MEASLES 2	64.7	36.5
FULL VACCINATION	43.8	

Source: Government of Sindh, Bureau of Statistics, Multiple Indicator Cluster Survey 2018-19.

1.2.10 Education

District of Jacobabad has a total of 1,555 schools out of a total of 49,103 schools in the province of Sindh. Out of 1,555 schools, there are 200 schools for boys, 248 schools for girls, and 1,107 mixed schools.

1,555 schools in District Jacobabad have a total enrollment of 148,444 with 94,359 boys (64.2%) and 54,085 girls (35.8%). There are 3,601 male teachers (78.1%) and 1,011 female teachers (21.9%) in the schools in Jacobabad. Total number of rooms in 1,555 schools in Jacobabad amount to 3,563 out of which 2,900 are classrooms. There are 1,166 functional schools in Jacobabad while 389 schools are dysfunctional, non-functional, non-viable or closed.

Male literacy rate (15-49 years) in Jacobabad is 36.4% compared to 59.0% in Sindh while the female literacy rate is 17.0% compared to 40.9% in Sindh.

Table 1-16: Number of Schools

Description	Total	Boys	Girls	Mixed
Sindh	49,103	8,617	6,685	33,801
Jacobabad	1,555	200	248	1,107

Table 1-17: Number of Enrollments

Description	Boys	Girls
Sindh	2,812,000	1,749,140
Jacobabad	94,359	54,085

1.2.10.1 Enrollment

Male 63.5%

Female 36.5%

Table 1-18: Teachers by Gender

Description	Male%	Female%
Primary	82.2	17.8
Middle	70.6	29.4
Secondary	70.6	29.4
Higher Secondary	67.4	32.6

Source: Government of Sindh, School Education & Literacy Department, Sindh Education Profile, 2019.

Table 1-19: Class Rooms

Number of Rooms	Number of Schools	Percentage
1	338	28.8
2	531	45.2
3	65	5.5
4	44	3.7
5	53	4.5
> 5	144	12.3

Table 1-20: Teachers Strength

Description	Total	Male	Female
Sindh	157,035	90,207	42,869
Jacobabad	4,612	3,601	1,011

Table 1-21: Facilities in School

Description	Schools Without	Schools With
Boundary Walls	1,024	657
Drinking Water	1,253	428
Toilets	900	781
Electricity	1,306	375

Source: Government of Sindh, School Education & Literacy Department, Sindh Education Profile, 2019.

1.2.10.2 School Functionality

	Functional	Non-Functional
Jacobabad	74.9%	25.1%
Sindh	74.7%	25.3%

Table 1-22: Ownership Status of School Buildings

	Govt. Owned	Shared	Rented	Others	Shelter less
Sindh	38,390	1,187	164	1,629	7,733
Jacobabad	1,041	38	8	88	380

1,041 School buildings out of 1,555 are government-owned (70%), while 38 buildings are shared (2.4%). 24.4% of school buildings in Jacobabad are shelter-less, i.e., 380.

1.2.10.3 Literacy Rate

	Male	Female
Jacobabad	36.4%	17.0%
Sindh	59.0%	40.9%

Source: Government of Sindh, School Education & Literacy Department, Sindh Education Profile, 2019 / Government of Sindh, Bureau of Statistics, Multiple Indicator Cluster Survey 2018-19.

1.2.11 MPI (Multi-Dimensional Poverty Index)

Multi-Dimensional Poverty Index measures the number of people/households that are 'multi-dimensionally' poor. Essentially, it means the number of people (or HHs) deprived in at least one-third of the weighted indicators (H) along with the weighted average number of deprivations poor people experience at the same time (A). The weighted indicators are along three broad dimensions:

-Education, -Health, and -Living Standards.

In District Jacobabad, the MPI value is 0.5 which is considerably higher than the average MPI Value of 0.25 in Sindh. The headcount of households that are multi-dimensionally poor in Jacobabad is 81% compared to the headcount of 47% in Sindh.

In District Jacobabad, 11.8% of household members are vulnerable to poverty (i.e. deprived in one- fifth to one-third of weighted indicators). Similarly, 69.6% of household members are in severe multi-dimensional poverty (i.e. deprived in more than one-half of weighted indicators).

Table 1-23: MPI Head Count

	M-Poverty Headcount 2018 (H)	MPI 2018	% Vulnerable to Poverty	% in Severe Poverty
Sindh	0.47	0.25	12.50	28.30
Jacobabad	0.81	0.50	11.80	69.60

1.2.11.1 M-Poverty Headcount

Jacobabad 81.0%

Sindh 47.0%

1.2.11.2 MPI

Jacobabad 0.50

Sindh 0.25

District Jacobabad has a considerably higher MPI value (i.e., 0.5) than the provincial MPI value of 0.25 which indicates multiple deprivations along the dimensions of health, education and living standards.

11.8% of household members in District Jacobabad are vulnerable to poverty which means 11.8% of household members are deprived in one-fifth to one-third of weighted indicators.

A significant 69.6% of household members in District Jacobabad are in severe poverty. This essentially means that 69.6% of household's members in District Jacobabad are deprived in at least half of the weighted indicators.

Source: Government of Sindh, Bureau of Statistics, Multiple Indicator Cluster Survey 2018-19.

1.2.12 Economic Profile

1.2.12.1 Agriculture

Out of the area under cultivation for major crops, District Jacobabad contributes to 148,465 hectares (4.9%) out of 3,028,496 hectares in Sindh. In terms of highest proportions of area under cultivation for major crops, Wheat, Rice and Mustard are at the forefront in Jacobabad with 29,808 hectares. 111,770 hectares and 4,308 hectares under cultivation respectively in the district. Similarly, the production of Wheat, Rice and Mustard is 72,568 M. Tons, 381,551 M. Tons and 5,114 M. Tons.

Irrigated Area in District Jacobabad is 26,141 hectares and Un-Irrigated area is 69,181 hectares. Canals are the mode of irrigation for 22,141 hectares in District Jacobabad out of 1,287,845 hectares irrigated by Canals in Sindh (17%). Tube-wells are the mode of irrigation for 3,997 hectares in Jacobabad out of 361,199 hectares irrigated by Tube-wells in Sindh (1.1%).

Table 1-24: Area under Cultivation

Crops	Sindh Area (ha)	Jacobabad Area (ha)	Share of Jacobabad (%)
Bajra	46,156	0	0.0
Barley	6,801	399	5.9
Cotton (bales)	611,689	0	0.0
Gram	19,023	1,935	10.2
Jowar	11,651	95	0.8
Maize	3,559	0	0.0
Mustard	48,355	4,308	8.9
Rice	828,292	111,770	13.5
Sesamum	9,952	0	0.0
Sugarcane	333,262	150	0.0
Tobacco	136	0	0.0
Wheat	1,089,587	29,808	2.7

Table 1-25: Crop Production

Crops	Area (Hectarage)	Share in Acreage (%)	Production (M. Tons)	Share in Production (%)
Bajra	0	0.0	0	0.0
Barley	399	5.9	207	5.2
Cotton (bales)	0	0.0	0	0.0
Gram	1,935	10.2	1,869	10.4
Jowar	95	0.8	81	0.7
Maize	0	0.0	0	0.0
Mustard	4,308	8.9	5,114	10.1
Rice	111,770	13.5	381,551	13.4
Sesamum	0	0.0	0	0.0
Sugarcane	150	0.05	6,079	0.03
Tobacco	0	0.0	0	0.0
Wheat	29,808	2.7	72,568	2.0

Table 1-26: Crop Share

Crops	Sindh Production (M. Tons)	Jacobabad Production (M. Tons)	Share of Jacobabad (%)
Bajra	23,711	0	0.0
Barley	4,008	207	5.2
Cotton (in bales)	3,775,761	0	0.0
Gram	17,930	1,869	10.4
Jowar	11,078	81	0.7
Maize	3,616	0	0.0
Mustard	50,700	5,114	10.1
Rice	2,850,524	381,551	13.4
Sesamum	4,448	0	0.0
Sugarcane	20,611,878	6,079	0.03
Tobacco	198	0	0.0
Wheat	3,639,544	72,568	2.0

1.2.12.2 Irrigation

	Irrigated Area (Ha)	Un-Irrigated Area (Ha)
Jacobabad	27.4%	72.6%
Sindh	62.3%	37.7%

Source: Government of Sindh, Bureau of Statistics, Development Statistic of Sindh, 2019.

Table 1-27: Mode of Irrigation

Description	Canal (Hectarage)	Tube well (Hectarage)
Sindh	1,287,845	361,199
Jacobabad	22,141	3,997
District Share (%)	1.70%	1.10%

Canal in Jacobabad (22,141 Ha) 84.6%

Tube Well in Jacobabad (3,997 Ha) 15.2%

1.2.12.3 Forest

Total area under forest cover in Sindh 271,372 (Ha)

Jacobabad 0(ha) There is no reported forest cover in Jacobabad.

Canals are the mode of irrigation for 22,141 hectares in District Jacobabad out of 1,287,845 hectares irrigated by Canals in Sindh (17%). Tube-wells are the mode of irrigation for 3,997 hectares in Jacobabad out of 361,199 hectares irrigated by Tube-wells in Sindh (1.1%).

Source: Government of Sindh, Bureau of Statistics, Development Statistic of Sindh, 2019.

1.2.13 Livestock & Fisheries

The livestock head-count in District Jacobabad is 3,019,814 out of the total livestock count of 46,279,313 in Sindh (6.5%). District Jacobabad has 507,241 cattle, 469,182 buffaloes, 369,693 sheep, 524,396 goats, and 1,061,207 poultry.

Fish production in Jacobabad is 1,234 M. Tons out of 133,150 M. Tons in Sindh (0.9%). Jacobabad has a total of 267 fishermen out of 45,013 in Sindh (0.6%). Similarly, Jacobabad has 29 boats out of 7,215 boats in Sindh (0.4%).

Table 1-28: Livestock Count

Description	Sindh	Jacobabad	%Share
Cattle	6,925,022	507,241	7.3
Buffaloes	7,340,162	469,182	6.3
Sheep	3,958,508	369,693	9.3
Goats	12,572,221	524,396	4.1
Camels	278,424	1,588	0.5
Horses	44,999	1,975	4.3
Mules	19,512	1,252	6.4
Asses	1,004,925	83,280	8.2
Poultry	14,135,540	1,061,207	7.5

Livestock Share 6.5%

Fisheries Share 0.9%

Table 1-29: Fish Production (In Metric Tons)

Description	Sindh	Jacobabad	% Share
Fish Production	133,150	1,234	0.9
Fishermen	45,013	267	0.6
Full Time	28,716	102	0.4
Part Time	16,297	165	1.0
Boats	7,215	29	0.4
Sail	2,689	29	1.1
Row	4,526	0	0.0

Source: Government of Sindh, Bureau of Statistics, Development Statistic of Sindh, 2019 / Government of Pakistan, Bureau of Statistics, Sindh Province Report, Livestock Census, 2006.

1.2.14 Manufacturing & Communications

Number of reporting manufacturing establishments in District Jacobabad is 97 out of the 1,825 manufacturing units in Sindh (5.3%). District Jacobabad has a road network of 652 km out of the 22,283 km in Sindh (2.9%).

Table 1-30: Establishments

Description	Number of Manufacturing Units	% Share
Sindh	1,825	100
Jacobabad	97	5.3

97 Units Percentage 5.3

Table 1-31: Roads

Description	Road Kilometers	Road Density/Km²
Sindh	22,283	0.15
Jacobabad	652	0.24

District Road Length Share 2.9%

Source: Government of Sindh, Bureau of Statistics, Development Statistic of Sindh, 2019.

1.2.15 Wealth

The wealth index is a composite measure of a household's cumulative living standard. The wealth index is calculated using easy-to-collect data on a household's ownership of selected assets, such as televisions and bicycles; materials used for housing construction; and types of water access and sanitation facilities. (The DHS Program) Distribution of household population by wealth index quintile for District Jacobabad reveals that 44.1% of the population is in the poorest 20% quintile and 30.5% population is in the second poorest quintile while only 5.3% of the population lie in the top 20% quintile.

41.2% of the households in the two poorest wealth quintiles of Jacobabad receive social transfers or benefits compared to 33.7% coverage in Sindh.

Table 1-32: Income Quintiles

Description	Poorest %	Second %	Middle %	Fourth %	Richest %
Sindh	20.0	20.0	20.0	20.0	20.0
Jacobabad	44.1	30.5	13.8	6.2	5.3

Source: Government of Sindh, Bureau of Statistics, Development Statistic of Sindh, 2019.

1.2.16 Ethnicity and Castes

Majority of the population in the project area is Muslim and Sindhis. The castes mainly living in Jacobabad district include: Bijarani, Pechuho,Jakhrani, Sundrani,Mehar,Khoso Soomra, Sammo, Syed, Uner, Abro, Bhayo , Mahajir, Surhio, Gabol, Lashari, Dahani Brohi, Chandio, Sheikh, Qureshi, Mirani, Machhi etc.

1.2.17 Types of the Methods for Livelihoods Adopted

- Farming
- Livestock
- Poultry

Cultivation and the related businesses are the main occupations adopted throughout the district also our project area. Livestock is also one of the key livelihood source for the rural population of the area. The farmers in these districts traditionally keep a few heads of livestock, ranging from bullocks for draught to the cows and the buffalos for the milk, and the poultry for the protein supply including the eggs and the meat. There have been many traditional communities in the area exclusively dependent on livestock for their livelihood, however, the importance of livestock as a source of income has declined over the years. Good breeds of buffalos and cows are found in these districts. The urban center of the district offers a significant number of employment opportunities in commercial setups, whereas cultivation remains the prime occupation in the rural parts of the district.

1.2.18 Commerce and Industry

There is no heavy Industrial unit in this District. Being and agricultural district, rich in paddy and wheat crops, there are only agricultural oriented industry units in this District. Which in all count a number 225, this includes both the rice husking as well as flour mills. In addition to these recently three Ghee plants have also been installed, associated with a Soap factory, which produces raw Soap only good for cloth washing.

1.2.19 Vocational and Cottage Industrial Position

In the fielded of Small Industries this District is leading the whole country in Jandree production. Fine coated and glazed furniture and other house-hold items can be prized as highlight of this district. Though this art was introduced and taught in vocational school of Jacobabad city. Yet it flourished in Kashmore Tehsil, where small Industries department of Sindh Government has established a display and a selling centre for the patronization of the Industry. Few other private centers are also functioning at Kashmore. Apart from this presentable Industry this district also claims regards in embroidery which is working as a home Industry and produce mirror work embroidery items such as Caps, Laces, Ghghra, Gaj, Waist coats and other embroidered garments which are exported from here to other parts of the country.

1.2.20 Festivals and Social Gatherings

Generally special occasions and specific days are celebrated with enthusiasm. People of surrounding areas get together on appointed spot of the celebration. These occasions display finest example of human concord. People of all walks of life, irrespective of their cast or clan, all join hands and greet each other with love and humble submission. The religious festivities and National days are also colorfully observed and enjoyed with evident leisured and fervors. Everybody is seen wearing clean bright and colure full dresses and exchanging gifts among each other and embracing and kissing hands of each other. The Shab-e-Barat occasion is specially known for its decorum and lightings in the city. Children practice fireworks and boom crackers at this evening.

1.2.21 Market Place and Trade Centre

Jacobabad District finds a very important place in the surrounding locality which for all sort of their supplies, depend entirely upon the Markets of Jacobabad District. The grain Markets and also cattle Markets are open every day except Fridays at all the Taluka Headquarter places of District. Apart from these markets there are also fruit Market and vegetable markets. To operate the trade of these markets a large community of the Gumanshtas and commission agents is putting up in Jacobabad. These people are in direct communication with all the important markets of the country. The consumer goods are supplied from here on demand, ordered to and from any other market of the country.

Smiths, workshops, hard-ware commodities and every other house-hold items are available on stores of the cities in the District. The Bazaars at every Taluka Headquarter place are rich and busy every day. Thousands of people come to buy or sale at the markets or the commercial centers every day. People from all other provinces of the country also come here for purchasing the goods and cattle. The cows and buffaloes of this area are specially known for large quantities of milk. The Horses of this district are known for large fine breed so the horse trading is an important trade of the district.

1.2.22 Law and Order

In Jacobabad city, also at some other interior places of the district, Motor Cycle snatching incidents are frequently reported. House burglary cases and deco tees can be found frequently in these years, Highway robbery cases, murders, Siah Kari cases, elopements and cases of Kidnapping (This has ever remained most serious offense inflicting the area) for ransom and sometimes serious tribal feuds take place in this district. River Indus flows through the Kashmore and Kandh Kot subdivisions of the district. On either side of the river and also in the river Islands, dense forests occur, which provide shelter to dacoits who, in gangs, are ambushed in those forests. About 50 KMs of the Indus highway run in vicinity and in easy reach of these law bandits. So this part of road is generally insecure, especially for the night journey. Most of the road robbery cases occur in this part of the Indus Highway. Sukkur, Quetta and also Jacobabad Garhi Khairo road traffic is also unsafe during the late hours. Therefore, Abad Police station area and the Moladad police station areas of the roads often report road hazards by the hands of the robbers. Very few incidents of car theft have been reported so far in this district, but M. Cycle snatching and tractor robberies seem more common cases here. The northern boundary of the district is joined with Baluchistan province. Though Shahi Wah canal runs along the northern border of the district. There are recesses at places from which Trans border culprits slip into Sindh and cause problem in this District.

1.2.23 Gender Perspectives

The women particularly in the rural areas have fewer rights in all the aspects of their lives. The literacy data clearly corroborates this, and indicates that compared to men, the women are far behind in education, which is a key development indicator. Furthermore, this disparity is more generally prominent in the rural communities. The rural female literacy is quite low in all districts of the project area, with Jacobabad being the worst in this respect (6%). Furthermore, the gap between the male and female literacy is also quite high, and this gap is generally more prominent in the rural areas. Total number of schools in the whole district is 1440 with 390 for boys, 221 for girls and 829 combined education

institutions. Total number of boys is 95807 and 68279 girls making a total of 164086 students. Including male 3883 and female 1076 teachers making it a total of 4,959[1].

Women in most rural communities in the project area equally participate in livelihood activities along family lines. However, there exists a difference in mobility between Muslim and Non-Muslim women. Women from non-Muslim community work in the field right from the weeding to the harvesting. These women also receive money from farmers at the harvest; as such they are equal work sharers with men. While the Muslim women only work in the field at the harvest time. They do not frequency visit fields for work at any other time during the year. Almost in all of the project area, women role in decision-making is also negligible. They mostly remain subordinate to men throughout their lives regarding important decisions concerning them and the family. Unmarried girls are preferred to stay at home or work in fields. Usually they are married at an early age. Exchange marriages are a common feature in the rural communities. Women's household role is taken for granted. Since their work inside the house and in the fields goes largely unpaid, they cannot assert economic independence and this affects their status to a large extent. Agriculture economy in the villages and cultural values discouraging women mixing with men hamper women's access to the markets. Therefore, men get control on all capital, monetary and productive resources.

1.3 Socio-Economic Setup in Shikarpur District

1.3.1 Overview

During the Kalhora rule, the town was economically significant and regarded as central Asia's financial hub. In 1743, Talpur Mirs defeated the Kalhora dynasty in the Battle of Halani. Some historians believe that the town was famous for hunting, and Talpurs used to stopover this region for hunting (Shikar) and named it Shikarpur, meaning Hunting Place.Shikarpur District is located in the northern part of Sindh, Shikarpur district borders Larkana, Jacobabad, Khairpur and Sukkur. Due to intersection of two National Highways (N-65 & N-55) the city of Shikarpur being junction of all the four provinces play a vital in the area.

1.3.2 History

The district was established in 1617 AD. It has four talukas, including Lakhi Ghulam Shah, Garhi Yasin, Khanpur and Shikarpur itself, while according to historians, in the 17th century, Shikarpur had a land full of forests and was a favourite hunting ground (Shikargah) of the Daudpota tribe.

1.3.3 Administrative Setup

The administrative setup of the district Shikarpur is similar to the other districts of Pakistan. District administration is headed by the Deputy Commissioner (DC) who is assisted by heads of other departments. The DC is responsible for the coordination of functions of all the departments in the district. The main district departments include: district administration body, judiciary, police, education, health, communication and works, agriculture, forestry, irrigation, telecommunication, livestock and fisheries. The head of district department is responsible for the performance of his department and is generally designated as the Deputy Director or District Officer. On the judicial side, the Deputy Director/Officer is assisted by an Additional District Magistrate and on the revenue side by an Assistant Deputy Commissioner.

1.3.4 Location

Shikarpur district is located in the Division of Larkano, Sindh, Pakistan. The district is situated around 18 miles from the right bank of the Indus in Larkana division with the 1.23 million population. Shikarpur district borders meet with Larkana, Jacobabad, Khairpur Mir, Sukkur and Katcha area touches with Ghotki district. The two national highways N-65 and N-55 intersect the city of Shikarpur making it the junction points of four provinces.

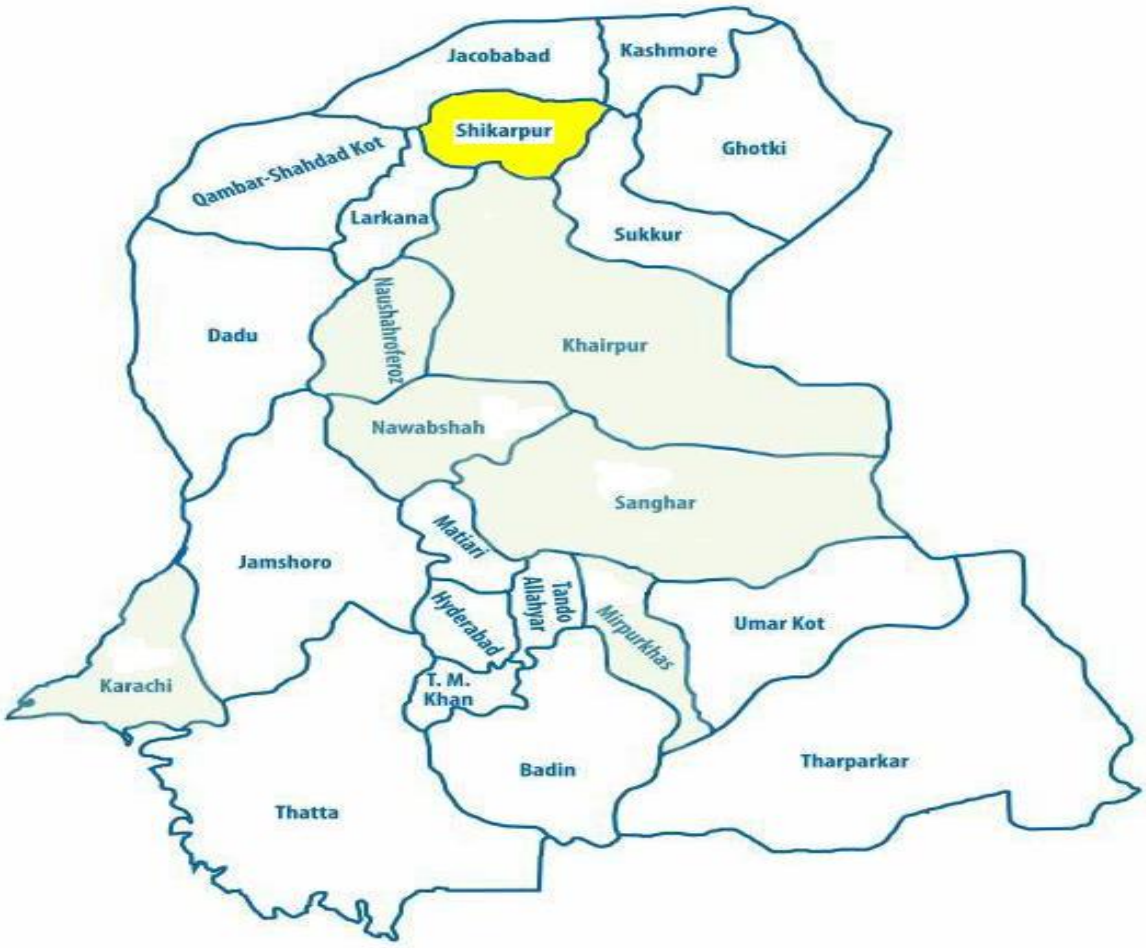


Figure 1-2: Location of District Shikarpur in the Province Map

1.3.5 Culture

1.3.5.1 Thaheeman-Ja-Quba (Bohi Quba)

Thaheeman-Ja-Quba also known as "Bohi Quba" belongs to the Thaheems, who historically are known to have fought with the Pathans during the Kalhora period in which Thaheems were martyred. These tombs were built by their family members in 1781 AD. The graveyard consists of four tombs namely of Shah Sahib Khan Thaheem, Jalal khan Thaheem, Dilawar Khan Thaheem (Kalhora period) and the 4th smaller tomb belongs to a saint known as Jafar Shah (recent), some recent graves are also scattered around these tombs.

1.3.6 Population

District of Shikarpur's population is about 1,231,481 which is almost 2.6% of Sindh's population of about 47.9 million. With 207,555 households, the average household size in the district of Shikarpur is 5.93

as per the Census of 2017 compared to average household size of 5.58 in Sindh. According to MICS 2018- 19, mean household size of Shikarpur is 6.9 as compared to mean household size of 6.5 in Sindh. 75.4% of Shikarpur's population resides in rural areas and 24.6% resides in the urban areas.

Shikarpur's population comprises of 634,985 males and 596,477 females with 51.6% and 48.4% of the district's population respectively. District of Shikarpur spans over an area of 2,577 sq. km which is 1.8% of Sindh's total area of 140,914 sq. km. The population density of the district is 478/sq.km.

Table 1-33: Population by Gender

Description	Total	Rural	Urban
Male	634,985	479,419	155,566
Female	596,477	448,803	147,674
Transgender	19	10	9
Total	**1231481**	**928232**	**303249**

Table 1-34: Population and Households by Taluka

Talukas	Population (#)	Population (%)	Households (#)	Households (%)
Gahri yasin	315,883		53,053	
Rural		89.0	47,001	89.0
Urban	35,849	11.0	65,052	11.0
Khanpur	276,832		43,892	
Rural	251,384	91.0	39,597	90.0
Urban	24,899	9.0	4,295	10.0
Lakhi	391,172		67,557	
Rural	201,079	81.0	34,605	80.0
Urban	47,064	19.0	8,448	20.0
Shikarpur	391,172		67,557	
Rural	195,735	50.0	34,699	51.0
Urban	195,437	50.0	32,858	49.0

Source: Government of Pakistan, Pakistan Bureau of Statistics, Population Census, 2017.

1.3.7 Social Profile

1.3.7.1 Housing

Housing characteristics including household size, ownership status, roofing, walls and assets provide a holistic description of the overall well-being of the household. Description of household characteristics provide a snapshot for the government to improve target housing conditions as per district-wise deprivations.

In District Shikarpur, 70.5% of population owns houses while 29.5% don't own their houses (8.7% rented) compared to 77.7% of the population in Sindh province who own their houses. According to MICS 2018-19, the average number of persons per room in Shikarpur is 5.2 compared 4.1 persons per room in Sindh. Similarly, the mean household size of District Shikarpur is 7.0 compared to mean household size of 6.5 in Sindh.

42.5% of households in Shikarpur have Pacca roofing compared to 70.7% households in province that have Pacca roofing. Similarly, 52.9% households in Shikarpur have Pacca walls compared to 70.7% households in the province that have Pacca walls.

Table 1-35: Housing by Ownership

Description	Own%	Rent%	Other/Missing%
Sindh	77.7	14.9	7.3
Shikarpur	70.5	8.7	20.8

Table 1-36: Mean Number of Persons Per Room

Description	1	2-3,	4-5,	6-7,	8-9,	10+
Sindh	0.6	12.5	30.1	27.4	15.5	13.9
Shikarpur	0.5	10.2	22.9	28.3	22.3	15.8

1.3.8 Utilities

Access to basic facilities like clean drinking water, toilets and sanitation services provide a holistic supply- side service provision coverage in a district.

In District Shikarpur, 100% of households have improved sources of drinking water compared to 96.0% households in Sindh having improved sources of drinking water. In terms of access to sanitation services, 21.3% of households in Shikarpur have access to improved sanitation services compared to 65.9% of households in Sindh with access to improved sanitation services. The prevalence of open defecation in Shikarpur is 27.2% compared to 24.0% in Sindh.

To ascertain whether environment-friendly practices are adopted at household level for cooking, heating and lighting, it is essential to gauge the prevalence of reliance on clean fuels. In District Shikarpur, 24.4% of the households rely primarily on clean fuels for cooking compared to 50.2% of households relying on clean fuel for cooking in Sindh. 28.9% of households in District Shikarpur rely primarily on clean fuels for space heating compared to 30.2% of households in Sindh.

Table 1-37: Source of Drinking Water

Description	Basic service %	Limited service %	Unimproved %	Surface water %
Sindh	90.3	5.7	2.1	1.9
Shikarpur	100.0	0.0	0.0	0.0

Table 1-38: Access to Sanitation

Description	Basic Service %	Limited Service %	Unimproved %	Open Defecation %
Sindh	58.8	7.1	10.1	24.0
Shikarpur	14.9	6.4	51.5	27.2

Source: Government of Sindh, Bureau of Statistics, Multiple Indicator Cluster Survey 2018-19.

1.3.9 Health

District Shikarpur has a total of 29 Government, Departmental, Private and Local Bodies Hospitals with a capacity of 542 beds out of 648 Hospitals in Sindh with a capacity of 30,126 beds. Shikarpur has a

total of 36 Basic Health Units (BHUs) with a capacity of 72 beds out of 800 BHUs in Sindh with a capacity of 1615 beds. Shikarpur has a total of 9 Rural Health Centers (RHCs) with a capacity of 110 beds out of 133 RHCs in Sindh with a capacity of 1703 beds in Sindh.

District Shikarpur has a total of 102 Dispensaries with a capacity of 12 beds out of 2996 Dispensaries with a capacity of 715 beds in Sindh. District Shikarpur has a total of 14 TB Clinics with no beds out of 228 TB Clinics with total capacity of 42 beds in Sindh. Shikarpur has 7 Mother & Child Health Centers (MCHCs) with 4 beds out of 227 MCHCs with a total of 181 beds. Similarly, Shikarpur has no Maternity Homes out of 42 Maternity Homes in the province.

Number of indoor patients served in District Shikarpur are 21,345 out of 744,618 indoor patients in the province. Similarly, number of outdoor patients served in District Shikarpur are 1,393,843 out of 43,718,506 outdoor patients in Sindh.

Table 1-39: Health Facilities

Description	Medical Centers	Beds
Basic Health Units (BHUs)	**36**	**72**
Rural Health Centres (RHCs)	**9**	**110**
Dispensaries	**102**	**12**
Government	13	0
Semi Government	2	0
Local Bodies	15	0
Private	72	12
TB Clinics	**14**	**0**
Government	9	0
Private	5	0
Mother and Child Health Centres (MCHC)	**7**	**4**
Government/Semi-Government	5	4
Local Bodies	0	0
Private	2	0
Maternity Homes (Government)	**3**	**NA**

1.3.9.1 Population Served

Patients per Bed 1,812

Patients per Doctor 3,624

Patients per Nurse 38,314

Indoor Patients			Outdoor Patients		
Male	Female	**Total**	Male	Female	**Total**
10,125	**11,220**	**21,345**	**607,409**	**786,434**	**1,393,843**
(47.0%)	(53.0%)		(44.0%)	(56.0%)	

Source: Government of Sindh, Bureau of Statistics, Health Profile of Sindh, 2017.

Hospital 29 Beds 542

Table 1-40: Details of Hospitals in the District

Description	Hospitals	Beds
Civil	1	295
Teaching	Nil	Nil
Major	1	20
Specialized	Nil	Nil
Taluka	3	64
Departmental	Nil	Nil
Private	24	163
Local Bodies	Nil	Nil

The patients per bed in District Shikarpur are 1,812 compared to 1,455 patients per bed in Sindh. The patients per doctor in Shikarpur are 3,624 compared to 3,159 patients per doctor in Sindh. Patients per nurse in Shikarpur are 38,314 compared to 12,411 patients per nurse in Sindh. Total Number of Government Medical, Nursing & Para-Medical Staff is 616 in District Shikarpur out of 18,429 Government Staff in Sindh. The total number of Semi-Government Medical, Nursing & Para-Medical Staff is 3 out of 2,985 Semi- Government Staff in Sindh. The total number of Local Bodies Medical, Nursing & Para-Medical Staff in District Shikarpur is 80 out of 4,119 in Sindh. There are 161 reported Private/Missionary Staff in Shikarpur out of 15,051 in Sindh.

Table 1-41: Numbers of Medical Nursing & Para-Medical Staff

Description	Government	Semi-Government	Local Bodies	Private
Physician	3	0	0	0
Surgeons	3	0	0	0
Gynecologist	3	0	0	0
Pediatricians	3	0	0	0
Doctors/GMO	254	1	0	103
Dentists	8	0	0	0
Nurse	32	0	0	3
LHV	56	0	0	0
ECG. Technician	12	0	0	0
O.T. Assistant	4	0	0	0
Midwives	54	0	20	0
Medical Technician	52	0	0	0
Dispenser/Dresser	75	2	60	40
Lab Technician	6	0	0	6
Lab Assistant	10	0	0	0
X-ray Technician	8	0	0	5
O.T. Technician	7	0	0	4
Dental Technician	17	0	0	0
X-ray Assistant	1	0	0	0

Description	Government	Semi-Government	Local Bodies	Private
Ultra sound Assistant	3	0	0	0
Blood Bank Technician	5	0	0	0
ICU Technician	0	0	0	0

Source: Government of Sindh, Bureau of Statistics, Health Profile of Sindh, 2017.

1.3.9.2 Maternal and Child Healthcare

The place of delivery in District Shikarpur is 25.6% in public health facility and 32.8% in private health facility which translates into 58.4% institutional deliveries. For the province, the average of institutional deliveries is 70.1%. In terms of home deliveries, Shikarpur has 41.2% of those compared to 29.0% in Sindh. In terms of assistance during delivery, District Shikarpur has 67.5% of deliveries with skilled birth attendants in Sindh.

In terms of ante-natal care coverage, 66.5% of women (15-49 years) were attended at least once by skilled health personnel in Shikarpur as compared to 76.7% in Sindh. The median months of pregnancy during first ANC visit is 5 months in Shikarpur as compared to 3 months in Sindh.

In District Shikarpur, women (15-49 years) who received at least two Tetanus Toxoid vaccine doses during the pregnancy of the most recent live birth is 43.3% compared to 48.3% in Sindh.

In District Shikarpur, 52.3% of women reported having health checks following birth at home or facility compared to 56.4% in Sindh.

In District Shikarpur, the prevalence of pre- mature births is 3.9% compared to 7.5% in Sindh.

Description	Shikarpur	Sindh
Public Facility	25.6 %	31.9%
Private Facility	32.8	38.2%
Home	41.2 %	29.0%
Others	0.4%	0.8%

Table 1-42: Assistance in Delivery

Description	Sindh %	Shikarpur %
Doctor	67.4	55.3
Nurse/ Midwife	6.3	2.6
Lady Health volunteer (LHV)	1.0	0.4
Community Midwife	8.1	9.1
Traditional Birth Attendant	12.3	20.9
Family Member/Neighbour/Friend	3.4	10.8
Others	1.0	0.8
No Attendant	0.6	0.0

Table 1-43: Antenatal Care

Description	Medical Doctor %	Nurse/ Midwife %	LHV%	Community Midwife %	Traditional Birth Attendant %	Other %	No Natal Care %
Sindh	71	3.7	0.4	1.7	1.5	0.1	21.7
Shikarpur	57.0	4.2	4.2	1.1	0.8	0.0	32.6

66.5 Percent of women who were attended at least once by skilled health personnel.

Table 1-44: Neonatal Care

Description	Percentage of women who received at least 2 tetanus toxoid containing vaccine doses during the pregnancy of the most recent live birth %	2 doses, the last within prior 3 years %	3 doses, the last within prior 5 years %	4 doses, the last within prior 10 years %	5 or more doses during lifetime %	Protected against tetanus %
Sindh	48.3	6.8	0.7	0.2	0.1	56.1
Shikarpur	43.3	4.2	0.0	0.0	0.0	47.4

Source: Government of Sindh, Bureau of Statistics, Multiple Indicator Cluster Survey 2018-19.

Table 1-45: Postnatal Care

Description	Health check following birth while in facility or at home %	Same day %	1 day following birth %	2 day following birth %	PNC visit for mothers		No post-natal care visit %	Missing/ DK %
					3-6 days following birth %	After the first week following birth %		
Sindh	56.4	20.1	4.2	3.3	6.3	2.2	63.0	0.8
Shikarpur	52.3	22.3	1.1	1.7	7.2	1.0	66.6	0.0

1.3.9.3 Pre-Mature Birth

In terms of age-specific fertility for adolescents (15-19 years), District Shikarpur has a rate of 96.2 per 1000 women compared to 49.5 per 1000 women in Sindh. For total fertility rate of women (15-49 years), District Shikarpur 6.6 per woman compared to 3.7 per woman in Sindh

In terms of nutritional status of children, in District Shikarpur, 53.7% of the children under 5 underweight compared to 40.7% in Sindh. Similarly, 9.3% are wasted compared to 14.8% in Sindh.

Shikarpur 3.9% Sindh 7.5%

Total Fertility Rate (women aged 15-49 years) 6.6

Adolescent Birth Rate (fertility rate for women age 15-19 years) 96 Per Thousand Women

Source: Government of Sindh, Bureau of Statistics, Multiple Indicator Cluster Survey 2018-19.

1.3.9.4 Early Child Bearing

(Percentage of men/women aged 20-24 years who had a live birth before the age of 18).

	Male	Female
Shikarpur	7.7%	17.3%
Sindh	2.8%	11.6%

Table 1-46: Children Nutrition

Description	Shikarpur	Sindh
Stunting	53.7 %	50.2%
Wasting	9.3%	14.8%
Overweight	2..2%	3.7%
Underweight	37.9%	40.7%

Table 1-47: Mortality Rates

Description	Neonatal Mortality Rate	Infant Mortality Rate	Under-five Mortality Rate
Sindh	24	39	46
Shikarpur	41	52	58

Table 1-48: Immunization Coverage

Description	Shikarpur	Sindh
At Birth	82.4	82.4
OPV-1	80.1	80.1
OPV-2	69.9	69.9
OPV-3	61.2	61.2
OPV-3 & IPV	48.6	48.6

Neo-natal, infant and under-5 mortality rate in Shikarpur is 41, 52 & 58 per 1000 live births compared to 24, 39 & 46 in Sindh respectively.

Full vaccination coverage for basic antigens for children (12-23 months) in Shikarpur is 28.6% compared to 43.8% in Sindh.

Table 1-49: Vaccination Coverage

Description	Shikarpur	Sindh
BCG	86.7	82.4
PENTA 1	76.1	75.1
PENTA 2	67.0	68.1
PENTA 3	50.7	57.6
PCV 1	74.0	72.2
PCV 2	68.7	65.5
PCV 3	49.7	55.4
MEASLES 1	66.4	62.7
MEASLES 2	72.6	64.7
FULL VACCINATION	28.6	43.8

Source: Government of Sindh, Bureau of Statistics, Multiple Indicator Cluster Survey 2018-19.

1.3.10 Education

District of Shikarpur has a total of 1,374 schools out of a total of 49,103 schools in the province of Sindh. Out of 1,374 schools, there are 337 schools for boys, 190 schools for girls, and 847 mixed schools.

1,374 schools in District Shikarpur have a total enrolment of 151,821 with 98,172 boys (64.7%) and 53,649 girls (35.3%). There are 3,306 male teachers (78.6%) and 899 female teachers (21.4%) in the schools in Shikarpur. Total number of rooms in 1,374 schools in Shikarpur amount to 4,713 out of which 3,149 are classrooms. There are 971 functional schools in Shikarpur while 403 schools are dysfunctional, non-functional, non-viable or closed.

Male literacy rate (15-49 years) in Shikarpur is 51.2% compared to 59% in Sindh while the female literacy rate is 27.7% compared to 40.9% in Sindh.

Table 1-50: Number of Schools

	Total	Boys	Girls	Mixed
Sindh	49,103	8,617	6,685	33,801
Shikarpur	1,374	337	190	847

Table 1-51: Number of Enrollments

	Boys	Girls
Sindh	2,812,000	1,749,140
Shikarpur	98,172	53,649

1.3.10.1 Enrollment

Male 64.6% Female 35.4%

Table 1-52: Teachers by Gender

Description	Male	Female
Primary	85.5	14.5
Middle	81.6	18.4
Secondary	81.0	19.0
Higher Secondary	82.1	17.9

Source: Government of Sindh, School Education & Literacy Department, Sindh Education Profile, 2019.

Table 1-53: Teachers Strength

Description	Total	Male	Female
Sindh	157,035	90,207	42,869
Shikarpur	4,612	3,601	1,011

Table 1-54: Rooms

Number of Rooms	Number of Schools	Percentage
1	333	24.3
2	638	46.6
3	76	5.
4	59	5.5
5	457	4.3
> 5	207	15.1

Table 1-55: Facilities in School

Description	Schools Without	Schools With
Boundary Walls	504	783
Drinking Water	527	760
Toilets	479	808
Electricity	741	546

Source: Government of Sindh, School Education & Literacy Department, Sindh Education Profile, 2019.

Table 1-56: School Functionality

Description	Shikarpur	Sindh
Functional	70.6	74.4%
Non-Functional	29.4%	25.3%

Table 1-57: Ownership Status of School Building

Description	Govt. Owned	Shared	Rented	Others	Shelter less
Sindh	38,390	1,187	164	1,629	7,733
Shikarpur	1,150	15	5	200	4

1,150 School buildings out of 1,374 are government-owned (83.7%), while 15 buildings are shared (1.1%). 0.3% of school buildings in Shikarpur are shelter-less, i.e., 4.

Table 1-58: Literacy Rate

Description	Shikarpur	Sindh
Male	51.2%	59.0%
Female	27.7%	40.9%

Source: Government of Sindh, School Education & Literacy Department, Sindh Education Profile, 2019 / Government of Sindh, Bureau of Statistics, Multiple Indicator Cluster Survey 2018-19.

1.3.11 MPI (Multi-Dimensional Poverty Index)

Multi-Dimensional Poverty Index measures the number of people/households that are 'multi-dimensionally' poor. Essentially, it means the number of people (or HHs) deprived in at least one-third of the weighted indicators (H) along with the weighted average number of deprivations poor people experience at the same time (A). The weighted indicators are along three broad dimensions:

-Education, -Health, and -Living Standards

In District Shikarpur, the MPI value is 0.4 which is slightly higher than the average MPI Value of 0.25 in Sindh. The headcount of households that are multidimensionally poor in Shikarpur is 71.6% compared to the headcount of 47% in Sindh.

In District Shikarpur, 14.8% of household members are vulnerable to poverty (i.e. deprived in one-fifth to one-third of weighted indicators). Similarly, 46.3% of household members are in severe multi-dimensional poverty (i.e. deprived in more than one-half of weighted indicators).

Table 1-59: MPI Head Count

Description	M-Poverty Headcount 2018 (H)	MPI 2018	% Vulnerable to Poverty	% in Severe Poverty
Sindh	0.47	0.25	12.50	28.30
Shikarpur	0.72	0.40	14.80	46.30

1.3.11.1 M-Poverty Headcount

Shikarpur 72.0% Sindh 47.0%

1.3.11.2 MPI

Shikarpur 0.40 Sindh 0.25

District Shikarpur has a slightly higher MPI value (i.e., 0.4) than the provincial MPI value of 0.25 with indicates multiple deprivations along the dimensions of health, education and living standards.

14.8% of household members in District Shikarpur are vulnerable to poverty which means 14.8% of household members are deprived in one-fifth to one-third of weighted indicators.

46.3% of household members in District Shikarpur are in severe poverty. This essentially means that 46.3% of household's members in District Shikarpur are deprived in at least half of the weighted indicators.

Source: Government of Sindh, Bureau of Statistics, Multiple Indicator Cluster Survey 2018-19.

1.3.12 Economic Profile

1.3.12.1 Agriculture

Out of the area under cultivation for major crops, District Shikarpur contributes to 159,269 hectares (5.3%) out of 3,028,496 hectares in Sindh. In terms of highest proportions of area under cultivation for major crops, Wheat, Rice, and Gram are at the forefront in Shikarpur with 37,778 hectares. 117,955 hectares, and 1,685 hectares under cultivation respectively in the district. Similarly, the production of Wheat, Rice, and Gram is 108,623 M. Tons, 357,654 M. Tons, and 1,582 M. Tons.

Table 1-60: Area Under Cultivation

Crops	Sindh Area (ha)	Shikarpur Area (ha)	Share of Shikarpur (%)
Bajra	46,156	0	0.0
Barley	6,801	68	1.0
Cotton	611,689	196	0.03
Gram	19,023	1,685	8.9
Jowar	11,651	9	0.08
Maize	3,559	12	0.3
Mustard	48,355	1,050	2.2
Rice	828,292	117,955	14.2
Sesamum	9,952	46	0.5
Sugarcane	333,262	470	0.1
Tobacco	136	0	0.0
Wheat	1,089,587	37,778	3.5

Table 1-61: Crop Production

Crops	Area (Hectarage)	Share in Acreage (%)	Production (M. Tons)	Share in Production (%)
Bajra	0	0.0	0	0.0
Barley	68	1.0	46	1.1
Cotton (bales)	196	0.03	1,063	0.03
Gram	1,685	8.9	1,582	8.8
Jowar	9	0.08	10	0.09
Maize	12	0.3	12	0.3
Mustard	1,050	2.2	1,100	2.2

Crops	Area (Hectarage)	Share in Acreage (%)	Production (M. Tons)	Share in Production (%)
Rice	117,955	14.2	357,654	12.5
Sesamum	46	0.5	23	0.5
Sugarcane	470	0.1	21,370	0.1
Tobacco	0	0.0	0	0.0
Wheat	37,778	3.5	108,623	3.0

Source: Government of Sindh, Bureau of Statistics, Development Statistic of Sindh, 2019.

Table 1-62: Crop Share

Crops	Sindh Production (M. Tons)	Shikarpur Production (M. Tons)	Share of Shikarpur (%)
Bajra	23,711	0	0.0
Barley	4,008	46	1.1
Cotton (in bales)	3,775,761	1,063	0.03
Gram	17,930	1,582	8.8
Jowar	11,078	10	0.09
Maize	3,616	12	0.3
Mustard	50,700	1,100	2.2
Rice	2,850,524	357,654	12.5
Sesamum	4,448	23	0.5
Sugarcane	20,611,878	21,370	0.1
Tobacco	198	0	0.0
Wheat	3,639,544	108,623	3.0

Table 1-63: Irrigation

Description	Shikarpur	Sindh
Irrigated Area (Ha)	54.1%	62.3%
Un-Irrigated Area (Ha)	46.9%	37.7%

Source: Government of Sindh, Bureau of Statistics, Development Statistic of Sindh, 2019.

Table 1-64: Mode of Irrigation

Description	Canal	Tube well
Sindh	1,287,845	361,199
Shikarpur	51,128	2,320
District Share (%)	4.0%	0.6%

1.3.12.2 Shikarpur

Canal 95.6% (51,128 Ha) Tube well 4.4% (2,320 Ha)

1.3.13 Forest

Canals are the mode of irrigation for 51,128 hectares in District Shikarpur out of 1,287,845 hectares irrigated by Canals in Sindh (4.0%). Tube-wells are the mode of irrigation for 2,320 hectares in Shikarpur out of 361,199 hectares irrigated by Tube-wells in Sindh (0.6%).

Total area under forest cover in Sindh is 271,372 hectares. There is 27,540 hectares reported forest cover in Shikarpur (10.1%).

	Sindh	Shikarpur
Forest Area	271,372 (Ha)	27,540 (Ha)

Source: Government of Sindh, Bureau of Statistics, Development Statistic of Sindh, 2019.

1.3.14 Livestock & Fisheries

The livestock head-count in District Shikarpur is 2,823,437 out of the total livestock count of 46,279,313 in Sindh (5.6%). District Shikarpur has 511,040 cattle, 549,631 buffaloes, 342,054 goats, and 1,065,707 poultry.

Fish production in Shikarpur is 10,346 M. Tons out of 133,150 M. Tons in Sindh (7.8%). Shikarpur has a total of 1,180 fishermen out of 45,013 in Sindh (2.6%). Similarly, Shikarpur has 98 boats out of 7,215 boats in Sindh (1.4%).

Table 1-65: Livestock Count

Description	Sindh	Shikarpur	%Share
Buffaloes	7,340,162	511,040	7.3
Sheep	3,958,508	549,631	7.4
Goats	12,572,221	293,468	2.7
Camels	278,424	342,054	0.3
Horses	44,999	1,080	4.1
Mules	19,512	1,846	8.6
Asses	1,004,925	1,683	5.6
Poultry	14,135,540	1,065,707	7.5

Table 1-66: Fish Production

Description	Sindh	Shikarpur	% Share
Fish Production	133,150	10,346	7.8
Fishermen	45,013	1,180	2.6
Full Time	28,716	715	2.5
Part Time	16,297	465	2.9
Boats	7,215	98	1.4
Sail	2,689	75	2.8
Row	4,526	23	0.5

Livestock Share 5.6% Fisheries Share 7.8%

Source: Government of Sindh, Bureau of Statistics, Development Statistic of Sindh, 2019 / Government of Pakistan, Bureau of Statistics, Sindh Province Report, Livestock Census, 2006

1.3.15 Manufacturing & Communications

Number of reporting manufacturing establishments in District Shikarpur is 25 out of the 1,825 manufacturing units in Sindh (1.4%). District Shikarpur has a road network of 709 km out of the 22,283 km in Sindh (3.2%).

Table 1-67: Establishments

Description	Number of Manufacturing Units	% Share
Sindh	1,825	100
Shikarpur	25	1.4

Table 1-68: Roads

Description	Road Kilometers	Road Density/Km²
Sindh	22,283	0.15
Shikarpur	709	0.28
District Road Length Share	3.2%	

Source: Government of Sindh, Bureau of Statistics, Development Statistic of Sindh, 2019.

1.3.16 Wealth

The wealth index is a composite measure of a household's cumulative living standard. The wealth index is calculated using easy-to-collect data on a household's ownership of selected assets, such as televisions and bicycles; materials used for housing construction; and types of water access and sanitation facilities. (The DHS Program) Distribution of household population by wealth index quintile for District Shikarpur reveals that 18.5% of the population is in the poorest 20% quintile and 39.6% population is in the second poorest quintile while only 5.7% of the population lie in the top 20% quintile.

48.5% of the households in the two poorest wealth quintiles of Shikarpur receive social transfers or benefits compared to 33.7% coverage in Sindh.

Table 1-69: Income Quintiles

Description	Poorest%	Second%	Middle%	Fourth%	Richest%
Sindh	20.0	20.0	20.0	20.0	20.0
Shikarpur	18.5	39.6	26.7.7	9.5	5.7

Source: Government of Sindh, Bureau of Statistics, Development Statistic of Sindh, 2019.

1.3.17 Religion

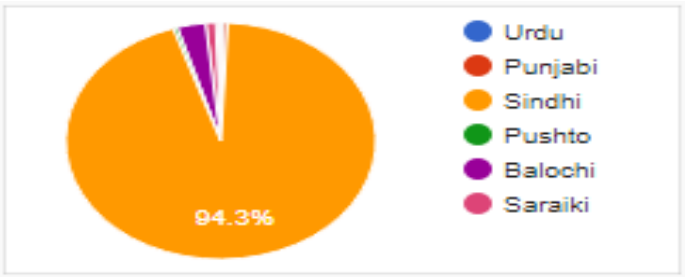
The majority religion is Islam, with 98.39% of the population. Hinduism (including those from Scheduled Castes) is practiced by 1.40% of the population.

1.3.18 Ethnicity and Tribes

The dominant ethnic group in the project area of Shikarpur is the Pathan tribe. The Mazari Sardars are the controlling authority in the project area and hold the majority of the agricultural land. Other tribes include the Mirani, Soomro, Solongy, Sheikh and the Chacher, Arain, Sher, Datsi, Malik, Indhar, Bhatti and Khosa. Member of the Mirani tribe are commonly working as fishermen or employed as laborers in the city. Ethnic minorities include Pathan and Daya that are living in the vicinity of Shikarpur town.

1.3.19 Languages

Sindhi, Saraiki and Balochi are the major languages in the project area whereas Brohi and Urdu are also spoken. The ratio of languages spoken in the district is shown below:



Mother Tongue (C 2017)	
Urdu	3,081
Punjabi	4,597
Sindhi	1,028,582
Pushto	4,480
Balochi	32,638
Kashmiri	178
Saraiki	11,404
Hindko	604
Brahvi	3,816
Other Language	956

Figure 1-3: Linguistics Proportions

1.3.20 Household and Family System

The majority of those in the study area live together with their extended family (parents living with married children and their families). Families believe this is a more economical way of living as they often work together on the same land and are able to share their joint incomes to support the entire family, including elderly relatives who are unable to work. It is also thought to be more efficient to share basic amenities such as water, electricity, housing and food rather than for each immediately family to purchase or source their own.

1.3.21 Dwellings/Source of Income

Agriculture is the most widespread source of income in the project area. Livestock rearing and laboring is the second major sources of income while Government jobs is the third major source of income.

The lands in project area are fertile and farmers grow rice, sugarcane, cotton, sorghum and vegetables during the Kharif season (April to November) and wheat, oil seed, pulses and vegetables during Rabi season (April to October). Kharif crops are often flooded by the high floods in the river Indus and Rabi crops are usually sown on the residual flood moisture. Sugarcane is a cash crop and is the most commonly grown crop in the project area due to the availability of the surrounding sugar mills making it easy to sell.

Livestock is a significant, albeit often a secondary, source of income. Most of the farming communities own livestock with significant numbers. Majority of the households own 3 or 4 animals. Cow and buffalo are most commonly owned. Livestock is a prestigious symbol and an additional source of income for the farming community, providing milk, ghee and meat.

Small businesses, the private sector and fishing do not represent significant income sources in the project area.

1.3.22 Transport

Most of the villages have village tracks or unsurfaced (Kacha) roads that are in bad condition. Construction and maintenance of village roads is the responsibility of local government. Three provincial highways also pass through the project area and connect Sindh with Punjab and Baluchistan.

Guddu Barrage is linked to Shikarpur and Kandhkot by Indus highway. Indus highway passes through Punjab and Baluchistan on the right side of the Barrage. The Shikarpur road cross the Guddu barrage to Ubaro town at national high way that further go to Lahore and Peshawar. The district Shikarpur is also served by Pakistan railway.

The major source of the human transport is Railway, Buses, Suzuki Van, Rickshaw and Private Cars. The farm inputs and outputs are transported through Trucks Trailer and Tractor Trolley. The animals from the project area transported to Hyderabad and Karachi by Trucks. The Firewood and Furniture wood is also transported through Trucks and Trolleys.

1.3.23 Culture and Customs

Sindh province has rich culture, customs and traditions. The project area has almost similar culture and customs with slight differences on the basis of ethnic and religious groups. Being traditional Muslims there is a greater influence of the Arabian culture, however, the traces of Hindu, Buddhism and other religious thoughts are also present in the cultural attitudes and approaches of the local communities. The Pirs and Murshids (religious leaders, saints) are held in high esteem and confidence amongst the Muslims particularly in the uneducated and poor class of the rural areas. Annual festivals at the shrines of saints are regularly held in which people very enthusiastically take part. Similarly, the Hindus also hold great confidence and reverence in Thakurs and Brahmans (the higher castes). The Brahmans usually perform spiritual rites of Hindus on special occasions.

1.3.24 Social Cohesion and Conflict in the Project Area

The area is dominated by tribes originating from Balochistan, in particular the Mazari tribe. After the construction of Guddu Barrage people migrated from Balochistan and purchased the land in the canal command areas. These people have settled in the area but have maintained the customs and traditions from the homeland. People from each province have different traditions and customs, and the way of life of people from each province is very different.

Social organization in all villages is strongly based on Biradari (tribal) system, where each tribe has a tribal leader. The Tribe Leaders are mostly landlords and political leaders. All families belonging to the same tribe have strong interactions with one another but mostly remain separate from other tribes. This extends to marriages, where it is the preference for young tribal members to marry a member of the same tribe. Interactions between different tribes are less common.

There is a large number of villages in the area. Separate villages have been established as tribes and families have grown and the land owned by one family becomes sub-divided between the brothers of successive generations.

1.3.25 Conflict Resolution within Tribes and Villages

In the project corridor, the decisions about conflict, right of vote, marriage settlements and other matters are usually resolved by the village head, while the head of a tribe shall resolve major disputes. It was found during survey that 90 percent of the conflicts were resolved at village level. Those living within communities of the project area feel obliged to accept the decision of the village or tribal leaders.

In case of serious matters, local influential politicians (who are often also tribal leaders) intervene to settle the dispute. Occasionally, when parties do not agree on the decision of caste or tribal leaders, matters may go to the police and ultimately a court of law. The police and the court of law are the last options and these are rarely exercised

1.3.26 Role of Women

The women of the project area have no any role in the decision making such as marriage of children, sale and purchase of property, sale and purchase of animals, decision regarding schooling of children and to attend social events. It was found during the field survey that the oldest male member of the family has the power of decision making and he determines the family

1.4 Socio-Economic Setup in Kashmore District

1.4.1 Overview

Kashmore District is located in the northern part of Sindh, bordering Ghrotki, Jacobabad, Shikarpur and Sukkur within Sindh. It also borders Baluchistan on one side and Punjab on the other. The Indus River runs through the Eastern side of Kashmore district. The south-eastern side of Kashmore District has forest of "kacha" that supports wild animals. The Thar dessert falls on the Eastern side of the district, and is home to the wild desert animals.

1.4.2 History

The district Kashmore-kandhkot was created by bifurcating District Jacobabad in to two parts. Earlier Jacobabad had five talukas and after bifurcation three Talukas namely, Thull, Garhi khero and Jacobabad were included in district Jacobabad, where as Kandhkot and Kashmore were included in the district Kashmore & Kandhkot. The Head Quarter of district Kashmore is situated in Kandhkot. After some time, Tangwani was given the status of Taluka and the number of talukas of district Kashmore-Kandhkot increased from two to three.

1.4.3 Administrative Setup

The administrative setup of the district Kashmore is similar to the other districts of Pakistan. District administration is headed by the Deputy Commissioner (DC) who is assisted by heads of other departments. The DC is responsible for the coordination of functions of all the departments in the district. The main district departments include: district administration body, judiciary, police, education, health, communication and works, agriculture, forestry, irrigation, telecommunication, livestock and fisheries. The head of district department is responsible for the performance of his department and is generally designated as the Deputy Director or District Officer. On the judicial side, the Deputy Director/Officer is assisted by an Additional District Magistrate and on the revenue side by an Assistant Deputy Commissioner.

1.4.4 Location

District Kashmore-Kandhkot is part of the Larkano Division. District Kashmore-Kandhkot is situated in upper Sindh. Its eastern borders touch district Rajanpur of Punjab by crossing Guddu Barrage and its northern borders touch district Sibi of Baluchistan. The District Jacobabad and Shikarpur are Located in its west. Its southern side meets with River Indus and District Ghotki.

Figure 1-4: Location of District Kashmore in the Province Map

1.4.5 Population

District of Kashmore-Kandhkot's population is about 1,089,169 which is almost 2.3% of Sindh's population of about 47.9 million. With 185,143 households, the average household size in the district of Kashmore- Kandhkot is 5.9 as per the Census of 2017 compared to average household size of 5.58 in Sindh. According to MICS 2018-19, mean household size of Kashmore-Kandhkot is 8.5 as compared to mean household size of 6.5 in Sindh. 77.0% of Kashmore-Kandhkot's population resides in rural areas and 23.0% resides in the urban areas.

Kashmore-Kandhkot's population comprises of 564,843 males and 524,307 females with 52.0% and 48.0% of the district's population respectively. District of Kashmore-Kandhkot spans over an area of 2,551 sq. km which is 1.8% of Sindh's total area of 140,914 sq. km.

Table 1-70: Population by Gender

Description	Total	Rural	Urban
Male	564,843	433,475	131,368
Female	524,307	402,076	122,231
Transgender	19	5	14

Table 1-71: Population and Households by Talukas of District

Talukas	Population (#)	Population (%)	Households (#)	Households (%)
Kandhkot	**366,484**		**66,279**	
Rural	230,486	63.0	41,898	63.0
Urban	135,998	37.0	24,381	37.0
Kashmore	**434,975**		**70,063**	
Rural	343,855	79.0	54,862	78.0
Urban	91,120	21.0	15,201	22.0
Tangwani	**287,710**		**48,801**	
Rural	261,215	91.0	44,112	90.0
Urban	26,495	9.0	4,689	10.0

1.4.6 Faith of the Population

The majority religion is Islam, with **96.73**% of the population. Hinduism (including those from Scheduled Castes) is practiced by **3.22**% of the population.

Table 1-72: Religions in District Kashmore

Religion	Percentage (%)
Muslims	96.73
Hindus	3.22
Other beliefs	0.05

1.4.7 Culture

1.4.7.1 Dargah Hazrat Shah Hussain

Dargah Hazrat Shah Hussain alias Shah Ghous Jeelani in the middle of the town of Ghouspur is an ancient literary centre and a monument. It is said that Hazrat Shah Hussain, a pious saint, came here from an unknown Arab land way back 400 years ago, and opted to settle in this area which was called as Fatehpur. After his demise the village's name was changed and began to be known as Ghouspur. The main graveyard in the dargah's vicinity houses 3 graves.

1.4.7.2 Chittee Mosque

This is a remarkable architectural contribution in the remotest part of this area. "Chitee" or "Chito", are the Sindhi words meaning clear or white. Perhaps the name suggested to the mosque was because of its white colour. The village where it is located is itself called as "Goth Chitee Maseet". It was built by Noor Muhammad Faqeer Chachar, who was infamous because of his cattle lifting activities in the area. One day he decided to abandon his anti-social activities. In order to celebrate his new life, he further decided to build a mosque on the bank of river Indus. The mosque was built in 1235 Hijri.

1.4.8 Social Profile

1.4.8.1 Housing

Housing characteristics including household size, ownership status, roofing, walls and assets provide a holistic description of the overall well-being of the household. Description of household characteristics provide a snapshot for the government to improve target housing conditions as per district-wise deprivations.

In District Kashmore-Kandhkot, 76.5% of population owns houses while 23.5% don’t own their houses (14.1% rented) compared to 77.7% of the population in Sindh province who own their houses. According to MICS 2018-19, the average number of persons per room in Kashmore-Kandhkot is 5.1 compared 4.1 persons per room in Sindh. Similarly, the mean household size of District Kashmore- Kandhkot is 8.5 compared to mean household size of 6.5 in Sindh.

48.4% of households in Kashmore-Kandhkot have Pacca roofing compared to 70.7% households in province that have Pacca roofing. Similarly, 30.2% households in Kashmore-Kandhkot have Pacca walls compared to 70.7% households in the province that have Pacca walls.

Table 1-73: Housing by Ownership

Description	Own	Rent	Other/Missing
	%	%	%
Sindh	77.7	14.9	7.3
Kashmore- Kandhkot	76.5	14.1	9.4

Table 1-74: Mean Number of Persons per Room

Description	1	2-3,	4-5,	6-7,	8-9,	10+
Sindh	0.6	12.5	30.1	27.4	15.5	13.9
Kashmore Kandhkot	0.0	6.4	22.1	21.3	18.9	31.3

1.4.9 Utilities

Access to basic facilities like clean drinking water, toilets and sanitation services provide a holistic supply-side service provision coverage in a district.

In District Kashmore-Kandhkot, 99.2% of households have improved sources of drinking water compared to 96.0% households in Sindh having improved sources of drinking water. In terms of access to sanitation services, 31.5% of households in Kashmore-Kandhkot have access to improved sanitation services compared to 65.9% of households in Sindh with access to improved sanitation services. The prevalence of open defecation in Kashmore-Kandhkot is 37.2% compared to 24.0% in Sindh.

To ascertain whether environment-friendly practices are adopted at household level for cooking, heating and lighting, it is essential to gauge the prevalence of reliance on clean fuels. In District Kashmore-Kandhkot, 10.9% of the households rely primarily on clean fuels for cooking compared to 50.2% of households relying on clean fuel for cooking in Sindh. 18.5% of households in District Kashmore-Kandhkot rely primarily on clean fuels for space heating compared to 30.2% of households in Sindh.

Table 1-75: Source of Drinking Water

Description	Basic Service %	Limited Service %	Unimproved %	Surface Water %
Sindh	90.3	5.7	2.1	1.9
Kashmore Kandhkot	98.8	0.4	0.5	0.3

Table 1-76: Access to Sanitation

Description	Basic Service %	Limited Service %	Unimproved %	Open Defecation %
Sindh	58.8	7.1	10.1	24.0
Kashmore Kandhkot	24.8	6.7	31.2	37.2

1.4.10 Health

District Kashmore-Kandhkot has a total of 5 Government, Departmental, Private and Local Bodies Hospitals with a capacity of 122 beds out of 648 Hospitals in Sindh with a capacity of 30,126 beds. Kashmore-Kandhkot has a total of 25 Basic Health Units (BHUs) with a capacity of 50 beds out of 800 BHUs in Sindh with a capacity of 1615 beds. Kashmore-Kandhkot has a total of 4 Rural Health Centers (RHCs) with a capacity of 26 beds out of 133 RHCs in Sindh with a capacity of 1703 beds in Sindh.

District Kashmore-Kandhkot has a total of 45 Dispensaries with no beds out of 2996 Dispensaries with a capacity of 715 beds in Sindh. District Kashmore-Kandhkot has a total of 3 TB Clinics with no beds out of 228 TB Clinics with total capacity of 42 beds in Sindh. Kashmore-Kandhkot has 2 Mother & Child Health Centers (MCHCs) with 4 beds out of 227 MCHCs with a total of 181 beds. Similarly, Kashmore-Kandhkot has 0 Maternity Homes out of 42 Maternity Homes in the province.

Number of indoor patients served in District Kashmore-Kandhkot are 4,587 out of 744,618 indoor patients in the province. Similarly, number of outdoor patients served in District Kashmore-Kandhkot are 600,747 out of 43,718,506 outdoor patients in Sindh.

Table 1-77: Health Facilities

Description	Medical Centers	Beds
Basic Health Units (BHUs)	**25**	**50**
Rural Health Centres (RHCs)	**4**	**26**
Dispensaries	**45**	**0**
Government	31	0
Semi Government	0	0
Local Bodies	13	0
Private	1	0
TB Clinics	**3**	**0**
Government	3	0
Private	0	0
Mother and Child Health Centres (MCHC)	**2**	**4**
Government/Semi-Government	2	4
Local Bodies	0	0
Private	2	0
Maternity Homes (Government)	**0**	**0**

1.4.10.1 Population Served

Patients per Bed 5,188

Patients per Doctor 5,822

Patients per Nurse 95,273

Indoor Patients			Outdoor Patients		
Male **2,149** (47.0%)	Female **2,438** (53.0%)	**Total 4,587**	Male **287,953** (48.0%)	Female **312,794** (52.0%)	**Total 600,747**

Source: Government of Sindh, Bureau of Statistics, Health Profile of Sindh, 2017.

Hospital 5 Beds 122

Description	Hospitals	Beds
Civil	1	20
Teaching	Nil	Nil
Major	Nil	Nil
Specialized	Nil	Nil

Description	Hospitals	Beds
Taluka	1	30
Departmental	1	50
Private	2	22
Local Bodies	Nil	Nil

The patients per bed in District Kashmore-Kandhkot are 5,188 compared to 1,455 patients per bed in Sindh. The patients per doctor in Kashmore-Kandhkot are 5,822 compared to 3,159 patients per doctor in Sindh. Patients per nurse in Kashmore-Kandhkot are 95,273 compared to 12,411 patients per nurse in Sindh. Total Number of Government Medical, Nursing & Para-Medical Staff is 320 in District Kashmore-Kandhkot out of 18,429 Government Staff in Sindh. The total number of Semi-Government Medical, Nursing & Para-Medical Staff is 17 out of 2,985 Semi-Government Staff in Sindh. The total number of Local Bodies Medical, Nursing & Para-Medical Staff in District Kashmore-Kandhkot is 33 out of 4,119 in Sindh. There are 64 reported Private/Missionary Staff in Kashmore-Kandhkot out of 15,051 in Sindh.

Table 1-78: Numbers of Medical Nursing & Para-Medical Staff

Description	Government	Semi-Government	Local Bodies	Private
Physician	1	0	0	0
Surgeons	1	0	0	0
Gynecologist	1	0	0	0
Pediatricians	1	0	0	0
Doctors/GMO	130	6	0	40
Dentists	5	0	0	0
Nurse	11	0	0	0
LHV	15	0	0	0
ECG. Technician	5	0	0	0
O.T. Assistant	4	0	0	0
Midwives	35	0	0	0
Medical Technician	38	0	0	0
Dispenser/Dresser	44	11	33	24
Lab Technician	5	0	0	0
Lab Assistant	5	0	0	0
X-ray Technician	5	0	0	0
O.T. Technician	4	0	0	0
Dental Technician	9	0	0	0
X-ray Assistant	0	0	0	0
Ultra sound Assistant	1	0	0	0
Blood Bank Technician	0	0	0	0
ICU Technician	0	0	0	0

Source: Government of Sindh, Bureau of Statistics, Health Profile of Sindh, 2017.

1.4.11 Maternal and Child Healthcare

The place of delivery in District Kashmore- Kandhkot is 27.0% in public health facility and 0% in private health facility which translates into 27% institutional deliveries. For the province, the average of institutional deliveries is 70.1%. In terms of home deliveries, Kashmore-Kandhkot has 73.0% of those compared to 29.0% in Sindh. In terms of assistance during delivery, District Kashmore-Kandhkot has 100.0% of deliveries with skilled birth attendants compared to 82.7% of deliveries with skilled birth attendants in Sindh.

In terms of ante-natal care coverage, 63.9% of women (15-49 years) were attended at least once by skilled health personnel in Kashmore-Kandhkot as compared to 76.7% in Sindh. The median months of pregnancy during first ANC visit is 5 months in Kashmore-Kandhkot as compared to 3 months in Sindh.

In District Kashmore-Kandhkot, women (15-49 years) who received at least two Tetanus Toxoid vaccine doses during the pregnancy of the most recent live birth is 50.5% compared to 48.3% in Sindh.

In District Kashmore-Kandhkot, 10.8% of women reported having health checks following birth at home or facility compared to 56.4% in Sindh.

In District Kashmore-Kandhkot, the prevalence of pre-mature births is 4.2% compared to 7.5% in Sindh.

Table 1-79: Health Facilities

Description	Kashmore-Kandhkot	Sindh
Public Facility	27.0%	31.9%
Private Facility	0.0%	38.2%
Home	73.0%	29.0%
Others	0.0%	0.8%

Table 1-80: Assistance in Delivery

Description	Sindh %	Kashmore-Kandhkot %
Doctor	67.4	20.9
Nurse/ Midwife	6.3	32.8
Lady Health volunteer (LHV)	1.0	2.2
Community Midwife	8.1	44.2
Traditional Birth Attendant	12.3	0.0
Family Member/Neighbour/Friend	3.4	0.0
Others	1.0	0.0
No Attendant	0.6	0.0

Table 1-81: Antenatal Care

Description	Medical Doctor %	Nurse/ Midwife %	LHV %	Community Midwife %	Traditional Birth Attendant %	Other%	No Natal Care %
Sindh	71.0	3.7	0.4	1.7	1.5	0.1	21.7
Kashmore-Kandhkot	18.9	24.1	0.0	20.9	0.0	0.0	36.1

Percent of women who were attended at least once by skilled health personnel 63.9.

Table 1-82: Neonatal Care

Description	Percentage of women who received at least 2 tetanus toxoid containing vaccine doses during the pregnancy of the most recent live birth %	2 doses, the last within prior 3 years %	3 doses, the last within prior 5 years %	4 doses, the last within prior 10 years %	5 or more doses during lifetime %	Protected against tetanus %
Sindh	48.3	6.8	0.7	0.2	0.1	56.1
Kashmore-Kandhkot	50.5	3.6	0.0	0.3	0.0	54.4

Table 1-83: Postnatal Care

Description	Health check following birth while in facility or at home %	Same day %	1 day following birth %	2 days following birth %	PNC visit for mothers		No post-natal care visit %	Missing/ DK %
					3-6 days following birth %	first week following birth %		
Sindh	56.4	20.1	4.2	3.3	6.3	2.2	63.0	0.8
Kashmore-Kandhkot	10.8	1.4	0.0	0.2	0.0	0.8	97.6	0.0

1.4.11.1 Pre-Mature Birth

In terms of age-specific fertility for adolescents (15-19 years), District Kashmore-Kandhkot has a rate of 125.3 per 1000 women compared to 49.5 per 1000 women in Sindh. For total fertility rate of women (15-49 years), District Kashmore- Kandhkot 6.5 per woman compared to 3.7 per woman in Sindh.

In terms of nutritional status of children, in District Kashmore-Kandhkot, 54.6% of the children under 5 years are stunted (moderate or severe) compared to 50.2% in Sindh. 26.5% of children are underweight compared to 40.7% in Sindh. Similarly, 5.5% are wasted compared to 14.8% in Sindh.

Kashmore 4.2% Sindh 7.5%

Total Fertility Rate (women aged 15-49 years) 6.5

Adolescent Birth Rate
(fertility rate for women age 15-19 years) 125 Per Thousand Women

1.4.11.2 Early Child Bearing

(Percentage of men/women aged 20-24 years who had a live birth before the age of 18)

Description	Kashmore	Sindh
Male	11.6%	2.8%
Female	26.8%	11.6%

Table 1-84: Children Nutrition

Description	Kashmore	Sindh
Stunting	54.6%	50.2%
Wasting	5.5%	14.8%
Overweight	14.7%	3.7%
Underweight	26.5%	40.7%

Table 1-85: Mortality Rates

Description	Neonatal Mortality Rate	Infant Mortality Rate	Under-five Mortality Rate
Sindh	24	39	46
Kashmore-Kandhkot	40	54	67

Table 1-86: Immunization Coverage

Description	Kashmore	Sindh
At Birth	70.5	82.4
OPV-1	64.1	80.1
OPV-2	47.9	69.9
OPV-3	34.1	61.2
OPV-3 & IPV	31.9	48.6

Neo-natal, infant and under-5 mortality rate in Kashmore-Kandhkot is 40, 54 & 67 per 1000 live births compared to 24, 39 & 46 in Sindh respectively.

Full vaccination coverage for basic antigens for children (12-23 months) in Kashmore-Kandhkot is 18.6% compared to 43.8% in Sindh.

Table 1-87: Vaccination Coverage

Description	Kashmore	Sindh
BCG	69.3	82.4
PENTA 1	59.5	75.1
PENTA 2	54.7	68.1
PENTA 3	39.7	57.6
PCV 1	59.5	72.2
PCV 2	55.8	65.5
PCV 3	33.9	55.4
MEASLES 1	27.1	62.7
MEASLES 2	38.5	64.7
FULL VACCINATION	18.6	43.8

Source: Government of Sindh, Bureau of Statistics, Multiple Indicator Cluster Survey 2018-19.

1.4.12 Education

District of Kashmore-Kandhkot has a total of 1,681 schools out of a total of 49,103 schools in the province of Sindh. Out of 1,681 schools, there are 237 schools for boys, 233 schools for girls, and 1,211 mixed schools.

1,681 schools in District Kashmore-Kandhkot have a total enrollment of 147,463 with 104,287 boys (70.7%) and 43,176 girls (29.3%). There are 3,209 male teachers (84.0%) and 613 female teachers (16.0%) in the schools in Kashmore-Kandhkot. Total number of rooms in 1,681 schools in Kashmore-Kandhkot amount to 3,123 out of which 2,5121 are classrooms. There are 1,222 functional schools in Kashmore-Kandhkot while 459 schools are dysfunctional, non-functional, non-viable or closed.

Male literacy rate (15-49 years) in Kashmore-Kandhkot is 38.1% compared to 59% in Sindh while the female literacy rate is 6.5% compared to 40.9% in Sindh.

Table 1-88: Number of Schools

Description	Total	Boys	Girls	Mixed
Sindh	49,103	8,617	6,685	33,801
Kashmore-Kandhkot	1,681	237	233	1,211

Table 1-89: Number of Enrollments

Description	Kashmore	Sindh
Boys	104,287	2,812,000
Girls	43,176	1,749,140
Percentage	29.3%	70.7%

Table 1-90: Enrollment

Description	Male	Female
Kashmore	70.7%	29.3%

Table 1-91: Teachers by Gender

Description	Male	Female
Primary	85.5	14.5
Middle	81.6	18.4
Secondary	81.0	19.0
Higher Secondary	82.1	17.9

Source: Government of Sindh, School Education & Literacy Department, Sindh Education Profile, 2019.

Table 1-92: Teachers Strength

Description	Total	Male	Female
Sindh	157,035	90,207	42,869
Kashmore- Kandhkot	3,822	3,209	613

Table 1-93: Rooms

Number of Rooms	Number of Schools	Percentage
1	209	21.1
2	540	54.6
3	50	5.1
4	34	3.4
5	48	4.9
> 5	108	10.9

Table 1-94: Facilities in School

Description	Schools Without	Schools With
Boundary Walls	563	992
Drinking Water	467	907
Toilets	736	638
Electricity	1,059	315

Source: Government of Sindh, School Education & Literacy Department, Sindh Education Profile, 2019.

Table 1-95: School Functionality

Description	Kashmore	Sindh
Functional	72.9%	74.4%
Non-Functional	27.1%	25.3%

Table 1-96: Ownership Status of School Building

Description	Govt. Owned	Shared	Rented	Others	Shelter less
Sindh	38,390	1,187	164	1,629	7,733
Kashmore-Kandhkot	958	14	1	16	692

958 School buildings out of 1,681 are government-owned (57.0%), while 14 buildings are shared (0.8%). 41.2% of school buildings in Kashmore-Kandhkot are shelter-less, i.e., 692.

Table 1-97: Literacy Rate

Description	Kashmore	Sindh
Male	38.1%	59.0%
Female	6.5%	40.9%

Source: Government of Sindh, School Education & Literacy Department, Sindh Education Profile, 2019 / Government of Sindh, Bureau of Statistics, Multiple Indicator Cluster Survey 2018-19.

1.4.13 MPI (Multi-Dimensional Poverty Index)

Multi-Dimensional Poverty Index measures the number of people/households that are 'multi-dimensionally' poor. Essentially, it means the number of people (or HHs) deprived in at least one- third of the weighted indicators (H) along with the weighted average number of deprivations poor people experience at the same time (A). The weighted indicators are along three broad dimensions:

-Education, -Health, and -Living Standards

In District Kashmore-Kandhkot, the MPI value is 0.4 which is slightly higher than the average MPI Value of 0.25 in Sindh. The headcount of households that are multidimensionally poor in Kashmore- Kandhkot is 83.5% compared to the headcount of 47% in Sindh.

In District Kashmore-Kandhkot, 7.5% of household members are vulnerable to poverty (i.e. deprived in one-fifth to one-third of weighted indicators). Similarly, 59.4% of household members are in severe multi-dimensional poverty (i.e. deprived in more than one-half of weighted indicators).

Table 1-98: MPI Head Count

Description	M-Poverty Headcount 2018 (H)	MPI 2018	% Vulnerable to Poverty	% in Severe Poverty
Sindh	0.47	0.25	12.50	28.30
Kashmore-Kandhkot	0.84	0.40	7.50	59.40

1.4.13.1 M-Poverty Headcount

Kashmore 84.0% Sindh 47.0%

1.4.13.2 MPI

Kashmore 0.40 Sindh 0.25

District Kashmore-Kandhkot has a slightly higher MPI value (i.e., 0.4) than the provincial MPI value of 0.25 which indicates multiple deprivations along the dimensions of health, education and living standards.

7.5% of household members in District Kashmore-Kandhkot are vulnerable to poverty which means 7.5% of household members are deprived in one-fifth to one-third of weighted indicators.

59.4% of household members in District Kashmore-Kandhkot are in severe poverty. This essentially means that 59.4% of household's members in District Kashmore-Kandhkot are deprived in at least half of the weighted indicators.

Source: Government of Sindh, Bureau of Statistics, Multiple Indicator Cluster Survey 2018-19.

1.4.14 Economic Profile

1.4.14.1 Agriculture

Out of the area under cultivation for major crops, District Kashmore-Kandhkot contributes to 137,922 hectares (4.6%) out of 3,028,496 hectares in Sindh. In terms of highest proportions of area under cultivation for major crops, Wheat, Rice and Gram are at the forefront in Kashmore-Kandhkot with 34,386 hectares, 90,528 hectares and 9,200 hectares under cultivation respectively in the district. Similarly, the production of Wheat, Rice and Gram is 110,847 M. Tons, 308,617 M. Tons and 8,457 M. Tons.

Irrigated Area in District Kashmore-Kandhkot is 42,005 hectares and Un-Irrigated area is 47,659 hectares. Canals are the mode of irrigation for 34,267 hectares in District Kashmore-Kandhkot out of 1,287,845 hectares irrigated by Canals in Sindh (2.7%). Tube-wells are the mode of irrigation for 7,732 hectares in Kashmore-Kandhkot out of 361,199 hectares irrigated by Tube-wells in Sindh (2.1%).

1.4.14.2 Area Under Cultivation

Crops	Sindh Area (ha)	Kashmore- Kandhkot Area (ha)	Share of Kashmore-Kandhkot (%)
Bajra	46,156	12	0.0
Barley	6,801	356	5.2
Cotton	611,689	0	0.0
Gram	19,023	9,200	48.4
Jowar	11,651	15	0.1
Maize	3,559	10	0.3
Mustard	48,355	2,910	6.0
Rice	828,292	90,528	10.9
Sesamum	9,952	55	0.6
Sugarcane	333,262	0	0.0
Tobacco	136	0	0.0
Wheat	1,089,587	34,836	3.2

Table 1-99: Crop Production

Crops	Area (Hectarage)	Share in Acreage (%)	Production (M. Tons)	Share in Production (%)
Bajra	12	0.03	7	0.03
Barley	356	5.2	233	5.8
Cotton (bales)	0	0.0	0	0.0
Gram	9,200	48.4	8,457	47.2
Jowar	15	0.1	13	0.1
Maize	10	0.3	9	0.2
Mustard	2,910	6.0	2,894	5.7
Rice	90,528	10.9	308,617	10.8
Sesamum	55	0.6	27	0.6
Sugarcane	0	0.0	0	0.0
Tobacco	0	0.0	0	0.0
Wheat	34,836	3.2	110,847	3.0

Source: Government of Sindh, Bureau of Statistics, Development Statistic of Sindh, 2019.

Table 1-100: Crop Share

Crops	Sindh Production (M. Tons)	Kashmore-Kandhkot Production (M. Tons)	Share of Kashmore-Kandhkot (%)
Bajra	23,711	7	0.03
Barley	4,008	233	5.8
Cotton (in bales)	3,775,761	0	0.0
Gram	17,930	8,457	47.2
Jowar	11,078	13	0.1
Maize	3,616	9	0.2
Mustard	50,700	2,894	5.7
Rice	2,850,524	308,617	10.8
Sesamum	4,448	27	0.6
Sugarcane	20,611,878	0	0.0
Tobacco	198	0	0.0
Wheat	3,639,544	110,847	3.0

Table 1-101: Irrigation

Description	Kashmore	Sindh
Irrigated Area (Ha)	46.8%	62.3%
Un-Irrigated Area (Ha)	53.2%	37.7%

Source: Government of Sindh, Bureau of Statistics, Development Statistic of Sindh, 2019.

Table 1-102: Mode of Irrigation

Description	Canal	Tube well
Sindh	1,287,845	361,199
Kashmore-Kandhkot	34,267	7,732
District Share (%)	2.7%	2.1%

1.4.14.3 Kashmore-Kandhkot

Canal 81.5% (34,267 Ha) Tube well 18.5% (7,732 Ha)

1.4.15 Forest

Canals are the mode of irrigation for 34,267 hectares in District Kashmore-Kandhkot out of 1,287,845 hectares irrigated by Canals in Sindh (2.7%). Tube-wells are the mode of irrigation for 7,732 hectares in Kashmore-Kandhkot out of 361,199 hectares irrigated by Tube-wells in Sindh (2.1%).

Total area under forest cover in Sindh is 271,372 hectares. There is 4,672 hectares reported forest cover in Kashmore-Kandhkot (1.7%).

Description	Sindh	Kashmore
Forest Area	271,372 (Ha)	4,672 (Ha)

Source: Government of Sindh, Bureau of Statistics, Development Statistic of Sindh, 2019.

1.4.16 Livestock & Fisheries

The livestock head-count in District Kashmore-Kandhkot is 1,232,526 out of the total livestock count of 46,279,313 in Sindh (2.7%). District Kashmore-Kandhkot has 190,872 cattle, 195,704 buffaloes, 148,022 goats, and 519,589 poultry.

Fish production in Kashmore-Kandhkot is 9,664 M. Tons out of 133,150 M. Tons in Sindh (7.3%). Kashmore- Kandhkot has a total of 2,225 fishermen out of 45,013 in Sindh (4.9%). Similarly, Kashmore-Kandhkot has 106 boats out of 7,215 boats in Sindh (1.5%).

Table 1-103: Livestock Count

Description	Sindh	Kashmore- Kandhkot	%Share
Buffaloes	7,340,162	195,704	2.7
Sheep	3,958,508	138,344	3.4
Goats	12,572,221	148,022	1.1
Camels	278,424	1,411	0.5
Horses	44,999	2,587	5.7
Mules	19,512	4,089	20.9
Asses	1,004,925	31,908	3.1
Poultry	14,135,540	519,589	3.6

Table 1-104: Fish Production

Description	Sindh	Kashmore-Kandhkot	% Share
Fish Production	**133,150**	**9,664**	**7.3**
Fishermen	**45,013**	**2,225**	**4.9**
Full Time	28,716	1980	6.9
Part Time	16,297	245	1.5
Boats	**7,215**	**106**	**1.5**
Sail	2,689	13	0.5
Row	4,526	103	2.3

Livestock Share 2.7% Fisheries Share 7.3%

Source: Government of Sindh, Bureau of Statistics, Development Statistic of Sindh, 2019 / Government of Pakistan, Bureau of Statistics, Sindh Province Report, Livestock Census, 2006.

1.4.17 Manufacturing & Communications

Number of reporting manufacturing establishments in District Kashmore-Kandhkot is 0 out of the 1,825 manufacturing units in Sindh (0%). District Kashmore-Kandhkot has a road network of 512 km out of the 22,283 km in Sindh (2.3%).

Table 1-105: Establishments

Description	Number of Manufacturing Units	% Share
Sindh	1,825	100
Kashmore-Kandhkot	0	0.0

Table 1-106: Roads

Description	Road Kilometers	Road Density/Km²
Sindh	22,283	0.15
Kashmore-Kandhkot	512	0.20
District Road Length Share	2.3%	

Source: Government of Sindh, Bureau of Statistics, Development Statistic of Sindh, 2019.

1.4.18 Wealth

The wealth index is a composite measure of a household's cumulative living standard. The wealth index is calculated using easy-to-collect data on a household's ownership of selected assets, such as televisions and bicycles; materials used for housing construction; and types of water access and sanitation facilities. (The DHS Program)

Distribution of household population by wealth index quintile for District Kashmore-Kandhkot reveals that 23.7% of the population is in the poorest 20% quintile and 51.5% population is in the second poorest quintile while only 2% of the population lie in the top 20% quintile.

29.3% of the households in the two poorest wealth quintiles of Kashmore-Kandhkot receive social transfers or benefits compared to 33.7% coverage in Sindh.

Table 1-107: Income Quintiles

Description	Poorest %	Second %	Middle %	Fourth %	Richest %
Sindh	20.0	20.0	20.0	20.0	20.0
Kashmore-Kandhkot	23.7	51.5	18.7	4.1	2.0

Source: Government of Sindh, Bureau of Statistics, Development Statistic of Sindh, 2019.

1.4.19 Ethnicity and Tribes

The dominant ethnic group in the project area of Kashmore is the Mazari Baloch Tribe (50%). The Mazari Sardars are the controlling authority in the project area and hold the majority of the agricultural land. Other tribes include the Mirani (30%), Soomro (10%), Solongy (4%), Sheikh (3%) and the Chacher, Arain, Sher, Dasti, Malik, Indhar, Bhatti and Khosa (3%). Member of the Mirani tribe are commonly working as fishermen or utilized as the labor force when required. Ethnic minorities include Pathan and Daya that are living in the vicinity of Kashmore.

1.4.20 Languages

Sindhi, Saraiki and Balochi are the major languages in the project area whereas Brahvi, Urdu, Punjabi are also spoken. The ratio of languages spoken in the district is shown below:

Table 1-108: Mother-Tongue/Major Languages in Kashmore -2017

Mother Tongue (Census 2017)	
Sindhi	1,141,485
Urdu	15,106
Balochi	16,067
Saraiki	12,054
Brahvi	41,764
Punjabi	4,421
Pashto	1,706
Hindko	418
Kashmiri	28
Other Languages	711

Source: *Pakistan Bureau of Statistics, Pakistan, https://www.pbs.gov.pk/content/population-*

1.4.21 Household and Family System

The majority of those in the study area live together with their extended family (parents living with married children and their families. Families believe this is a more economical way of living as they often work together on the same land and are able to share their joint incomes to support the entire family, including elderly relatives who are unable to work. It is also thought to be more efficient to share basic amenities such as water, electricity, housing and food rather than for each immediately family to purchase or source their own.

1.4.22 Pattern of Settlement

In most parts of Kashmore, the settlement has emerged after construction of Pat Feeder Canal and mainly after construction of Rabi canal in the year 2002. Settlements are mainly in the form of scattered hamlets comprising small clusters of houses. Villages in the area are named after the local headman.

1.4.23 Dwellings

It is evident from the 2017 Census that in about 60% of the houses in Kashmore are single room houses. In rural as well as urban areas, the predominant roof material used housing units is of wood/bamboo in Kashmore. Only a few have roofs constructed with cement/iron sheets respectively. The project area is consisting of rural population lives in comparative isolation. There are very few villages of the conventional type. Majority of the population live in small settlements of five to twenty houses scattered all over the project area. Mud houses or huts are built without layout or plan and without any regard to blocks. All mud houses usually have a boundary wall enclosing enough space for cattle and storage. Only 10% houses are built semi pakka (mud, bricks, iron, or cement and bricks, with roof of wood and grass) and 6% are pakka (bricks or blocks with iron and cement roof). The roof of a mud house consists of wooden beams of all shapes and sizes, cover of thick date-palm mats and a layer of mud with clay plaster at the top. It was observed that all the people were living in self-owned houses.

Figure 1-5: Pacca House at the Project Area

1.4.24 Source of Income

Agriculture is the most widespread source of income in the project area. Livestock rearing and laboring is the second major sources of income while Government jobs is the third major source of income.

The lands in project area are fertile and farmers grow rice, sugarcane, cotton, sorghum and vegetables during the Kharif season (April to November) and wheat, oil seed, pulses and vegetables during Rabi season (April to October). Kharif crops are often flooded by the high floods in the river Indus and Rabi crops are usually sown on the residual flood moisture. Sugarcane is a cash crop and is the most commonly grown crop in the project area due to the availability of the surrounding sugar mills making it easy to sell.

Livestock is a significant, albeit often a secondary, source of income. Most of the farming communities own livestock with significant numbers. Majority of the households own 3 or 4 animals. Amongst livestock, the cow and buffalos are mostly kept for dairy business. Livestock is a prestigious symbol and an additional source of income for the farming community, providing dairy products such as the fresh milk, butter, cheese and other related products along with the meat.

Small businesses, the private sector and fishing do not represent significant income sources in the project area.

1.4.25 Agriculture Market

For the purchase of farm inputs and sale of crops the landlords and farmer commonly use one of the surrounding city markets located in Kashmore and Khandhkot. The farm inputs and outputs are transported through Trucks Trailer and Tractor Trolley. The animals from the project area transported to Hyderabad and Karachi by Trucks.

Figure 1-6: A View of Rice Market at the Project Area

1.4.26 Commute and Logistics

Most of the villages have village tracks or unsurfaced (kacha) roads that are in bad condition. Construction and maintenance of village roads is the responsibility of local government. Three provincial highways also pass through the project area and connect Sindh with Punjab and Baluchistan.

Guddu Barrage is linked to Kashmore and Kandhkot by Indus highway. Indus highway passes through Punjab and Baluchistan on the right side of the Barrage. The Kashmore road cross the Guddu Barrage to Ubaro Town at national highway that further connects to Lahore and Peshawar. The district Kashmore is also served by Pakistan Railway.

The major source of the human transport is railway, buses, van, rickshaw and private cars. The farm inputs and outputs are transported through trucks trailer and tractor trolley. The animals from the project area transported to Hyderabad and Karachi by trucks. The firewood and furniture wood is also transported through trucks and trolleys.

1.4.27 Culture and Customs

Sindh province has rich culture, customs and traditions. The project area has almost similar culture and customs with slight differences on the basis of ethnic and religious groups. Being traditional Muslims there is a greater influence of the Arabian culture, however, the traces of Hindu, Buddhism and other religious thoughts are also present in the cultural attitudes and approaches of the local communities. The Pirs and Murshids (religious leaders, saints) are held in high esteem and confidence amongst the Muslims particularly in the uneducated and poor class of the rural areas. Annual festivals at the shrines of saints are regularly held in which people very enthusiastically take part. Similarly, the Hindus also hold great confidence and reverence in Thakurs and Brahmans (the higher castes). The Brahmans usually perform spiritual rites of Hindus on special occasions.

1.4.28 Social Cohesion and Conflict in the Project Area

The area is dominated by tribes originating from Baluchistan, in particular the Mazari Tribe. After the construction of Guddu Barrage people migrated from Baluchistan and purchased the land in the canal command areas. These people have settled in the area but have maintained the customs and traditions

from the homeland. People from each province have different traditions and customs, and the way of life of people from each province is very different.

Social organization in all villages is strongly based on Biradari (tribal) system, where each tribe has a tribal leader. The Tribe Leaders are mostly landlords and political leaders. All families belonging to the same tribe have strong interactions with one another but mostly remain separate from other tribes. This extends to marriages, where it is the preference for young tribal members to marry a member of the same tribe. Interactions between different tribes are less common.

There is a large number of villages in the area. Separate villages have been established as tribes and families have grown and the land owned by one family becomes sub-divided between the brothers of successive generations.

1.4.29 Conflict Resolution within Tribes and Villages

In the project corridor, the decisions about conflict, right of vote, marriage settlements and other matters are usually resolved by the village head, while the head of a tribe shall resolve major disputes. It was found during survey that 90 percent of the conflicts were resolved at village level. Those living within communities of the project area feel obliged to accept the decision of the village or tribal leaders.

In case of serious matters, local influential politicians (who are often also tribal leaders) intervene to settle the dispute. Occasionally, when parties do not agree on the decision of caste or tribal leaders, matters may go to the police and ultimately a court of law. The police and the court of law are the last options and these are rarely exercised

1.4.30 Role of Women

The women of the project area have no role in the decision making such as marriage of children, sale and purchase of property, sale and purchase of animals, decision regarding schooling of children and to attend social events. It was found during the field survey that the oldest male member of the family has the power of decision making and he determines the family interests and makes decisions with regards to the family.

2 Baseline Socio Economic Field Survey

2.1 General

In this chapter the objective of the field survey, formulation of questionnaire, methodology of survey data collected and analysis of data and results have been described.

2.2 Objective of the Survey

The major focus of this study is on understanding and describing the socio-economic conditions in project impacted areas. The Baseline survey consists of two parts. The first part deals with socio economic conditions of entire Jacobabad, Shikarpur and Kashmore districts based on published and online data. This component has already been completed and explained in heading 2. The second part is based on actual field survey of project impacted areas. The aspects deal within the survey are: Family size, education of children, literacy ratio, human health, hygiene, age structure, migration for work, professions, residential accommodation, sources of drinking water and electricity, household gadgets, sources of information, cooking fuel, agriculture, livestock and trees, crops, family Income and expenditure patterns/etc.

2.3 Formation of Questionnaires

A questionnaire for the baseline Socio Economic survey of impacted population to study the parameters as described was formulated and is attached as Annex-1.

2.4 Methodology of Field Survey

Hundreds of households likely to be impacted by various components of the project area. Consultant's team consisting of experts of different disciplines: Expert Environment, Junior Sociologist, Junior Environmental Engineer Resettlement expert and one Enumerator with the ranks of Junior Officer collected the required data.

2.5 Sampling of Households for Survey

The most suitable sampling technique for this survey was considered as the stratified random sampling technique. The consultants interviewed about 24 household from Jacobabad district impacted areas 18 household from Shikarpur district impacted areas and 16 household from Kashmore district impacted areas for conducting socio-economic survey 58 households almost 98% of total number of households, people were willing to cooperate with the consultants for survey and provide the information to the experts.

2.6 Data Management and Analysis

2.6.1 Classification of Surveyed Households

The Consultants viewed that household the sampled households have been divided into three groups:

Jacobabad Area - Refer to the sample collected from the project area falls in district Jacobabad n=24 (n Means Number of Sample Households)

Shikarpur Area - Refers to sample collected from the project area falls in district Shikarpur n=18 (n Means Number of Sample Households)

Kashmore Area - Refers to sample collected from the project area falls in district Kashmore n=16 (n Means Number of Sample Households)

Total Number of Samples = 58.

2.6.2 Processing of Data and Analysis

The filled in Questionnaires were edited in the office and the data were entered into an Excel Spreads Sheet. The statistical analysis of the data was completed and the results were tabulated and are explained and conclusions are subsequently drawn.

Table 2-1: Family Structure in the Project Area

Description	Age of Head			No. of Wives			No. of Children		
	Area Jacobabad	Area Shikarpur	Area Kashmore	Area Jacobabad	Area Shikarpur	Area Kashmore	Area Jacobabad	Area Shikarpur	Area Kashmore
Average	48	50	50	1	1	1	8	7	7
Min.	30	28	30	1	1	1	1	1	1
Max.	65	64	66	2	2	2	11	9	10

Source: Field Survey October 2022.

2.6.3 Household Size

The minimum number of members varies from two (2) to six (6) and maximum varies from 13 to 14. The average number of household members is 8.65, minimum number 2 and maximum number is 14.

Table 2-2: Household Structure in the Project Area

Description	Total Household Members			
	Area Jacobabad	Area Shikarpur	Area Kashmore	Total
Average	8.91	8.33	8.72	8.65
Min	2	2	2	2
Max	14	13	13	13.33

Source: Field Survey October 2022.

2.6.4 Age Structures of Family Members

The Age structure of households is given in Table 2-3. In the project, 51.3% of the survey population is below 18 years and 44.43% falls in the age group of 18 to 60 years and only 4.27% is above 60 years.

Table 2-3: Age Structure of Household Members (Percent)

Area	Below 18 Years	18-60 Years	Above 60 Years	Total
Jacobabad	51.3	44.5	4.2	100
Shikarpur	51.7	43.9	4.4	100
Kashmore	50.9	44.9	4.2	100
Total	**51.3**	**44.43**	**4.27**	**100**

Source: Field Survey October 2022.

2.7 Salient Characteristics of Houses and Population

2.7.1 Average Distances from Houses to Various Institutions

The distances of institutions to houses are shown in Table 2-4. The institution like union council office, basic health unit, primary school for boys and girls.

Table 2-4: Average Distance of Houses to Various Facilities (km)

Component	UC1)	Basic Health Unit	Lady Health Visitor	Veterinary Health	Primary School (Boys)	Primary School (Girls)
Area Jacobabad	1.75	6.3	6.3	6.4	1.7	1
Area Shikarpur	2.73	2.57	2.57	5	3.57	1.3
Area Kashmore	1.5	2	2	7	2.8	1.2

2.7.2 Household Gadgets and Sources of Information

Ownership of household gadgets by respondents is presented in Table 10.5. In Area Jacobabad 16.6% respondent own a refrigerator, in Area Shikarpur 22.31% and in Area Kashmore 14.9% In Area Jacobabad 15.4%, Shikarpur 10.52% and Kashmore 13.3% respondents own television attached with dish/ antenna. Mobile telephone ownership is 70% in the entire project area. Radio sets are owned by 22.1%, 19.5 and 6% respondents in all three areas respectively. PTCL connection is available to small number of respondents as compared with the ownership of Mobile telephones. The population of the area is more interested in local news. Due to their interest in local news, 40% respondents referred to

Newspaper as sources of information in Area Jacobabad, 40.52% in area Shikarpur and 39% in Area Kashmore.

Table 2-5: Household Gadgets and Sources of Information (Percent)

Areas	Household Gadgets and Sources						Sources of Information	
	Refrigerator	Television		Radio	Mobile Phone	PTCL	Newspapers	
		Antenna/ Satellite	Cable					
Jacobabad	16.6	15.4	6.0	22.1	70	2.2	40	
Shikarpur	22.31	10.52	8.2	19.5.	70	1.9	40.52	
Kashmore	14.9	13.3	7.8	16	70	1.5	38	39.0

Source: *Field Survey October 2022*

2.7.3 Sources of Drinking Water, Responsibility for Collect Water and Availability of Electricity

The respondents were asked to indicate from which source they obtain drinking water. Most of the respondents indicated source of drinking water that is hand pumps Consultants observed that major source of drinking water are hand pumps. Women are mainly responsible for fetching water. Majority of villagers are using electricity from WAPDA.

Table 2-6: Sources of Drinking Water and Electricity in Houses in (Percentage)

Area	Source of Drinking Water		Responsibility to Fetch and Store Water		Availability of Electricity in the House		
					Yes		No
	Hand Pump	Public Supply	Men	Women	WAPDA	Solar	
Jacobabad	100	0.0	37.5	62.5	70	30	0.0
Shikarpur	100	0.0	31.57	68.42	70	30	0.0
Kashmore	100	0.0	32.2	67.8	70	30	0

Source: Field Survey October 2012.

2.7.4 Professions of the Affected Population

The data presented in Table 2-7 show the professions of male members in impact area of the project. During interviews of sample respondents, it was reported that 132 persons work in various types of professions. According to the field survey undertaken by the consultants, the major profession is farmer in the villages.

Table 2-7: Profession of Affected Population

Sr. No.	Occupation	Number	Percent %
1	Agriculture and Livestock	99	75
2	Government Servant and Teachers	4	3.03
3	Employment in Shops and Others	15	11.36
4	Labour Work within Pakistan	8	6.06
5	Drivers and Transport	2	1.51
6	Workers gone Abroad	1	0.75
7	Contractors, Construction Works	3	2.27
TOTAL		**132**	**100.0**

Source: Field Survey October 2022.

2.8 Health Conditions and Housing Hygiene in the Project Area

2.8.1 Occurrence of Diseases

The occurrence of diseases in the project area is shown in Table 2-8 by Area Jacobabad, Shikarpur and Jacobabad. The focus of the questionnaire was on water borne diseases and malaria.

Table 2-8: Occurrence of Diseases in Project Area

Description		Area Jacobabad	Area Shikarpur	Area Kashmore	Total
Gastro enteritis	No.	2	3	1	6
	%	4.54	9.37	3.44	17.35
Skin diseases	No.	1	0	2	3
	%	2.27	0	6.89	9.16
Polio	No.	1	0	0	1
	%	2.27	0	0	2.27
Hepatitis	No.	4	8	7	19
	%	9.09	25	24.13	58.22
Malaria	No.	28	17	13	58
	%	63.63	53.12	44.82	161.57
Others	No.	9	4	6	19
	%	20.45	12.5	20.68	53.68
Total	**No.**	**44**	**32**	**29**	**105**
	%	**100**	**100**	**100**	**100**
Average Annual Expenditure on Medicine (Rs.)		**10,723**	**11460**	**9894.73**	**10692.57**

Source: Field Survey October 2022.

2.8.2 Places for Medical Treatment

The places of treatment for project Areas Jacobabad, Shikarpur and Kashmore are shown in Table 2-9. Respondents indicated the availability of Lady Health visitor and qualified midwives are 26.66%.

Table 2-9: Places of Treatment

Description (Areas)	% of places from where people get medical treatment					% Availability of Lady Health Visitor Near Residence	% Availability of Qualified Midwives at Time of Delivery
	Local (Nearest BHU)	Jacobabad (City)	Shikarpur (City)	Kashmore (Kandhkot City)	Sukkur (City)		
Jacobabad	81.6	9.7	3.0	0.0	5.7	25	25
Shikarpur	67.5	0.0	24.5	0.0	8.0	30	30
Kashmore	56.2	0.0	9.3	29.5	5.0	25	25

Source: Field Survey October 2022.

2.8.3 Housing Hygiene

Average human refuse in Area Jacobabad is 2.43 kg per day, 2.52 kg for Area Shikarpur and in Area Kashmore is 2.48. Detailed are following (Table 2-10).

Table 2-10: Housing Hygiene

Description	HOUSING HYGIENE							
	Avg. House Human Refuge Generated/ Day (Kg)	% Disposal of Refuse				Animal Refuse Disposal (%)		
		Open Areas	Well Pit	Water Channel	Municipal Collection	As Fuel	Sold	Manure for Crop
Area Jacobabad	2.43	78.2	18.59	3.21	0.0	72	17	11
Area Shikarpur	2.52	74.49	23.14	2.37	0.0	69	22	9
Area Kashmore	2.48	76.81	21.26	1.93	0.0	74	13	13

Source: Field Survey October 2022.

2.9 Irrigated Agriculture, Livestock and Forestry

2.9.1 Irrigated Cultivated Lands

The number of landless households was counted as 13 in Area Jacobabad (48.14%), 7 in Area Shikarpur (25.92%) and 7 in Area Kashmore (25.92%). Overall, average farm is 13.16 (Acre).

Table 2-11: Cultivated Irrigated Lands and Landless Households

Description	Cultivated Irrigated Land Holdings (Acres)			
	Area Jacobabad	*Area Shikarpur*	*Area Kashmore*	*Total*
Sum	192	139	77	408
Average	17.45	12.63	8.55	13.161
Min	4	6	4	4
Max	45	26	13	45
Landless Households	13	8	6	27

Source: Field Survey October 2022.

2.9.2 Inventory of Livestock in Impacted Areas of Reservoir

The data collected from 58 respondents regarding number of livestock by area Jacobabad, Shikarpur Area and Area of Kashmore have been shown in Table 2-12. The total number of livestock excluding poultry has been counted as 551. The livestock are owned by 100% respondents.

Table 2-12: Inventory of Livestock in Sample Farms of Reservoir Affected Area

Description	Buffaloes (No.)	Cows (No.)	Goats (No.)	Sheep (No.)	Horses (No.)	Donkeys & Mules (No.)	Poultry (No.)
Area Jacobabad	19	20	38	11	0	3	71
Area Shikarpur	16	38	40	5	0	1	101
Area Kashmore	20	9	51	13	0	4	91
Total	**55**	**67**	**129**	**29**	**0**	**8**	**263**

Source: Field Survey October 2022.

2.10 Income Expenditure Analysis

2.10.1 Composition of Income

The data presented in Table 2-13 show consumption and cash income of households in the project area. The major source of cash income is from agriculture crops. The wages are earned by unskilled and skilled labour working within districts (Jacobabad, Shikarpur & Kashmore), in Sukkur, Karachi areas of Pakistan, Salaries from government services and private jobs (Hotel etc.) account for 4% of total income. From livestock sector is 13% of total income.

Table 2-13: Composition of Income of Surveyed Households

Sr. No.	Description	Income (%)		
		Consumption Income	Cash Income	Total
1	Remittance from wages	0	6.38	6.38
2	Salaries from Govt. and other jobs	0	4	4
4	Agriculture Crops	23.54	47.08	70.62
5	Vegetable & Products	1	2	3
6	Livestock & Products	3	10	13
7	Fuel wood	0	3	3
Total		**27.54**	**72.46**	**100**

Source: Field Survey October 2022.

2.10.2 Composition of Expenditures

Composition of household expenditures is presented in Table 2-14. The expenditures consist of two components i.e. consumption of home produced commodities and purchased commodities. Purchased items comprise 82% of total expenditures. The total share of food items has been calculated to be 48% of total expenditures, which looks very high. The reason for high expenditures on food is high prices of wheat flour, rice and other purchased items in the area. The high expenditure on food leaves very little for spending on education and health care.

Table 2-14: Composition of Household Expenditures

Sr. No.	Description	Home Produced %	Purchased %	Total %
1	Food	18	30	48
2	Clothing	0	10	10
3	Furnishing and HH Equipment	0	6	6
4	Transport	0	2	2
5	Education	0	4	4
6	Health	0	8	8
7	Misc. Goods and Services	0	6	6
8	Weddings and Ceremonies	0	16	16
Total		**18**	**82**	**100**

** Composition of income of surveyed households is provided in Table 2.13.*

ANNEXURE 2

DISASTER RISK ASSESSMENT MANAGEMENT PLAN

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ABBREVIATIONS

Abbreviations	Term
AIDs	Acquired Immunodeficiency Syndrome
Dba	Decibel A
HIV	Human Immunodeficiency Virus
HSE	Health Safety Environment
IPD	Integrated Project Delivery
PM	Particulate Matter
PPE	Personal Protective Equipment
Row	Right of Way
UV	Ultra Violet

ANNEXURE-2: DISASTER RISK ASSESSMENT MANAGEMENT PLAN

EXECUTIVE SUMMARY

- A risk is an impact that could cause some loss or threaten the success of project, but which hasn't happened yet and one is like to keep it away. These potential problems might have an adverse impact on the human life, natural environment, cost of the project, project schedule, or technical success of the project, the quality of performances, or team morale. Risk management is the process of assessing, identifying, addressing, and controlling these potential impacts before they happen and do any harm.
- Risks have a potentially huge impact on many aspects of projects. The assumption that nothing unexpected will derail the project is simply not realistic. Estimates should incorporate best judgment about the potentially scary things that could happen on each project, and managers need to respect the assessments.
- Floods are the most common natural disaster and the leading cause of natural disaster fatalities worldwide. Risk of catastrophic losses due to flooding is significant given deforestation and the increasing proximity of large populations to coastal areas, river basins and lakeshores. Floods caused worldwide 6.8 million deaths in the 20th century. Asia is the most flood-affected region, accounting for nearly 50% of flood-related fatalities in the last quarter of the 20th century. The events and factors that precipitate flood events are diverse, multifaceted, and interrelated. Weather factors include heavy or sustained precipitation, snowmelts, or storm surges from cyclones whereas important human factors include structural failures of dams, alteration of absorptive land cover with impervious surfaces and inadequate drainage systems. Geographic regions such as coastal areas, river basins and lakeshores are particularly at risk from storms or cyclones that generate high winds and storm surge. Environmental/physical land features including soil type, the presence of vegetation, and other drainage basin characteristics also influence flood outcomes. Floods transpire on varying timelines, ranging from flash floods with little warning to those that evolve over days or weeks (riverine). Flash floods, characterized by high-velocity flows and short warning times have the highest average mortality rates per event and are responsible for the majority of flood deaths in developed countries. In contrast, riverine floods which are caused by gradual accumulation of heavy rainfall are less likely to cause mortality because of sufficient time for warning and evacuation.

1 DISASTER RISK ASSESSMENT AND MANAGEMENT PLAN

1.1 An Overview of Risk Associated with Flood

A risk is an impact that could cause some loss or threaten the success of project, but which hasn't happened yet and one is like to keep it away. These potential problems might have an adverse impact on the human life, natural environment, cost of the project, project schedule, or technical success of the project, the quality of performances, or team morale. Risk management is the process of assessing, identifying, addressing, and controlling these potential impacts before they happen and do any harm.

Risks have a potentially huge impact on many aspects of projects. The assumption that nothing unexpected will derail the project is simply not realistic. Estimates should incorporate best judgment about the potentially scary things that could happen on each project, and managers need to respect the assessments.

Floods are the most common natural disaster and the leading cause of natural disaster fatalities worldwide. Risk of catastrophic losses due to flooding is significant given deforestation and the increasing proximity of large populations to coastal areas, river basins and lakeshores. Floods caused worldwide 6.8 million deaths in the 20th century. Asia is the most flood-affected region, accounting for nearly 50% of flood-related fatalities in the last quarter of the 20th century. The events and factors that precipitate flood events are diverse, multifaceted, and interrelated. Weather factors include heavy or sustained precipitation, snowmelts, or storm surges from cyclones whereas important human factors include structural failures of dams, alteration of absorptive land cover with impervious surfaces and inadequate drainage systems. Geographic regions such as coastal areas, river basins and lakeshores are particularly at risk from storms or cyclones that generate high winds and storm surge. Environmental/physical land features including soil type, the presence of vegetation, and other drainage basin characteristics also influence flood outcomes. Floods transpire on varying timelines, ranging from flash floods with little warning to those that evolve over days or weeks (riverine). Flash floods, characterized by high-velocity flows and short warning times have the highest average mortality rates per event and are responsible for the majority of flood deaths in developed countries. In contrast, riverine floods which are caused by gradual accumulation of heavy rainfall are less likely to cause mortality because of sufficient time for warning and evacuation.

According to the Federal Flood Commission (FFC) report Pakistan has witnessed 20 major floods; in 1950, 1955, 1956, 1957, 1959, 1973, 1975, 1976, 1977, 1978, 1981, 1983, 1984, 1988, 1992, 1994, 1995, 2010, 2011 and 2012. These floods affected 599,459 square kilometers area, snatched 11,239 precious human lives and caused losses worth over Rs39 billion to the national economy. During last 63 years, floods have affected 180,234 villages. The first catastrophe, which hit the country in 1950, was the deadliest in terms of human losses. It claimed 2,190 lives and flooded 10,000 villages, spreading over an area of 17,920 square kilometers. In 1992, floods killed over 1,000 people and submerged 13,208 villages. Flood eliminated around 848 lives in the 1977 flood and damaged 2,185 villages. The floods in 2010 were the second deadliest. They took 1,985 lives and inundated 17, 553 villages over 160,000-square kilometer area, affecting 21 million people. During 2011 and 2012, floods claimed 516 and 571 lives respectively. Cumulatively in 2010, 2011 and 2012, Pakistan lost 3,072 precious lives and $16 billion.

National Disaster Management Authority (NDMA) assessment shows that the floods in the last five years have proved more disastrous to the national economy than the calamities of the last 63 years' put together. Due to absence of a disaster management system to counter floods, Pakistan suffers a

loss of around $800 million each year. These floods have affected every area of social infrastructure from housing, health and education to Irrigation, transport and communication, water supply and sanitation and energy sectors. The agriculture sector, which is a source of livelihood of Pakistan's major population, is badly affected, followed by private sector and industries in economic sectors.

1.1.1 Flood 2022

The floods were caused by heavier than usual and melting glaciers that monsoon rains followed a severe heat wave, all of which are linked to climate change. It is the world's deadliest flood since the 2017 South Asian floods and described as the worst in the country's history. In July, Sindh and Baluchistan received over 500% more rain than the 30-year average of about 39 mm. The province of Sindh received rainfall over 784% more in August than the average of about 43 mm. In an official notification on 21st August, Sindh Government announced that there have been "heavy losses which include loss of human lives, livestock, the damages to the houses and standing crops". Agriculture is one of the most affected sectors. On 25th August, Pakistan declared a state of emergency because of the flooding. By 29th August, around "one-third" of the country was under water, affecting 33 million people. These are the deadliest floods in Pakistan since 2010, when nearly 2,000 died due to floods, and the deadliest in the world since the 2017 South Asian floods.

The rise in sea surface temperatures is believed to increase monsoon rainfall. In addition, southern Pakistan experienced back-to-back heat waves in May and June, which were record setting and themselves made more likely by climate change.

Pakistan contributes less than 1% of global greenhouse gas emissions, but is one of the places most vulnerable to climate change. A study by an international team of climate scientists says that global heating made the flooding up to 50% worse and future floods more likely. Deforestation in Pakistan has also been a factor worsening the floods.

1.1.2 Causes of Flood in the Project Area

The proposed project area comprising of districts of Jacobabad, Shikarpur and Kashmore, located on right bank of Indus River falls in Guddu Right Bank Basin. The project is envisaged to cater the drainage needs of the area. The project area has flat topography with no drainage facility infrastructure. The natural drainage is further restrained due to irrigation and road network infrastructure. Recent extraordinary monsoon rains turned into floods submerging most of the agriculture land and settlements in the absence of drainage system. The rain water is still inundating vast area and if not drained out, it is strong apprehension that wheat sowing will not be possible giving another shock to farming community.

1.1.3 Crop Losses in the Project Area

Flood damage to agriculture can be categorized as direct damage (damage due to direct flood exposure) and indirect damage (damage not directly due to flood exposure). Direct and indirect damage can be further categorized as instantaneous damage (occurs during or immediately after the flood event) and induced damage (occurs later in time, not immediately after flooding) The flood damage to rice crops considered in this study was direct instantaneous damage (e.g., crop yield reduction due to flooding), and rice crop damage was monetized on the basis of crop yield reduction. Our primary goal in this study was to assess flood damage to crops by collecting flood damage data through personal observations, affectees interviews and discussions with relevant officials during visit of the project area comprising districts of Jacobabad, Shikarpur, and Kashmore.

The project area falls in Rice-Wheat cropping system of Sindh North Rice-Wheat agro-climate zone on Right Bank of Indus River. Rice is a major crop with about 99% of kharif cropped area; while negligible acreage is under jowar, bajra, sugarcane etc. Rice sown area in the project is about 37% of area sown in Sindh Province. Flood damage to agricultural crops causes economic loss and also impacts food security and rural livelihoods. Therefore, assessment of flood damage to agricultural crops is also an important part of flood-risk management. Therefore, depth-duration-damage functions were used to estimate rice crop damage. The flood damage estimation is also required to quantify flood risk and for long-term flood-control planning, land use regulations, and emergency management. The flood yield loss of rice crops may also vary with the crop growth stage. However, the flooding tolerance of rice plants in complete submergence, has been reported to be longer than two or three weeks. The flood damage to rice crops considered in this study was direct instantaneous damage (e.g., crop yield reduction due to flooding), and rice crop damage was monetized on the basis of crop yield reduction.

Flood characteristics in the paddy field were observed and noted which included the start date of flooding, flood depth, and duration in the paddy field. For estimating agricultural crop losses and damages, the planted areas of rice crop, inundated rice paddy fields, expected rice yield from the inundated paddy field if not flooded were enquired. Flood depth and duration are the main factors causing flood damage to rice crops. The growth stages of the rice crop can be classified as a vegetative stage, a reproductive stage, a maturity stage, and a ripening stage. By using developed damage functions according to flood depth and duration, flood damage to the rice crop can be estimated in monetary value using the following equations.

- Yield Loss% = [1-(Rice yield in inundated area / Expected rice yield for no flood area)] x 100
- Volume Loss of Rice Production (kg) = Yield Loss (%) / 100 × Rice Yield (kg per ha) x Damaged Areas (ha)
- Damage Value (damage cost) = Volume Loss of Rice Production (kg) × Farm gate Price per kg.

The data of crops damaged due to recent rains was collected from Department of Agriculture Extension, Larkana Division and is given in Table 1-1. The area under vegetables and other crops are 100% damaged and it is complete loss. Rice crop area is damaged up to about 82%. Rice plant is semi aquatic and better survives to floods up to 4 days. Therefore, to assess the yield loss of rice crop, “depth-duration damage functions” referred in literature and given as Figure 1-1Figure 1-1, were used. Data regarding extent of rice area under different water depths was not available with any agency so it was quantified on the basis of personal observations and affectees interviews.

Table 1-1: Area under Different Crops Sown and Damaged due to Recent Disastrous Rains in the Project Area

Sr. No	District	Rice			Kharif Vegetables			Other Crops		
		Baseline Area Sown	Area Damaged	Yield (Tons/ (acre)	Baseline Area Sown	Area Damaged	Yield (Tons/ (acre)	Baseline Area Sown	Area Damaged	Yield Tons/ (acre)
1	Shikarpur	215,000	167,388	1.6	600	600	3.0	90	90	0.9
2	Jacobabad	227,300	190,300	2.7	-	-	-	-	-	-
3	Kashmore	220,622	187,792	2.7	8,509	8,509	3.0	3,000	3,000	0.9
4	Total	662922	545480	2.3	9109	9109	3.0	3090	3090	0.9
5	Damaged area (%)		82			100			100	

Source: *Directorate of Agriculture Extension, Larkana.*

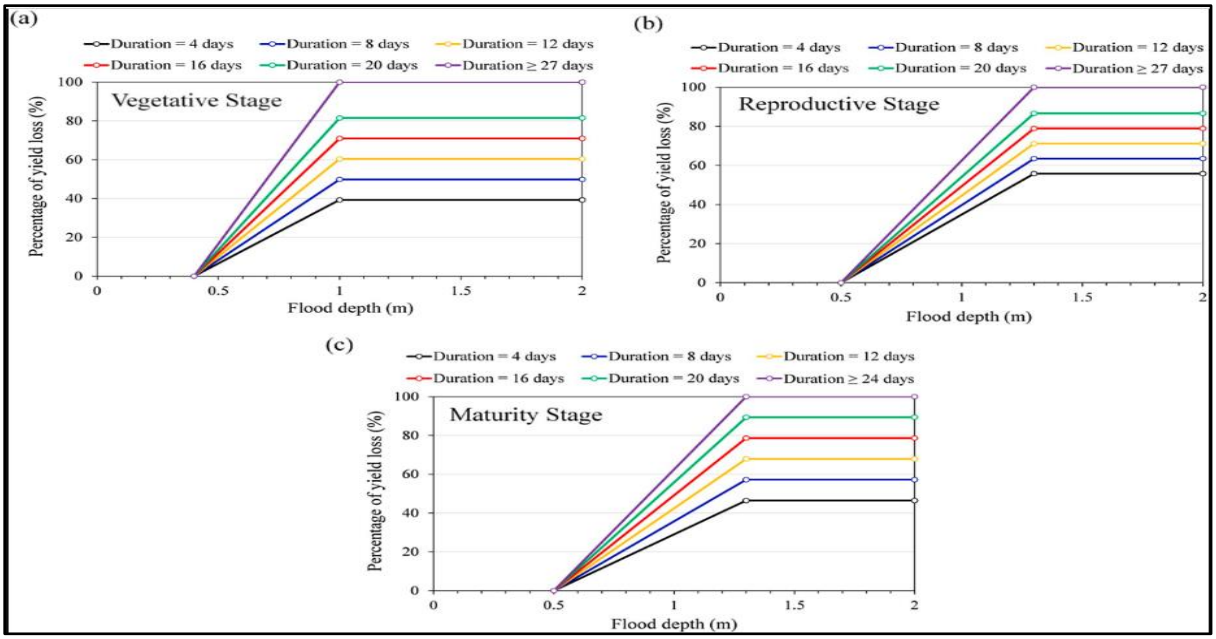

Figure 1-1: Effect of Depth and Duration of Flood on Rice Yield at Different Stages

The damage curves show that rice crop damage occurs if flood depth is higher than 0.4 m at the vegetative and reproductive stages. The curves also show that no damage occurs if flood duration is less than 3 days. The rice crop is completely damaged by the flood when rice crop is fully submerged in flood for longer than 3 weeks. If the water level reaches over the height of the rice plants, it is considered to be complete crop submergence. The slope of the damage curves shown in above figure used in this study at the vegetative stage is steeper than that at reproductive or maturity stages. Flooding for a duration of 8 days and at a depth of 1.0 m can cause 50, 40, and 36 % rice crop damage in the vegetative, reproductive, and maturity stages respectively. The yield loss for the vegetative stage is the most severe, which initiates complete damage during the 27-day flood duration with a flood depth of 1.0 m. Since the height of rice plants during the vegetative stage is shorter than that during the reproductive or maturity stages, larger paddy field areas are affected by flood during the vegetative stage.

The rice area reported in Table 1-1 as damaged to the extent of about 82%, will not completely fail to mature, but about 20 to 25 percent of this will reach to maturity stage with 60% yield loss. This judgement is made in the light of personal observations of the area and using Flood Damage Function Curves as shown in Figure 1-1. The rice production loss comes to about 1154 thousand tons and in monetary terms it is about 72 billion Rs using paddy rice farm gate price at the rate of Rs 2500 per 40 Kgs. Total crop losses including vegetables and other crops come to about Rs 73.8 billion. This crop loss on an average comes to about Rs 829400 per farm in the project area. And it is exclusive of other household farm infrastructure losses.

1.1.4 Mitigation Measures of Flood Risk

Flooding is a natural phenomenon which cannot be avoided but its impacts can be reduced by the effective integration of structural and non- structural measures before, during and after the floods.

In the aftermath of recent floods, it is evident that both structural and non- structural measures adopted in Pakistan were not sufficient to reduce the huge losses. Particularly Sindh incurred most losses.

Thousands of people have migrated, standing crops destroyed and thousands of homes destroyed/ damaged.

Plantation reduces erosion, surface water runoff and is a basic component of watershed management recognized by the UN- Flood Guidelines. Similarly, avoiding construction in the floodplains is the best way to avoid losses but cannot be exercised in upper Sindh without empowering the poor communities through employment opportunities. Early and clear warnings through identified institutions are a key to evacuate the communities at risk and prepare for effective response but were found in-effective during the recent event.

Early warning system should be fully utilized and should ensure timely, accurate and clear messages. Flash floods forecasting should also be improved.

Awareness raising and capacity building at all levels especially at local level should be increased as they are the first responders.

Local bodies should be strengthened and corruption abated. This is important because there had been injustices during flood events like the lands of feudal landlords were saved at the expense of poor people's lives and lands.

Political will is needed to ensure timely adaptability to such disasters.

The project area suffered heavy crop losses due to prolonged inundation of rice crop; and hence, water need be pumped out for making land available for wheat sowing; otherwise, food security of area will be threatened.

The need for effective drainage system in the project area is imperative to mitigate such havocs in future.

1.2 Risk Identification

The risk identification is important to mitigate or minimize the risks anticipated due to project interventions. The risk identification can be achieved through following steps:

- Onsite inspections
- Study of maps
- Analysis of water flows and rainfall records & predictions
- Documentation of historic events
- Through technological checks
- Discussions with the area people.

1.3 Risk Analysis

Risks pose danger to the internal and external environment of the project area. The occupants living in and around the project area remain under threat if the risks expose to them. The quantitative expressions of risks provide a basis for risk assessment and management. The quantitative expressions may be shown by:

- Fatalities:
  - Individual risk: The individual is exposed to project related hazards.
  - Collective risk: Fatality risks to groups of persons in the project area.
- Environmental Risks: The environmental risks pertain to natural environment loss deterioration in the project area.

- Health Risks: These risks damage the health of the humans due to waterborne and vector diseases.
- Economic Risks: The economic risks pertain to annual economic losses due to livelihood losses.

1.4 Risk Assessment Process

The main phase of the risk assessment process are summarized and explained in the following Section and illustrated in Figure 1-2.

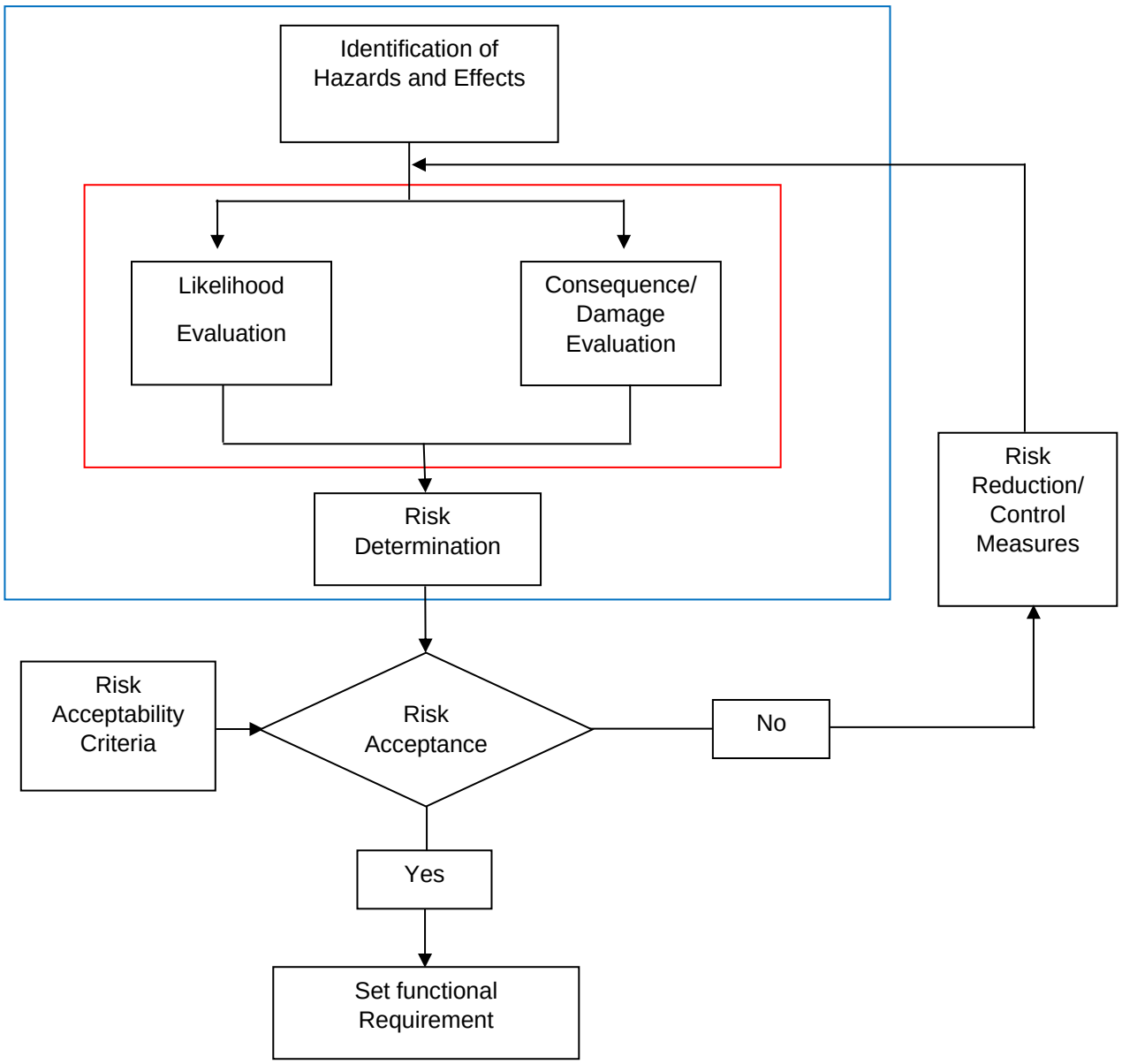

Figure 1-2: Risk Assessment Process

1.5 Flood Risk Ranking and Scoring with Respect to the Project Area

Flood risk ranking	
Causes	- Poor land use policies

	- Deforestation - Seasonal tropical rain - Climate change - Un precedent rain fall
Direct Impact (of the hazard on the local environment)	- Cultivated land becomes water-logged - Inhabited areas are subjected to flooding - Flooding makes the road to the market impassable
Criteria for Ranking	**Ranking order is Low (1), Medium (2) and High (3)**
1. Intensity	1) Not severe 2) Severe 3) Very severe
2. Seasonality	1. During long rains 2. During long and short rains 3. During long and short rains and flash floods at other times of years
3. Frequency	1) Last very severe floods in 2010 and 2012 so approx. every 15 years 2) Every two years 3) Every one year
4. History and Trends	1) Repeating cyclically

Table above is summarized and scored in the table below. Based on the criteria, the hazard can be classified as low (score 1), medium (score 2), and high (score 3). Total scores divided by the number of criteria.

Flood risk scouring		
Criteria	**Score**	**Remarks**
Intensity	2	severe
Seasonality	2	during long and short rains
Frequency	2	Every 2 years
History and trends	2	Repeating every two years
Total	**2/4= 2.0**	**Medium to High**

1.5.1 Risk Assessment Recommendations:

- Be proactive in its scope and not applied only once incident have occurred;
- Be consistent with operating experience and risk control measures employed;
- Be as early as possible in order that sufficient time can be given to the study before determining the most appropriate solution to manage;
- Provide input into the determination of facility requirements (training needs, administrative, engineering or operational controls etc.);
- Involving personnel at all organisational levels.

1.6 Hazard Identification

Before the risk associated with a particular activity can be assessed, it is first necessary to systematically identify the hazards which may effect, or arise from, the particular operation under

consideration. The identification of potential HSE hazards and effects covers all phases of construction activities at the appropriate level of accuracy, taking also into account all phases in the life of any installation including temporary conditions dictated by maintenance activities.

For each activity, the most significant hazards should be identified in term of:

- Potential sources of incident;
- Human health hazards;
- Environmental hazards;
- Reputation hazards;
- Possibility of breaching applicable law and rules;
- Possibility of violating construction policy, assigned objectives and targets
- Possibility of violating identified expectancy of stakeholders;
- Potential sources of economic loss.

Example of the aspects to be considered are:

- Fire and explosion;
- Exposure to chemical;
- Driving;
- Asphyxiation and electrocution;
- Human factors;
- Emission;
- Wastes;
- Noise;
- Vibration;
- Water;
- Atmosphere;
- Ecosystems alteration;
- Construction;
- Machineries;
- Local weather.

1.7 Risk Assessment Team

The Risk team is composed of four to six members who have sufficient knowledge to recognize and identify all the safety issues related to construction activities and operations subjected to the Risk Assessment and skill in the risk techniques and objectives of the Risk Assessment like:

- Skilled in the Risk techniques and objectives of the Risk Assessment;

- Knowledgeable about the design, operation maintenance of the facilities and activities under consideration.

The Risk Team must be composed at least of:

- A Team Leader, who leads the Risk Team and the Risk Assessment session;
- A Secretary, who records accurately the discussions to ensure that the minutes fully reflect the points identified during the Risk Assessment;
- The Participants, who contribute and provide input into the discussion

The Risk Team must perform the identification of the hazards and effects using adequate personal experience, checklist, codes and standards references and specialized hazards identification techniques.

1.8 Risk Assessment Plan with Respect to the Project Area

Risk assessment of the main drains during construction activities are summarized in the following Table 1-2.

Table 1-2: Risk Assessment Plan

Construction Activity	Hazards to Consider	Environmental Management Measures
Removal of vegetation / clearance of site	Damage to vegetation beyond project footprint	Indicate the limits of a clearing with highly visible markers. Clearing of vegetation will be kept to a minimum with regeneration and growth on the project area on the cleared area with native species. The cutting of trees will be prohibited. Under unavoidable circumstances any clearing required shall be done with prior approval and be compensated as per rules and regulations of Forest department. Minimum of 10,000 new plants will be provided as native species for compensation and regeneration with one year protection by contractor. It will be the responsibility of Contractor to plant at least seven new plants against every cutting of tree as per ADB requirements. Use of local vegetation/wood as fuel by crew personnel will be prohibited. Unnecessary land uptake will be minimized.
	Damage to important habitats and ecosystems	Monitor area for fauna prior to clearing operation, with catcher to remove fauna for release elsewhere; when the clearing is complete, fauna spotter/catcher should remain on call. Noise from construction activities and unnecessary movement of vehicles will be minimized by continuous monitoring. Night work will not be allowed where nocturnal species are found. Effective construction planning and management to ensure that works are completed within time. Noise from generators and machinery will be minimized using appropriate means (silencers, barriers, etc.) as required. No refuse or waste will be left lying around work site. Waste disposal will be carried out to ensure no contamination of soil.
	Erosion of exposed areas	Erect slit fences around perimeter of works area, sedimentation ponds, and silt traps.

Construction Activity	Hazards to Consider	Environmental Management Measures
		The area covered by the project activities will be kept to a minimum. Movement of construction equipment and vehicles will be restricted to the work areas. The construction corridor will be properly marked. Surplus soil will be disposed of in a manner that does not disturb the natural drainage. The natural drainage pattern will not be disturbed, and will be repaired where damaged. Safe driving practices will be observed to minimize soil erosion.
	Loss of topsoil	Give stockpiles protective covering, e.g., geotextiles, etc. Topsoil along the trench will be stockpiles separately, and will be used as the upper most soil layer during the backfilling of trench.
	Dust generation	Use water truck to wet exposed areas. Fugitive dust emissions will be minimized by appropriate methods, such as spraying water on soil, where required. Vehicle speed will be reduced to 15 km/h in dirt patches to avoid excessive dust emissions. In order to minimize exhaust emissions, generators, construction machinery and vehicles will be kept in good working condition and properly tuned. Construction camps will be located at different places of the project area. No any camp will be established in protected area.
	Noise & Vibration	Limit works around residential areas from 7 a.m. to 5 p.m. Minimize noise whenever possible, Consult regularly with local residents. Pump House will be confined with bufferwall so that noise level could be reduced to below 60dBA at outside pump house. Machinery and equipment (potential noise producers) will be kept in good condition and fitted with mufflers where necessary. The exposure to construction workers to noise will be minimized by use of ear plugs and maintaining safe distance from high noise generating sources. Construction work will be restricted by allowing 6 hrs continuous work at site and the work will start again after 2 hrs interval during the same day. The pump house will be supported on piles to avoid vibration. Best available techniques will be used to minimize vibration at source.
Material Storage Room	Dust generation	Water the material stockpiles, access roads and bare soils on an as required basis to minimize the potential for environmental nuisance due to dust. Increase the watering frequency during periods of high risk (e.g. high winds). Stored materials such as gravel and sand shall be covered and confined to avoid their being wind-drifted. Minimize the extent and period of exposure of the bare surfaces.
	Fuel and Hazardous Goods	Store dangerous goods in bounded areas on top of a sealed plastic sheets.

Construction Activity	Hazards to Consider	Environmental Management Measures
		Make sure all containers, drums, and tanks that are used for storage are in good condition and labeled with expiry date. Any container, drum, or tank that is dented, cracked, or rusted might eventually leak. Check for leakage regularly to identify potential problems before they occur.
Excavation	Damage to vegetation	Indicate the limits of a clearing with highly visible markers. Clearing of vegetation will be kept to a minimum with regeneration and growth on the project area and on the cleared area with native species. The cutting of trees will be prohibited. Under unavoidable circumstances any clearing required shall be done with prior approval and be compensated as per rules and regulations of Forest department. Minimum of 10,000 new plants will be provided as native species for compensation and regeneration with one year protection by contractor. Use of local vegetation/wood as fuel by crew personnel will be prohibited. Unnecessary land uptake will be minimized.
	Damage to important habitats	Monitor area for fauna prior to clearing operation, with catcher to remove fauna for release elsewhere; when the clearing is complete, fauna spotter/catcher should remain on call. Noise from construction activities and unnecessary movement of vehicles will be minimized by continuous monitoring. Night work will not be allowed to provide relief to especially nocturnal species. Effective construction planning and management to ensure that works are completed within time. Noise from generators and machinery will be minimized using appropriate means (silencers, barriers, etc.) as required. No refuse or waste will be left lying around work site. Waste disposal will be carried out to ensure no contamination of soil.
	Erosion of exposed areas	Erect slit fences around perimeter of works area, sedimentation ponds, and silt traps. The area covered by the project activities will be kept to a minimum. Movement of construction equipment and vehicles will be restricted to the work areas. The construction corridor along the pipeline RoW will be properly marked. Surplus soil will be disposed of in a manner that does not disturb the natural drainage. The natural drainage pattern will not be disturbed, and will be repaired where damaged. Top soil along the trench will be stockpiles separately, and will be used as the upper most soil layer during the backfilling of the trench. Safe driving practices will be observed to minimize soil erosion.
	Loss of topsoil	Give stockpiles protective covering, e.g., geotextiles, etc. Topsoil along the trench will be stockpiles separately, and will be used as the upper most soil layer during the backfilling of trench.
	Dust generation	Use water truck to wet exposed areas. Fugitive dust emissions will be minimized by appropriate methods, such as spraying water on soil, where required.

Construction Activity	Hazards to Consider	Environmental Management Measures
		Vehicle speed will be reduced to 15 km/h in dirt patches to avoid excessive dust emissions. In order to minimize exhaust emissions, generators, construction machinery and vehicles will be kept in good working condition and properly tuned. Construction camp will be located at Sukkur. No any camp will be established in protected area.
	Noise & Vibration	Limit works around residential areas from 7 a.m. to 5 p.m. Minimize noise whenever possible, Consult regularly with local residents. Pump House will be confined with bufferwall so that noise level could be reduced to below 60dBA at outside pump house. Construction camp will be located at Sukkur outside protected area. Machinery and equipment (potential noise producers) will be kept in good condition and fitted with mufflers where necessary. The exposure to construction workers to noise will be minimized by use of ear plugs and maintaining safe distance from high noise generating sources. Construction work will be restricted by allowing 6 hrs continuous work at site and the work will start again after 2 hrs interval during the same day. The pump house will be supported on piles to avoid vibration. Best available techniques will be used to minimize vibration at source.
Soil Stripping and Profiling	Dust generation	Water spray to wet topsoils.
	Loss of topsoil	Stockpiles to get protect covering geotextiles.
	Noise & Vibration	Limit works around residential areas from 7 a.m. to 5 p.m. Minimize noise whenever possible liaison with residents.
	Erosion & sediment loss in wet conditions	Erect silt fences, restrict vehicle movement. Keep natural drainage way intact.
Surfacing	Vibration from rollers	Vibration monitoring of nearby sensitive areas to identified. Vibration monitoring of identified areas to undertaken.
	Sediment and water quality issues in river	Regular testing and measuring accordingly.
	Fuel / oil spills	Storage on plastic sheets on bunded area.
	Vehicle movements	Community to be informed of all works two weeks prior to commencement. Access to be via shortest possible routes.
	Noise and dust issues	Follow noise, vibration, dust & air quality procedures.
Painting & Finishing Structures	Concrete wash out pollution	Bunding to be used for any high-pressure water cleaning of walls and piers.
	Sediment and erosion control	Maintain silt fences around perimeter of works area, and sedimentation ponds and silt traps.
	Noise	Limit works around residential areas from 7 a.m. to 5 p.m. Minimize noise whenever possible liaison with residents.
	Waste management	Recycling bins to be used and set up before finishing starts for collection and proper disposal. Industrial bins used for appropriate waste.

Construction Activity	Hazards to Consider	Environmental Management Measures
Landscaping	Dust from spreading and moving materials	Water truck to wet all exposed areas, access tracks and stockpile areas.
	Sediment and erosion control	Plantation of 10,000 native species along the banks of the drains to avoid erosion in affected area.
	Imported pests	All landscaping materials to be obtained from a source that has been certified as pest free.

1.9 Risk Management Plan

Risk Management is the identification, assessment, and prioritization of risks followed by coordinated and economical application of resources to minimize, monitor, and control the probability and/or impact of unfortunate events. Risk management is an attempt to identify and analyze the threats associated with the project that could severely damage the project development. The steps may involve:

- **Early warning system:** The early warning system is effective in managing the risk. In case of flood, outbreak of infectious diseases the information is quickly received and sent to relevant quarters for making all necessary arrangements. In case of incoming flood, the Project Manager forward the information to the engineer. The engineer shares the information with contractor and makes all possible arrangements like deployment of staff, arrangement of vehicles and equipment, gunny bags, stones, etc. to cope the incoming flood situation properly.
- **Preparedness for risks mitigation:** In this arrangement all nature of readiness is assured in place so that risks can be mitigated by the mobilization of relevant staff, health professionals, etc.
- **Mobilization of the concerned quarters:** In this arrangement the persons on whom the responsibilities are fixed are mobilized to fulfill their assignment as per risk management plans.
- **Site specific actions:** Site specific actions refer to nature of the risk belonging to some specific nature e.g. oil spillage, wastewater release, soil/water erosion.
- **Cause identification and fixing of responsibilities:** Identification of cause of the risk and fixation of its responsibilities due to which that specific nature of risk emerged.
- **Post actions monitoring:** In this step after incident situation is kept under observation and it is observed that with the preventive measures the system is fully restored for further progress or it is still incapable to work and sustain the operational activities. If it shows indications after monitoring that it still need some sort of improvement or repairment then it is stopped and rechecked and repaired again for complete fitness.
- **Preventive measures:** In this step those methodologies are applied which assist in avoiding the repetition of risks resurgence.

1.9.1 Risk Management Process

The Risk Management process consists of the identification of the Hazards, the evaluation of the risks and it allows to have a definite overview of the project activities and to understand if the necessary control measures are carried out.

Risk Management can be summarized follows and shown in Figure 1-3.

- Risk Assessment
- Risk Analysis;
- Risk Evaluation.
- Risk Reduction/Control

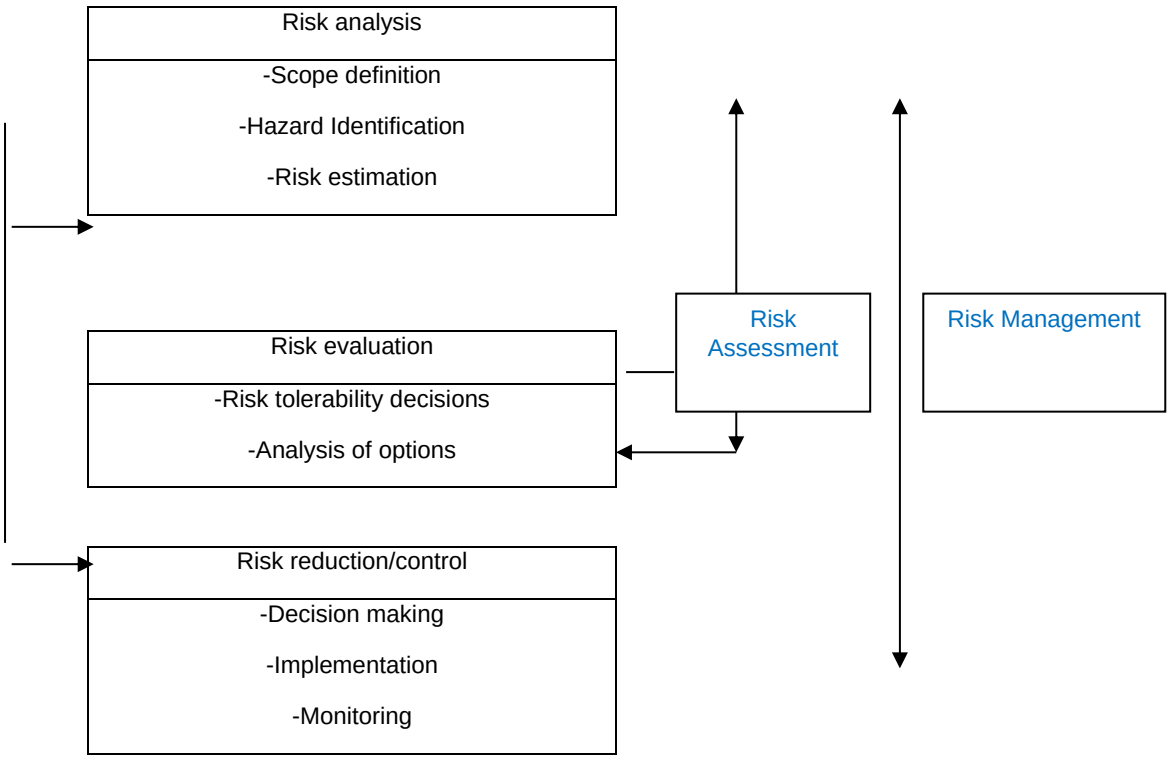

Figure 1-3: Main Phases of Risk Management Process

The above Risk Management approach must be applied to all the site work/process.

In this procedure only the Risk Assessment tool and terms are described; for the risk reduction/control refer to the specific Plans and procedures; however, as general framework, the main concepts and documents related to the Risk Reduction and Control are given in Table 1-3.

Table 1-3: Risk Management Plan

Sr. No.	Type of Risk	Impact of Risks	Plan for Mitigation of Risks	Actions Level	Responsibility
1.	Fatal accidents/ injuries	a) Death/ injury to humans	a) Shifting of injury affected persons for medical treatment immediately. b) Proper check on vehicle/equipment movement when in operation. c) Proper check on vehicle/equipment accessories e.g. Cables, shovels, etc.	a) Contractor to assure shifting of injured persons to medical facility. b) Health Department to extend medical facilities.	a) Contractor* b) Health Department* c) PMO***
2.	Air Pollution (Gases & Dust) from construction machinery/ vehicles.	a) Human health illness	a) Proper maintenance of alternate routes by compaction b) Regular showering of water on the alternate routes. c) Pavement of service roads.	a) Contractor to assure control of air emissions b) Health Department to go for medical facilities.	a) Contractor* b) Health Department* c) PMO***
3.	Epidemics (communicable diseases) e.g. HIV/ AIDS, Tuberculosis, respiratory, viruses, etc.	b) Human health illness	a) Regular check of people for any contagious disease. b) Provision of First Aid & medical facilities.	a) Contractor to assure isolation of the patient from rest of the community. b) Shifting of the patient to the medical treatment facility for proper treatment.	a) Contractor* b) Health Department* c) PMO***
4.	Oil spillage	a) Human, animal health. b) Soil deterioration	a) Availability & use of shovels, buckets at the time of incident of oil spillage, b) Proper these of these substances in case of spillage	a) Vehicle user to inform about the oil spillage incident to the contractor immediately b) Contractor immediately depute the relevant staff for recovery of oil and its stoppage from further spread.	a) Vehicle incharge b) Contractor
5.	Contamination of drinking water source from waste, hazardous substances & soil erosion.	a) Human & animal health	a) Early warning to people in use of contaminated water. b) Arrangement of clean water tankers. c) Rehabilitate/ restore clean water.	a) The contractor to make arrangements of clean water through tankers & restore clean water supplies.	a) Contactor* b) PM0tr*
6.	High noise levels from vehicles/ equipment	a) Damage to hearing capability b) High blood pressure c) Psychological behavior change.	a) Use of Personnel Protective Equipment (PPE). b) Proper tuning of vehicles/equipment c) Halt/ground the noise producing vehicle equipment.	a) Vehicle incharge to intimate the condition of vehicle to the contractor. b) Contractors to take relevant action for stoppage of noise levels.	a) Vehicle incharge* b) Contractor*

Sr. No.	Type of Risk	Impact of Risks	Plan for Mitigation of Risks	Actions Level	Responsibility
			d) Keeping vehicles in fit & proper conditions.		
7.	Bush fires/ waste burning	a) Burn injury to humans, loss of assets	a) Information dissemination to concerned section immediately. b) Preparedness for control of fire through fire extinguishers, sands, water showering etc. c) Ambulance facility d) Proper storage of combustible material	a) Site supervisor to inform the Contractor about the incident of fire. b) Contractor to evacuee people from the site of fire. c) e) Shifting of injured person if any for the medical treatment.	a) Site supervisor* b) Contractor* c) PMO***
8.	Construction activity	a) Environmental Health & Safety	a) Availability of First Aid b) Access facility to Medical Treatment facility c) Ambulance facility.	a) Site supervisor to the Contractor, PMO, Health Department, IPD.	a) Site Supervisor* b) Contractor* c) Health Department* d) PMO***
9.	Wastewater Releases	a) Environmental Pollution	a) Avoiding direct discharge of wastewater to open environment b) Relevant treatment must be ensured.	a) The engineer to assure control of release of wastewater. b) The Contractor to take relevant steps with the consultation of the engineer,	a) The Engineer* b) Contractor* c) PM0***
10.	Prevailing situation in the nearby area & due to International Funding & presence of foreigners.	a) Security Risk	a) Shifting the foreigner and at risk personnel to the safe locality. b) Extending medical treatment, if any to the injured. c) The site engineer and the contractor make arrangement of required security.	a) Site supervisor to inform the incident immediately to the Contractor and Police administration.	a) Site Supervisor* b) Contractor* c) Interior Ministry* d) Local Police administration
11.	Terrorism	a) Sabotage	a) Shifting the foreigner and the at risk personnel to the safe locality. b) Extending medical treatment, if any to the injured. c) The site engineer and the contractor make arrangement of required security.	a) Site supervisor to inform the incident immediately to the Contractor and Police administration.	a) Site Supervisor* b) Contractor* c) Interior Ministry* d) Local Police administration.
12.	Seismic Tremors	a) Destruction of human life & structure	a) Information for safety measures in case of earthquake occurrence.	a) The engineer to inform the contractor, PMO, persons about the natural disaster.	a) The Engineer* b) Contractor*

Sr. No.	Type of Risk	Impact of Risks	Plan for Mitigation of Risks	Actions Level	Responsibility
			b) Availability of First Aid c) Access facility to Medical Treatment.		c) PMO***
13.	Conflicts/ clashes	a) Injuries, fatalities	a) Availability of First Aid b) Access facility to Medical Treatment location. c) Ambulance facility.	a) Site supervisor to inform the incident immediately to the Contractor and Police administration.	a) Supervisor* b) Contractor* c) Interior Ministry* d) Local Police administration.
14.	Release of water towards graveyard area	a) Inundation of graveyards	a) Arrangements for complete control over water flow towards graveyards	a) The engineer to inform the contractor, about the matter, The contractor take immediate action for stoppage of inundation of graveyards	a) The engineer* b) Contractor*
15.	Mismanagement in traffic flow	a) Blockage of traffic	a) Preparedness for smooth traffic flow	a) The contractor takes immediate action for smooth flow of traffic.	a) Contractor*
16.	Late arrival of construction material.	a) Disruption in construction material supplies	a) Arrangements for timely arrival of all the construction material.	a) The contractor takes measures for timely arrival of all types of construction materials.	a) Contractor*
17.	Soft underneath soil/ weaker embankments	a) Seepage	a) Prediction of seepage in advance b) Relevant control measures	a) Evacuee operation to save life & if possible the assets. b) Deploy manpower & equipment ready for the purpose.	a) Contractor* b) PM0***
18.	Soft soil Water flows	a) Internal erosion	a) Prediction of erosion in advance detection b) Timely detection of the initiating	a) The contractor takes immediate action for control of emerging erosion.	a) Contractor*
19.	Excavation activities	a) Land excavation	a) Avoiding out of way excavations	a) The contractor assure the approved site for excavation activities.	a) Contractor*

Table 1-4: Detailed Disaster Risk Assessment of the Project Area

Hazard Type	Elements at Risk	Extent of Risk	Risk
District Jacobabad			
➢ Heatwave	• Settlements, • Population, • Household, • Agricultural Area, • Pakka Planned Area, • Pacca Unplanned Area.	➢ **Low-Medium**	• Historically, Jacobabad district has a Hot and Arid climate and is prone to severe heatwave seasons. However, most of the district is sparsely populated, which significantly lowers the chances of severe heatwave impacts • Heatwaves are forecastable hazards and actions can be taken well before occurrence of heatwaves. The most suitable action is issuance of warnings and alerts in public for precautions and safety. Suitable media for the purpose is social media and SMS • Scientific studies suggest that, frequency and intensity of heatwaves is increased due to climate change. Though climate change is global phenomena, however, its impacts can be minimized through local interventions. The most efficient and cost-effective solution is tree plantation. Tree plantation must be encouraged at different levels including government functionaries, NGOs, community and individual levels • Additionally, introduction of reduced Urban Heat Islands (UHI) through policies and implementation in infrastructure development will significantly reduce impacts of heatwaves
Earthquake	Agriculture area, Natural vegetation in wet areas, Pacca planned areas, Pacca unplanned areas, Education facilities, Petrol pumps, Settlements, Irrigation and drainage network, railway lines, Road network, population, household. Settlement, Agriculture area, natural vegetation in wet areas, waterbodies, wet areas, population, household	➢ **Low**	• The geology of Sindh is divisible in three main regions, the mountain ranges of Kirthar, Pab containing a chain of minor hills in the west and in east it is covered by the Thar Desert and part of Indian Platform where the main exposure is of Karoonjhar Mountains, which is famous for Nagar Parkar Granite • Some of prominent faults situated in Sindh are (a) Karachi-Jati, (b) Surjan- Jhimpir, (c) Pab Fault (d) Hub Fault and (e) Allah Bund-Rann of Kutch faults • Though risk of geophysical hazards in Jacobabad district is low but still some actions must be taken to avoid losses in case of minor jolts. Urban settings are most likely to be affected by jolts. It is highly recommended to identify old and weak buildings in the cities and other urban settings of the district. Local concerned authorities may decide evacuation or retrofitting of such buildings / structures. • It is also recommended that, new housing schemes, societies and infrastructure be built with proper town planning and following Building Codes recommended for the zone in which Jacobabad district is situated.

Hazard Type	Elements at Risk	Extent of Risk	Risk
			• Local government departments must be strengthened to manage situation arisen from earthquake jolts. Strengthening must include capacity building to act as first responder in any likely situation. • Geographically, district Jacobabad has Hot and Arid climate. Average annual rainfall across the district is 83.34 mm
Drought	Agriculture area, natural vegetation in wet areas, waterbodies, wet areas, population, household	➢ **Medium-Extreme**	• Drought is also forecastable hazard and can be predicted well in advance. Though drought does not bring any prominent or famine like conditions in the districts, however, it causes reduction in agricultural production and some extent disturb food supply for the animals and livestock. The best practice to manage drought related impacts is storage of food supplies for both humans and animals. • The situation of drought may vary in future due to climate change effects, therefore, introduction of drought resilient crops is need of the time. Additionally, efficient use of available water resources and introduction of efficient agricultural systems is also required. • Further, farmers may be encouraged for alternative crops during expected drought seasons. Also policies for compensation of framers must also be introduced to assist and encourage drought hit farmers. • According to Multi-Hazard Vulnerable Risk Assessment (MHVRA) Study 2022 conducted by Provincial Disaster Management Authority (PDMA) Sindh, there is no Cyclone Hazard in Jacobabad district. • According to Multi-Hazard Vulnerable Risk Assessment (MHVRA) Study 2022 conducted by Provincial Disaster Management Authority (PDMA) Sindh, there is no Tsunami Hazard in Jacobabad district. • According to Multi-Hazard Vulnerable Risk Assessment (MHVRA) Study 2022 conducted by Provincial Disaster Management Authority (PDMA) Sindh, there is no Riverine Flood Hazard in Jacobabad district.
Cyclone		**Nil**	▪
Tsunami		**Nil**	▪
Riverine Flood		**Nil**	▪
District Shikarpur			
Heatwave	Settlements, Population, Household, Agricultural Area,		• The district has witnessed rapidly increased severity of heatwave in the past five years. The district is moderately populated, which significantly increases the chances of heatwave impacts

Hazard Type	Elements at Risk	Extent of Risk	Risk
	Pakka Planned Area, Pacca Unplanned Area.		• Heatwaves are forecastable hazards and actions can be taken well before occurrence of heatwaves. The most suitable action is issuance of warnings and alerts in public for precautions and safety. Suitable media for the purpose is social media and SMS • Scientific studies suggest that, frequency and intensity of heatwaves is increased due to climate change. Though climate change is global phenomena, however, its impacts can be minimized through local interventions. The most efficient and cost-effective solution is tree plantation. Tree plantation must be encouraged at different levels including government functionaries, NGOs, community and individual levels. • Additionally, introduction of reduced Urban Heat Islands (UHI) through policies and implementation in infrastructure development will significantly reduce impacts of heatwaves.
Earthquake	Agriculture area, Natural vegetation in wet areas, Pacca planned areas, Pacca unplanned areas, Education facilities, Petrol pumps, Settlements, Irrigation and drainage network, railway lines, Road network, population, household.	➢ **Low**	• The geology of Sindh is divisible in three main regions, the mountain ranges of Kirthar, Pab containing a chain of minor hills in the west and in east it is covered by the Thar Desert and part of Indian Platform where the main exposure is of Karoonjhar Mountains, which is famous for Nagar Parkar Granite. District Shikarpur falls away from any major fault line and is unlikely to be affected by a massive earthquake. • Some of prominent faults situated in Sindh are (a) Karachi-Jati, (b) Surjan-Jhimpir, (c) Pab Fault (d) Hub Fault and (e) Allah Bund-Rann of kutch faults • Though risk of geophysical hazards in Shikarpur district is low but still some actions must be taken to avoid losses in case of minor jolts. It is highly recommended to identify old and weak buildings in the city and other urban settings of the district. Local concerned authorities may decide evacuation or retrofitting of such buildings / structures. • It is also recommended that, new housing schemes, societies and infrastructure be built with proper town planning and following Building Codes recommended for the zone in which Shikarpur district is situated. • Local government departments must be strengthened to manage situation arisen from earthquake jolts. Strengthening must include capacity building to act as first responder in any likely situation.
Drought	Agriculture area, natural vegetation in wet areas,	➢ **Medium-Extreme**	• Climatic condition of the district can be categorized as Hot and Arid (Climate Classification of Pakistan (Khan et al., 2010). Average

Hazard Type	Elements at Risk	Extent of Risk	Risk
	waterbodies, wet areas, population, household		annual rainfall received during a year across the district is 75.95mm. Agriculture is practiced in the district which is mainly dependent on canal irrigation. • Drought is also forecastable hazard and can be predicted well in advance. Though drought may not bring any prominent or famine like conditions in the district, however, it may cause reduction in agricultural production and some extent disturb food supply for the animals and livestock. The best practice to manage drought related impacts is storage of food supplies for both humans and animals. • The situation of drought may vary in future due to climate change effects, therefore, introduction of drought resilient crops is need of the time. Additionally, efficient use of available water resources and introduction of efficient irrigation systems in agriculture sector is also required.
Cyclone		Nil	According to MulHVRA Study 2022, there is no Cyclone Hazard in Shikarpur district
Tsunami		Nil	• According to MHVRA Study 2022, there is no Tsunami Hazard in Shikarpur district.
Riverine Flood		Nil	• River Indus in Sindh can be segmented in three broad reaches Guddu to Hyderabad, Hyderabad to Kotri and Kotri to Arabian Sea. Additionally, during past years, road bridges have been built over river Indus at different location. Though such developments and interventions were essential to bring prosperity in the region, however, have embedded impacts on fluvial geomorphology and natural flood plain of the Indus. Further, extensive human interventions such as use of land for agriculture, road infrastructure, civil embankments, etc. are observed through satellite imagery within the existing flood plain. In such scenario, risk of breaches in flood protective embankments and consequential flooding of adjoining areas have been increased. To minimize this risk, it is essential to restore Indus flood plain in its natural form. This arrangement will significantly reduce riverine flood risk through adoption of ecosystem friendly disaster risk reduction. The arrangement will not only reduce disaster risk but restore and enrich biodiversity in Indus flood plain. • Though river Indus floodplain is bounded by flood protective embankment, but still some parts of district Shikarpur adjoining river Indus are likely to be affected due to breaches in embankments of river Indus.

Hazard Type	Elements at Risk	Extent of Risk	Risk
			• It is highly recommended to identify and reinforce sections of vulnerable embankments before flooding season to avoid breaches in embankments and consequential damages. • As far as riverine floods are concerned, the Sindh province has sufficient time for preparation and reaction. Close monitoring of river discharge level in coordination with irrigation department, the government of Punjab, Federal Flood Commission and Pakistan Meteorological (PMD) be conducted. • Timely alerts be issued to people living in low lying areas within flood plain. • In case of high anticipated flows evacuation of people and livestock be carried out. • Soaking and compacting of embankments before arrival of flood water • Reinforcement and stone pitching of high-risk embankments • Use alternative eco-friendly options like use of bamboo wood etc. to minimize erosion impact on high-risk embankments • Where necessary and possible, erection of guide embankments and spur before arrival of high flood water. • 24/7 vigilance of high-risk embankments by Sindh Irrigation Department. • Readily availability of breach filling stock and machinery at high risk embankments. • Restoration of natural eco-system within flood plain such as revival of braided/Yazoo channels and natural lakes within flood plain to disperse and distribute flood water across the plain. • Removal of possible congestion factors within the flood plain. • Public participation comprising local people be encouraged in pre and during flood periods.
District Kashmore			
Heatwave	Settlements, Population, Household, Agricultural Area, Pakka Planned Area, Pacca Unplanned Area.	➢ **Medium**	• The district has witnessed rapidly increased severity of heatwave in the past five years. The district is moderately populated, which significantly increases the chances of heatwave impacts • Heatwaves are forecastable hazards and actions can be taken well before occurrence of heatwaves. The most suitable action is issuance of warnings and alerts in public for precautions and safety. Suitable media for the purpose is social media and SMS

Hazard Type	Elements at Risk	Extent of Risk	Risk
			• Scientific studies suggest that, frequency and intensity of heatwaves is increased due to climate change. Though climate change is global phenomena, however, its impacts can be minimized through local interventions. The most efficient and cost-effective solution is tree plantation. Tree plantation must be encouraged at different levels including government functionaries, NGOs, community and individual levels. • Additionally, introduction of reduced Urban Heat Islands (UHI) through policies and implementation in infrastructure development will significantly reduce impacts of heatwaves.
Earthquake	Agriculture area, Natural vegetation in wet areas, Pacca planned areas, Pacca unplanned areas, Education facilities, Petrol pumps, Settlements, Irrigation and drainage network, railway lines, Road network, population, household.	➢ **Low**	• The geology of Sindh is divisible in three main regions, the mountain ranges of Kirthar, Pab containing a chain of minor hills in the west and in east it is covered by the Thar Desert and part of Indian Platform where the main exposure is of Karoonjhar Mountains, which is famous for Nagar Parkar Granite. District Kashmore falls away from any major fault line and is unlikely to be affected by a massive earthquake. • Some of prominent faults situated in Sindh are (a) Karachi-Jati, (b) Surjan- Jhimpir, (c) Pab Fault (d) Hub Fault and (e) Allah Bund-Rann of Kutch faults. • Though risk of geophysical hazards in Kashmore district is low but still some actions must be taken to avoid losses in case of minor jolts. It is recommended to identify old and weak buildings in urban settings of the district. Local concerned authorities may decide evacuation or retrofitting of such buildings / structures. • It is also recommended that, new housing schemes, societies and infrastructure be built with proper town planning and following Building Codes recommended for the zone in which Kashmore district is situated. • Local government departments must be strengthened to manage situation arisen from earthquake jolts. Strengthening must include capacity building to act as first responder in any likely situation.
Drought	Agriculture area, natural vegetation in wet areas, waterbodies, wet areas, population, household	➢ **Medium - Extreme**	• Kashmore is a moderately populated district with closely spaced homes in major cities. Climatic condition of the district can be categorized as Hot and Arid (Climate Classification of Pakistan (Khan et al., 2010). Average annual rainfall received during a year across the district is 94.64 mm. Agriculture is practiced in the district which is mainly dependent on rainfall.

Hazard Type	Elements at Risk	Extent of Risk	Risk
			• Drought is also forecastable hazard and can be predicted well in advance. Though drought does not bring any prominent or famine like conditions in the districts, however, it causes reduction in agricultural production and some extent disturb food supply for the animals and livestock. The best practice to manage drought related impacts is storage of food supplies for both humans and animals. • The situation of drought may vary in future due to climate change effects, therefore, introduction of drought resilient crops is need of the time. Additionally, efficient use of available water resources and introduction of efficient irrigation systems in agriculture sector is also required.
Cyclone		Nil	According to MHVRA Study 2022, there is no Cyclone Hazard in Kashmore district
Tsunami		Nil	• According to MHVRA Study 2022, there is no Tsunami Hazard in Kashmore district.
Riverine Flood		Nil	• River Indus in Sindh can be segmented in three broad reaches Guddu to Sukkur, Sukkur to Kotri and Kotri to Arabian Sea. Additionally, during past years, road bridges have been built over river Indus at different location. Though such developments and interventions were essential to bring prosperity in the region, however, have embedded impacts on fluvial geomorphology and natural Riverine Flood plain of the Indus. Further, extensive human interventions such as use of land for agriculture, road infrastructure, civil embankments, etc. are observed through satellite imagery within the existing Riverine Flood plain. In such scenario, risk of breaches in Riverine Flood protective embankments and consequential Riverine Flooding of adjoining areas have been increased. To minimize this risk, it is essential to restore Indus Riverine Flood plain in its natural form. This arrangement will significantly reduce Riverine Flood risk through adoption of ecosystem friendly disaster risk reduction. The arrangement will not only reduce disaster risk but restore and enrich biodiversity in Indus Riverine Flood plain. • Though river Indus Riverine Floodplain is bounded by Riverine Flood protective embankment, but still some parts of district Kashmore adjoining river Indus are at high vulnerability to be affected due to breaches in embankments of river Indus.

Hazard Type	Elements at Risk	Extent of Risk	Risk
			• It is highly recommended to identify and reinforce sections of vulnerable embankments before Riverine Flooding season to avoid breaches in embankments and consequential damages. • As far as Riverine Floods are concerned, the Sindh province has sufficient time for preparation and reaction. Close monitoring of river discharge level in coordination with irrigation department, the government of Punjab, Federal Riverine Flood Commission and Pakistan Meteorological Department (PMD) be conducted. • Timely alerts be issued to people living in low lying areas within Riverine Flood plain. • In case of high anticipated flows evacuation of people and livestock be carried out. • Soaking and compacting of embankments before arrival of Riverine Flood water. • Reinforcement and stone pitching of high-risk embankments. • Use alternative eco-friendly options like use of bamboo wood etc. to minimize erosion impact on high-risk embankments. • Where necessary and possible, erection of guide embankments and spur before arrival of high Riverine Flood water. • 24/7 vigilance of high-risk embankments by Sindh Irrigation Department. • Readily availability of breach filling stock and machinery at high risk embankments. • Restoration of natural eco-system within Riverine Flood plain such as revival of braided/Yazoo channels and natural lakes within Riverine Flood plain to disperse and distribute Riverine Flood water across the plain. • Removal of possible congestion factors within the Riverine Flood plain. • Public participation comprising local people be encouraged in pre and during Riverine Flood periods. • Though river Indus floodplain is bounded by flood protective embankment, but still some parts of district Shikarpur adjoining river Indus are likely to be affected due to breaches in embankments of river Indus. • It is highly recommended to identify and reinforce sections of vulnerable embankments before flooding season to avoid breaches in embankments and consequential damages.

Hazard Type	Elements at Risk	Extent of Risk	Risk
			• As far as riverine floods are concerned, the Sindh province has sufficient time for preparation and reaction. Close monitoring of river discharge level in coordination with irrigation department, the government of Punjab, Federal Flood Commission and Pakistan Meteorological (PMD) be conducted. • Timely alerts be issued to people living in low lying areas within flood plain. • In case of high anticipated flows evacuation of people and livestock be carried out. • Soaking and compacting of embankments before arrival of flood water • Reinforcement and stone pitching of high-risk embankments • Use alternative eco-friendly options like use of bamboo wood etc. to minimize erosion impact on high-risk embankments • Where necessary and possible, erection of guide embankments and spur before arrival of high flood water. • 24/7 vigilance of high-risk embankments by Sindh Irrigation Department. • Readily availability of breach filling stock and machinery at high-risk embankments. • Restoration of natural eco-system within flood plain such as revival of braided/Yazoo channels and natural lakes within flood plain to disperse and distribute flood water across the plain. • Removal of possible congestion factors within the flood plain. • Public participation comprising local people be encouraged in pre and during flood.

ANNEXURE 3

AIR & NOISE QUALITY MONITORING REPORT RECEIVED FROM "NATIONAL ENVIRONMENTAL SERVICES AND CONSULTANTS

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ABBREVIATIONS

Abbreviations	Term
CO	Carbon Monoxide
Db	Disable Meter
EHS	Environmental Health and Safety
EIA	Environmental Impact Assessment
EPAs	Environmental Protection Agencies
GIIP	Good International Industry Practice
GPS	Geographic Position System
IEE	Initial Environmental Examination
IFC	International Finance Corporation
ISO	International Standard Organization
MoE	Ministry of Environment
MR	Monitoring Report
NCS	National Conservation Strategy
ND	Not Detected
NEAP	National Environmental Action Plan
NEP	National Environment Policy
NEQS	National Environmental Quality Standards
NESC	National Environmental Services Corporation
NO	Nitrogen Oxide
O/L	Out of Limit
O_3	Ozone
PEPC	Pakistan Environmental Protection Council
PM	Particulate Matter
SEPA	Sindh Environmental Protection Act
SEQs	Sindh Environmental Quality Standards
SO_2	Sulphur Dioxide
SOX	Sulphur Dioxide
SPM	Suspended Particulate Matter
TSP	Total suspended particles
USEPA	United State Environment Protection Agency
W/L	Within Limits
WHO	World Health Organization

ANNEXURE 3: AIR & NOISE QUALITY MONITORING REPORT RECEIVED FROM "NATIONAL ENVIRONMENTAL SERVICES AND CONSULTANTS"

1 Introduction

This Air Quality Monitoring Report has been prepared by "National Environmental Services and Consultants" for MM Pakistan (Pvt) Ltd located at 2nd Floor, CTI Building 27-Empress Road, Lahore.

1.1 Project Title

The proposed Project for which this Monitoring Report (MR) relates is "Ambient Air QualityMonitoring in the Jacobabad Drainage Project" at five (05) points.

1.2 Project Scope

- To carry out Ambient Air Quality Monitoring activities in the Jacobabad, Shikarpur Drainage Project at below mentioned Five (05) points.
  - ✓ Kandhkot- Thul Road
  - ✓ Shikarpur-Mirpur Burero Road.
  - ✓ Jacobabad- Ghari Khairo Road.
  - ✓ Rato Dero-Jacobabad Road.
  - ✓ Shahdad Kot-Ghari Khairo Road.

"Ambient Air Quality Continuous Monitoring" (24 Hours) conducted at points mentionedabove along Drainage project, for the below parameters:

- Nitrogen oxide (NO)
- Sulphur dioxide (SO2)
- Carbon monoxide (CO)
- Ozone (O3)
- PM2.5
- PM10
- Lead
- Suspended Particulate Matter (SPM)

Noise monitoring also has been conducted with Air Quality Monitoring at the same points along the drainage project as per Sindh Environmental quality standards. 24 hours continuousmonitoring carried out on day and night time basis.

Unit of Noise is dB (a)

1.3 Organization of the Report

This report has been structured in the following manner:

(Legal Requirements) provides an overview of policy and legislation along with internationalguidelines relevant to Environmental Monitoring.

(Methodology Site Selection Criteria) provides the description of the testing methodology thathas been adopted for testing and sampling.

(GPS Coordinates of the Monitoring Sites) provide the description of the physical locationwhere the testing and sampling has been carried out.

(Monitoring Results) Provides the values of Pollutants measured against the standards.

(Interpretation and Compliance of Monitoring Results) provides a brief explanation of the monitoring result and its compliance.

(Mitigation Measures) Highlight mitigation measures proposed for the project to minimizethe impacts of the project.

(Conclusion) provides the summary of the entire project.

2 LEGISLATIVE REQUIREMENTS

This chapter provides an overview of the national environmental policies, legislation, and guidelines and international conventions and guidelines that have relevance to the project.

2.1 Statutory Framework

The Ministry of Environment (or MoE), was a Cabinet-level ministry of Government of Pakistan established in 1975, tasked and primarily responsible for planning, coordinating, promoting, protecting and overseeing the policy implementation of government sanctioned environmental and forestry programs in the country.

Initially the Ministry was responsible for promulgation of the environmental ProtectionOrdinance of Pakistan in 1983. It was the first comprehensive legislation prepared in the country.

In 1992, Pakistan prepared National Conservation Strategy (NCS), which provided a broad frame work for addressing environmental concerns in the country. In 1993 National Environmental Quality Standards (NEQS) were designed.

The Pakistan Environmental Protection Act was enacted on 6th December 1997, repealing the Pakistan Environmental Protection Ordinance, 1983. Pakistan Environmental Protection Agency was an attached department of the Ministry of Environment and responsible to implement the Pakistan Environmental Protection Act, 1997 in the country.

The federal ministry has been abolished after the 18th constitutional amendment requirements in Pakistan on June 30, 2011. The said ministry of environment has been devolved into provinces and Pakistan Environmental Protection Agency is now working under the umbrellaof Climate Change Division and provides all kind of technical assistance to the ministry of climate change. The powers of the provincial Environmental Protection Agencies (EPAs) have been considerably enhanced and they have been given the power to enact their own provincial legislation according to provincial requirements.

2.2 National Environmental Policies & Legislations National Environmental Policy, 2005

The National Environment Policy (NEP), prepared under National Environmental ActionPlan (NEAP) and published by the Ministry of Environment in 2005, provides an overarchingframework for addressing the environmental issues. The National Environmental Policy(NEP) was approved by the Pakistan Environmental Protection Council (PEPC) in its 10th meeting on 27th December, 2004 under

the chairmanship of the Prime Minister of Pakistan and thereafter approved by the Cabinet on 29th June 2005.

The National Environment Policy, while recognizing the goals and objectives of the National Conservation Strategy (NCS), National Environmental Action Plan (NEAP) and other existing environment related national policies, strategies and action plans; provides broad guidelines to the Federal Government, Provincial Governments, Federally Administrated.

Territories and Local Governments for addressing environmental concerns and ensuring effective management of their environmental resources.

The broad Goal of NEP is, “To protect, conserve and restore Pakistan’s Environment in orderto improve the quality of life of the citizens through sustainable development”. The NEP identifies the following set of sectoral and cross-sectoral guidelines to achieve its Goal of sustainable development.

2.2.1 Sectoral Guidelines:

Sectoral Guidelines covers the following parameters: Water and sanitation, Air quality and noise, Waste management, Forestry, Biodiversity and Protected areas, Climate change and Ozone depletion, Energy efficiency and renewable, agriculture and livestock, and Multilateralenvironmental agreements.

2.2.2 Cross Sectoral Guidelines:

The NEP suggests the following policy instruments to overcome the environmental problems throughout the country:

- Integration of environment into development planning,
- Legislation and regulatory framework,
- Capacity development,
- Economic and market based instrument,
- Public awareness and education, and
- Public private civil society partnership

NEP is a policy document and does not apply to projects. However AGP pharma limited should ensure that their activities should not add to the aggravation of the environmental issues identified in NEP and mitigation measures should be adopted to minimize or avoid anycontribution in these areas.

2.3 National Conservation Strategy

Before the approval of National Environmental Policy, 2005; the National Conservation Strategy (NCS), that was approved in 1992; was considered as the Government’s primary policy document on national environmental issues. At the moment this strategy just exists asa national conservation program. The NCS identifies 14 core areas including conservation of biodiversity; pollution prevention and abatement; soil and water conservation; andpreservation of cultural heritage, and recommends immediate attention to these core areas in order to preserve the country’s environment.

2.4 The Pakistan Environmental Protection Act, 1997

The PEPA’ 1997 provides the framework for implementation of NCS, establishment of Provincial Sustainable development Funds, Protection and conservation of species, conservation of renewable resources, establishment of Environmental Tribunals andappointment of Environmental Magistrates, Initial Environmental Examination (IEE), and Environmental Impact Assessment (EIA).

In all four provinces, Environmental Protection Agencies were created under the provision of Pakistan Environmental Protection Act, 1997.

2.5 Provincial Environmental Legislations Sindh Environmental Protection Act, 2014

The Sindh Environmental Protection Act, 2014 (SEPA) is the basic legislative tool empowering the Sindh provincial government to frame regulations for the protection, conservation, rehabilitation and improvement of the environment. The SEPA is broadlyapplicable to air, water, soil, hazardous waste, marine and noise pollution. Penalties have been prescribed for those contravening the provisions of the Act. The powers of the provincial Environmental Protection Agencies (EPAs) are also 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.

2.6 The Sindh Environmental Quality Standards (SEQS)

In exercise of the powers conferred by section 37 of the Sindh Environmental Protection Act, 2014, the Sindh Environmental Protection Agency, with the approval of Government, presented Sindh Environmental Quality Standard in December 2014 which outlines different types of contaminants in air, water and noise, and their acceptable limits.

The SEQS promulgated under the SEPA 2016 specify standards for industrial and municipal effluents, gaseous emissions, vehicular emissions, and noise levels. During the whole project span, SEQS will apply to the gaseous emission generated from vehicular exhaust, stacks emissions & to the ambient air quality of the plant during all production activities.

2.7 International Guidelines

2.7.1 EHS Guidelines of IFC - World Bank Group

IFC has also developed Environmental, Health, and Safety (EHS) Guidelines. These guidelines are technical reference documents with general and industry specific examples of Good International Industry Practice (GIIP). The EHS Guidelines are required to adhere by IFC clients under Performance Standard 3 on Pollution Prevention and Abatement.

2.8 World Bank Guidelines on Environment

The principal World Bank publications that contain environmental guidelines are listedbelow.

- Environmental Assessment-Operational Policy 4.01. Washington, DC, USA. World Bank 1999.
- Environmental Assessment Sourcebook, Volume I: Policies, Procedures, and Cross-Sectoral Issues. World Bank Technical Paper Number 139, Environment Department, the World Bank, 1991,
- Pollution Prevention and Abatement Handbook: Towards Cleaner Production, Environment Department, the World Bank, United Nations Industrial Development Organization and the United Nations Environment Program, 1998.
- Environmental Health and Safety (EHS) guidelines, International Finance Corporation (IFC) World Bank Group, 2007.

3 Methodology

3.1 Ambient Air Quality Monitoring:

To assess the status of environmental conditions especially ambient air quality, criteriapollutants (NO, SO2, CO, O3, SPM, PM_{10}, $PM_{2.5}$ and Lead) were monitored at designated location identified by the client.

NESC collected the ambient air data using its USEPA recommended monitoring equipmentat Five (05) sites of filtration plant.

3.2 Data Acquisition Criteria

- Air Quality data (concentration) of criteria pollutants such as NO, SO2, CO, SPM, PM_{10}, $PM_{2.5}$, O3 and Lead along with additional Noise Level Monitoring were also collected at all sites.
- The meteorological parameters (Wind Speed, Wind Direction, Temperature and Relative Humidity) were also measured at site.
- The data (air quality parameters and meteorological parameters) was collected with interval of 01 hour for 24 hours. Minimum detection limits for analysers are given in Table 1 for monitoring the air quality.

3.3 Ambient Air Quality Monitoring Methods and Ambient Air Quality Standards

Ambient air quality is measured with monitoring devices that have the capability to capture & analyse criteria air borne pollutants including CO, NO, NO2, SO2, TSP, PM_{10}, $PM_{2.5}$, O3 & Lead (Pb) at micro levels. The monitoring techniques of each of these pollutant gases based on USEPA defined standard methods depicted in Table 3-1.

Table 3-1: Ambient Air Monitoring Methodology

Air Pollutant	Monitoring Technique	Reference Method	Measurement Range	Lowest Detection Limit
Carbon Monoxide (CO)	Gas Filter Correlation CO Analyzer	US EPA Designated Method RFCA-0981-054	0 – 100 mg/m^3	0.01 mg/m^3
Sulfur Dioxide (SO_2)	Pulsed Fluorescent Analyzer	US EPA Designated Method EQSA-0486-060	0 – 50 µg/m^3 0 – 100 mg/m^3	0.01 µg/m^3
Nitrogen Dioxide (NO_2)	Chemiluminescent Analyzer	US EPA Designated Method RFNA-1289-074	0 – 50 µg/m^3 0 – 100 mg/m^3	0.01 µg/m^3
Nitrogen Dioxide (NO)	Chemiluminescent Analyzer	US EPA Designated Method RFNA-1289-074	0 – 50 µg/m^3 0 – 100 mg/m^3	0.01 µg/m^3
Total Suspended Particulate (TSP)	High Volume PM10 Sampler	40 CFR 50, Appendix J (US EPA)	2 – 750 µg/m^3	2 µg/m^3
Particulate Matter (PM_{10})	High Volume PM10 Sampler	40 CFR 50, Appendix J (US EPA)	2 – 750 µg/m^3	2 µg/m^3
Particulate Matter ($PM_{2.5}$)	High Volume PM10 Sampler	40 CFR 50, Appendix J (US EPA)	2 – 750 µg/m^3	2 µg/m^3
Ozone (O_3)	EN50270:1999	Electro chemical	2-500 µg/m^3	2 µg/m^3
Lead (Pb)	Radiello tubes	JIS B 9921:2010/ISO 2150-4:2007	-	-

SEQS for air quality standards have been introduced in Sindh since 2016; therefore, the monitoring values of Carbon monoxide (CO), Sulphur dioxide (SO2), Nitrogen Oxide (NO), Particulate Matter (TSP, PM10 & PM2.5), Ozone (O3) & Lead (Pb) were compared with standards set by SEQS.

Table 3-2: Ambient Air Quality Standards of Sindh EPA, USEPA, WHO and World Bank

Pollutants	USEPA		WHO		World Bank		SEQS	
	Avg. Time	*Standard*	Avg. Time	Standard	Avg. Time	*Standard*	Avg. Time	*Standard*
SO_2	24 HRS	365ug/m3 (140 ppb)	24 HRS 1 HR	90 ug/m3 (34 ppb) 350 ug/m3	ANNUAL MEAN 24 HRS	100 ug/m3 (38 ppb) 500 ug/m3	ANNUAL MEAN 24 HRS	80 ug/m3 120 ug/m3
CO	8 HRS 1 HR	10 mg/m3 (9 ppm) 40 mg/m3	8 HRS	10 mg/m3 (8.7 ppm)	-	-	8 HRS 1 HR	5 mg/m3 10 mg/m3
NO_x	ANNUAL MEAN	100 ug/m3 (53 ppb)	1 HR	190-320 ug/m3	ANNUAL MEAN	100 ug/m3 (50 ppb)	ANNUAL MEAN 24 HRS	80 ug/m3 - 120 ug/m3
O_3	1 HRS	235ug/m3	8 HRS 1 HR	120 ug/m3 200 ug/m3	-	-	-	130 ug/m3
TSP	24 HRS	260 ug/m3	24 HRS	150-230 ug/m3	A.MEAN	100 ug/m3	A.MEAN 24 HRS	360 ug/m3 500 ug/m3
					24 HRS	500 ug/m3		
PM_{10}	24 HRS	150 ug/m3	-	-	-	-	A.MEAN 24 HRS	120 ug/m3 150 ug/m3
$PM_{2.5}$							24 HRS	75 ug/m3
Lead							A.MEAN 24 HRS	1 ug/m3 1.5ug/m3

3.4 Noise Monitoring

Noise is regarded important environmental stressor pollutant and is monitored as essential matrix particularly during baseline environmental studies. In the absence of any reliable and established Noise data, noise monitoring was conducted at the same location where ambient air quality measurements were carried out.

3.4.1 Data Acquisition Criteria

- As per SEQS defined guidelines, the Noise measurements were made at a height of 1.5 meters.
- The data was collected with interval of 01 hour for 24 hours. Minimum detection limits for Sound level meter is given in Table 3-3 for monitoring the noise levels.

Table 3-3: Noise Monitoring Methodology

Parameter	Monitoring Technique	Reference Method	Measurement Range	Lowest Detection Limit
Noise dB(a)	IEC PUB 651 TYPE2	ISO 1996-2:2017	30~130dBA	0.1dB

3.4.2 Noise Monitoring Method and Quality Standards

Noise measurement was carried out using a Benetech GM1356 Integrating Sound Level Meter fitted with A, and C filter networks in accordance with IEC PUB 651 TYPE2 for compliance with virtually all Noise measurement regulations.

SEQS for Noise quality standards have been introduced in Sindh since 2016; therefore, the monitoring value of Noise was compared with standards set by SEQS.

Table 3-4: Quality Standards for Noise of Sindh EPA

Sr. No.	Category of Area/Zones	Day Time	Night Time
1	Residential Area (A)	65	50
2	Commercial Area (B)	70	60
3	Industrial Area (C)	80	75
4	Silence Zones (D)	55	45

4 GPS Coordinates of Monitoring Sites

There were Five (05) sites where ambient air monitoring has been conducted. Sites namewith their GPS coordinates are as given below in Table 4-1.

Table 4-1: GPS Coordinates of Monitoring Sites

Sr. No	Names	Latitude	Longitude
1	Ali Sher Gola (Kandhkot)	28° 15' 24.3252"	69° 12' 46.566"
2	Garhi Yain, Shikarpur	27° 53' 53.88"	68° 31' 32.9628"
3	Jacobabad Road– Garhi Khero	28° 03' 07.6212"	67° 59' 24.6588"
4	Mero Khan Rato Daro Road– (GARHI KHERO)	27° 48' 01.1988"	68° 16' 27.3832"
5	Garhi Khairo Road (ShahdadKot)	27° 51' 51.894"	67° 54' 51.624"

5 Monitoring Results

5.1 Ambient Air Monitoring:

Ambient Air Monitoring has been carried out on the following Locations with the duration of 24Hrs on each location.

5.1.1 Location 1: Garhi Yain, Shikarpur

Start Date: 11-07-2023 Start Time: 0945

Completion Date: 12-07-2023 Completion Time: 0845

Duration: 24 Hrs

Table 5-1: Represents Ambient Air Monitoring Results of Location 1

Sr. No.	Measuring Parameters.	Unit	Obtained Concentration	SEQs Limit	WHO AAQSD
1	Nitrogen Oxide (NO)	(µg/m^3)	13.91	40	-
2	Nitrogen Dioxide (NO_2)	(µg/m^3)	26.57	80	25
3	Sulfur Dioxide (SO_2)	(µg/m^3)	8.65	120	40

Sr. No.	Measuring Parameters.	Unit	Obtained Concentration	SEQs Limit	WHO AAQSD
4	Carbon Monoxide (CO)	(mg/m³)	4.94	5	4
5	Suspended Particulate Matter (SPM)	(µg/m³)	150.13	500	-
6	Particulate Matter (PM_{10})	(µg/m³)	123.80	150	45
7	Particulate Matter ($PM_{2.5}$)	(µg/m³)	28.89	75	15
8	Ozone (O_3)	(µg/m³)	18	130	100/8hrs
9	Lead (Pb)	(µg/m³)	ND	1.5	-

5.1.2 Location 2: Ali Sher Gola (Kandhkot)

Start Date: 12-07-2023 Start Time: 1030

Completion Date: 13-07-2023 Completion Time: 0930

Duration: 24 Hrs

Table 5-2: Represents Ambient Air Monitoring Results of Location 2

S. No.	Measuring Parameters.	Unit	Obtained Concentration	SEQs Limit	WHO AAQSD
1	Nitrogen Oxide (NO)	(µg/m³)	13.73	40	-
2	Nitrogen Dioxide (NO_2)	(µg/m³)	23.80	80	25
3	Sulfur Dioxide (SO_2)	(µg/m³)	8.36	120	40
4	Carbon Monoxide (CO)	(mg/m³)	4.23	5	4
5	Suspended Particulate Matter (SPM)	(µg/m³)	145.1	500	-
6	Particulate Matter (PM_{10})	(µg/m³)	118.01	150	45
7	Particulate Matter ($PM_{2.5}$)	(µg/m³)	27.13	75	15
8	Ozone (O_3)	(µg/m³)	16	130	100/8hrs
9	Lead (Pb)	(µg/m³)	ND	1.5	-

5.1.3 Location 3: Mero Khan Rato Daro Road– (GARHI KHERO)

Start Date: 13-07-2023 Start Time: 1100

Completion Date: 14-07-2023 Completion Time: 1000

Duration: 24 Hrs

Table 5-3: Represents Ambient Air Monitoring Results of Location 3

S. No.	Measuring Parameters.	Unit	Obtained Concentration	SEQs Limit	WHO AAQSD
1	Nitrogen Oxide (NO)	(µg/m³)	15.94	40	-
2	Nitrogen Dioxide (NO_2)	(µg/m³)	25.22	80	25
3	Sulfur Dioxide (SO_2)	(µg/m³)	8.95	120	40
4	Carbon Monoxide (CO)	(mg/m³)	4.30	5	4
5	Suspended Particulate Matter (SPM)	(µg/m³)	146.06	500	-
6	Particulate Matter (PM_{10})	(µg/m³)	117.2	150	45

S. No.	Measuring Parameters.	Unit	Obtained Concentration	SEQs Limit	WHO AAQSD
7	Particulate Matter ($PM_{2.5}$)	(µg/m3)	28.84	75	15
8	Ozone (O_3)	(µg/m3)	17	130	100/8hrs
9	Lead (Pb)	(µg/m3)	ND	1.5	-

5.1.4 Location 4: Jacobabad Road– Garhi Khero

Start Date: 14-07-2023 Start Time: 1100

Completion Date: 15-07-2023 Completion Time: 1000

Duration: 24 Hrs

Table 5-4: Represents Ambient Air Monitoring Results of Location 4

S. No.	Measuring Parameters.	Unit	Obtained Concentration	SEQs Limit	WHO AAQSD
1	Nitrogen Oxide (NO)	(µg/m3)	13.31	40	-
2	Nitrogen Dioxide (NO_2)	(µg/m3)	25.35	80	25
3	Sulfur Dioxide (SO_2)	(µg/m3)	9.91	120	40
4	Carbon Monoxide (CO)	(mg/m3)	3.95	5	4
5	Suspended Particulate Matter (SPM)	(µg/m3)	147.86	500	-
6	Particulate Matter (PM_{10})	(µg/m3)	119.96	150	45
7	Particulate Matter ($PM_{2.5}$)	(µg/m3)	27.89	75	15
8	Ozone (O_3)	(µg/m3)	18	130	100/8hrs
9	Lead (Pb)	(µg/m3)	ND	1.5	-

5.1.5 Location 5: Garhi Khairo Road (Shahdad Kot)

Start Date: 15-07-2023 Start Time: 1110

Completion Date: 16-07-2023 Completion Time: 1010

Duration: 24 Hrs

Table 5-5: Represents Ambient Air Monitoring Results of Location 5

S. No.	Measuring Parameters.	Unit	Obtained Concentration	SEQs Limit	WHO AAQSD
1	Nitrogen Oxide (NO)	(µg/m3)	14.33	40	-
2	Nitrogen Dioxide (NO_2)	(µg/m3)	25.48	80	25
3	Sulfur Dioxide (SO_2)	(µg/m3)	8.68	120	40
4	Carbon Monoxide (CO)	(mg/m3)	3.94	5	4
5	Suspended Particulate Matter (SPM)	(µg/m3)	150.75	500	-
6	Particulate Matter (PM_{10})	(µg/m3)	121.86	150	45
7	Particulate Matter ($PM_{2.5}$)	(µg/m3)	28.89	75	15
8	Ozone (O_3)	(µg/m3)	17	130	100/8hrs
9	Lead (Pb)	(µg/m3)	ND	1.5	-

5.1.6 Metrological Data of All Sites

Table 5-6: Represents Ambient Air Metrological Data of 5 Sites

Location	Wind Speed (m/s)	Temp °C	Relative Humidity (%)	Wind Direction
Ali Sher Gola (Kandhkot)	11.67	32	52%	W
Garhi Yain, Shikarpur	3.6	22	56%	NE
Jacobabad Road– Garhi Khero	3.1	30	95%	N
Mero Khan Rato Daro Road– (GARHI KHERO)	6.3	29	33%	S
Garhi Khairo Road (ShahdadKot)	4.9	32	16%	NW

5.2 Noise Monitoring:

Results of Noise monitoring for all locations are summarized in Table 5-7 as given below:

Table 5-7: Noise Monitoring Results

Sr. No.	Monitoring Location	Time	Category	Start Date	EndDate	Monitoring Value	SEQs
1	Garhi Yain, Shikarpur	Day	Res	11-07-2023	12-07-2023	48.13	70
		Night				47.05	60
2	Ali Sher Gola (Kandhkot)	Day	Res	12-07-2023	13-07-2023	47.35	65
		Night				44.95	50
3	Mero Khan Rato Daro Road– (GARHIKHERO)	Day	Res	13-07-2023	14-07-2023	47.7	65
		Night				43.14	50
4	Jacobabad Road– Garhi Khero	Day	Res	14-07-2023	15-07-2023	44.51	65
		Night				42.95	50
5	Garhi Khairo Road (ShahdadKot)	Day	Res	15-07-2023	16-07-2023	54.86	70
		Night				48.75	60

6 Interpretation and Compliance of Monitoring Results

6.1 Ambient Air Monitoring:

6.1.1 Nitrogen Oxide:

6.1.1.1 Sources and Nature

NO is produced from natural sources, motor vehicles and other fuel combustion processes. NO is colorless and odorless and is oxidized in the atmosphere to form NO2. These gases form when fuel is burned at high temperatures, and come principally from motor vehicle exhaust andstationary sources such as electric utilities and industrial boilers. It also plays a major role in the atmospheric reactions that produce ground-level ozone (or smog).

6.1.1.2 Monitoring Results of NO

Values of NO are expressed in µg/Nm³ and are found to be within the SEQs limits at all locations.

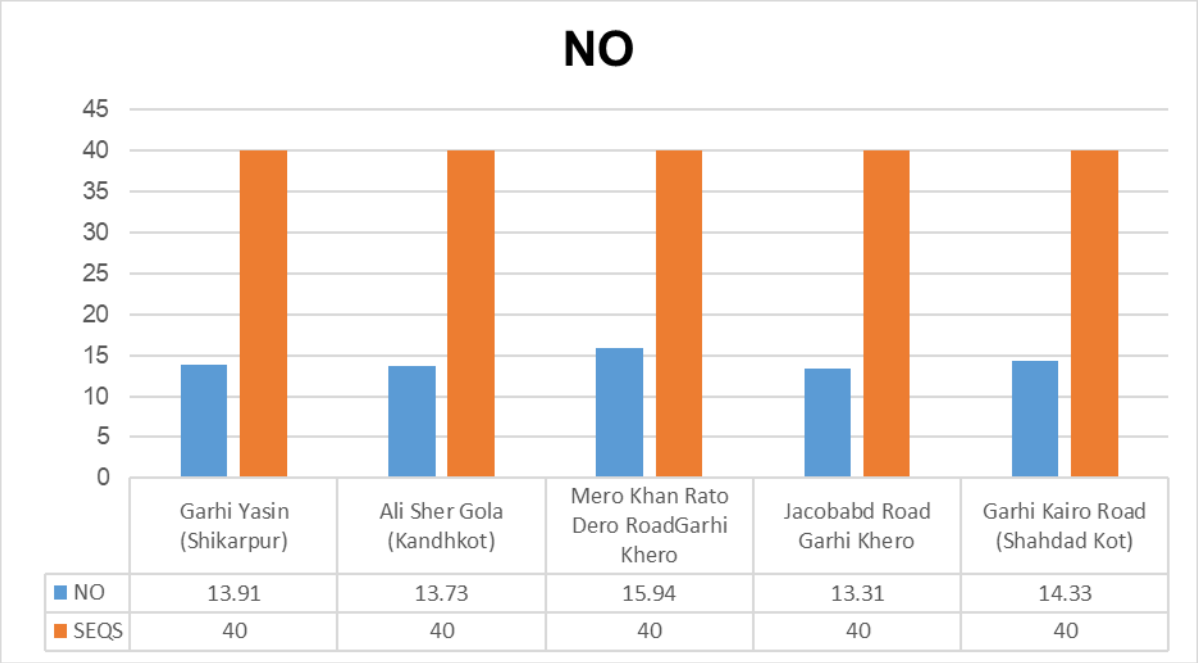


Figure 6-1: Graphical Representation of NO Average Value for 05 Locations

6.1.2 Sulphur Dioxide (Sox):

6.1.2.1 Sources and Nature

Sulphur dioxide belongs to the family of sulphur oxide gases (SOx). These gases are formed when fuel containing sulphur (mainly coal and oil) is burned, and during metal smelting and other industrial processes.

6.1.2.2 Monitoring Results of Sox

The results of Sox are also expressed in µg/Nm³ and are found to be within the SEQs limit at all locations.

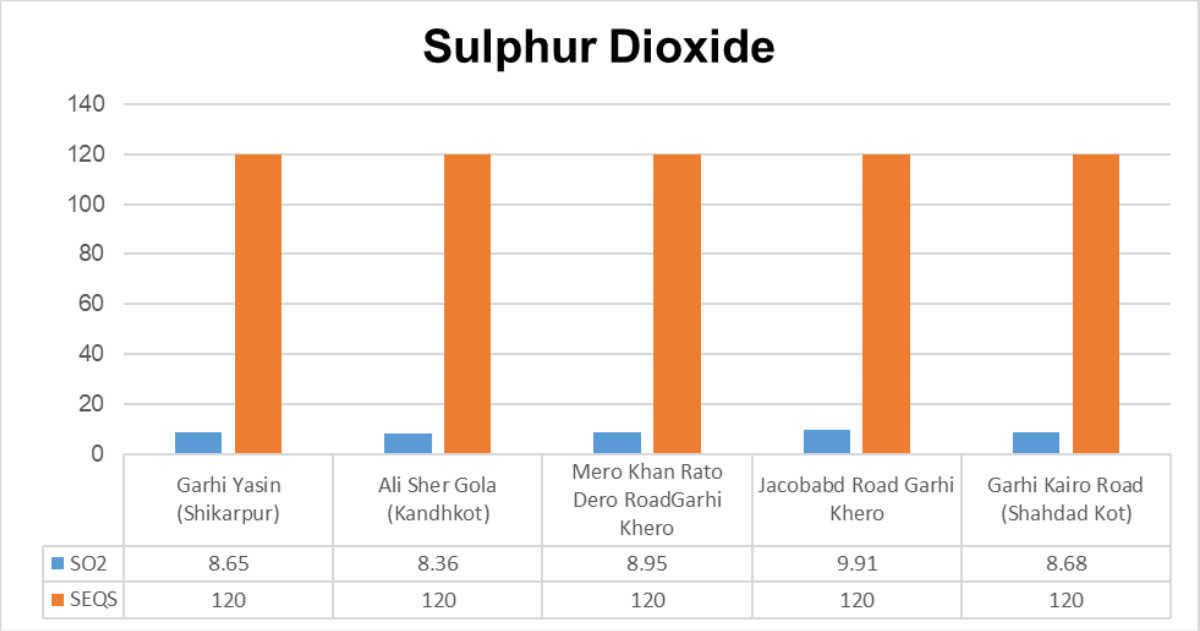


Figure 6-2: Graphical Representation of Sox Average Value for 05 Locations

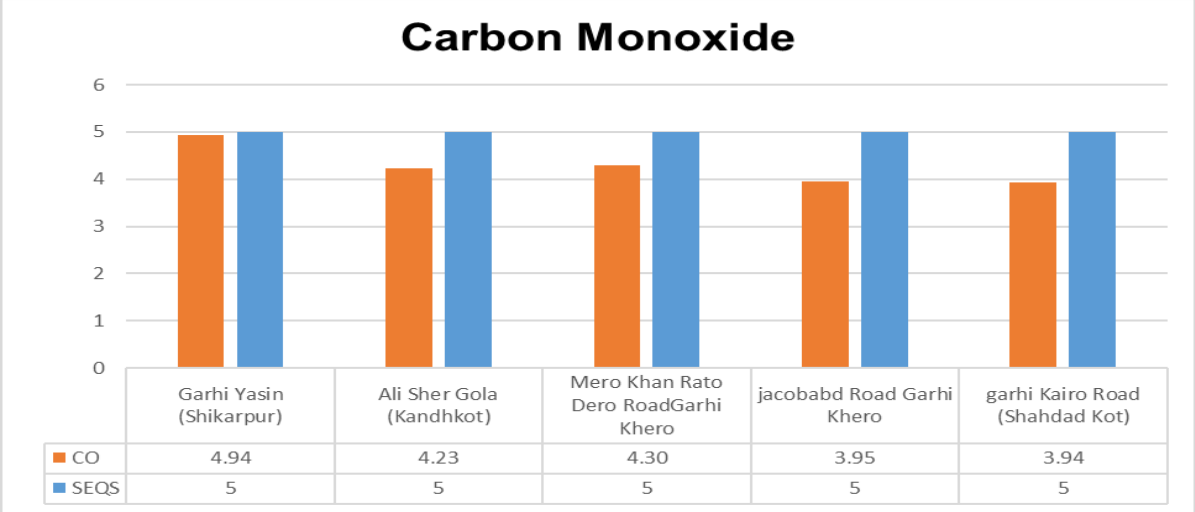
6.1.3 Carbon Monoxide (Co):

6.1.3.1 Sources and Nature

Carbon monoxide is a colorless odorless poisonous gas formed when carbon in fuels is not burned completely. It is a by product of motor vehicle exhaust, which contributes more than two- thirds of all CO emissions nationwide. In cities, automobile exhaust can cause as much as 95 percent of all CO emissions. These emissions can result in high concentrations of CO, particularly in local areas with heavy traffic congestion. Other sources of CO emissions include industrial processes and fuel combustion in sources such as boilers and incinerators. Despite an overall downward trend in concentrations and emissions of CO, some metropolitan areas still experience high levels of CO.

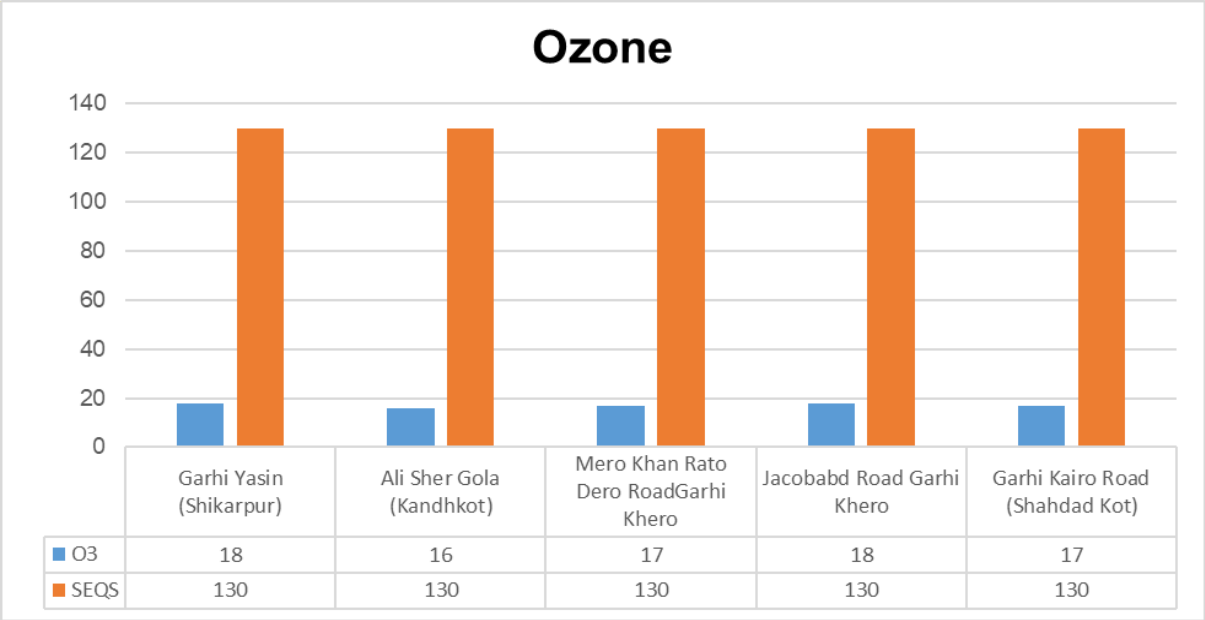
6.1.3.2 Monitoring Results of CO

The values of CO are expressed in mg/Nm³ and found to be within the SEQs limit at all five (05) locations. The Values of CO were found to be within the SEQs at all locations.



	Garhi Yasin (Shikarpur)	Ali Sher Gola (Kandhkot)	Mero Khan Rato Dero RoadGarhi Khero	jacobabd Road Garhi Khero	garhi Kairo Road (Shahdad Kot)
CO	4.94	4.23	4.30	3.95	3.94
SEQS	5	5	5	5	5

Ozone (O3):



	Garhi Yasin (Shikarpur)	Ali Sher Gola (Kandhkot)	Mero Khan Rato Dero RoadGarhi Khero	Jacobabd Road Garhi Khero	Garhi Kairo Road (Shahdad Kot)
O3	18	16	17	18	17
SEQS	130	130	130	130	130

Sources and Nature

Ground-level ozone (the primary constituent of smog) is the most complex, difficult to control, and pervasive of the six principal pollutants. Unlike other pollutants, ozone is not emitteddirectly into the air by specific sources. Ozone is created by sunlight acting on nitrogren oxides (NOx) and volatile organic compound (VOC) emissions in the air. Some of the more common sources include gasoline vapors, chemical solvents, combustion products of various fuels, and consumer products. They can originate from large industrial facilities, gas stations, and small businesses such as bakeries and dry cleaners. Often these "precursor" gases are emitted in one area, but the actual chemical reactions, stimulated by sunlight and temperature, take place in another. Combined emissions from motor vehicles and stationary sources can be carried hundreds of miles from their origins, forming high ozone concentrations over very large regions.

6.1.3.3 Monitoring Results of Ozone

The values of Ozone are also expressed in µg/Nm³ and are found to be within the SEQs limit at all locations.

6.1.4 Particulate Matter (PM_{10}, $PM_{2.5}$ and TSP):

Particulate matter is the term for solid or liquid particles found in the air. Some particles are largeor dark enough to be seen as soot or smoke. Others are so small they can be detected only withan electron microscope. Because particles originate from a variety of mobile and stationary sources (diesel trucks, wood stoves, power plants, etc.), their chemical and physicalcompositions vary widely. Particulate matter (PM) is a complex mixture consisting of varying combinations of dry solid fragments, solid cores with liquid coatings and small droplets of liquid.These tiny particles vary greatly in shape, size and chemical composition, and can be made up ofdifferent materials such as metals, soot, soil and dust. PM may also contain sulfate particles. PM may be divided into many size fractions, measured in microns (a micron is one-millionth of a meter). Pak EPA regulates three classes of particles - particles up to 10 microns (PM_{10}),particles up to 2.5 microns in size ($PM_{2.5}$) and Total Suspended Particulate as TSP. $PM_{2.5}$ particles are a subset of PM_{10} whereas PM_{10} particles are subset of TSP.

6.1.4.1 Monitoring Results of (PM_{10}, $PM_{2.5}$, &TSP)

The Monitoring results of PM_{10}, $PM_{2.5}$ and TSP are expressed in µg/Nm³. The values of TSP. PM_{10} and $PM_{2.5}$ were found to be complying with SEQs limits at all locations.

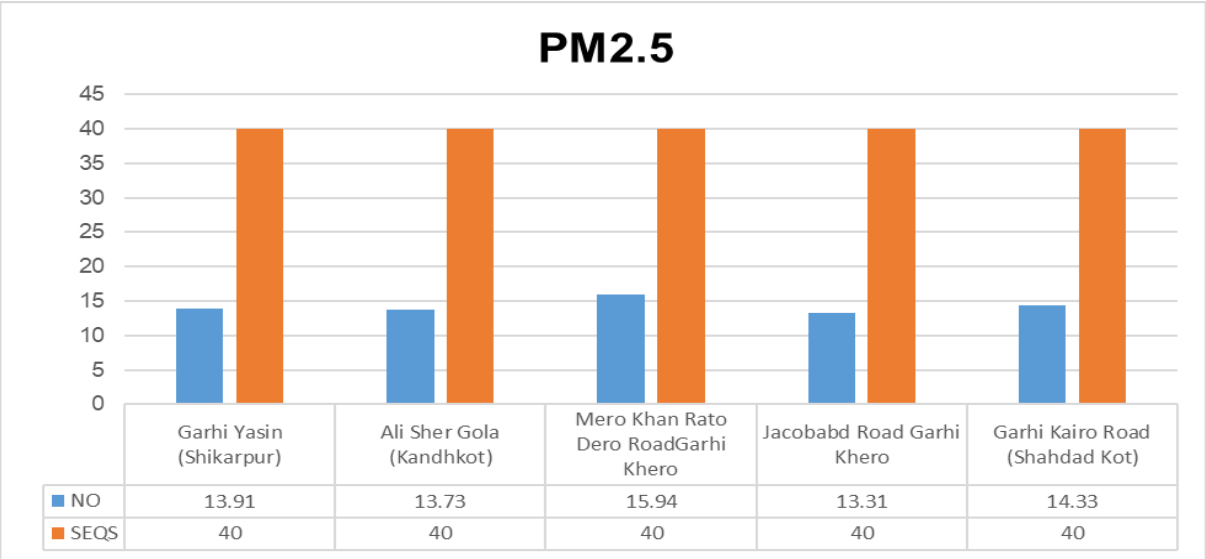


Figure 6-3: Graphical Representation of $PM_{2.5}$ Average Value for 05 Locations

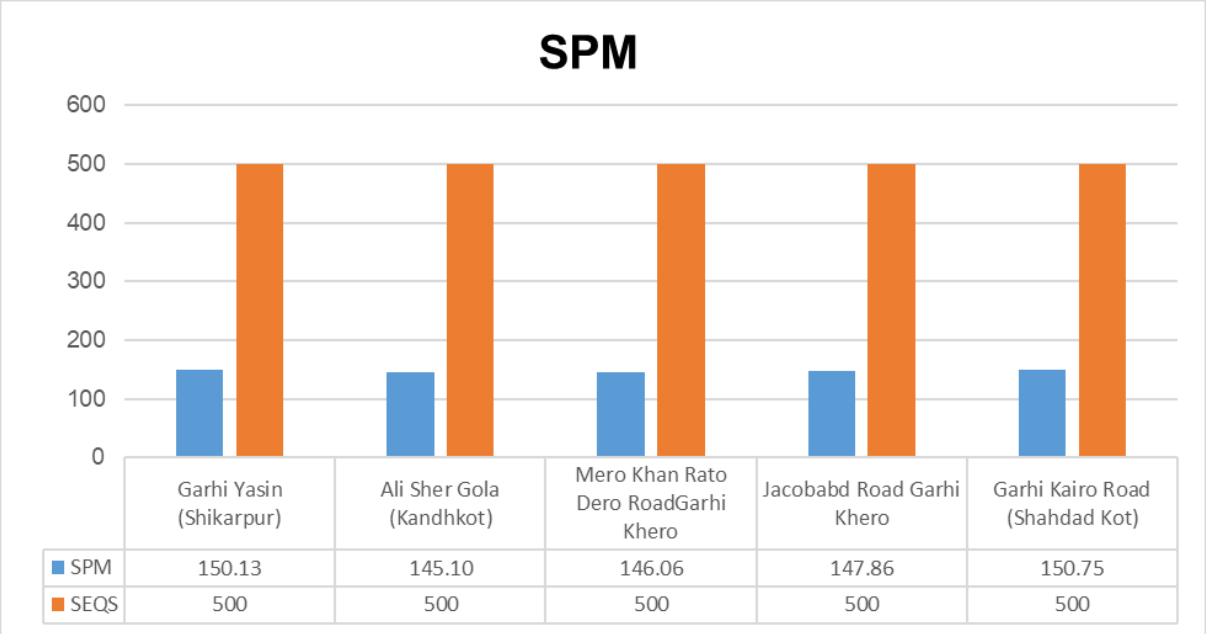


Figure 6-4: Graphical Representation of SPM Average Value for 05 Locations

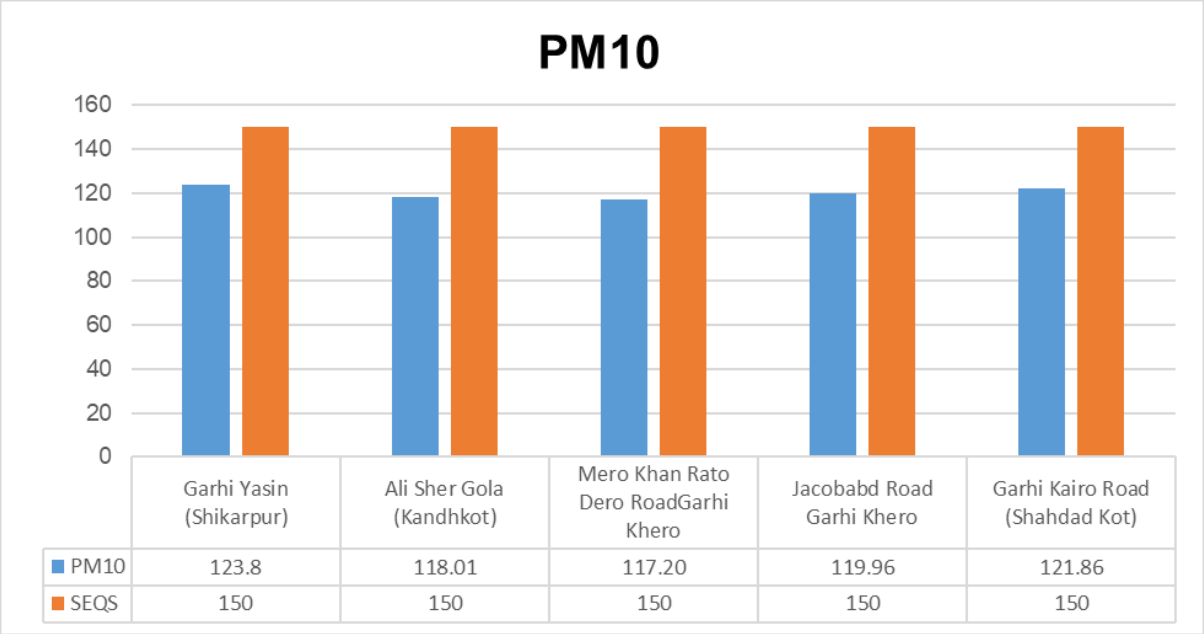


Figure 6-5: Graphical Representation of PM10 Average Value for 05 Locations

6.1.5 Lead (Pb):

Lead (Pb) is a metal found naturally in the environment as well as in manufactured products.The major sources of lead emissions have historically been from fuels in on-road motor vehicles (such as cars and trucks) and industrial sources. The highest levels of lead in air are usually found near lead smelters. The major sources of lead emissions to the air today are ore and metals processing and piston-engine aircraft operating on leaded aviation gasoline.

6.1.5.1 Monitoring Results of Lead

The values of Lead are also expressed in µg/Nm³ were found to be Not detected at all locations.

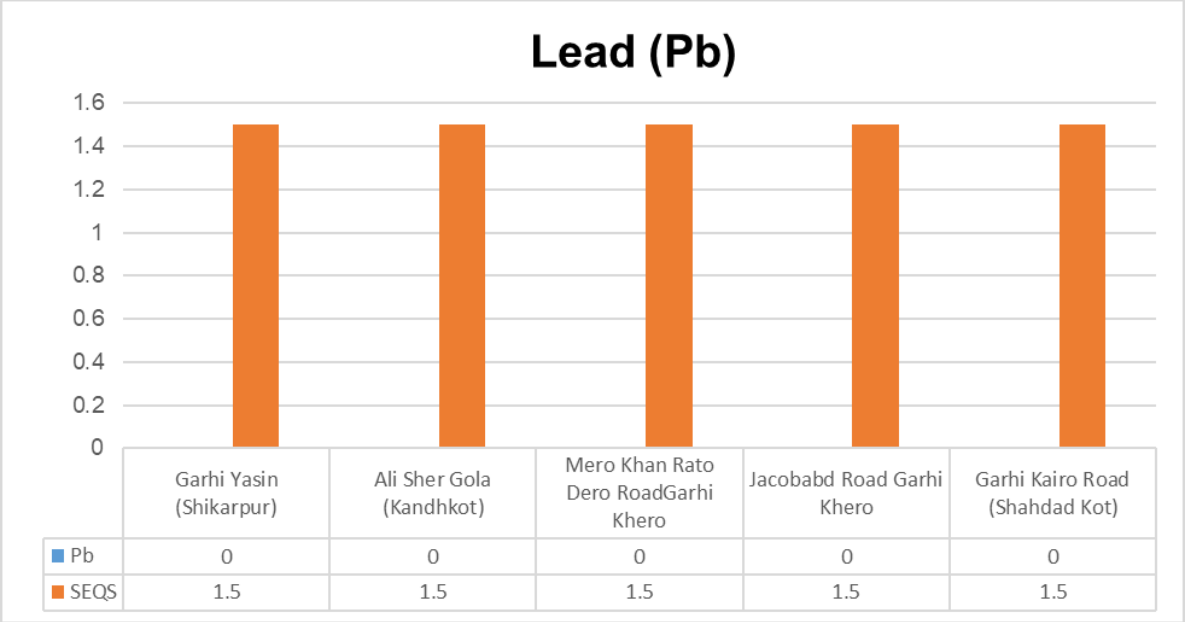


Figure 6-6: Graphical Representation of Lead Average Value for 05 Locations

6.1.6 Noise Monitoring:

The readings of noise are expressed in dB(a). Locations are categories as Residential whereas the values are reported in Day and Night time separately.

From the above readings it is clearly observed that all the Noise values of Day and Night timeare complying with SEQs limit

7 CONCLUSION

- This study report indicates that the average levels of all Ambient Air Pollutants were found to be within the SEQs limits define by the local environmental regulatory authority at all locations except the average value of CO at location 5 i.e. Garhi kairo road (Shahdad Kot) (see Table 5-5 for reference).
- The average value of Noise for Day and Night Time at each location is found to be within the prescribed limit of SEQs.

8 AIR QUALITY MONITORING REPORTS

AMBIENT AIR MONITORING REPORT

Report No	NESC/MMP/AL-AA/JULY-23	**Report Date**	18-07-2023
Client Name	M/S MM Pakistan (Pvt) Ltd	**Job Start Date**	13-07-2023
Client Address		**Job End Date**	14-07-2023
Monitoring Location	Mero Khan Rato Dero Road (GARHI KHERO)	**Sampling Duration**	24 Hrs.
Coordinates	N.68°19110.617" E 27°58.8.053"		

SEQs Limits		**80**	**40**	**120**	**05**	**500**	**75**	**150**	**130**	**1.5**
Pollutants		**NO_2**	**NO**	**SO_2**	**CO**	**SPM**	**$PM_{2.5}$**	**PM_{10}**	**O_3**	**Pb**
Units		**µg/m³**	**µg/m³**	**µg/m³**	**mg/m³**	**µg/m³**	**µg/m³**	**µg/m³**	**µg/m³**	**µg/m³**
Date	Time	Measured Values								
13-July-23	11:00am	26.09	16.91	8.75	2.74	143.78	32.61	111.17	17	ND
13-July-23	12:00pm	27.28	17.74	11.15	2.27	145.09	27.17	117.92		
13-July-23	13:00pm	25.11	17.90	10.16	5.71	138.44	27.27	111.17		
13-July-23	14:00pm	28.30	18.68	10.52	2.13	162.34	33.07	129.27		
13-July-23	15:00pm	27.24	17.69	10.64	3.11	158.85	33.32	125.53		
13-July-23	16:00pm	26.32	16.84	8.92	5.38	152.58	26.16	126.42		
13-July-23	17:00pm	27.13	15.74	10.14	7.16	149.20	27.02	122.18		
13-July-23	18:00pm	24.24	17.26	11.38	3.30	140.12	28.55	111.57		
13-July-23	19:00pm	24.77	14.94	7.03	6.58	150.40	33.16	117.24		
13-July-23	20:00pm	22.86	15.93	10.23	1.43	140.43	27.91	112.52		
13-July-23	21:00pm	21.58	14.86	5.61	8.01	138.41	25.24	113.17		
13-July-23	22:00pm	27.22	18.78	7.45	6.99	140.77	28.67	111.77		
13-July-23	23:00pm	28.56	14.49	8.05	6.88	147.84	33.09	114.84		
14-July-23	00:00am	21.27	16.22	8.16	4.21	139.03	26.01	113.02		
14-July-23	01:00am	22.92	17.81	6.25	2.42	137.71	26.91	110.80		
14-July-23	02:00am	29.24	13.84	9.00	4.83	155.38	26.61	128.77		
14-July-23	03:00am	29.41	17.39	8.44	2.03	146.78	28.27	118.51		
14-July-23	04:00am	22.84	16.08	5.83	0.51	145.25	30.86	114.39		
14-July-23	05:00am	27.02	12.27	10.51	2.39	144.33	31.91	112.42		
14-July-23	06:00am	26.34	15.82	8.02	4.23	145.38	27.19	118.19		
14-July-23	07:00am	22.51	13.33	13.10	4.81	150.70	33.31	117.39		
14-July-23	08:00am	20.68	15.84	10.76	6.51	145.64	26.52	119.12		
14-July-23	09:00am	22.11	12.62	7.92	3.77	142.72	24.44	118.28		
14-July-23	10:00am	24.36	13.78	6.98	5.86	144.29	27.02	117.27		
Average		25.22	15.94	8.95	4.30	146.06	28.84	117.20	17	ND

Note:

The results are based on SEPA standard SEQs 2016
The instrument used was duly calibrated.
The measurements were carried out on client's request.
This report is not valid for court evidence / judicial knowledge.

ND= Not Detected
O/L= Out of Limit
W/L= Within Limits

Lab. Inch

AMBIENT AIR MONITORING REPORT

Report No	NESC/MMP/AL-AA/JULY-23	**Report Date**	18-07-2023
Client Name	M/S MM Pakistan (Pvt) Ltd	**Job Start Date**	14-07-2023
Client Address		**Job End Date**	15-07-2023
Monitoring Location	Jacobabad Road Garhi Khero	**Sampling Duration**	24 Hrs.
Coordinates	N.28°03"07.6212" E 67°59"24.6588"		

SEQs Limits		**80**	**40**	**120**	**05**	**500**	**75**	**150**	**130**	**1.5**
Pollutants		**NO_2**	**NO**	**SO_2**	**CO**	**SPM**	**$PM_{2.5}$**	**PM_{10}**	**O_3**	**Pb**
Units		**µg/m³**	**µg/m³**	**µg/m³**	**mg/m³**	**µg/m³**	**µg/m³**	**µg/m³**	**µg/m³**	**µg/m³**
Date	Time	Measured Values								
14-July-23	11:00am	23.41	11.35	11.99	4.86	148.85	27.86	120.99		
14-July-23	12:00pm	29.43	11.71	9.55	0.42	148.10	27.02	121.08		
14-July-23	13:00pm	29.18	16.45	10.55	4.84	153.86	31.63	122.23		
14-July-23	14:00pm	28.84	17.58	8.86	2.61	155.82	31.18	124.64		
14-July-23	15:00pm	25.56	12.67	11.79	5.52	147.78	26.42	121.36		
14-July-23	16:00pm	22.98	14.36	9.70	3.74	149.80	27.38	122.42		
14-July-23	17:00pm	27.18	16.24	13.11	1.96	145.57	24.98	120.59		
14-July-23	18:00pm	24.72	13.76	10.24	4.48	144.39	25.23	119.16		
14-July-23	19:00pm	26.22	11.80	8.88	2.12	145.77	27.19	118.38		
14-July-23	20:00pm	22.64	16.55	11.12	5.23	145.43	28.20	117.23		
14-July-23	21:00pm	27.36	14.98	9.06	3.38	147.01	27.99	119.02		
14-July-23	22:00pm	24.96	15.17	10.52	4.55	139.42	28.47	110.95		
14-July-23	23:00pm	26.72	15.86	6.29	1.18	150.51	29.50	121.01	18	ND
15-July-23	00:00am	23.12	11.27	8.83	2.96	152.80	27.88	124.92		
15-July-23	01:00am	26.31	14.06	5.72	1.06	142.73	26.93	115.80		
15-July-23	02:00am	22.08	12.14	9.90	3.38	146.16	28.44	117.72		
15-July-23	03:00am	24.18	11.31	7.36	2.12	139.24	25.64	113.60		
15-July-23	04:00am	23.98	10.19	9.18	4.53	136.66	23.74	112.92		
15-July-23	05:00am	24.12	13.72	10.89	5.73	141.81	26.95	114.86		
15-July-23	06:00am	25.36	14.98	11.61	6.18	144.92	28.18	116.74		
15-July-23	07:00am	26.42	10.18	13.92	3.71	151.12	25.82	125.30		
15-July-23	08:00am	23.05	11.36	9.24	8.03	155.74	28.65	127.09		
15-July-23	09:00am	22.60	10.02	8.64	5.19	156.17	31.93	124.24		
15-July-23	10:00am	28.17	11.82	11.02	7.09	159.19	32.18	127.01		
Average		25.35	13.31	9.91	3.95	147.86	27.89	119.96	18	ND

Note:

The results are based on SEPA standard SEQs 2016
The instrument used was duly calibrated.
The measurements were carried out on client's request.
This report is not valid for court evidence / judicial knowledge.

ND= Not Detected
O/L= Out of Limit
W/L= Within Limits

Lab. Inch

AMBIENT AIR MONITORING REPORT

Report No	NESC/MMP/AL-AA/JULY-23	**Report Date**	18-07-2023
Client Name	M/S MM PAKISTAN (Pvt) Ltd	**Job Start Date**	11-07-2023
Client Address		**Job End Date**	12-07-2023
Monitoring Location	Garhi Yasin, Shikarpur	**Sampling Duration**	24 Hrs.
Coordinates	N.27°53"53.88" E 68°31"32.9628"		

SEQs Limits		**80**	**40**	**120**	**05**	**500**	**75**	**150**	**130**	**1.5**
Pollutants		**NO_2**	**NO**	**SO_2**	**CO**	**SPM**	**$PM_{2.5}$**	**PM_{10}**	**O_3**	**Pb**
Units		**µg/m³**	**µg/m³**	**µg/m³**	**mg/m³**	**µg/m³**	**µg/m³**	**µg/m³**	**µg/m³**	**µg/m³**
Date	Time	Measured Values								
11-July-23	09:45am	26.96	17.43	10.94	5.62	160.23	30.37	129.86	18	ND
11-July-23	10:45am	25.97	18.46	12.02	5.34	148.30	26.00	122.30		
11-July-23	11:45am	23.54	13.69	8.24	9.04	160.73	32.35	128.38		
11-July-23	12:45pm	29.52	13.29	6.78	8.64	151.15	28.88	122.27		
11-July-23	13:45pm	28.65	14.86	11.23	3.95	150.37	31.14	119.23		
11-July-23	14:45pm	28.35	12.39	7.30	6.99	154.09	31.32	122.77		
11-July-23	15:45pm	22.79	14.70	8.16	6.36	142.67	30.12	112.55		
11-July-23	16:45pm	24.05	13.91	13.35	6.48	155.06	27.14	127.92		
11-July-23	17:45pm	24.53	15.21	10.56	3.70	155.84	31.46	124.38		
11-July-23	18:45pm	30.42	16.16	7.25	4.12	140.00	27.02	112.98		
11-July-23	19:45pm	25.10	14.61	8.71	5.15	140.08	26.84	113.24		
11-July-23	20:45pm	29.10	11.01	6.93	2.89	158.23	28.28	129.95		
11-July-23	21:45pm	22.92	12.48	7.14	6.62	140.78	26.48	114.30		
11-July-23	22:45pm	28.62	11.85	8.84	3.24	150.65	26.80	123.85		
11-July-23	23:45pm	28.96	12.19	5.88	1.36	150.44	27.08	123.36		
12-July-23	00:45am	26.77	14.24	7.16	8.99	157.91	28.32	129.59		
12-July-23	01:45am	29.65	17.01	5.85	4.38	158.87	32.44	126.43		
12-July-23	02:45am	25.77	13.40	7.20	3.57	138.26	26.21	112.05		
12-July-23	03:45am	24.02	14.40	8.17	1.49	155.40	27.7	127.70		
12-July-23	04:45am	25.73	13.82	8.58	6.36	148.45	29.62	118.83		
12-July-23	05:45am	25.12	11.90	11.03	0.25	148.53	27.81	120.72		
12-July-23	06:45am	22.69	11.25	12.07	3.22	149.92	30.51	119.41		
12-July-23	07:45am	30.38	13.10	7.32	6.49	143.00	30.61	112.39		
12-July-23	08:45am	28.16	12.44	6.82	4.38	144.16	27.54	116.62		
Average		26.57	13.91	8.65	4.94	150.13	28.89	123.80	18	ND

Note:

The results are based on SEPA standard SEQs 2016
The instrument used was duly calibrated.
The measurements were carried out on client's request.
This report is not valid for court evidence / judicial knowledge.

ND= Not Detected
O/L= Out of Limit
W/L= Within Limits

Lab. Inch

AMBIENT AIR MONITORING REPORT

Report No	NESC/MMP/AL-AA/JULY-23	**Report Date**	18-07-2023
Client Name	M/S MM PAKISTAN (Pvt) Ltd	**Job Start Date**	15-07-2023
Client Address		**Job End Date**	16-07-2023
Monitoring Location	Garhi Kairo Road (Shahdad Kot)	**Sampling Duration**	24 Hrs.
Coordinates	N.27°51"51.894" E 67°54"51.624"		

SEQs Limits		**80**	**40**	**120**	**05**	**500**	**75**	**150**	**130**	**1.5**
Pollutants		**NO_2**	**NO**	**SO_2**	**CO**	**SPM**	**$PM_{2.5}$**	**PM_{10}**	**O_3**	**Pb**
Units		**µg/m³**	**µg/m³**	**µg/m³**	**mg/m³**	**µg/m³**	**µg/m³**	**µg/m³**	**µg/m³**	**µg/m³**
Date	Time	Measured Values								
15-July-23	11:10am	26.76	17.34	9.46	8.68	158.79	28.70	130.09		
15-July-23	12:10pm	24.40	16.82	7.83	6.70	156.10	26.92	129.18		
15-July-23	13:10pm	23.92	12.49	8.93	5.08	155.85	30.99	124.86		
15-July-23	14:10pm	24.84	15.12	6.38	3.92	149.95	27.60	122.35		
15-July-23	15:10pm	24.51	16.83	10.12	6.55	153.53	29.69	123.84		
15-July-23	16:10pm	23.87	11.66	7.53	4.84	150.85	31.16	119.69		
15-July-23	17:10pm	26.93	16.28	11.18	5.19	148.56	33.24	115.32		
15-July-23	18:10pm	29.90	16.69	9.17	8.53	146.49	27.81	118.68		
15-July-23	19:10pm	29.37	12.28	8.02	5.28	161.05	32.71	128.34		
15-July-23	20:10pm	28.21	14.54	6.49	4.42	139.91	27.72	112.19		
15-July-23	21:10pm	23.94	12.63	5.6	7.84	142.83	29.12	113.74		
15-July-23	22:10pm	24.18	17.33	8.16	4.66	160.00	33.11	126.89	17	ND
15-July-23	23:10pm	23.05	12.08	10.54	7.43	152.74	26.60	126.14		
16-July-23	00:10am	28.30	17.83	9.24	5.86	143.51	25.59	117.92		
16-July-23	01:10am	25.38	12.17	9.53	9.34	149.98	26.81	123.17		
16-July-23	02:10am	23.46	13.27	5.07	3.42	154.49	32.03	122.46		
16-July-23	03:10am	29.20	11.96	12.09	1.27	158.04	31.74	126.30		
16-July-23	04:10am	29.65	12.97	6.21	4.77	144.23	27.12	117.11		
16-July-23	05:10am	29.04	11.56	11.44	3.16	147.36	29.34	118.02		
16-July-23	06:10am	22.79	12.15	7.69	1.34	152.15	26.11	126.04		
16-July-23	07:10am	22.66	15.65	6.41	5.42	147.74	26.83	120.91		
16-July-23	08:10am	23.21	13.82	7.91	2.12	158.01	29.31	128.70		
16-July-23	09:10am	21.28	16.03	12.42	0.98	141.73	28.59	113.14		
16-July-23	10:10am	22.70	14.63	10.99	4.46	144.20	24.52	119.68		
Average		25.48	14.33	8.68	5.05	150.75	28.89	121.86	17	ND

Note:

The results are based on SEPA standard SEQs 2016
The instrument used was duly calibrated.
The measurements were carried out on client's request.
This report is not valid for court evidence / judicial knowledge.

ND= Not Detected
O/L= Out of Limit
W/L= Within Limits

Lab. Inch

AMBIENT AIR MONITORING REPORT

Report No	NESC/MMP/AL-AA/JULY-23	**Report Date**	18-07-2023
Client Name	M/S MM PAKISTAN (Pvt) Ltd	**Job Start Date**	12-07-2023
Client Address		**Job End Date**	13-07-2023
Monitoring Location	Ali Sher Gola (Kandhkot)	**Sampling Duration**	24 Hrs.
Coordinates	N.28°15"2403252" E 69°12"46.566"		

SEQs Limits		**80**	**40**	**120**	**05**	**500**	**75**	**150**	**130**	**1.5**
Pollutants		**NO_2**	**NO**	**SO_2**	**CO**	**SPM**	**$PM_{2.5}$**	**PM_{10}**	**O_3**	**Pb**
Units		**µg/m³**	**µg/m³**	**µg/m³**	**mg/m³**	**µg/m³**	**µg/m³**	**µg/m³**	**µg/m³**	**µg/m³**
Date	Time	Measured Values								
12-July-23	10:30am	24.20	11.77	6.18	2.62	154.21	32.03	122.18	16	ND
12-July-23	11:30am	29.72	16.31	7.36	6.39	139.53	28.19	111.34		
12-July-23	12:30pm	24.74	14.30	13.14	1.26	137.77	26.25	111.52		
12-July-23	13:30pm	25.33	12.08	8.03	6.13	153.84	25.45	128.39		
12-July-23	14:30pm	26.22	15.92	13.12	3.85	144.46	28.53	115.93		
12-July-23	15:30pm	22.12	13.73	11.84	5.43	138.50	23.94	114.56		
12-July-23	16:30pm	24.51	11.88	9.80	7.62	131.30	21.12	110.18		
12-July-23	17:30pm	24.21	17.27	5.89	2.96	157.11	30.29	126.82		
12-July-23	18:30pm	23.16	14.20	12.64	0.44	151.24	25.59	125.65		
12-July-23	19:30pm	28.62	11.32	9.10	5.23	142.84	32.17	110.67		
12-July-23	20:30pm	23.86	13.60	8.81	6.60	147.02	31.60	115.42		
12-July-23	21:30pm	25.48	12.06	11.60	6.05	150.72	31.07	119.65		
12-July-23	22:30pm	27.05	17.60	12.66	0.94	142.69	25.74	116.95		
12-July-23	23:30pm	24.66	14.38	6.92	4.18	136.56	22.82	113.74		
13-July-23	00:30am	21.02	11.86	9.24	2.32	133.27	20.44	112.83		
12-July-23	01:30am	21.14	10.12	6.64	7.90	135.98	21.34	114.64		
13-July-23	02:30am	22.14	12.42	5.06	1.12	147.57	27.14	120.43		
13-July-23	03:30am	21.12	11.41	5.92	4.39	149.15	28.03	121.12		
13-July-23	04:30am	19.32	13.26	6.84	3.42	145.14	26.22	118.92		
13-July-23	05:30am	23.20	17.89	7.56	2.84	154.78	32.61	122.17		
13-July-23	06:30am	24.19	15.73	6.30	6.46	147.16	26.87	120.29		
13-July-23	07:30am	23.81	17.90	5.96	4.40	150.57	29.02	121.55		
13-July-23	08:30am	21.52	10.89	4.48	1.92	146.82	27.64	119.18		
13-July-23	09:30am	19.92	11.64	5.56	7.08	144.21	24.43	119.78		
Average		23.80	13.73	8.36	4.23	145.10	27.13	118.01	16	ND

Note:

The results are based on SEPA standard SEQs 2016
The instrument used was duly calibrated.
The measurements were carried out on client's request.
This report is not valid for court evidence / judicial knowledge.

ND= Not Detected
O/L= Out of Limit
W/L= Within Limits

Lab. Inch

NOISE MONITORING REPORT

Report No	NESC/MMP/AL-AA/JUlY-23	**Report Date**	18-07-2023
Client Name	M/S MM PAKISTAN LTD.	**Job Start Date**	13-07-2023
Client Address		**Job End Date**	14-07-2023
Monitoring Location	Mero Khan Rato Road (Garhi Khero)	**Sampling Duration**	24 Hrs.
Coordinates	N.68°19110.617" E 27°58.8.053"		

S.NO	Parameter	Time	Unit	Method	Measured Values	SEQs Limits	Remarks
01	Noise	11:00am	dB(A)	ASTM-E1686-16	48.1	75	W/L
02		12:00pm			45.2		W/L
03		13:00pm			47.8		W/L
04		14:00pm			46.9		W/L
05		15:00pm			48.2		W/L
06		16:00pm			49.8		W/L
07		17:00pm			50.1		W/L
08		18:00pm			48.6		W/L
09		19:00pm			45.8		W/L
10		20:00pm			46.6		W/L
11		21:00pm			45.1		W/L
12		22:00pm			44.9	65	W/L
13		23:00pm			42.8		W/L
14		00:00am			43.8		W/L
15		01:00am			43.1		W/L
16		02:00am			42.4		W/L
17		03:00am			43.1		W/L
18		04:00am			42.7		W/L
19		05:00am			42.3		W/L
20		06:00am			44.6	75	W/L
21		07:00am			44.7		W/L
22		08:00am			43.8		W/L
23		09:00am			42.6		W/L
24		10:00am			43.1		W/L

Note:

The results are based on SEPA standard SEQs 2016
The instrument used was duly calibrated.
The measurements were carried out on client's request.
This report is not valid for court evidence / judicial knowledge.
The measurement of results based on the time of monitoring.
Day time hours: 6 am to 10 pm; Night time hours: 10 pm to 6 am.

ND= Not Detected
O/L= Out of Limit
W/L= Within Limits

Report Prepared by Report Verified

NOISE MONITORING REPORT

Report No	NESC/MMP/AL-AA/JUlY-23	**Report Date**	18-07-2023
Client Name	M/S MM PAKISTAN LTD.	**Job Start Date**	14-07-2023
Client Address		**Job End Date**	15-07-2023
Monitoring Location	Jacobabad Road Garhi Khairo	**Sampling Duration**	24 Hrs.
Coordinates	N.28°03"07.6212" E 67°59"24.6588"		

S.NO	Parameter	Time	Unit	Method	Measured Values	SEQs Limits	Remarks
01	Noise	11:00am	dB(A)	ASTM-E1686-16	53.7	75	W/L
02		12:00pm			44.3		W/L
03		13:00pm			41.9		W/L
04		14:00pm			43.8		W/L
05		15:00pm			42.3		W/L
06		16:00pm			42.9		W/L
07		17:00pm			43.6		W/L
08		18:00pm			44.2		W/L
09		19:00pm			47.1		W/L
10		20:00pm			43.6		W/L
11		21:00pm			42.2		W/L
12		22:00pm			41.8	65	W/L
13		23:00pm			42.2		W/L
14		00:00am			42.5		W/L
15		01:00am			43.2		W/L
16		02:00am			42.8		W/L
17		03:00am			43.8		W/L
18		04:00am			43.2		W/L
19		05:00am			44.1		W/L
20		06:00am			44.9	75	W/L
21		07:00am			42.6		W/L
22		08:00am			43.8		W/L
23		09:00am			48.5		W/L
24		10:00am			49.3		W/L

Note:

The results are based on SEPA standard SEQs 2016
The instrument used was duly calibrated.
The measurements were carried out on client's request.
This report is not valid for court evidence / judicial knowledge.
The measurement of results based on the time of monitoring.
Day time hours: 6 am to 10 pm; Night time hours: 10 pm to 6 am.

ND= Not Detected
O/L= Out of Limit
W/L= Within Limits

Report Prepared by Report Verified

NOISE MONITORING REPORT

Report No	NESC/MMP/AL-AA/JUlY-23	**Report Date**	18-07-2023
Client Name	M/S MM PAKISTAN LTD.	**Job Start Date**	15-07-2023
Client Address		**Job End Date**	16-07-2023
Monitoring Location	Garhi Khairo Road (Shahdad Kot)	**Sampling Duration**	24 Hrs.
Coordinates	N.27°51"51.894" E 67°54"51.624"		

S.NO	Parameter	Time	Unit	Method	Measured Values	SEQs Limits	Remarks
01	Noise	11:10am	dB(A)	ASTM-E1686-16	57.3	75	W/L
02		12:10pm			58.1		W/L
03		13:10pm			52.4		W/L
04		14:10pm			51.6		W/L
05		15:10pm			54.3		W/L
06		16:10pm			55.1		W/L
07		17:10pm			56.4		W/L
08		18:10pm			55.8		W/L
09		19:10pm			53.2		W/L
10		20:10pm			54.3		W/L
11		21:10pm			55.0		W/L
12		22:10pm			55.2	65	W/L
13		23:10pm			52.6		W/L
14		00:10am			50.3		W/L
15		01:10am			49.4		W/L
16		02:10am			49.1		W/L
17		03:10am			47.2		W/L
18		04:10am			43.6		W/L
19		05:10am			42.6		W/L
20		06:10am			46.1	75	W/L
21		07:10am			47.4		W/L
22		08:10am			47.9		W/L
23		09:10am			49.3		W/L
24		10:10am			53.2		W/L

Note:

The results are based on SEPA standard SEQs 2016
The instrument used was duly calibrated.
The measurements were carried out on client's request.
This report is not valid for court evidence / judicial knowledge.
The measurement of results based on the time of monitoring.
Day time hours: 6 am to 10 pm; Night time hours: 10 pm to 6 am.

ND= Not Detected
O/L= Out of Limit
W/L= Within Limits

Report Prepared by Report Verified

NOISE MONITORING REPORT

Report No	NESC/MMP/AL-AA/JUlY-23	**Report Date**	18-07-2023
Client Name	M/S MM PAKISTAN LTD.	**Job Start Date**	11-07-2023
Client Address		**Job End Date**	12-07-2023
Monitoring Location	Garhi Yasin (Shikarpur)	**Sampling Duration**	24 Hrs.
Coordinates	N.27°53"53.88" E 68°31"32.9628"		

S.NO	Parameter	Time	Unit	Method	Measured Values	SEQs Limits	Remarks
01	Noise	09:45am	dB(A)	ASTM-E1686-16	49.9	75	W/L
02		10:45am			50.3		W/L
03		11:45am			46.7		W/L
04		12:45pm			48.6		W/L
05		13:45pm			48.2		W/L
06		14:45pm			47.5		W/L
07		15:45pm			46.4		W/L
08		16:45pm			49.2		W/L
09		17:45pm			48.3		W/L
10		18:45pm			43.1		W/L
11		19:45pm			50.2		W/L
12		20:45pm			48.2		W/L
13		21:45pm			49.1		W/L
14		22:45pm			46.2	65	W/L
15		23:45pm			45.4		W/L
16		00:45am			46.3		W/L
17		01:45am			47.9		W/L
18		02:45am			48.2		W/L
19		03:45am			45.3		W/L
20		04:45am			46.4		W/L
21		05:45am			50.7		W/L
22		06:45am			49.6	75	W/L
23		07:45am			50.6		W/L
24		08:45am			51.2		W/L

Note:

The results are based on SEPA standard SEQs 2016
The instrument used was duly calibrated.
The measurements were carried out on client's request.
This report is not valid for court evidence / judicial knowledge.
The measurement of results based on the time of monitoring.
Day time hours: 6 am to 10 pm; Night time hours: 10 pm to 6 am.
.

ND= Not Detected
O/L= Out of Limit
W/L= Within Limits

Report Prepared by Report Verified

NOISE MONITORING REPORT

Report No	NESC/MMP/AL-AA/JUlY-23	**Report Date**	18-07-2023
Client Name	M/S MM PAKISTAN LTD.	**Job Start Date**	12-07-2023
Client Address		**Job End Date**	13-07-2023
Monitoring Location	Ali Sher Gola (Kandhkot, Kashmore)	**Sampling Duration**	24 Hrs.
Coordinates	N.28°15"2403252" E 69°12"46.566"		

S.NO	Parameter	Time	Unit	Method	Measured Values	SEQs Limits	Remarks
01	Noise	10:30am	dB(A)	ASTM-E1686-16	47.3	75	W/L
02		11:30am			46.8		W/L
03		12:30pm			49.3		W/L
04		13:30pm			43.6		W/L
05		14:30pm			48.5		W/L
06		15:30pm			46.2		W/L
07		16:30pm			44.8		W/L
08		17:30pm			49.1		W/L
09		18:30pm			48.3		W/L
10		19:30pm			49.4		W/L
11		20:30pm			48.1		W/L
12		21:30pm			46.9		W/L
13		22:30pm			42.2	65	W/L
14		23:30pm			42.9		W/L
15		00:30am			43.8		W/L
16		01:30am			45.2		W/L
17		02:30am			45.2		W/L
18		03:30am			46.3		W/L
19		04:30am			46.8		W/L
20		05:30am			47.2		W/L
21		06:30am			48.2	75	W/L
22		07:30am			50.2		W/L
23		08:30am			48.1		W/L
24		09:30am			47.4		W/L

Note:

The results are based on SEPA standard SEQs 2016
The instrument used was duly calibrated.
The measurements were carried out on client's request.
This report is not valid for court evidence / judicial knowledge.
The measurement of results based on the time of monitoring.
Day time hours: 6 am to 10 pm; Night time hours: 10 pm to 6 am.

ND= Not Detected
O/L= Out of Limit
W/L= Within Limits

Report Prepared by Report Verified

Reference No: SEPA/ Kot/Lab/Certificate/NSEC/24/1169

SINDH ENVIRONMENTAL PROTECTION AGENCY
GOVERNMENT OF SINDH

HEAD OFFICE:
Plot # ST-2/1, Sector- 23, Shan Chowrangi,
Korangi Industrial Area, Karachi.
Ph:35065950, 35065598, 35065532
epasindh.gov.pk
Facimile: 35065940

CERTIFICATE AS AN ENVIRONMENTAL LABORATORY

In exercise of power conferred by clause (k) of sub section (1) of section 6 of the Sindh Environmental Protection Act-2014, Environmental Protection Agency Sindh is pleased to certify the Laboratory mention below as an Environmental Laboratory.

Name: **National Environmental Services & Consultant (NESC) Karachi.**
Address: Plot. No.ST-6/4, Mujahid Arcade, Sector 24, Korangi Industrial Area, Karachi.
Certificate: EPA/Lab/Certificate/NESC/ 24/2021

1. This Certificate is Conditional and Valid for testing of Parameter as per facilities mentioned in application:

   a. Liquid effluent/ wastes.
   b. Portal Water
   c. Vehicular Emission
   d. Ambient air Quality
   e. Gaseous Emission
   f. Noise level

2. This Certificate is Subject to Condition laid down in regulation 9 of the Sindh Environmental Quality Standards (Certification of Environmental Laboratories) Regulation,2014.
3. This Certificate is valid for two (02) years w.e.f.22-12-2021 to 22-12-2023 unless earlier suspended or revoked.

Deputy Director (Lab)
SEPA, Karachi

Dated of issue:22-12-2021

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CB 008 QMS

Verification Certificate

Certificate No: 9796_20221003002

COMPANY NAME : NATIONAL ENVIRONMENT SERVICES AND CONSULTANTS.

TAG #	:	**NES-WS-001**	Environmental Conditions		
Calibration Date	:	13/12/2022	Temperature	:	23 ± 3 °C
Calibration Due	:	12/12/2023	Humidity	:	45% ± 10% RH

INSTRUMENT DETAILS

Equipment Name	:	AMBIENT AIR MONITORING SYSTEM			
Equipment Reference	:	-			
Area	:	-			
Parameter	:	SIGNALS	Range	:	MULTI
Make	:	AIR POINTER(AQM-006)	Resolution	:	-
Model	:	6007050	Tolerance	:	± 1°C|2% RH|2mb
Type	:	DIGITAL	Working Range:		-
Serial	:	AMQ-0507-23	Accuracy	:	-

Sensors Simulation Input In mb	INSTRUMENT READING	REFERENCE READING	STATUS
CO_2	300µg/m³	300µg/m³	**SATISFACTORY**
NO	300µg/m³	300µg/m³	**SATISFACTORY**
NO_2	300µg/m³	300µg/m³	**SATISFACTORY**
SO_2	500µg/m³	500µg/m³	**SATISFACTORY**
O_3	400	400	**SATISFACTORY**
PM_{10}	500µg/m³	500µg/m³	**SATISFACTORY**
$PM_{2.5}$	400µg/m³	400µg/m³	**SATISFACTORY**

- RESULT: PASS
- Deviation Within Min. Readability & Accuracy
- **TRACEABILITY:** International Calibration Traceable to ISO 17025.

MASTER : 1. ANEMOMETER, MODEL # BE856
S # DD345566, CERTIFICATE # 2022038635
2. WEATHER STATION

PERMORMED BY

Code PE-1501 # 01

VERIFIED BY

PACE ENGINEERING

Note:
- This instrument has been calibrated, verified and complies with the manufacturing specification at the measured points.
- Calibration / Testing were controlled by the use of document procedure using equipment traceable to International Standard.
- The above equipment which has been calibrated should not be used for re-calibration of other process instruments.

Calibration, Testing , Mapping Services, Validation & Supply of Industrial Instruments

orion international

Calibration Certificate

M/s. National Environmental Service & Consultants.

Certificate No: 0231

M/s K-Electric LTD.

		Calibration date:	03-07-2023
Model:	GM1356	**Recommended Due:**	02-07-2024
Serial No:	ALI-NM-00A21		
Description:	Digital sound Meter		

Above mentioned instrument has been checked and calibrated as per Manufacturer's recommendation in accordance with ASTM Procedure.

S. No	Standard Solution	Reading Before Calibration	Reading After Calibration	Error Left
1	Calibration of filters for the range 6.3Hz to 20 kHz.	20dB SPL	21dB SPL	1.0

ORION INTERNATIONAL KARACHI

Certified By: _____

319, 320, 357
Hotel Metropole, Club Road,
Karachi - Pakistan.

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Lahore Branch
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32 - Davis Road, Lahore - Pakistan.

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ANNEXURE 4

WATER QUALITY ANALYSIS RECEIVED FROM "ENVI TECH AL"

CONTENTS

ANNEXURE – 4: WATER QUALITY ANALYSIS RECEIVED FROM "ENVI TECH AL" 1

ANNEXURE – 4: WATER QUALITY ANALYSIS RECEIVED FROM "ENVI TECH AL"

ENVI TECH AL

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GREEN LAB CERTIFICATION

Lab Report No. : 202301011-MMP-GW
Invoice Bill No. : MMP-202301-407

Page: 2 of 3
Reporting Date: 16-Jan-2023

Report to:	M/s. MM Pakistan (Pvt) Ltd. C.T.I. Plaza, 27 Empress Road, Lahore.
Attention:	Mr. Imtiaz Ali Khoso E-mail: imtia.khoso@mmpakistan.com

Sample ID:	**GW-202301011**
Sample Location:	**Jacobabad**
Site Co-ordinates:	**28°38'81.9"E , 68°72'86.9"N,**
Sample Receiving Date:	**02-Jan-2023**
Sample Description:	Ground Water (17 as mentioned by Customer)
Sample Type:	Liquid – Sample
Sample Collected / Submitted By:	MM Pakistan
Date of Analysis:	02-Jan-2023 to 14-Jan-2023
Test Description:	Sindh Standards / WHO – Drinking Water Quality (32 – Parameters)

ANALYTICAL TEST REPORT

Sr. #	Parameters / Analytes Description	Methods	Unit	Test Results	SEQS Limits	*WHO
15	Barium (Ba)	HACH 8014	mg/L	N.D.	0.7	0.7
16	Antimony (Sb)	*APHA 3111-B	mg/L	N.D.	≤ 0.005	0.02
17	Arsenic (As)	*APHA 3114-B	mg/L	N.D.	≤ 0.05	0.01
18	Boron (B)	HACH 8015	mg/L	N.D.	0.3	0.5
19	Cadmium (Cd)	*APHA 3111-B	mg/L	<0.0028	0.01	0.003
20	Chromium (Cr)	*APHA 3111-B	mg/L	0.0289	≤ 0.05	0.05
21	Selenium (Se)	*APHA 3114-B	mg/L	N.D.	0.01	0.01
22	Copper (Cu)	*APHA 3111-B	mg/L	0.0223	2	2
23	Cyanide (CN)	HACH 8027	mg/L	N.D.	≤ 0.05	0.07
24	Mercury (Hg)	*APHA 3112-B	mg/L	N.D.	≤ 0.001	0.006
25	Manganese (Mn)	*APHA 3111-B	mg/L	<0.0016	≤ 0.5	0.4
26	Zinc (Zn)	*APHA 3111-B	mg/L	0.0166	≤ 5.0	3
27	Residual Chlorine	HACH 10069	mg/L	N.D.	0.2 - 0.5	5
28	Phenolic Compounds as Phenols	ASTM-D-1783	mg/L	N.D.	-	0.002

Disclaimer:

- Report is Valid for current batch (sample).
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ETAL-LMS-ASR-01	Issue Date:12-7-21	Issue No: 01

Lahore Office: 87-E Madina Height, Office # A/30 & A/31, 8th Floor, Maulana Shaukat Ali Road, Johar Town, Lahore. +92 42 32296099
Head Office: 345, First Floor, Street-15, Block-3, Bahadurabad, Karachi, 75900, Pakistan. 0310-2288801
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Attention:	Mr. Imtiaz Ali Khoso E-mail: imtia.khoso@mmpakistan.com

Sample ID:	**GW-202301011**
Sample Location:	**Jacobabad**
Site Co-ordinates:	**28°38'81.9"E , 68°72'86.9"N,**
Sample Receiving Date:	**02-Jan-2023**
Sample Description:	Ground Water (17 as mentioned by Customer)
Sample Type:	Liquid – Sample
Sample Collected / Submitted By:	MM Pakistan
Date of Analysis:	02-Jan-2023 to 14-Jan-2023
Test Description:	Sindh Standards / WHO – Drinking Water Quality (32 – Parameters)

ANALYTICAL TEST REPORT

Sr. #	Parameters / Analytes Description	Methods	Unit	Test Results	SEQS Limits	*WHO
01	pH @ 25 °C	*APHA 4500 H	-	7.37	6.5 – 8.5	6.5 – 8.5
02	Total Dissolved Solids (TDS)	*APHA 2540-C	mg/L	**1015**	< 1000	< 1000
03	Total Hardness as CaCo3	ASTM D 1126	mg/L	480	< 500	-
04	Color	HACH 8025	TCU	14	≤ 15	≤ 15
05	Turbidity	*APHA 2130	NTU	04	≤ 5	≤ 5
06	Nitrite	HACH 8507	mg/L	0.054	≤ 3	3
07	Nitrate (NO3)	HACH 8039	mg/L	0.4	≤ 0.50	50
08	Taste	*APHA 2160	-	Tasteless	Non-Objectionable	Non-Objectionable
09	Odor	*APHA 2150	-	Odorless	Non-Objectionable	Non-Objectionable
10	Chloride (Cl)	*APHA 4500 Cl	mg/L	**499.84**	≤ 250	250
11	Fluoride	HACH 8029	mg/L	0.66	≤ 1.5	1.5
12	Aluminum	*APHA 3111-D	mg/L	<0.028	≤ 0.2	0.2
13	Nickel	*APHA 3111-B	mg/L	<0.008	≤ 0.02	0.07
14	Lead (Pb)	*APHA 3111-B	mg/L	<0.016	≤ 0.05	0.01

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Sample Receiving Date:	**02-Jan-2023**
Sample Description:	Ground Water (17 as mentioned by Customer)
Sample Type:	Liquid – Sample
Sample Collected / Submitted By:	MM Pakistan
Date of Analysis:	02-Jan-2023 to 14-Jan-2023
Test Description:	Sindh Standards / WHO – Drinking Water Quality (32 – Parameters)

ANALYTICAL TEST REPORT

Sr. #	Parameters / Analytes Description	Methods	Unit	Test Results	SEQS Limits	*WHO
29	Sodium	*APHA 3111-B	mg/L	**269.3250**	-	200
30	Fecal Coliform	USEPA 1604	Cfu/100 ml	N.D.	-	0/100ml
31	E-Coli	USEPA 1604	Cfu/100 ml	N.D.	-	-
32	Total Coliform	*APHA 922 B	Cfu/100 ml	**08**	-	0/100ml

Note: Measurement of uncertainty will be provided on customer Demand. Environmental Conditions at the time of Testing; Temperature: 22 °C (+- 1°C) & Humidity: 33 % (+- 1%).

Conclusion:

Test Result = F

*APHA Standard Methods for Examination of water & wastewater 23rd Edition (2017).

SEQS Limits = Sindh Environmental Quality Standard (Reference: SEQS 2016).

WHO = World Health Organization.

*WHO Guideline Value for Drinking Water Quality follows by The World Bank

M = Meet SEQS-2016 requirements/ WHO Guideline Value for Drinking Water Quality , **F** = Below SEQS-2016 requirements/, WHO Guideline Value for Drinking Water Quality **N.D.** = Not Detected.

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Analyzed By | **Reviewed By** | **Approved By**

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Invoice Bill No. : MMP-202301-407

Page: 1 of 3
Reporting Date: 16-Jan-2023

Report to:	M/s. MM Pakistan (Pvt) Ltd. C.T.I. Plaza, 27 Empress Road, Lahore.
Attention:	Mr. Imtiaz Ali Khoso E-mail: imtia.khoso@mmpakistan.com

Sample ID:	**GW-202301005**
Sample Location:	**Shikarpur**
Site Co-ordinates:	**28°15'40.06"E , 68°54'83.05"N,**
Sample Receiving Date:	**02-Jan-2023**
Sample Description:	Ground Water (05 as mentioned by Customer)
Sample Type:	Liquid – Sample
Sample Collected / Submitted By:	MM Pakistan
Date of Analysis:	02-Jan-2023 to 14-Jan-2023
Test Description:	Sindh Standards / WHO – Drinking Water Quality (32 – Parameters)

ANALYTICAL TEST REPORT

Sr. #	Parameters / Analytes Description	Methods	Unit	Test Results	SEQS Limits	*WHO
01	pH @ 25 °C	*APHA 4500 H	-	7.65	6.5 – 8.5	6.5 – 8.5
02	Total Dissolved Solids (TDS)	*APHA 2540-C	mg/L	694	< 1000	< 1000
03	Total Hardness as CaCo3	ASTM D 1126	mg/L	212	< 500	-
04	Color	HACH 8025	TCU	**19**	≤ 15	≤ 15
05	Turbidity	*APHA 2130	NTU	**11**	≤ 5	≤ 5
06	Nitrite	HACH 8507	mg/L	0.003	≤ 3	3
07	Nitrate (NO3)	HACH 8039	mg/L	0.1	≤ 0.50	50
08	Taste	*APHA 2160	-	Tasteless	Non-Objectionable	Non-Objectionable
09	Odor	*APHA 2150	-	Odorless	Non-Objectionable	Non-Objectionable
10	Chloride (Cl)	*APHA 4500 Cl	mg/L	**399.87**	≤ 250	250
11	Fluoride	HACH 8029	mg/L	0.11	≤ 1.5	1.5
12	Aluminum	*APHA 3111-D	mg/L	<0.028	≤ 0.2	0.2
13	Nickel	*APHA 3111-B	mg/L	<0.008	≤ 0.02	0.07
14	Lead (Pb)	*APHA 3111-B	mg/L	<0.016	≤ 0.05	0.01

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(Certificate # 202101031) (EAR/L.C/ENVI TECH AL-20/225/20) (Certificate # 202101032)

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GREEN LAB CERTIFICATION

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Invoice Bill No. : MMP-202301-407

Page: 2 of 3
Reporting Date: 16-Jan-2023

Report to:	M/s. MM Pakistan (Pvt) Ltd. C.T.I. Plaza, 27 Empress Road, Lahore.
Attention:	Mr. Imtiaz Ali Khoso E-mail: imtia.khoso@mmpakistan.com

Sample ID:	**GW-202301005**
Sample Location:	**Shikarpur**
Site Co-ordinates:	**28°15'40.06"E , 68°54'83.05"N,**
Sample Receiving Date:	**02-Jan-2023**
Sample Description:	Ground Water (05 as mentioned by Customer)
Sample Type:	Liquid – Sample
Sample Collected / Submitted By:	MM Pakistan
Date of Analysis:	02-Jan-2023 to 14-Jan-2023
Test Description:	Sindh Standards / WHO – Drinking Water Quality (32 – Parameters)

ANALYTICAL TEST REPORT

Sr. #	Parameters / Analytes Description	Methods	Unit	Test Results	SEQS Limits	*WHO
15	Barium (Ba)	HACH 8014	mg/L	N.D.	0.7	0.7
16	Antimony (Sb)	*APHA 3111-B	mg/L	N.D.	≤ 0.005	0.02
17	Arsenic (As)	*APHA 3114-B	mg/L	N.D.	≤ 0.05	0.01
18	Boron (B)	HACH 8015	mg/L	N.D.	0.3	0.5
19	Cadmium (Cd)	*APHA 3111-B	mg/L	<0.0028	0.01	0.003
20	Chromium (Cr)	*APHA 3111-B	mg/L	0.0078	≤ 0.05	0.05
21	Selenium (Se)	*APHA 3114-B	mg/L	N.D.	0.01	0.01
22	Copper (Cu)	*APHA 3111-B	mg/L	0.1256	2	2
23	Cyanide (CN)	HACH 8027	mg/L	N.D.	≤ 0.05	0.07
24	Mercury (Hg)	*APHA 3112-B	mg/L	N.D.	≤ 0.001	0.006
25	Manganese (Mn)	*APHA 3111-B	mg/L	<0.0016	≤ 0.5	0.4
26	Zinc (Zn)	*APHA 3111-B	mg/L	0.0123	≤ 5.0	3
27	Residual Chlorine	HACH 10069	mg/L	N.D.	0.2 - 0.5	5
28	Phenolic Compounds as Phenols	ASTM-D-1783	mg/L	N.D.	-	0.002

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GREEN LAB CERTIFICATION

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Page: 3 of 3
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Attention:	Mr. Imtiaz Ali Khoso E-mail: imtia.khoso@mmpakistan.com

Sample ID:	**GW-202301005**
Sample Location:	**Shikarpur**
Site Co-ordinates:	**28°15'40.06"E , 68°54'83.05"N,**
Sample Receiving Date:	**02-Jan-2023**
Sample Description:	Ground Water (05 as mentioned by Customer)
Sample Type:	Liquid – Sample
Sample Collected / Submitted By:	MM Pakistan
Date of Analysis:	02-Jan-2023 to 14-Jan-2023
Test Description:	Sindh Standards / WHO – Drinking Water Quality (32 – Parameters)

ANALYTICAL TEST REPORT

Sr. #	Parameters / Analytes Description	Methods	Unit	Test Results	SEQS Limits	*WHO
29	Sodium	*APHA 3111-B	mg/L	145.0123	-	200
30	Fecal Coliform	USEPA 1604	Cfu/100 ml	N.D.	-	0/100ml
31	E-Coli	USEPA 1604	Cfu/100 ml	N.D.	-	-
32	Total Coliform	*APHA 922 B	Cfu/100 ml	**01**	-	0/100ml

Note: Measurement of uncertainty will be provided on customer Demand. Environmental Conditions at the time of Testing; Temperature: 22 °C (+- 1°C) & Humidity: 33 % (+- 1%).

Conclusion:

Test Result = F

*APHA Standard Methods for Examination of water & wastewater 23rd Edition (2017).

SEQS Limits = Sindh Environmental Quality Standard (Reference: SEQS 2016).

WHO = World Health Organization.

*WHO Guideline Value for Drinking Water Quality follows by The World Bank

M = Meet SEQS-2016 requirements/ WHO Guideline Value for Drinking Water Quality , **F** = Below SEQS-2016 requirements/, WHO Guideline Value for Drinking Water Quality **N.D.** = Not Detected.

ENVI TECH AL

Analyzed By | **Reviewed By** | **Approved By**

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GREEN LAB CERTIFICATION

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Invoice Bill No. : MMP-202301-407

Page: 1 of 3
Reporting Date: 16-Jan-2023

Report to:	M/s. MM Pakistan (Pvt) Ltd. C.T.I. Plaza, 27 Empress Road, Lahore.
Attention:	Mr. Imtiaz Ali Khoso E-mail: imtia.khoso@mmpakistan.com

Sample ID:	**GW-202301006**
Sample Location:	**Kashmore**
Site Co-ordinates:	**28°26'36.9"E , 68°98'69.3"N,**
Sample Receiving Date:	**02-Jan-2023**
Sample Description:	Ground Water (08 as mentioned by Customer)
Sample Type:	Liquid – Sample
Sample Collected / Submitted By:	MM Pakistan
Date of Analysis:	02-Jan-2023 to 14-Jan-2023
Test Description:	Sindh Standards / WHO – Drinking Water Quality (32 – Parameters)

ANALYTICAL TEST REPORT

Sr. #	Parameters / Analytes Description	Methods	Unit	Test Results	SEQS Limits	*WHO
01	pH @ 25 °C	*APHA 4500 H	-	7.76	6.5 – 8.5	6.5 – 8.5
02	Total Dissolved Solids (TDS)	*APHA 2540-C	mg/L	500	< 1000	< 1000
03	Total Hardness as CaCo3	ASTM D 1126	mg/L	320	< 500	-
04	Color	HACH 8025	TCU	10	≤ 15	≤ 15
05	Turbidity	*APHA 2130	NTU	<1	≤ 5	≤ 5
06	Nitrite	HACH 8507	mg/L	0.002	≤ 3	3
07	Nitrate (NO3)	HACH 8039	mg/L	0.1	≤ 0.50	50
08	Taste	*APHA 2160	-	Tasteless	Non-Objectionable	Non-Objectionable
09	Odor	*APHA 2150	-	Odorless	Non-Objectionable	Non-Objectionable
10	Chloride (Cl)	*APHA 4500 Cl	mg/L	99.96	≤ 250	250
11	Fluoride	HACH 8029	mg/L	0.23	≤ 1.5	1.5
12	Aluminum	*APHA 3111-D	mg/L	<0.028	≤ 0.2	0.2
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SMS (Certificate # 202101031) (LAB/L-C/ENVI TECH AL-20/225/20) SMS (Certificate # 202101032)

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Attention:	Mr. Imtiaz Ali Khoso E-mail: imtia.khoso@mmpakistan.com

Sample ID:	**GW-202301006**
Sample Location:	**Kashmore**
Site Co-ordinates:	**28°26'36.9"E , 68°98'69.3"N,**
Sample Receiving Date:	**02-Jan-2023**
Sample Description:	Ground Water (08 as mentioned by Customer)
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17	Arsenic (As)	*APHA 3114-B	mg/L	N.D.	≤ 0.05	0.01
18	Boron (B)	HACH 8015	mg/L	N.D.	0.3	0.5
19	Cadmium (Cd)	*APHA 3111-B	mg/L	<0.0028	0.01	0.003
20	Chromium (Cr)	*APHA 3111-B	mg/L	0.0156	≤ 0.05	0.05
21	Selenium (Se)	*APHA 3114-B	mg/L	N.D.	0.01	0.01
22	Copper (Cu)	*APHA 3111-B	mg/L	0.0299	2	2
23	Cyanide (CN)	HACH 8027	mg/L	N.D.	≤ 0.05	0.07
24	Mercury (Hg)	*APHA 3112-B	mg/L	N.D.	≤ 0.001	0.006
25	Manganese (Mn)	*APHA 3111-B	mg/L	<0.0016	≤ 0.5	0.4
26	Zinc (Zn)	*APHA 3111-B	mg/L	0.0101	≤ 5.0	3
27	Residual Chlorine	HACH 10069	mg/L	N.D.	0.2 - 0.5	5
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Reporting Date: 16-Jan-2023

Report to:	M/s. MM Pakistan (Pvt) Ltd. C.T.I. Plaza, 27 Empress Road, Lahore.
Attention:	Mr. Imtiaz Ali Khoso E-mail: imtia.khoso@mmpakistan.com

Sample ID:	**GW-202301006**
Sample Location:	**Kashmore**
Site Co-ordinates:	**28°26'36.9"E , 68°98'69.3"N,**
Sample Receiving Date:	**02-Jan-2023**
Sample Description:	Ground Water (08 as mentioned by Customer)
Sample Type:	Liquid – Sample
Sample Collected / Submitted By:	MM Pakistan
Date of Analysis:	02-Jan-2023 to 14-Jan-2023
Test Description:	Sindh Standards / WHO – Drinking Water Quality (32 – Parameters)

ANALYTICAL TEST REPORT

Sr. #	Parameters / Analytes Description	Methods	Unit	Test Results	SEQS Limits	*WHO
29	Sodium	*APHA 3111-B	mg/L	45.1230	-	200
30	Fecal Coliform	USEPA 1604	Cfu/100 ml	N.D.	-	0/100ml
31	E-Coli	USEPA 1604	Cfu/100 ml	N.D.	-	-
32	Total Coliform	*APHA 922 B	Cfu/100 ml	01	-	0/100ml

Note: Measurement of uncertainty will be provided on customer Demand. Environmental Conditions at the time of Testing; Temperature: 22 °C (+- 1°C) & Humidity: 33 % (+- 1%).

Conclusion:

Test Result = F

*APHA Standard Methods for Examination of water & wastewater 23rd Edition (2017).

SEQS Limits = Sindh Environmental Quality Standard (Reference: SEQS 2016).

WHO = World Health Organization.

*WHO Guideline Value for Drinking Water Quality follows by The World Bank

M = Meet SEQS-2016 requirements/ WHO Guideline Value for Drinking Water Quality , **F** = Below SEQS-2016 requirements/, WHO Guideline Value for Drinking Water Quality **N.D.** = Not Detected.

Analyzed By | **Reviewed By** | **Approved By**

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ETAL-LMS-ASR-01 | Issue Date: 12-7-21 | Issue No: 01

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Lab Report No. : 202301007-MMP-GW
Invoice Bill No. : MMP-202301-407

Page: 1 of 3
Reporting Date: 16-Jan-2023

Report to:	M/s. MM Pakistan (Pvt) Ltd. C.T.I. Plaza, 27 Empress Road, Lahore.
Attention:	Mr. Imtiaz Ali Khoso E-mail: imtia.khoso@mmpakistan.com

Sample ID:	**GW-202301007**
Sample Location:	**Shikarpur**
Site Co-ordinates:	**28°03'25.4"E , 68°61'47"N,**
Sample Receiving Date:	**02-Jan-2023**
Sample Description:	Ground Water (09 as mentioned by Customer)
Sample Type:	Liquid – Sample
Sample Collected / Submitted By:	MM Pakistan
Date of Analysis:	02-Jan-2023 to 14-Jan-2023
Test Description:	Sindh Standards / WHO – Drinking Water Quality (32 – Parameters)

ANALYTICAL TEST REPORT

Sr. #	Parameters / Analytes Description	Methods	Unit	Test Results	SEQS Limits	*WHO
01	pH @ 25 °C	*APHA 4500 H	-	7.85	6.5 – 8.5	6.5 – 8.5
02	Total Dissolved Solids (TDS)	*APHA 2540-C	mg/L	868	< 1000	< 1000
03	Total Hardness as CaCo3	ASTM D 1126	mg/L	500	< 500	-
04	Color	HACH 8025	TCU	14	≤ 15	≤ 15
05	Turbidity	*APHA 2130	NTU	05	≤ 5	≤ 5
06	Nitrite	HACH 8507	mg/L	0.033	≤ 3	3
07	Nitrate (NO3)	HACH 8039	mg/L	0.3	≤ 0.50	50
08	Taste	*APHA 2160	-	Tasteless	Non-Objectionable	Non-Objectionable
09	Odor	*APHA 2150	-	Odorless	Non-Objectionable	Non-Objectionable
10	Chloride (Cl)	*APHA 4500 Cl	mg/L	199.93	≤ 250	250
11	Fluoride	HACH 8029	mg/L	0.44	≤ 1.5	1.5
12	Aluminum	*APHA 3111-D	mg/L	<0.028	≤ 0.2	0.2
13	Nickel	*APHA 3111-B	mg/L	<0.008	≤ 0.02	0.07
14	Lead (Pb)	*APHA 3111-B	mg/L	<0.016	≤ 0.05	0.01

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(Certificate # 202101031) (LAB/L.C/ENVI TECH AL-20/225/20) (Certificate # 202101032)

ETAL-LMS-ASR-01	Issue Date:12-7-21	Issue No: 01

Lahore Office: 87-E Madina Height, Office # A/30 & A/31, 8th Floor, Maulana Shaukat Ali Road, Johar Town, Lahore. +92 42 32296099
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GREEN LAB CERTIFICATION

Lab Report No. : 202301007-MMP-GW
Invoice Bill No. : MMP-202301-407

Page: 2 of 3
Reporting Date: 16-Jan-2023

Report to:	M/s. MM Pakistan (Pvt) Ltd. C.T.I. Plaza, 27 Empress Road, Lahore.
Attention:	Mr. Imtiaz Ali Khoso E-mail: imtia.khoso@mmpakistan.com

Sample ID:	**GW-202301007**
Sample Location:	**Shikarpur**
Site Co-ordinates:	**28°03'25.4"E , 68°61'47"N,**
Sample Receiving Date:	**02-Jan-2023**
Sample Description:	Ground Water (09 as mentioned by Customer)
Sample Type:	Liquid – Sample
Sample Collected / Submitted By:	MM Pakistan
Date of Analysis:	02-Jan-2023 to 14-Jan-2023
Test Description:	Sindh Standards / WHO – Drinking Water Quality (32 – Parameters)

ANALYTICAL TEST REPORT

Sr. #	Parameters / Analytes Description	Methods	Unit	Test Results	SEQS Limits	*WHO
15	Barium (Ba)	HACH 8014	mg/L	N.D.	0.7	0.7
16	Antimony (Sb)	*APHA 3111-B	mg/L	N.D.	≤ 0.005	0.02
17	Arsenic (As)	*APHA 3114-B	mg/L	N.D.	≤ 0.05	0.01
18	Boron (B)	HACH 8015	mg/L	N.D.	0.3	0.5
19	Cadmium (Cd)	*APHA 3111-B	mg/L	<0.0028	0.01	0.003
20	Chromium (Cr)	*APHA 3111-B	mg/L	0.0299	≤ 0.05	0.05
21	Selenium (Se)	*APHA 3114-B	mg/L	N.D.	0.01	0.01
22	Copper (Cu)	*APHA 3111-B	mg/L	0.0420	2	2
23	Cyanide (CN)	HACH 8027	mg/L	N.D.	≤ 0.05	0.07
24	Mercury (Hg)	*APHA 3112-B	mg/L	N.D.	≤ 0.001	0.006
25	Manganese (Mn)	*APHA 3111-B	mg/L	<0.0016	≤ 0.5	0.4
26	Zinc (Zn)	*APHA 3111-B	mg/L	0.0139	≤ 5.0	3
27	Residual Chlorine	HACH 10069	mg/L	N.D.	0.2 - 0.5	5
28	Phenolic Compounds as Phenols	ASTM-D-1783	mg/L	N.D.	-	0.002

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Invoice Bill No. : MMP-202301-407

Page: 3 of 3
Reporting Date: 16-Jan-2023

Report to:	M/s. MM Pakistan (Pvt) Ltd. C.T.I. Plaza, 27 Empress Road, Lahore.
Attention:	Mr. Imtiaz Ali Khoso E-mail: imtia.khoso@mmpakistan.com

Sample ID:	**GW-202301007**
Sample Location:	**Shikarpur**
Site Co-ordinates:	**28°03'25.4"E , 68°61'47"N,**
Sample Receiving Date:	**02-Jan-2023**
Sample Description:	Ground Water (09 as mentioned by Customer)
Sample Type:	Liquid – Sample
Sample Collected / Submitted By:	MM Pakistan
Date of Analysis:	02-Jan-2023 to 14-Jan-2023
Test Description:	Sindh Standards / WHO – Drinking Water Quality (32 – Parameters)

ANALYTICAL TEST REPORT

Sr. #	Parameters / Analytes Description	Methods	Unit	Test Results	SEQS Limits	*WHO
29	Sodium	*APHA 3111-B	mg/L	85.1110	-	200
30	Fecal Coliform	USEPA 1604	Cfu/100 ml	N.D.	-	0/100ml
31	E-Coli	USEPA 1604	Cfu/100 ml	N.D.	-	-
32	Total Coliform	*APHA 922 B	Cfu/100 ml	03	-	0/100ml

Note: Measurement of uncertainty will be provided on customer Demand. Environmental Conditions at the time of Testing; Temperature: 22 °C (+- 1°C) & Humidity: 33 % (+- 1%).

Conclusion:

Test Result = F

*APHA Standard Methods for Examination of water & wastewater 23rd Edition (2017).

SEQS Limits = Sindh Environmental Quality Standard (Reference: SEQS 2016).

WHO = World Health Organization.

*WHO Guideline Value for Drinking Water Quality follows by The World Bank

M = Meet SEQS-2016 requirements/ WHO Guideline Value for Drinking Water Quality , **F** = Below SEQS-2016 requirements/, WHO Guideline Value for Drinking Water Quality **N.D.** = Not Detected.

Analyzed By | Reviewed By | Approved By

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Lab Report No. : 202301008-MMP-GW
Invoice Bill No. : MMP-202301-407

Page: 1 of 3
Reporting Date: 16-Jan-2023

Report to:	M/s. MM Pakistan (Pvt) Ltd. C.T.I. Plaza, 27 Empress Road, Lahore.
Attention:	Mr. Imtiaz Ali Khoso E-mail: imtia.khoso@mmpakistan.com

Sample ID:	**GW-202301008**
Sample Location:	**Kashmore**
Site Co-ordinates:	**28°22'99.6"E , 68°99'94.2"N,**
Sample Receiving Date:	**02-Jan-2023**
Sample Description:	Ground Water (10 as mentioned by Customer)
Sample Type:	Liquid – Sample
Sample Collected / Submitted By:	MM Pakistan
Date of Analysis:	02-Jan-2023 to 14-Jan-2023
Test Description:	Sindh Standards / WHO – Drinking Water Quality (32 – Parameters)

ANALYTICAL TEST REPORT

Sr. #	Parameters / Analytes Description	Methods	Unit	Test Results	SEQS Limits	*WHO
01	pH @ 25 °C	*APHA 4500 H	-	7.64	6.5 – 8.5	6.5 – 8.5
02	Total Dissolved Solids (TDS)	*APHA 2540-C	mg/L	862	< 1000	< 1000
03	Total Hardness as CaCo3	ASTM D 1126	mg/L	492	< 500	-
04	Color	HACH 8025	TCU	10	≤ 15	≤ 15
05	Turbidity	*APHA 2130	NTU	02	≤ 5	≤ 5
06	Nitrite	HACH 8507	mg/L	0.022	≤ 3	3
07	Nitrate (NO3)	HACH 8039	mg/L	0.3	≤ 0.50	50
08	Taste	*APHA 2160	-	Tasteless	Non-Objectionable	Non-Objectionable
09	Odor	*APHA 2150	-	Odorless	Non-Objectionable	Non-Objectionable
10	Chloride (Cl)	*APHA 4500 Cl	mg/L	193.93	≤ 250	250
11	Fluoride	HACH 8029	mg/L	0.32	≤ 1.5	1.5
12	Aluminum	*APHA 3111-D	mg/L	<0.028	≤ 0.2	0.2
13	Nickel	*APHA 3111-B	mg/L	<0.008	≤ 0.02	0.07
14	Lead (Pb)	*APHA 3111-B	mg/L	<0.016	≤ 0.05	0.01

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SMS (Certificate # 202101031) (LAB/L.C/ENVI TECH AL-20/225/20) SMS (Certificate # 202101032)

ETAL-LMS-ASR-01	Issue Date:12-7-21	Issue No: 01

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Page: 2 of 3
Reporting Date: 16-Jan-2023

Report to:	M/s. MM Pakistan (Pvt) Ltd. C.T.I. Plaza, 27 Empress Road, Lahore.
Attention:	Mr. Imtiaz Ali Khoso E-mail: imtia.khoso@mmpakistan.com

Sample ID:	GW-202301008
Sample Location:	Kashmore
Site Co-ordinates:	28°22'99.6"E , 68°99'94.2"N,
Sample Receiving Date:	02-Jan-2023
Sample Description:	Ground Water (10 as mentioned by Customer)
Sample Type:	Liquid – Sample
Sample Collected / Submitted By:	MM Pakistan
Date of Analysis:	02-Jan-2023 to 14-Jan-2023
Test Description:	Sindh Standards / WHO – Drinking Water Quality (32 – Parameters)

ANALYTICAL TEST REPORT

Sr. #	Parameters / Analytes Description	Methods	Unit	Test Results	SEQS Limits	*WHO
15	Barium (Ba)	HACH 8014	mg/L	N.D.	0.7	0.7
16	Antimony (Sb)	*APHA 3111-B	mg/L	N.D.	≤ 0.005	0.02
17	Arsenic (As)	*APHA 3114-B	mg/L	N.D.	≤ 0.05	0.01
18	Boron (B)	HACH 8015	mg/L	N.D.	0.3	0.5
19	Cadmium (Cd)	*APHA 3111-B	mg/L	<0.0028	0.01	0.003
20	Chromium (Cr)	*APHA 3111-B	mg/L	0.0189	≤ 0.05	0.05
21	Selenium (Se)	*APHA 3114-B	mg/L	N.D.	0.01	0.01
22	Copper (Cu)	*APHA 3111-B	mg/L	0.0360	2	2
23	Cyanide (CN)	HACH 8027	mg/L	N.D.	≤ 0.05	0.07
24	Mercury (Hg)	*APHA 3112-B	mg/L	N.D.	≤ 0.001	0.006
25	Manganese (Mn)	*APHA 3111-B	mg/L	<0.0016	≤ 0.5	0.4
26	Zinc (Zn)	*APHA 3111-B	mg/L	0.0111	≤ 5.0	3
27	Residual Chlorine	HACH 10069	mg/L	N.D.	0.2 - 0.5	5
28	Phenolic Compounds as Phenols	ASTM-D-1783	mg/L	N.D.	-	0.002

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Page: 3 of 3
Reporting Date: 16-Jan-2023

Report to:	M/s. MM Pakistan (Pvt) Ltd. C.T.I. Plaza, 27 Empress Road, Lahore.
Attention:	Mr. Imtiaz Ali Khoso E-mail: imtia.khoso@mmpakistan.com

Sample ID:	**GW-202301008**
Sample Location:	**Kashmore**
Site Co-ordinates:	**28°22'99.6"E , 68°99'94.2"N,**
Sample Receiving Date:	**02-Jan-2023**
Sample Description:	Ground Water (10 as mentioned by Customer)
Sample Type:	Liquid – Sample
Sample Collected / Submitted By:	MM Pakistan
Date of Analysis:	02-Jan-2023 to 14-Jan-2023
Test Description:	Sindh Standards / WHO – Drinking Water Quality (32 – Parameters)

ANALYTICAL TEST REPORT

Sr. #	Parameters / Analytes Description	Methods	Unit	Test Results	SEQS Limits	*WHO
29	Sodium	*APHA 3111-B	mg/L	88.8652	-	200
30	Fecal Coliform	USEPA 1604	Cfu/100 ml	N.D.	-	0/100ml
31	E-Coli	USEPA 1604	Cfu/100 ml	N.D.	-	-
32	Total Coliform	*APHA 922 B	Cfu/100 ml	02	-	0/100ml

Note: Measurement of uncertainty will be provided on customer Demand. Environmental Conditions at the time of Testing; Temperature: 22 °C (+- 1°C) & Humidity: 33 % (+- 1%).

Conclusion:

Test Result = F

*APHA Standard Methods for Examination of water & wastewater 23rd Edition (2017).

SEQS Limits = Sindh Environmental Quality Standard (Reference: SEQS 2016).

WHO = World Health Organization.

*WHO Guideline Value for Drinking Water Quality follows by The World Bank

M = Meet SEQS-2016 requirements/ WHO Guideline Value for Drinking Water Quality , **F** = Below SEQS-2016 requirements/, WHO Guideline Value for Drinking Water Quality **N.D.** = Not Detected.

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Analyzed By | Reviewed By | Approved By

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Page: 1 of 3
Reporting Date: 16-Jan-2023

Report to:	M/s. MM Pakistan (Pvt) Ltd. C.T.I. Plaza, 27 Empress Road, Lahore.
Attention:	Mr. Imtiaz Ali Khoso E-mail: imtia.khoso@mmpakistan.com

Sample ID:	**GW-202301009**
Sample Location:	**Kashmore**
Site Co-ordinates:	**28°24'19.7"E , 68°94'60.1"N,**
Sample Receiving Date:	**02-Jan-2023**
Sample Description:	Ground Water (12 as mentioned by Customer)
Sample Type:	Liquid – Sample
Sample Collected / Submitted By:	MM Pakistan
Date of Analysis:	02-Jan-2023 to 14-Jan-2023
Test Description:	Sindh Standards / WHO – Drinking Water Quality (32 – Parameters)

ANALYTICAL TEST REPORT

Sr. #	Parameters / Analytes Description	Methods	Unit	Test Results	SEQS Limits	*WHO
01	pH @ 25 °C	*APHA 4500 H	-	7.66	6.5 – 8.5	6.5 – 8.5
02	Total Dissolved Solids (TDS)	*APHA 2540-C	mg/L	**1078**	< 1000	< 1000
03	Total Hardness as CaCo3	ASTM D 1126	mg/L	400	< 500	-
04	Color	HACH 8025	TCU	**15**	≤ 15	≤ 15
05	Turbidity	*APHA 2130	NTU	**05**	≤ 5	≤ 5
06	Nitrite	HACH 8507	mg/L	0.031	≤ 3	3
07	Nitrate (NO3)	HACH 8039	mg/L	0.4	≤ 0.50	50
08	Taste	*APHA 2160	-	Tasteless	Non-Objectionable	Non-Objectionable
09	Odor	*APHA 2150	-	Odorless	Non-Objectionable	Non-Objectionable
10	Chloride (Cl)	*APHA 4500 Cl	mg/L	**599.81**	≤ 250	250
11	Fluoride	HACH 8029	mg/L	0.56	≤ 1.5	1.5
12	Aluminum	*APHA 3111-D	mg/L	<0.028	≤ 0.2	0.2
13	Nickel	*APHA 3111-B	mg/L	<0.008	≤ 0.02	0.07
14	Lead (Pb)	*APHA 3111-B	mg/L	<0.016	≤ 0.05	0.01

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GREEN LAB CERTIFICATION GOLD

Lab Report No. : 202301009-MMP-GW
Invoice Bill No. : MMP-202301-407

Page: 2 of 3
Reporting Date: 16-Jan-2023

Report to:	M/s. MM Pakistan (Pvt) Ltd. C.T.I. Plaza, 27 Empress Road, Lahore.
Attention:	Mr. Imtiaz Ali Khoso E-mail: imtia.khoso@mmpakistan.com

Sample ID:	**GW-202301009**
Sample Location:	**Kashmore**
Site Co-ordinates:	**28°24'19.7"E , 68°94'60.1"N,**
Sample Receiving Date:	**02-Jan-2023**
Sample Description:	Ground Water (12 as mentioned by Customer)
Sample Type:	Liquid – Sample
Sample Collected / Submitted By:	MM Pakistan
Date of Analysis:	02-Jan-2023 to 14-Jan-2023
Test Description:	Sindh Standards / WHO – Drinking Water Quality (32 – Parameters)

ANALYTICAL TEST REPORT

Sr. #	Parameters / Analytes Description	Methods	Unit	Test Results	SEQS Limits	*WHO
15	Barium (Ba)	HACH 8014	mg/L	N.D.	0.7	0.7
16	Antimony (Sb)	*APHA 3111-B	mg/L	N.D.	≤ 0.005	0.02
17	Arsenic (As)	*APHA 3114-B	mg/L	N.D.	≤ 0.05	0.01
18	Boron (B)	HACH 8015	mg/L	N.D.	0.3	0.5
19	Cadmium (Cd)	*APHA 3111-B	mg/L	<0.0028	0.01	0.003
20	Chromium (Cr)	*APHA 3111-B	mg/L	0.0146	≤ 0.05	0.05
21	Selenium (Se)	*APHA 3114-B	mg/L	N.D.	0.01	0.01
22	Copper (Cu)	*APHA 3111-B	mg/L	0.0414	2	2
23	Cyanide (CN)	HACH 8027	mg/L	N.D.	≤ 0.05	0.07
24	Mercury (Hg)	*APHA 3112-B	mg/L	N.D.	≤ 0.001	0.006
25	Manganese (Mn)	*APHA 3111-B	mg/L	<0.0016	≤ 0.5	0.4
26	Zinc (Zn)	*APHA 3111-B	mg/L	0.0203	≤ 5.0	3
27	Residual Chlorine	HACH 10069	mg/L	N.D.	0.2 - 0.5	5
28	Phenolic Compounds as Phenols	ASTM-D-1783	mg/L	N.D.	-	0.002

Disclaimer:

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ETAL-LMS-ASR-01	Issue Date:12-7-21	Issue No: 01

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GREEN LAB CERTIFICATION

Lab Report No. : 202301009-MMP-GW
Invoice Bill No. : MMP-202301-407

Page: 3 of 3
Reporting Date: 16-Jan-2023

Report to:	M/s. MM Pakistan (Pvt) Ltd. C.T.I. Plaza, 27 Empress Road, Lahore.
Attention:	Mr. Imtiaz Ali Khoso E-mail: imtia.khoso@mmpakistan.com

Sample ID:	**GW-202301009**
Sample Location:	**Kashmore**
Site Co-ordinates:	**28°24'19.7"E , 68°94'60.1"N,**
Sample Receiving Date:	**02-Jan-2023**
Sample Description:	Ground Water (12 as mentioned by Customer)
Sample Type:	Liquid – Sample
Sample Collected / Submitted By:	MM Pakistan
Date of Analysis:	02-Jan-2023 to 14-Jan-2023
Test Description:	Sindh Standards / WHO – Drinking Water Quality (32 – Parameters)

ANALYTICAL TEST REPORT

Sr. #	Parameters / Analytes Description	Methods	Unit	Test Results	SEQS Limits	*WHO
29	Sodium	*APHA 3111-B	mg/L	**305.0300**	-	200
30	Fecal Coliform	USEPA 1604	Cfu/100 ml	N.D.	-	0/100ml
31	E-Coli	USEPA 1604	Cfu/100 ml	N.D.	-	-
32	Total Coliform	*APHA 922 B	Cfu/100 ml	**08**	-	0/100ml

Note: Measurement of uncertainty will be provided on customer Demand. Environmental Conditions at the time of Testing; Temperature: 22 °C (+- 1°C) & Humidity: 33 % (+- 1%).

Conclusion:

Test Result = F

*APHA Standard Methods for Examination of water & wastewater 23rd Edition (2017).

SEQS Limits = Sindh Environmental Quality Standard (Reference: SEQS 2016).

WHO = World Health Organization.

*WHO Guideline Value for Drinking Water Quality follows by The World Bank

M = Meet SEQS-2016 requirements/ WHO Guideline Value for Drinking Water Quality , **F** = Below SEQS-2016 requirements/, WHO Guideline Value for Drinking Water Quality **N.D.** = Not Detected.

Analyzed By | **Reviewed By** | **Approved By**

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ETAL-LMS-ASR-01	Issue Date: 12-7-21	Issue No: 01

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GREEN LAB CERTIFICATION GOLD

Lab Report No. : 202301012-MMP-GW
Invoice Bill No. : MMP-202301-407

Page: 1 of 3
Reporting Date: 16-Jan-2023

Report to:	M/s. MM Pakistan (Pvt) Ltd. C.T.I. Plaza, 27 Empress Road, Lahore.
Attention:	Mr. Imtiaz Ali Khoso E-mail: imtia.khoso@mmpakistan.com

Sample ID:	**GW-202301012**
Sample Location:	**Kashmore**
Site Co-ordinates:	**28°19'24.3"E , 69°13'70.7"N,**
Sample Receiving Date:	**02-Jan-2023**
Sample Description:	Ground Water (33 as mentioned by Customer)
Sample Type:	Liquid – Sample
Sample Collected / Submitted By:	MM Pakistan
Date of Analysis:	02-Jan-2023 to 14-Jan-2023
Test Description:	Sindh Standards / WHO – Drinking Water Quality (32 – Parameters)

ANALYTICAL TEST REPORT

Sr. #	Parameters / Analytes Description	Methods	Unit	Test Results	SEQS Limits	*WHO
01	pH @ 25 °C	*APHA 4500 H	-	7.69	6.5 – 8.5	6.5 – 8.5
02	Total Dissolved Solids (TDS)	*APHA 2540-C	mg/L	231	< 1000	< 1000
03	Total Hardness as CaCo3	ASTM D 1126	mg/L	80	< 500	-
04	Color	HACH 8025	TCU	12	≤ 15	≤ 15
05	Turbidity	*APHA 2130	NTU	04	≤ 5	≤ 5
06	Nitrite	HACH 8507	mg/L	0.041	≤ 3	3
07	Nitrate (NO3)	HACH 8039	mg/L	0.6	≤ 0.50	50
08	Taste	*APHA 2160	-	Tasteless	Non-Objectionable	Non-Objectionable
09	Odor	*APHA 2150	-	Odorless	Non-Objectionable	Non-Objectionable
10	Chloride (Cl)	*APHA 4500 Cl	mg/L	119.96	≤ 250	250
11	Fluoride	HACH 8029	mg/L	0.11	≤ 1.5	1.5
12	Aluminum	*APHA 3111-D	mg/L	<0.028	≤ 0.2	0.2
13	Nickel	*APHA 3111-B	mg/L	<0.008	≤ 0.02	0.07
14	Lead (Pb)	*APHA 3111-B	mg/L	<0.016	≤ 0.05	0.01

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ETAL-LMS-ASR-01	Issue Date:12-7-21	Issue No: 01

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Lab Report No. : 202301012-MMP-GW
Invoice Bill No. : MMP-202301-407

Page: 2 of 3
Reporting Date: 16-Jan-2023

Report to:	M/s. MM Pakistan (Pvt) Ltd. C.T.I. Plaza, 27 Empress Road, Lahore.
Attention:	Mr. Imtiaz Ali Khoso E-mail: imtia.khoso@mmpakistan.com

Sample ID:	**GW-202301012**
Sample Location:	**Kashmore**
Site Co-ordinates:	**28°19'24.3"E , 69°13'70.7"N,**
Sample Receiving Date:	**02-Jan-2023**
Sample Description:	Ground Water (33 as mentioned by Customer)
Sample Type:	Liquid – Sample
Sample Collected / Submitted By:	MM Pakistan
Date of Analysis:	02-Jan-2023 to 14-Jan-2023
Test Description:	Sindh Standards / WHO – Drinking Water Quality (32 – Parameters)

ANALYTICAL TEST REPORT

Sr. #	Parameters / Analytes Description	Methods	Unit	Test Results	SEQS Limits	*WHO
15	Barium (Ba)	HACH 8014	mg/L	N.D.	0.7	0.7
16	Antimony (Sb)	*APHA 3111-B	mg/L	N.D.	≤ 0.005	0.02
17	Arsenic (As)	*APHA 3114-B	mg/L	N.D.	≤ 0.05	0.01
18	Boron (B)	HACH 8015	mg/L	N.D.	0.3	0.5
19	Cadmium (Cd)	*APHA 3111-B	mg/L	<0.0028	0.01	0.003
20	Chromium (Cr)	*APHA 3111-B	mg/L	0.0101	≤ 0.05	0.05
21	Selenium (Se)	*APHA 3114-B	mg/L	N.D.	0.01	0.01
22	Copper (Cu)	*APHA 3111-B	mg/L	0.0075	2	2
23	Cyanide (CN)	HACH 8027	mg/L	N.D.	≤ 0.05	0.07
24	Mercury (Hg)	*APHA 3112-B	mg/L	N.D.	≤ 0.001	0.006
25	Manganese (Mn)	*APHA 3111-B	mg/L	<0.0016	≤ 0.5	0.4
26	Zinc (Zn)	*APHA 3111-B	mg/L	0.0098	≤ 5.0	3
27	Residual Chlorine	HACH 10069	mg/L	N.D.	0.2 - 0.5	5
28	Phenolic Compounds as Phenols	ASTM-D-1783	mg/L	N.D.	-	0.002

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Lab Report No. : 202301012-MMP-GW
Invoice Bill No. : MMP-202301-407

Page: 3 of 3
Reporting Date: 16-Jan-2023

Report to:	M/s. MM Pakistan (Pvt) Ltd. C.T.I. Plaza, 27 Empress Road, Lahore.
Attention:	Mr. Imtiaz Ali Khoso E-mail: imtia.khoso@mmpakistan.com

Sample ID:	**GW-202301012**
Sample Location:	**Kashmore**
Site Co-ordinates:	**28°19'24.3"E , 69°13'70.7"N,**
Sample Receiving Date:	**02-Jan-2023**
Sample Description:	Ground Water (33 as mentioned by Customer)
Sample Type:	Liquid – Sample
Sample Collected / Submitted By:	MM Pakistan
Date of Analysis:	02-Jan-2023 to 14-Jan-2023
Test Description:	Sindh Standards / WHO – Drinking Water Quality (32 – Parameters)

ANALYTICAL TEST REPORT

Sr. #	Parameters / Analytes Description	Methods	Unit	Test Results	SEQS Limits	*WHO
29	Sodium	*APHA 3111-B	mg/L	79.3695	-	200
30	Fecal Coliform	USEPA 1604	Cfu/100 ml	N.D.	-	0/100ml
31	E-Coli	USEPA 1604	Cfu/100 ml	N.D.	-	-
32	Total Coliform	*APHA 922 B	Cfu/100 ml	**01**	-	0/100ml

Note: Measurement of uncertainty will be provided on customer Demand. Environmental Conditions at the time of Testing; Temperature: 22 °C (+- 1°C) & Humidity: 33 % (+- 1%).

Conclusion:

Test Result = F

*APHA Standard Methods for Examination of water & wastewater 23rd Edition (2017).

SEQS Limits = Sindh Environmental Quality Standard (Reference: SEQS 2016).

WHO = World Health Organization.

*WHO Guideline Value for Drinking Water Quality follows by The World Bank

M = Meet SEQS-2016 requirements/ WHO Guideline Value for Drinking Water Quality , **F** = Below SEQS-2016 requirements/, WHO Guideline Value for Drinking Water Quality **N.D.** = Not Detected.

Analyzed By | **Reviewed By** | **Approved By**

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Page: 1 of 3
Reporting Date: 16-Jan-2023

Report to:	M/s. MM Pakistan (Pvt) Ltd. C.T.I. Plaza, 27 Empress Road, Lahore.
Attention:	Mr. Imtiaz Ali Khoso E-mail: imtia.khoso@mmpakistan.com

Sample ID:	**GW-202301013**
Sample Location:	**Kashmore**
Site Co-ordinates:	**28°23'72.6"E , 69°18'21.4"N,**
Sample Receiving Date:	**02-Jan-2023**
Sample Description:	Ground Water (34 as mentioned by Customer)
Sample Type:	Liquid – Sample
Sample Collected / Submitted By:	MM Pakistan
Date of Analysis:	02-Jan-2023 to 14-Jan-2023
Test Description:	Sindh Standards / WHO – Drinking Water Quality (32 – Parameters)

ANALYTICAL TEST REPORT

Sr. #	Parameters / Analytes Description	Methods	Unit	Test Results	SEQS Limits	*WHO
01	pH @ 25 °C	*APHA 4500 H	-	7.30	6.5 – 8.5	6.5 – 8.5
02	Total Dissolved Solids (TDS)	*APHA 2540-C	mg/L	446	< 1000	< 1000
03	Total Hardness as CaCo3	ASTM D 1126	mg/L	208	< 500	-
04	Color	HACH 8025	TCU	07	≤ 15	≤ 15
05	Turbidity	*APHA 2130	NTU	01	≤ 5	≤ 5
06	Nitrite	HACH 8507	mg/L	0.033	≤ 3	3
07	Nitrate (NO3)	HACH 8039	mg/L	0.2	≤ 0.50	50
08	Taste	*APHA 2160	-	Tasteless	Non-Objectionable	Non-Objectionable
09	Odor	*APHA 2150	-	Odorless	Non-Objectionable	Non-Objectionable
10	Chloride (Cl)	*APHA 4500 Cl	mg/L	199.93	≤ 250	250
11	Fluoride	HACH 8029	mg/L	0.25	≤ 1.5	1.5
12	Aluminum	*APHA 3111-D	mg/L	<0.028	≤ 0.2	0.2
13	Nickel	*APHA 3111-B	mg/L	<0.008	≤ 0.02	0.07
14	Lead (Pb)	*APHA 3111-B	mg/L	<0.016	≤ 0.05	0.01

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Lab Report No. : 202301013-MMP-GW
Invoice Bill No. : MMP-202301-407

Page: 2 of 3
Reporting Date: 16-Jan-2023

Report to:	M/s. MM Pakistan (Pvt) Ltd. C.T.I. Plaza, 27 Empress Road, Lahore.
Attention:	Mr. Imtiaz Ali Khoso E-mail: imtia.khoso@mmpakistan.com

Sample ID:	**GW-202301013**
Sample Location:	**Kashmore**
Site Co-ordinates:	**28°23'72.6"E , 69°18'21.4"N,**
Sample Receiving Date:	**02-Jan-2023**
Sample Description:	Ground Water (34 as mentioned by Customer)
Sample Type:	Liquid – Sample
Sample Collected / Submitted By:	MM Pakistan
Date of Analysis:	02-Jan-2023 to 14-Jan-2023
Test Description:	Sindh Standards / WHO – Drinking Water Quality (32 – Parameters)

ANALYTICAL TEST REPORT

Sr. #	Parameters / Analytes Description	Methods	Unit	Test Results	SEQS Limits	*WHO
15	Barium (Ba)	HACH 8014	mg/L	N.D.	0.7	0.7
16	Antimony (Sb)	*APHA 3111-B	mg/L	N.D.	≤ 0.005	0.02
17	Arsenic (As)	*APHA 3114-B	mg/L	N.D.	≤ 0.05	0.01
18	Boron (B)	HACH 8015	mg/L	N.D.	0.3	0.5
19	Cadmium (Cd)	*APHA 3111-B	mg/L	<0.0028	0.01	0.003
20	Chromium (Cr)	*APHA 3111-B	mg/L	N.D.	≤ 0.05	0.05
21	Selenium (Se)	*APHA 3114-B	mg/L	N.D.	0.01	0.01
22	Copper (Cu)	*APHA 3111-B	mg/L	0.0193	2	2
23	Cyanide (CN)	HACH 8027	mg/L	N.D.	≤ 0.05	0.07
24	Mercury (Hg)	*APHA 3112-B	mg/L	N.D.	≤ 0.001	0.006
25	Manganese (Mn)	*APHA 3111-B	mg/L	<0.0016	≤ 0.5	0.4
26	Zinc (Zn)	*APHA 3111-B	mg/L	0.0121	≤ 5.0	3
27	Residual Chlorine	HACH 10069	mg/L	N.D.	0.2 - 0.5	5
28	Phenolic Compounds as Phenols	ASTM-D-1783	mg/L	N.D.	-	0.002

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Invoice Bill No. : MMP-202301-407

Page: 3 of 3
Reporting Date: 16-Jan-2023

Report to:	M/s. MM Pakistan (Pvt) Ltd. C.T.I. Plaza, 27 Empress Road, Lahore.
Attention:	Mr. Imtiaz Ali Khoso E-mail: imtia.khoso@mmpakistan.com

Sample ID:	**GW-202301013**
Sample Location:	**Kashmore**
Site Co-ordinates:	**28°23'72.6"E , 69°18'21.4"N,**
Sample Receiving Date:	**02-Jan-2023**
Sample Description:	Ground Water (34 as mentioned by Customer)
Sample Type:	Liquid – Sample
Sample Collected / Submitted By:	MM Pakistan
Date of Analysis:	02-Jan-2023 to 14-Jan-2023
Test Description:	Sindh Standards / WHO – Drinking Water Quality (32 – Parameters)

ANALYTICAL TEST REPORT

Sr. #	Parameters / Analytes Description	Methods	Unit	Test Results	SEQS Limits	*WHO
29	Sodium	*APHA 3111-B	mg/L	69.1414	-	200
30	Fecal Coliform	USEPA 1604	Cfu/100 ml	N.D.	-	0/100ml
31	E-Coli	USEPA 1604	Cfu/100 ml	N.D.	-	-
32	Total Coliform	*APHA 922 B	Cfu/100 ml	**01**	-	0/100ml

Note: Measurement of uncertainty will be provided on customer Demand. Environmental Conditions at the time of Testing; Temperature: 22 °C (+- 1°C) & Humidity: 33 % (+- 1%).

Conclusion:

Test Result = F

*APHA Standard Methods for Examination of water & wastewater 23rd Edition (2017).

SEQS Limits = Sindh Environmental Quality Standard (Reference: SEQS 2016).

WHO = World Health Organization.

*WHO Guideline Value for Drinking Water Quality follows by The World Bank

M = Meet SEQS-2016 requirements/ WHO Guideline Value for Drinking Water Quality , **F** = Below SEQS-2016 requirements/, WHO Guideline Value for Drinking Water Quality **N.D.** = Not Detected.

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Analyzed By | Reviewed By | Approved By

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Invoice Bill No. : MMP-202301-407

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Reporting Date: 16-Jan-2023

Report to:	M/s. MM Pakistan (Pvt) Ltd. C.T.I. Plaza, 27 Empress Road, Lahore.
Attention:	Mr. Imtiaz Ali Khoso E-mail: imtia.khoso@mmpakistan.com

Sample ID:	**GW-202301014**
Sample Location:	**Jacobabad**
Site Co-ordinates:	**28°27'80.3"E , 68°42'42.9"N,**
Sample Receiving Date:	**02-Jan-2023**
Sample Description:	Ground Water (40 as mentioned by Customer)
Sample Type:	Liquid – Sample
Sample Collected / Submitted By:	MM Pakistan
Date of Analysis:	02-Jan-2023 to 14-Jan-2023
Test Description:	Sindh Standards / WHO – Drinking Water Quality (32 – Parameters)

ANALYTICAL TEST REPORT

Sr. #	Parameters / Analytes Description	Methods	Unit	Test Results	SEQS Limits	*WHO
01	pH @ 25 °C	*APHA 4500 H	-	7.42	6.5 – 8.5	6.5 – 8.5
02	Total Dissolved Solids (TDS)	*APHA 2540-C	mg/L	493	< 1000	< 1000
03	Total Hardness as CaCo3	ASTM D 1126	mg/L	220	< 500	-
04	Color	HACH 8025	TCU	10	≤ 15	≤ 15
05	Turbidity	*APHA 2130	NTU	01	≤ 5	≤ 5
06	Nitrite	HACH 8507	mg/L	0.022	≤ 3	3
07	Nitrate (NO3)	HACH 8039	mg/L	0.3	≤ 0.50	50
08	Taste	*APHA 2160	-	Tasteless	Non-Objectionable	Non-Objectionable
09	Odor	*APHA 2150	-	Odorless	Non-Objectionable	Non-Objectionable
10	Chloride (Cl)	*APHA 4500 Cl	mg/L	179.94	≤ 250	250
11	Fluoride	HACH 8029	mg/L	0.23	≤ 1.5	1.5
12	Aluminum	*APHA 3111-D	mg/L	<0.028	≤ 0.2	0.2
13	Nickel	*APHA 3111-B	mg/L	<0.008	≤ 0.02	0.07
14	Lead (Pb)	*APHA 3111-B	mg/L	<0.016	≤ 0.05	0.01

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ETAL-LMS-ASR-01	Issue Date:12-7-21	Issue No: 01

Lahore Office: 87-E Madina Height, Office # A/30 & A/31, 8th Floor, Maulana Shaukat Ali Road, Johar Town, Lahore. +92 42 32296099
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Lab Report No. : 202301014-MMP-GW
Invoice Bill No. : MMP-202301-407

Page: 2 of 3
Reporting Date: 16-Jan-2023

Report to:	M/s. MM Pakistan (Pvt) Ltd. C.T.I. Plaza, 27 Empress Road, Lahore.
Attention:	Mr. Imtiaz Ali Khoso E-mail: imtia.khoso@mmpakistan.com

Sample ID:	**GW-202301014**
Sample Location:	**Jacobabad**
Site Co-ordinates:	**28°27'80.3"E , 68°42'42.9"N,**
Sample Receiving Date:	**02-Jan-2023**
Sample Description:	Ground Water (40 as mentioned by Customer)
Sample Type:	Liquid – Sample
Sample Collected / Submitted By:	MM Pakistan
Date of Analysis:	02-Jan-2023 to 14-Jan-2023
Test Description:	Sindh Standards / WHO – Drinking Water Quality (32 – Parameters)

ANALYTICAL TEST REPORT

Sr. #	Parameters / Analytes Description	Methods	Unit	Test Results	SEQS Limits	*WHO
15	Barium (Ba)	HACH 8014	mg/L	N.D.	0.7	0.7
16	Antimony (Sb)	*APHA 3111-B	mg/L	N.D.	≤ 0.005	0.02
17	Arsenic (As)	*APHA 3114-B	mg/L	N.D.	≤ 0.05	0.01
18	Boron (B)	HACH 8015	mg/L	N.D.	0.3	0.5
19	Cadmium (Cd)	*APHA 3111-B	mg/L	<0.0028	0.01	0.003
20	Chromium (Cr)	*APHA 3111-B	mg/L	0.0098	≤ 0.05	0.05
21	Selenium (Se)	*APHA 3114-B	mg/L	N.D.	0.01	0.01
22	Copper (Cu)	*APHA 3111-B	mg/L	0.0125	2	2
23	Cyanide (CN)	HACH 8027	mg/L	N.D.	≤ 0.05	0.07
24	Mercury (Hg)	*APHA 3112-B	mg/L	N.D.	≤ 0.001	0.006
25	Manganese (Mn)	*APHA 3111-B	mg/L	<0.0016	≤ 0.5	0.4
26	Zinc (Zn)	*APHA 3111-B	mg/L	0.0101	≤ 5.0	3
27	Residual Chlorine	HACH 10069	mg/L	N.D.	0.2 - 0.5	5
28	Phenolic Compounds as Phenols	ASTM-D-1783	mg/L	N.D.	-	0.002

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Page: 3 of 3
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Report to:	M/s. MM Pakistan (Pvt) Ltd. C.T.I. Plaza, 27 Empress Road, Lahore.
Attention:	Mr. Imtiaz Ali Khoso E-mail: imtia.khoso@mmpakistan.com

Sample ID:	**GW-202301014**
Sample Location:	**Jacobabad**
Site Co-ordinates:	**28°27'80.3"E , 68°42'42.9"N,**
Sample Receiving Date:	**02-Jan-2023**
Sample Description:	Ground Water (40 as mentioned by Customer)
Sample Type:	Liquid – Sample
Sample Collected / Submitted By:	MM Pakistan
Date of Analysis:	02-Jan-2023 to 14-Jan-2023
Test Description:	Sindh Standards / WHO – Drinking Water Quality (32 – Parameters)

ANALYTICAL TEST REPORT

Sr. #	Parameters / Analytes Description	Methods	Unit	Test Results	SEQS Limits	*WHO
29	Sodium	*APHA 3111-B	mg/L	86.3005	-	200
30	Fecal Coliform	USEPA 1604	Cfu/100 ml	N.D.	-	0/100ml
31	E-Coli	USEPA 1604	Cfu/100 ml	N.D.	-	-
32	Total Coliform	*APHA 922 B	Cfu/100 ml	**02**	-	0/100ml

Note: Measurement of uncertainty will be provided on customer Demand. Environmental Conditions at the time of Testing; Temperature: 22 °C (+- 1°C) & Humidity: 33 % (+- 1%).

Conclusion:

Test Result = F

*APHA Standard Methods for Examination of water & wastewater 23rd Edition (2017).

SEQS Limits = Sindh Environmental Quality Standard (Reference: SEQS 2016).

WHO = World Health Organization.

*WHO Guideline Value for Drinking Water Quality follows by The World Bank

M = Meet SEQS-2016 requirements/ WHO Guideline Value for Drinking Water Quality , **F** = Below SEQS-2016 requirements/, WHO Guideline Value for Drinking Water Quality **N.D.** = Not Detected.

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Analyzed By | **Reviewed By** | **Approved By**

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Attention:	Mr. Imtiaz Ali Khoso E-mail: imtia.khoso@mmpakistan.com

Sample ID:	**GW-202301015**
Sample Location:	**Jacobabad**
Site Co-ordinates:	**28°28'43.7"E , 68°69'22.1"N,**
Sample Receiving Date:	**02-Jan-2023**
Sample Description:	Ground Water (41 as mentioned by Customer)
Sample Type:	Liquid – Sample
Sample Collected / Submitted By:	MM Pakistan
Date of Analysis:	02-Jan-2023 to 14-Jan-2023
Test Description:	Sindh Standards / WHO – Drinking Water Quality (32 – Parameters)

ANALYTICAL TEST REPORT

Sr. #	Parameters / Analytes Description	Methods	Unit	Test Results	SEQS Limits	*WHO
01	pH @ 25 °C	*APHA 4500 H	-	7.23	6.5 – 8.5	6.5 – 8.5
02	Total Dissolved Solids (TDS)	*APHA 2540-C	mg/L	**1778**	< 1000	< 1000
03	Total Hardness as CaCo3	ASTM D 1126	mg/L	**1080**	< 500	-
04	Color	HACH 8025	TCU	08	≤ 15	≤ 15
05	Turbidity	*APHA 2130	NTU	02	≤ 5	≤ 5
06	Nitrite	HACH 8507	mg/L	0.088	≤ 3	3
07	Nitrate (NO3)	HACH 8039	mg/L	**1.0**	≤ 0.50	50
08	Taste	*APHA 2160	-	Tasteless	Non-Objectionable	Non-Objectionable
09	Odor	*APHA 2150	-	Odorless	Non-Objectionable	Non-Objectionable
10	Chloride (Cl)	*APHA 4500 Cl	mg/L	**599.81**	≤ 250	250
11	Fluoride	HACH 8029	mg/L	0.55	≤ 1.5	1.5
12	Aluminum	*APHA 3111-D	mg/L	<0.028	≤ 0.2	0.2
13	Nickel	*APHA 3111-B	mg/L	<0.008	≤ 0.02	0.07
14	Lead (Pb)	*APHA 3111-B	mg/L	<0.016	≤ 0.05	0.01

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Attention:	Mr. Imtiaz Ali Khoso E-mail: imtia.khoso@mmpakistan.com

Sample ID:	**GW-202301015**
Sample Location:	**Jacobabad**
Site Co-ordinates:	**28°28'43.7"E , 68°69'22.1"N,**
Sample Receiving Date:	**02-Jan-2023**
Sample Description:	Ground Water (41 as mentioned by Customer)
Sample Type:	Liquid – Sample
Sample Collected / Submitted By:	MM Pakistan
Date of Analysis:	02-Jan-2023 to 14-Jan-2023
Test Description:	Sindh Standards / WHO – Drinking Water Quality (32 – Parameters)

ANALYTICAL TEST REPORT

Sr. #	Parameters / Analytes Description	Methods	Unit	Test Results	SEQS Limits	*WHO
15	Barium (Ba)	HACH 8014	mg/L	N.D.	0.7	0.7
16	Antimony (Sb)	*APHA 3111-B	mg/L	N.D.	≤ 0.005	0.02
17	Arsenic (As)	*APHA 3114-B	mg/L	N.D.	≤ 0.05	0.01
18	Boron (B)	HACH 8015	mg/L	N.D.	0.3	0.5
19	Cadmium (Cd)	*APHA 3111-B	mg/L	<0.0028	0.01	0.003
20	Chromium (Cr)	*APHA 3111-B	mg/L	0.0129	≤ 0.05	0.05
21	Selenium (Se)	*APHA 3114-B	mg/L	N.D.	0.01	0.01
22	Copper (Cu)	*APHA 3111-B	mg/L	0.0203	2	2
23	Cyanide (CN)	HACH 8027	mg/L	N.D.	≤ 0.05	0.07
24	Mercury (Hg)	*APHA 3112-B	mg/L	N.D.	≤ 0.001	0.006
25	Manganese (Mn)	*APHA 3111-B	mg/L	<0.0016	≤ 0.5	0.4
26	Zinc (Zn)	*APHA 3111-B	mg/L	0.0196	≤ 5.0	3
27	Residual Chlorine	HACH 10069	mg/L	N.D.	0.2 - 0.5	5
28	Phenolic Compounds as Phenols	ASTM-D-1783	mg/L	N.D.	-	0.002

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Report to:	M/s. MM Pakistan (Pvt) Ltd. C.T.I. Plaza, 27 Empress Road, Lahore.
Attention:	Mr. Imtiaz Ali Khoso E-mail: imtia.khoso@mmpakistan.com

Sample ID:	**GW-202301015**
Sample Location:	**Jacobabad**
Site Co-ordinates:	**28°28'43.7"E , 68°69'22.1"N,**
Sample Receiving Date:	**02-Jan-2023**
Sample Description:	Ground Water (41 as mentioned by Customer)
Sample Type:	Liquid – Sample
Sample Collected / Submitted By:	MM Pakistan
Date of Analysis:	02-Jan-2023 to 14-Jan-2023
Test Description:	Sindh Standards / WHO – Drinking Water Quality (32 – Parameters)

ANALYTICAL TEST REPORT

Sr. #	Parameters / Analytes Description	Methods	Unit	Test Results	SEQS Limits	*WHO
29	Sodium	*APHA 3111-B	mg/L	**386.1023**	-	200
30	Fecal Coliform	USEPA 1604	Cfu/100 ml	N.D.	-	0/100ml
31	E-Coli	USEPA 1604	Cfu/100 ml	N.D.	-	-
32	Total Coliform	*APHA 922 B	Cfu/100 ml	**02**	-	0/100ml

Note: Measurement of uncertainty will be provided on customer Demand. Environmental Conditions at the time of Testing; Temperature: 22 °C (+- 1°C) & Humidity: 33 % (+- 1%).

Conclusion:

Test Result = F

*APHA Standard Methods for Examination of water & wastewater 23rd Edition (2017).

SEQS Limits = Sindh Environmental Quality Standard (Reference: SEQS 2016).

WHO = World Health Organization.

*WHO Guideline Value for Drinking Water Quality follows by The World Bank

M = Meet SEQS-2016 requirements/ WHO Guideline Value for Drinking Water Quality , **F** = Below SEQS-2016 requirements/, WHO Guideline Value for Drinking Water Quality **N.D.** = Not Detected.

Analyzed By | **Reviewed By** | **Approved By**

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Invoice Bill No. : MMP-202301-407

Page: 1 of 3
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Report to:	M/s. MM Pakistan (Pvt) Ltd. C.T.I. Plaza, 27 Empress Road, Lahore.
Attention:	Mr. Imtiaz Ali Khoso E-mail: imtia.khoso@mmpakistan.com

Sample ID:	**GW-202301017**
Sample Location:	**Shikarpur**
Site Co-ordinates:	**28°03'35.2"E , 68°83'00.7"N,**
Sample Receiving Date:	**02-Jan-2023**
Sample Description:	Ground Water (43 as mentioned by Customer)
Sample Type:	Liquid – Sample
Sample Collected / Submitted By:	MM Pakistan
Date of Analysis:	02-Jan-2023 to 14-Jan-2023
Test Description:	Sindh Standards / WHO – Drinking Water Quality (32 – Parameters)

ANALYTICAL TEST REPORT

Sr. #	Parameters / Analytes Description	Methods	Unit	Test Results	SEQS Limits	*WHO
01	pH @ 25 °C	*APHA 4500 H	-	7.34	6.5 – 8.5	6.5 – 8.5
02	Total Dissolved Solids (TDS)	*APHA 2540-C	mg/L	471	< 1000	< 1000
03	Total Hardness as CaCo3	ASTM D 1126	mg/L	188	< 500	-
04	Color	HACH 8025	TCU	10	≤ 15	≤ 15
05	Turbidity	*APHA 2130	NTU	03	≤ 5	≤ 5
06	Nitrite	HACH 8507	mg/L	0.027	≤ 3	3
07	Nitrate (NO3)	HACH 8039	mg/L	0.2	≤ 0.50	50
08	Taste	*APHA 2160	-	Tasteless	Non-Objectionable	Non-Objectionable
09	Odor	*APHA 2150	-	Odorless	Non-Objectionable	Non-Objectionable
10	Chloride (Cl)	*APHA 4500 Cl	mg/L	179.94	≤ 250	250
11	Fluoride	HACH 8029	mg/L	0.36	≤ 1.5	1.5
12	Aluminum	*APHA 3111-D	mg/L	<0.028	≤ 0.2	0.2
13	Nickel	*APHA 3111-B	mg/L	<0.008	≤ 0.02	0.07
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Attention:	Mr. Imtiaz Ali Khoso E-mail: imtia.khoso@mmpakistan.com

Sample ID:	**GW-202301017**
Sample Location:	**Shikarpur**
Site Co-ordinates:	**28°03'35.2"E , 68°83'00.7"N,**
Sample Receiving Date:	**02-Jan-2023**
Sample Description:	Ground Water (43 as mentioned by Customer)
Sample Type:	Liquid – Sample
Sample Collected / Submitted By:	MM Pakistan
Date of Analysis:	02-Jan-2023 to 14-Jan-2023
Test Description:	Sindh Standards / WHO – Drinking Water Quality (32 – Parameters)

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Sr. #	Parameters / Analytes Description	Methods	Unit	Test Results	SEQS Limits	*WHO
15	Barium (Ba)	HACH 8014	mg/L	N.D.	0.7	0.7
16	Antimony (Sb)	*APHA 3111-B	mg/L	N.D.	≤ 0.005	0.02
17	Arsenic (As)	*APHA 3114-B	mg/L	N.D.	≤ 0.05	0.01
18	Boron (B)	HACH 8015	mg/L	N.D.	0.3	0.5
19	Cadmium (Cd)	*APHA 3111-B	mg/L	<0.0028	0.01	0.003
20	Chromium (Cr)	*APHA 3111-B	mg/L	0.0069	≤ 0.05	0.05
21	Selenium (Se)	*APHA 3114-B	mg/L	N.D.	0.01	0.01
22	Copper (Cu)	*APHA 3111-B	mg/L	0.0106	2	2
23	Cyanide (CN)	HACH 8027	mg/L	N.D.	≤ 0.05	0.07
24	Mercury (Hg)	*APHA 3112-B	mg/L	N.D.	≤ 0.001	0.006
25	Manganese (Mn)	*APHA 3111-B	mg/L	<0.0016	≤ 0.5	0.4
26	Zinc (Zn)	*APHA 3111-B	mg/L	0.099	≤ 5.0	3
27	Residual Chlorine	HACH 10069	mg/L	N.D.	0.2 - 0.5	5
28	Phenolic Compounds as Phenols	ASTM-D-1783	mg/L	N.D.	-	0.002

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Attention:	Mr. Imtiaz Ali Khoso E-mail: imtia.khoso@mmpakistan.com

Sample ID:	**GW-202301017**
Sample Location:	**Shikarpur**
Site Co-ordinates:	**28°03'35.2"E , 68°83'00.7"N,**
Sample Receiving Date:	**02-Jan-2023**
Sample Description:	Ground Water (43 as mentioned by Customer)
Sample Type:	Liquid – Sample
Sample Collected / Submitted By:	MM Pakistan
Date of Analysis:	02-Jan-2023 to 14-Jan-2023
Test Description:	Sindh Standards / WHO – Drinking Water Quality (32 – Parameters)

ANALYTICAL TEST REPORT

Sr. #	Parameters / Analytes Description	Methods	Unit	Test Results	SEQS Limits	*WHO
29	Sodium	*APHA 3111-B	mg/L	77.3256	-	200
30	Fecal Coliform	USEPA 1604	Cfu/100 ml	N.D.	-	0/100ml
31	E-Coli	USEPA 1604	Cfu/100 ml	N.D.	-	-
32	Total Coliform	*APHA 922 B	Cfu/100 ml	**01**	-	0/100ml

Note: Measurement of uncertainty will be provided on customer Demand. Environmental Conditions at the time of Testing; Temperature: 22 °C (+- 1°C) & Humidity: 33 % (+- 1%)

Conclusion:

Test Result = F

*APHA Standard Methods for Examination of water & wastewater 23rd Edition (2017).

SEQS Limits = Sindh Environmental Quality Standard (Reference: SEQS 2016).

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M = Meet SEQS-2016 requirements/ WHO Guideline Value for Drinking Water Quality , **F** = Below SEQS-2016 requirements/, WHO Guideline Value for Drinking Water Quality **N.D.** = Not Detected.

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Attention:	Mr. Imtiaz Ali Khoso E-mail: imtia.khoso@mmpakistan.com

Sample ID:	**GW-202301018**
Sample Location:	**Jacobabad**
Site Co-ordinates:	**28°32'52.5"E , 68°43'65.9"N,**
Sample Receiving Date:	**02-Jan-2023**
Sample Description:	Ground Water (44 as mentioned by Customer)
Sample Type:	Liquid – Sample
Sample Collected / Submitted By:	MM Pakistan
Date of Analysis:	02-Jan-2023 to 14-Jan-2023
Test Description:	Sindh Standards / WHO – Drinking Water Quality (32 – Parameters)

ANALYTICAL TEST REPORT

Sr. #	Parameters / Analytes Description	Methods	Unit	Test Results	SEQS Limits	*WHO
01	pH @ 25 °C	*APHA 4500 H	-	7.09	6.5 – 8.5	6.5 – 8.5
02	Total Dissolved Solids (TDS)	*APHA 2540-C	mg/L	777	< 1000	< 1000
03	Total Hardness as CaCo3	ASTM D 1126	mg/L	396	< 500	-
04	Color	HACH 8025	TCU	08	≤ 15	≤ 15
05	Turbidity	*APHA 2130	NTU	01	≤ 5	≤ 5
06	Nitrite	HACH 8507	mg/L	0.089	≤ 3	3
07	Nitrate (NO3)	HACH 8039	mg/L	**1.5**	≤ 0.50	50
08	Taste	*APHA 2160	-	Tasteless	Non-Objectionable	Non-Objectionable
09	Odor	*APHA 2150	-	Odorless	Non-Objectionable	Non-Objectionable
10	Chloride (Cl)	*APHA 4500 Cl	mg/L	**329.89**	≤ 250	250
11	Fluoride	HACH 8029	mg/L	1.0	≤ 1.5	1.5
12	Aluminum	*APHA 3111-D	mg/L	<0.028	≤ 0.2	0.2
13	Nickel	*APHA 3111-B	mg/L	<0.008	≤ 0.02	0.07
14	Lead (Pb)	*APHA 3111-B	mg/L	<0.016	≤ 0.05	0.01

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SMS (Certificate # 202101031) (LAB/L.C/ENVI TECH AL-20/225/20) SMS (Certificate # 202101032)

ETAL-LMS-ASR-01	Issue Date:12-7-21	Issue No: 01

Lahore Office: 87-E Madina Height, Office # A/30 & A/31, 8th Floor, Maulana Shaukat Ali Road, Johar Town, Lahore. +92 42 32296099
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Lab Report No. : 202301018-MMP-GW
Invoice Bill No. : MMP-202301-407

Page: 2 of 3
Reporting Date: 16-Jan-2023

Report to:	M/s. MM Pakistan (Pvt) Ltd. C.T.I. Plaza, 27 Empress Road, Lahore.
Attention:	Mr. Imtiaz Ali Khoso E-mail: imtia.khoso@mmpakistan.com

Sample ID:	**GW-202301018**
Sample Location:	**Jacobabad**
Site Co-ordinates:	**28°32'52.5"E , 68°43'65.9"N,**
Sample Receiving Date:	**02-Jan-2023**
Sample Description:	Ground Water (44 as mentioned by Customer)
Sample Type:	Liquid – Sample
Sample Collected / Submitted By:	MM Pakistan
Date of Analysis:	02-Jan-2023 to 14-Jan-2023
Test Description:	Sindh Standards / WHO – Drinking Water Quality (32 – Parameters)

ANALYTICAL TEST REPORT

Sr. #	Parameters / Analytes Description	Methods	Unit	Test Results	SEQS Limits	*WHO
15	Barium (Ba)	HACH 8014	mg/L	N.D.	0.7	0.7
16	Antimony (Sb)	*APHA 3111-B	mg/L	N.D.	≤ 0.005	0.02
17	Arsenic (As)	*APHA 3114-B	mg/L	N.D.	≤ 0.05	0.01
18	Boron (B)	HACH 8015	mg/L	N.D.	0.3	0.5
19	Cadmium (Cd)	*APHA 3111-B	mg/L	<0.0028	0.01	0.003
20	Chromium (Cr)	*APHA 3111-B	mg/L	0.0147	≤ 0.05	0.05
21	Selenium (Se)	*APHA 3114-B	mg/L	N.D.	0.01	0.01
22	Copper (Cu)	*APHA 3111-B	mg/L	0.0169	2	2
23	Cyanide (CN)	HACH 8027	mg/L	N.D.	≤ 0.05	0.07
24	Mercury (Hg)	*APHA 3112-B	mg/L	N.D.	≤ 0.001	0.006
25	Manganese (Mn)	*APHA 3111-B	mg/L	<0.0016	≤ 0.5	0.4
26	Zinc (Zn)	*APHA 3111-B	mg/L	0.0188	≤ 5.0	3
27	Residual Chlorine	HACH 10069	mg/L	N.D.	0.2 - 0.5	5
28	Phenolic Compounds as Phenols	ASTM-D-1783	mg/L	N.D.	-	0.002

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Lab Report No. : 202301018-MMP-GW
Invoice Bill No. : MMP-202301-407

Page: 3 of 3
Reporting Date: 16-Jan-2023

Report to:	M/s. MM Pakistan (Pvt) Ltd. C.T.I. Plaza, 27 Empress Road, Lahore.
Attention:	Mr. Imtiaz Ali Khoso E-mail: imtia.khoso@mmpakistan.com

Sample ID:	**GW-202301018**
Sample Location:	**Jacobabad**
Site Co-ordinates:	**28°32'52.5"E , 68°43'65.9"N,**
Sample Receiving Date:	**02-Jan-2023**
Sample Description:	Ground Water (44 as mentioned by Customer)
Sample Type:	Liquid – Sample
Sample Collected / Submitted By:	MM Pakistan
Date of Analysis:	02-Jan-2023 to 14-Jan-2023
Test Description:	Sindh Standards / WHO – Drinking Water Quality (32 – Parameters)

ANALYTICAL TEST REPORT

Sr. #	Parameters / Analytes Description	Methods	Unit	Test Results	SEQS Limits	*WHO
29	Sodium	*APHA 3111-B	mg/L	277.0202	-	200
30	Fecal Coliform	USEPA 1604	Cfu/100 ml	N.D.	-	0/100ml
31	E-Coli	USEPA 1604	Cfu/100 ml	N.D.	-	-
32	Total Coliform	*APHA 922 B	Cfu/100 ml	02	-	0/100ml

Note: Measurement of uncertainty will be provided on customer Demand. Environmental Conditions at the time of Testing; Temperature: 22 °C (+- 1°C) & Humidity: 33 % (+- 1%).

Conclusion:

Test Result = F

*APHA Standard Methods for Examination of water & wastewater 23rd Edition (2017).

SEQS Limits = Sindh Environmental Quality Standard (Reference: SEQS 2016).

WHO = World Health Organization.

*WHO Guideline Value for Drinking Water Quality follows by The World Bank

M = Meet SEQS-2016 requirements/ WHO Guideline Value for Drinking Water Quality , **F** = Below SEQS-2016 requirements/, WHO Guideline Value for Drinking Water Quality **N.D.** = Not Detected.

Analyzed By | Reviewed By | Approved By

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GREEN LAB CERTIFICATION GOLD

Lab Report No. : 202301010-MMP-GW
Invoice Bill No. : MMP-202301-407

Page: 1 of 3
Reporting Date: 16-Jan-2023

Report to:	M/s. MM Pakistan (Pvt) Ltd. C.T.I. Plaza, 27 Empress Road, Lahore.
Attention:	Mr. Imtiaz Ali Khoso E-mail: imtia.khoso@mmpakistan.com

Sample ID:	**GW-202301010**
Sample Location:	**Kashmore**
Site Co-ordinates:	**28°26'39.2"E , 68°94'60.1"N,**
Sample Receiving Date:	**02-Jan-2023**
Sample Description:	Ground Water (14 as mentioned by Customer)
Sample Type:	Liquid – Sample
Sample Collected / Submitted By:	MM Pakistan
Date of Analysis:	02-Jan-2023 to 14-Jan-2023
Test Description:	Sindh Standards / WHO – Drinking Water Quality (32 – Parameters)

ANALYTICAL TEST REPORT

Sr. #	Parameters / Analytes Description	Methods	Unit	Test Results	SEQS Limits	*WHO
01	pH @ 25 °C	*APHA 4500 H	-	7.59	6.5 – 8.5	6.5 – 8.5
02	Total Dissolved Solids (TDS)	*APHA 2540-C	mg/L	482	< 1000	< 1000
03	Total Hardness as CaCo3	ASTM D 1126	mg/L	200	< 500	-
04	Color	HACH 8025	TCU	14	≤ 15	≤ 15
05	Turbidity	*APHA 2130	NTU	04	≤ 5	≤ 5
06	Nitrite	HACH 8507	mg/L	0.011	≤ 3	3
07	Nitrate (NO3)	HACH 8039	mg/L	0.2	≤ 0.50	50
08	Taste	*APHA 2160	-	Tasteless	Non-Objectionable	Non-Objectionable
09	Odor	*APHA 2150	-	Odorless	Non-Objectionable	Non-Objectionable
10	Chloride (Cl)	*APHA 4500 Cl	mg/L	159.95	≤ 250	250
11	Fluoride	HACH 8029	mg/L	0.22	≤ 1.5	1.5
12	Aluminum	*APHA 3111-D	mg/L	<0.028	≤ 0.2	0.2
13	Nickel	*APHA 3111-B	mg/L	<0.008	≤ 0.02	0.07
14	Lead (Pb)	*APHA 3111-B	mg/L	<0.016	≤ 0.05	0.01

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GREEN LAB CERTIFICATION

Lab Report No. : 202301010-MMP-GW
Invoice Bill No. : MMP-202301-407

Page: 2 of 3
Reporting Date: 16-Jan-2023

Report to:	M/s. MM Pakistan (Pvt) Ltd. C.T.I. Plaza, 27 Empress Road, Lahore.
Attention:	Mr. Imtiaz Ali Khoso E-mail: imtia.khoso@mmpakistan.com

Sample ID:	**GW-202301010**
Sample Location:	**Kashmore**
Site Co-ordinates:	**28°26'39.2"E , 68°94'60.1"N,**
Sample Receiving Date:	**02-Jan-2023**
Sample Description:	Ground Water (14 as mentioned by Customer)
Sample Type:	Liquid – Sample
Sample Collected / Submitted By:	MM Pakistan
Date of Analysis:	02-Jan-2023 to 14-Jan-2023
Test Description:	Sindh Standards / WHO – Drinking Water Quality (32 – Parameters)

ANALYTICAL TEST REPORT

Sr. #	Parameters / Analytes Description	Methods	Unit	Test Results	SEQS Limits	*WHO
15	Barium (Ba)	HACH 8014	mg/L	N.D.	0.7	0.7
16	Antimony (Sb)	*APHA 3111-B	mg/L	N.D.	≤ 0.005	0.02
17	Arsenic (As)	*APHA 3114-B	mg/L	N.D.	≤ 0.05	0.01
18	Boron (B)	HACH 8015	mg/L	N.D.	0.3	0.5
19	Cadmium (Cd)	*APHA 3111-B	mg/L	<0.0028	0.01	0.003
20	Chromium (Cr)	*APHA 3111-B	mg/L	0.0089	≤ 0.05	0.05
21	Selenium (Se)	*APHA 3114-B	mg/L	N.D.	0.01	0.01
22	Copper (Cu)	*APHA 3111-B	mg/L	0.0123	2	2
23	Cyanide (CN)	HACH 8027	mg/L	N.D.	≤ 0.05	0.07
24	Mercury (Hg)	*APHA 3112-B	mg/L	N.D.	≤ 0.001	0.006
25	Manganese (Mn)	*APHA 3111-B	mg/L	<0.0016	≤ 0.5	0.4
26	Zinc (Zn)	*APHA 3111-B	mg/L	0.0066	≤ 5.0	3
27	Residual Chlorine	HACH 10069	mg/L	N.D.	0.2 - 0.5	5
28	Phenolic Compounds as Phenols	ASTM-D-1783	mg/L	N.D.	-	0.002

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GREEN LAB CERTIFICATION

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Page: 3 of 3
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Report to:	M/s. MM Pakistan (Pvt) Ltd. C.T.I. Plaza, 27 Empress Road, Lahore.
Attention:	Mr. Imtiaz Ali Khoso E-mail: imtia.khoso@mmpakistan.com

Sample ID:	**GW-202301010**
Sample Location:	**Kashmore**
Site Co-ordinates:	**28°26'39.2"E , 68°94'60.1"N,**
Sample Receiving Date:	**02-Jan-2023**
Sample Description:	Ground Water (14 as mentioned by Customer)
Sample Type:	Liquid – Sample
Sample Collected / Submitted By:	MM Pakistan
Date of Analysis:	02-Jan-2023 to 14-Jan-2023
Test Description:	Sindh Standards / WHO – Drinking Water Quality (32 – Parameters)

ANALYTICAL TEST REPORT

Sr. #	Parameters / Analytes Description	Methods	Unit	Test Results	SEQS Limits	*WHO
29	Sodium	*APHA 3111-B	mg/L	69.6578	-	200
30	Fecal Coliform	USEPA 1604	Cfu/100 ml	N.D.	-	0/100ml
31	E-Coli	USEPA 1604	Cfu/100 ml	N.D.	-	-
32	Total Coliform	*APHA 922 B	Cfu/100 ml	04	-	0/100ml

Note: Measurement of uncertainty will be provided on customer Demand. Environmental Conditions at the time of Testing, Temperature: 22 °C (+- 1°C) & Humidity: 33 % (+- 1%).

Conclusion:

Test Result = F

*APHA Standard Methods for Examination of water & wastewater 23rd Edition (2017).

SEQS Limits = Sindh Environmental Quality Standard (Reference: SEQS 2016).

WHO = World Health Organization.

*WHO Guideline Value for Drinking Water Quality follows by The World Bank

M = Meet SEQS-2016 requirements/ WHO Guideline Value for Drinking Water Quality , **F** = Below SEQS-2016 requirements/, WHO Guideline Value for Drinking Water Quality **N.D.** = Not Detected.

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Analyzed By | Reviewed By | Approved By

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GREEN LAB CERTIFICATION

Lab Report No. : 202301019-MMP-GW
Invoice Bill No. : MMP-202301-407

Page: 1 of 3
Reporting Date: 16-Jan-2023

Report to:	M/s. MM Pakistan (Pvt) Ltd. C.T.I. Plaza, 27 Empress Road, Lahore.
Attention:	Mr. Imtiaz Ali Khoso E-mail: imtia.khoso@mmpakistan.com

Sample ID:	**GW-202301019**
Sample Location:	**Kashmore**
Site Co-ordinates:	**28°24'39"E , 68°95'04.2"N,**
Sample Receiving Date:	**02-Jan-2023**
Sample Description:	Ground Water (46 as mentioned by Customer)
Sample Type:	Liquid – Sample
Sample Collected / Submitted By:	MM Pakistan
Date of Analysis:	02-Jan-2023 to 14-Jan-2023
Test Description:	Sindh Standards / WHO – Drinking Water Quality (32 – Parameters)

ANALYTICAL TEST REPORT

Sr. #	Parameters / Analytes Description	Methods	Unit	Test Results	SEQS Limits	*WHO
01	pH @ 25 °C	*APHA 4500 H	-	7.55	6.5 – 8.5	6.5 – 8.5
02	Total Dissolved Solids (TDS)	*APHA 2540-C	mg/L	**1055**	< 1000	< 1000
03	Total Hardness as CaCo3	ASTM D 1126	mg/L	**960**	< 500	-
04	Color	HACH 8025	TCU	**16**	≤ 15	≤ 15
05	Turbidity	*APHA 2130	NTU	**8**	≤ 5	≤ 5
06	Nitrite	HACH 8507	mg/L	0.045	≤ 3	3
07	Nitrate (NO3)	HACH 8039	mg/L	0.3	≤ 0.50	50
08	Taste	*APHA 2160	-	Tasteless	Non-Objectionable	Non-Objectionable
09	Odor	*APHA 2150	-	Odorless	Non-Objectionable	Non-Objectionable
10	Chloride (Cl)	*APHA 4500 Cl	mg/L	79.97	≤ 250	250
11	Fluoride	HACH 8029	mg/L	0.32	≤ 1.5	1.5
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Attention:	Mr. Imtiaz Ali Khoso E-mail: imtia.khoso@mmpakistan.com

Sample ID:	**GW-202301019**
Sample Location:	**Kashmore**
Site Co-ordinates:	**28°24'39"E , 68°95'04.2"N,**
Sample Receiving Date:	**02-Jan-2023**
Sample Description:	Ground Water (46 as mentioned by Customer)
Sample Type:	Liquid – Sample
Sample Collected / Submitted By:	MM Pakistan
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17	Arsenic (As)	*APHA 3114-B	mg/L	N.D.	≤ 0.05	0.01
18	Boron (B)	HACH 8015	mg/L	N.D.	0.3	0.5
19	Cadmium (Cd)	*APHA 3111-B	mg/L	<0.0028	0.01	0.003
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22	Copper (Cu)	*APHA 3111-B	mg/L	0.0129	2	2
23	Cyanide (CN)	HACH 8027	mg/L	N.D.	≤ 0.05	0.07
24	Mercury (Hg)	*APHA 3112-B	mg/L	N.D.	≤ 0.001	0.006
25	Manganese (Mn)	*APHA 3111-B	mg/L	<0.0016	≤ 0.5	0.4
26	Zinc (Zn)	*APHA 3111-B	mg/L	0.0110	≤ 5.0	3
27	Residual Chlorine	HACH 10069	mg/L	N.D.	0.2 - 0.5	5
28	Phenolic Compounds as Phenols	ASTM-D-1783	mg/L	N.D.	-	0.002

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Attention:	Mr. Imtiaz Ali Khoso E-mail: imtia.khoso@mmpakistan.com

Sample ID:	**GW-202301019**
Sample Location:	**Kashmore**
Site Co-ordinates:	**28°24'39"E , 68°95'04.2"N,**
Sample Receiving Date:	**02-Jan-2023**
Sample Description:	Ground Water (46 as mentioned by Customer)
Sample Type:	Liquid – Sample
Sample Collected / Submitted By:	MM Pakistan
Date of Analysis:	02-Jan-2023 to 14-Jan-2023
Test Description:	Sindh Standards / WHO – Drinking Water Quality (32 – Parameters)

ANALYTICAL TEST REPORT

Sr. #	Parameters / Analytes Description	Methods	Unit	Test Results	SEQS Limits	*WHO
29	Sodium	*APHA 3111-B	mg/L	37.0203	-	200
30	Fecal Coliform	USEPA 1604	Cfu/100 ml	N.D.	-	0/100ml
31	E-Coli	USEPA 1604	Cfu/100 ml	N.D.	-	-
32	Total Coliform	*APHA 922 B	Cfu/100 ml	**01**	-	0/100ml

Note: Measurement of uncertainty will be provided on customer Demand. Environmental Conditions at the time of Testing; Temperature: 22 °C (+- 1°C) & Humidity: 33 % (+- 1%).

Conclusion:

Test Result = F

*APHA Standard Methods for Examination of water & wastewater 23rd Edition (2017).

SEQS Limits = Sindh Environmental Quality Standard (Reference: SEQS 2016).

WHO = World Health Organization.

*WHO Guideline Value for Drinking Water Quality follows by The World Bank

M = Meet SEQS-2016 requirements/ WHO Guideline Value for Drinking Water Quality , **F** = Below SEQS-2016 requirements/, WHO Guideline Value for Drinking Water Quality **N.D.** = Not Detected.

Analyzed By | Reviewed By | Approved By

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ETAL-LMS-ASR-01	Issue Date:12-7-21	Issue No: 01

Lahore Office: 87-E Madina Height, Office # A/30 & A/31, 8th Floor, Maulana Shaukat Ali Road, Johar Town, Lahore. +92 42 32296099
Head Office: 345, First Floor, Street-15, Block-3, Bahadurabad, Karachi, 75900, Pakistan. 0310-2288801
info@envitechal.com
www.envitechal.com

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GREEN LAB CERTIFICATION

Lab Report No. : 202301016-MMP-GW
Invoice Bill No. : MMP-202301-407

Page: 1 of 3
Reporting Date: 16-Jan-2023

Report to:	M/s. MM Pakistan (Pvt) Ltd. C.T.I. Plaza, 27 Empress Road, Lahore.
Attention:	Mr. Imtiaz Ali Khoso E-mail: imtia.khoso@mmpakistan.com

Sample ID:	**GW-202301016**
Sample Location:	**Kashmore**
Site Co-ordinates:	**28°29'21.7"E , 69°30'65.6"N,**
Sample Receiving Date:	**02-Jan-2023**
Sample Description:	Ground Water (42 as mentioned by Customer)
Sample Type:	Liquid – Sample
Sample Collected / Submitted By:	MM Pakistan
Date of Analysis:	02-Jan-2023 to 14-Jan-2023
Test Description:	Sindh Standards / WHO – Drinking Water Quality (32 – Parameters)

ANALYTICAL TEST REPORT

Sr. #	Parameters / Analytes Description	Methods	Unit	Test Results	SEQS Limits	*WHO
01	pH @ 25 °C	*APHA 4500 H	-	7.58	6.5 – 8.5	6.5 – 8.5
02	Total Dissolved Solids (TDS)	*APHA 2540-C	mg/L	840	< 1000	< 1000
03	Total Hardness as CaCo3	ASTM D 1126	mg/L	400	< 500	-
04	Color	HACH 8025	TCU	10	≤ 15	≤ 15
05	Turbidity	*APHA 2130	NTU	03	≤ 5	≤ 5
06	Nitrite	HACH 8507	mg/L	0.027	≤ 3	3
07	Nitrate (NO3)	HACH 8039	mg/L	0.3	≤ 0.50	50
08	Taste	*APHA 2160	-	Tasteless	Non-Objectionable	Non-Objectionable
09	Odor	*APHA 2150	-	Odorless	Non-Objectionable	Non-Objectionable
10	Chloride (Cl)	*APHA 4500 Cl	mg/L	**399.87**	≤ 250	250
11	Fluoride	HACH 8029	mg/L	0.50	≤ 1.5	1.5
12	Aluminum	*APHA 3111-D	mg/L	<0.028	≤ 0.2	0.2
13	Nickel	*APHA 3111-B	mg/L	<0.008	≤ 0.02	0.07
14	Lead (Pb)	*APHA 3111-B	mg/L	<0.016	≤ 0.05	0.01

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Invoice Bill No. : MMP-202301-407

Page: 2 of 3
Reporting Date: 16-Jan-2023

Report to:	M/s. MM Pakistan (Pvt) Ltd. C.T.I. Plaza, 27 Empress Road, Lahore.
Attention:	Mr. Imtiaz Ali Khoso E-mail: imtia.khoso@mmpakistan.com

Sample ID:	**GW-202301016**
Sample Location:	**Kashmore**
Site Co-ordinates:	**28°29'21.7"E , 69°30'65.6"N,**
Sample Receiving Date:	**02-Jan-2023**
Sample Description:	Ground Water (42 as mentioned by Customer)
Sample Type:	Liquid – Sample
Sample Collected / Submitted By:	MM Pakistan
Date of Analysis:	02-Jan-2023 to 14-Jan-2023
Test Description:	Sindh Standards / WHO – Drinking Water Quality (32 – Parameters)

ANALYTICAL TEST REPORT

Sr. #	Parameters / Analytes Description	Methods	Unit	Test Results	SEQS Limits	*WHO
15	Barium (Ba)	HACH 8014	mg/L	N.D.	0.7	0.7
16	Antimony (Sb)	*APHA 3111-B	mg/L	N.D.	≤ 0.005	0.02
17	Arsenic (As)	*APHA 3114-B	mg/L	N.D.	≤ 0.05	0.01
18	Boron (B)	HACH 8015	mg/L	N.D.	0.3	0.5
19	Cadmium (Cd)	*APHA 3111-B	mg/L	<0.0028	0.01	0.003
20	Chromium (Cr)	*APHA 3111-B	mg/L	0.0163	≤ 0.05	0.05
21	Selenium (Se)	*APHA 3114-B	mg/L	N.D.	0.01	0.01
22	Copper (Cu)	*APHA 3111-B	mg/L	0.0111	2	2
23	Cyanide (CN)	HACH 8027	mg/L	N.D.	≤ 0.05	0.07
24	Mercury (Hg)	*APHA 3112-B	mg/L	N.D.	≤ 0.001	0.006
25	Manganese (Mn)	*APHA 3111-B	mg/L	<0.0016	≤ 0.5	0.4
26	Zinc (Zn)	*APHA 3111-B	mg/L	0.0102	≤ 5.0	3
27	Residual Chlorine	HACH 10069	mg/L	N.D.	0.2 - 0.5	5
28	Phenolic Compounds as Phenols	ASTM-D-1783	mg/L	N.D.	-	0.002

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Sample Location:	**Kashmore**
Site Co-ordinates:	**28°29'21.7"E , 69°30'65.6"N,**
Sample Receiving Date:	**02-Jan-2023**
Sample Description:	Ground Water (42 as mentioned by Customer)
Sample Type:	Liquid – Sample
Sample Collected / Submitted By:	MM Pakistan
Date of Analysis:	02-Jan-2023 to 14-Jan-2023
Test Description:	Sindh Standards / WHO – Drinking Water Quality (32 – Parameters)

ANALYTICAL TEST REPORT

Sr. #	Parameters / Analytes Description	Methods	Unit	Test Results	SEQS Limits	*WHO
29	Sodium	*APHA 3111-B	mg/L	170.0013	-	200
30	Fecal Coliform	USEPA 1604	Cfu/100 ml	N.D.	-	0/100ml
31	E-Coli	USEPA 1604	Cfu/100 ml	N.D.	-	-
32	Total Coliform	*APHA 922 B	Cfu/100 ml	**03**	-	0/100ml

Note: Measurement of uncertainty will be provided on customer Demand. Environmental Conditions at the time of Testing; Temperature: 22 °C (+- 1°C) & Humidity: 33 % (+- 1%).

Conclusion:

Test Result = F

*APHA Standard Methods for Examination of water & wastewater 23rd Edition (2017).

SEQS Limits = Sindh Environmental Quality Standard (Reference: SEQS 2016).

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M = Meet SEQS-2016 requirements/ WHO Guideline Value for Drinking Water Quality , **F** = Below SEQS-2016 requirements/, WHO Guideline Value for Drinking Water Quality **N.D.** = Not Detected.

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info@envitechal.com
www.envitechal.com

Reference No: SEPA/Lab/L.C/ENVI TECHAL-1/20/264/2022

SINDH ENVIRONMENTAL PROTECTION AGENCY
GOVERNMENT OF SINDH

HEAD OFFICE:
Plot # ST-2/1, Sector- 23, Shan Chowrangi,
Korangi Industrial Area, Karachi.
Ph:35065950, 35065598, 35065532
epasindh.gov.pk
Facimile: 35065940

RENEWAL OF CERTIFICATE AS AN ENVIRONMENTAL LABORATORY

In exercise of power conferred by clause (k) of sub section (1) of section 6 of the Sindh Environmental Protection Act-2014, Environmental Protection Agency Sindh is pleased to certify the Laboratory mention below as an Environmental Laboratory.

Name: **M/S Envi Tech AL Karachi.**
Address: Office Suite 345, 1st Floor, Street-15, Block-3, Bahadurabad, Karachi,
Certificate: EPA/Lab/L.C/ENVI TECH AL-1/20/2020

1. This Certificate is Conditional and Valid for testing of Parameter as per facilities mentioned in application:

   a. Liquid effluent/ wastes.
   b. Portal Water
   c. Stack and vehicular Emission
   d. Ambient Air Quality
   e. Noise level

2. This Certificate is Subject to Condition laid down in regulation 9 of the Sindh Environmental Quality Standards (Certification of Environmental Laboratories) Regulation,2014.
3. This Certificate is valid for two (02) years w.e.f.10-06-2022 to 10-06-2024 unless earlier suspended or revoked.

Deputy Director (Lab)
SEPA, Karachi

Dated of issue:24-05-2022

Always Remember---Reuse, Reduce & Recycle

ANNEXURE 5

RATE LIST RECEIVED FROM GOVERNMENT DEPARTMENT

CONTENTS

ANNEXURE – 5: RATE LIST RECEIVED FROM GOVERNMENT DEPARTMENT.....1

ANNEXURE – 5: RATE LIST RECEIVED FROM GOVERNMENT DEPARTMENT

OFFICE OF THE
MUKHTIARKAR TALUKA
KASHMORE

No: SM/- 4508 /2023.
Kashmore dt: 01/11 /2023.

To,

The Assistant Commissioner,
Kashmore

SUBJECT: **PREPARATION OF FEASIBILITY STUDY, DETAIL DESIGN, TENDER DOCUMENTS AND PC-I OF JACOBABAD, SHIKARPUR AND KASHMORE DRAINAGE PROJECT.**

Reference: Yours good office letter No: Asstt: 727 dated 30.10.2023.

It is submitted that in compliance of the directions contained in the letter under reference, the point wise data/requisite information is submitted as under:-

01. **COST OF LAND FOR BOTH AGRICULTURE AND NON-AGRICULTURE PURPOSES.**

The village staff of this Taluka was directed to provide the details in respect of cost of land for both agricultural & non-agricultural purposes. The village staff has submitted their report, which reveals that the averaged market rate of agricultural lands in Taluka Kashmore is about Rs: 15,00,000/- to 20,00,000/- per acre. However, the averaged rate of un-cultivated land is about Rs: 5,00,000/- to 8,00,000/- per acre. Moreover, in case of residential or commercial area, the rates would be different. As per notification bearing No: CIS/R & T-45-2/BOR/2023-1466 dated 19.05.2023 issued by the Chief Inspector of Stamps Board of Revenue Sindh Hyderabad **(copy attached at annexure "A")**, the rates of (non-agricultural) immoveable properties of Taluka Kashmore as notified as under:-

Category	Residential Open Plot per Sq: yard	Residential Built up Property Per Sq: Yard	Commercial Open Plot per Sq: Yard	Commercial Built up property per Sq: Yard	Industrial Open Plot per Sq: Yard	Industrial Built up Property per Sq: ft	Flats/ apartments per Sq: ft
01	02	03	04	05	06	07	08
I	1591	2629	2751	4326	478	559	-
II	1146	1893	1981	3115	344	402	-
III	620	921	961	1687	191	223	-

02. **RATES OF LAND TAXES FOR ALL TYPES OF LAND.**

The land tax for all types of lands is Rs: 200/- per acre.

03. **WATER RATE (ABIANA).**

The Irrigation Water Rate (Abiana) is Rs: 88.77 per acre during Kharif (paddy) season & Rs: 15.91 per acre during Rabi (wheat) season.

The report is being submitted for kind perusal, as desired.

01/11/23.
MUKHTIARKAR TALUKA
KASHMORE

Copy submitted for favour of information to the Deputy Commissioner Kashmore @ Kandhkot.

No.F&W(SOI)/2020-21
GOVERNMENT OF SINDH
FOREST & WILDLIFE DEPARTMENT
Karachi, dated 08th April, 2021

NOTIFICATION

No. FW&E(SOI)13(129)/2020-21: In exercise of the powers conferred vide section 68 (1)(a)&(b) of The Forest Act 1927 (XVI of 1927) in its application to the province of the Sindh and in supersession of all previous orders/instructions on the subject, the government of Sindh are pleased to fix the following revised schedule of valuation in respect of unauthorized felling/removal/transport of wood in Sindh with immediate effect and until further orders:-

Sr #	Particulars	Existing Rate of valuation (since 2011) (in Rs.)	New Rate of valuation (in Rs.)
i)	One head load/cycle load	150.0	450.0
ii)	One donkey load	350.0	1,050.0
iii)	One camel load	1,000.0	3,000.00
iv)	One Donkey cartload	1,800.00	5,400.00
v)	One Bullock cartload		
	a) Talhi Wood	7,500.00	22,500.00
	b) Salvadora (Khabbar)	-	20,500.00
	c) All other species	3,600.00	10,800.00
vi)	One Camel cartload		
	a) Talhi	12,000.00	36,000.00
	b) Salvadora (Khabbar)	-	30,000.00
	c) All other species	6,000.00	18,000.00
vii)	One Truck load (Rocket)		
	a) Talhi, Eucalyptus, Simal etc	36,000.00	108,000.00
	b) Salvadora (Khabbar)	-	98,000.00
	c) Pure Babul	24,0000.00	72,000.00
	d) Babul & Kandi Mixed	18,000.00	54,000.00
	e) Pure kandi	16,000.00	48,000.00
	d) Lai & Devi	15,000.00	45,000.00
viii)	One 8/10 wheeler Truck load/ Troller load		
	a) Talhi, Eucalyptus, Simal etc	54,000.00	162,000.00
	b) Salvadora (Khabbar)	-	130,000.00
	c) Pure Babul	24,000.00	100,000.00
	d) Babul & Kandi Mixed	18,000.00	75,000.00
	e) Pure kandi	16,000.00	60,000.00

	f) Lai & Devi	15,000.00	50,000.00
ix)	One Tractor Trolley load		
	a) Talhi, Eucalyptus, Simal etc	20,000.00	60,000.00
	b) Salvadora (Khabbar)	-	55,000.00
	c) Pure Babul	16,000.00	48,000.00
	d) Babul & Kandi Mixed	15,000.00	45,000.00
	e) Pure kandi	15,000.00	45,000.00
	f) Lai & Devi	10,000.00	30,000.00
x)	One Boatload		
	a) Talhi, Eucalyptus, Simal etc	48,000.00	144,000.00
	b) Salvadora (Khabbar)	-	122,000.00
	c) Pure Babul	30,000.00	90,000.00
	d) Babul & Kandi Mixed	24,000.00	72,000.00
	e) Pure kandi	21,000.00	63,000.00
	f) Lai & Devi	18,000.00	54,000.00
xi)	One small Boatload (Katar)		
	a) Talhi, Eucalyptus, Simal etc.	-	50,000.00
	b) Salvadora (Khabbar)	-	35,000.00
	c) Pure Babul	-	25,000.00
	d) Babul & Kandi Mixed	-	20,000.00
	e) Pure kandi	-	15,000.00
	f) Lai & Devi	-	10,000.00
xii)	Trees upto 2' girth		
	a) Talhi	2,000.00	6,000.00
	b) Salvadora (Khabbar)	-	5,000.00
	c) All other species	1,000.00	3,000.00
xiii)	Trees above 2.1' to 4' girth		
	a) Talhi	5,000.00	15,000.00
	b) Salvadora (Khabbar)	-	12,000.00
	c) All other species	2,000.00	6,000.00
xiv)	Trees above 4.1' to 6' girth		
	a) Talhi	12,000.00	36,000.00
	b) Salvadora (Khabbar)	-	28,000.00
	c) All other species	3,500.000	10,500.00
xv)	Trees from 6.1' and above		
	a) Talhi	21,000.00	63,000.00
	b) Salvadora (Khabbar)	-	55,000.00
	c) All other species	15,000.00	45,000.00
xvi)	Panjars (Lai)	40.00 each	120.00
xvii)	Lopping	20.00 per branch (Babul)	60.00

2/- All wood including timber and firewood in transit shall be taken as "Forest Produce" (unless contrary proved) as defined under Section 2(4)(a)&(b) of the Forest Act

1927 whether, it is brought from a forest, sate land (roadside & canal-side plantation) and wasteland or a private land and the valuation shall be charged accordingly.

3/- That in exercise of Section 42 (2) of Forest Act,1927 (XVI of 1927); the penalties shall be double in cases where the offence is committed after sunset and before sunrise or after preparation to lawful authority, or where the offender has been previously convicted of a like offence.

4/- That where the offenders deny to compound the offence; the legal proceeding shall be initiated under the provisions of Section-54 of Forest Act,1927 (XVI of 1927) or under Section 154 Cr.P.C.

5/- That in exercise of the West Pakistan Forest Manual Volume -III, Chapter-III, 3.8 (27); Misc: Executive Orders by Government and Chief Conservator of Forests; the prosecution of the case , where the accused refuses to compound the offence shall not be delayed and the prosecution challan should be made out and submitted in Range Office within a week after receipt of damage report or further report of the denial to compound the offence after seizure of the property under section 52 of the Forest Act, 1927.

6/- The sum of fine, which is to be recovered in addition to the value of the material by way of compensation, shall not be less then Rupees 2,000/- and shall not exceed Rupees 4,000/- for each forest offence depending upon the nature of each case.

DR. BADAR JAMIL MENDHRO
SECRETARY TO GOVERNMENT OF SINDH

No. F&W(SOI) /2020-21 Karachi, dated the 08th April, 2021

A copy forwarded to the following:-

1. Chief Conservator of Forests, (Riverine & Inland Forests) Sindh at Hyderabad.
2. Chief Conservator of Forests, Social Forestry Sindh at Hyderabad
3. Chief Conservator of Forests, Mangroves & Rangeland at Karachi.
4. Commissioners in Sindh (All).
5. Conservator of Forests in Sindh (All).
6. Deputy Commissioners in Sindh (All).
7. Divisional Forest Officer in Sindh (All).
8. Budget & Account Officer, Forests Sindh at Hyderabad.
9. Publisher, Sindh Govt. Printing Press Karachi for Publication in the next issue of Sindh Government Gazette and supply of 100 copies of the printed Notification.
10. P.S to Minister for Forest & Wildlife Department Govt. of Sindh Karachi.
11. Office order file.

08/04/21

SECTION OFFICER-I
FOR SECRETARY TO GOVERNMENT OF SINDH