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LIST OF ACRONYMS

AIDS/HIV	Acquired Immune Deficiency Syndrome/ Human Immunodeficiency Syndrome
APHA	American Public Health Association
BOD	Biological Oxygen Demand
CETP	Common Effluent Treatment Plant
COD	Chemical Oxygen Demand
CMS	Conservation of Migratory Species
CPEC	China Pakistan Economic Corridor
CSAs	Critical Sensitive Areas
DSEZ	Dhabeji Special Economic Zone
CSZA	Dhabeji Special Economic Zone Authority
EHS	Environmental Health and Safety
EIA	Environmental Impact Assessment
EPA	Environmental Protection Agency
EPFI	Equator Principles Financial Institutions
EMAP	Environmental Management Action Plan
EMMP	Environmental Management and Monitoring Plan
EMP	Environmental Management Plan
EMoP	Environmental Monitoring Plan
ESAs	Environmental Sensitive Areas
ETP	Effluent Treatment Plant
FMCGs	Fast Moving Consumer Goods Companies
GIS	Geographic Information System
GoP	Government of Pakistan
GoS	Government of Sindh
HDPE	High Density Polyethylene
IEE	Initial Environmental Examination
IFC	International Finance Corporation
IUCN	International Union for Conservation of Nature
SEQS	Sindh Environmental Quality Standards, 2015
SEZ	Special Economic Zone

SEZMC	Sindh Economic Zones Management Company
SEPA	Sindh Environmental Protection Agency
LPG	Liquid Pressurized Gas
NCS	National Conservation Strategy
NCCW	National Council for Conservation of Wildlife
NDRRP	Natural Disaster Risk Reduction Policy
NEAP	National Environmental Action Plan
NEQS	National Environmental Quality Standards
NEP	National Environmental Policy
OHS	Occupational Health Safety
PAHs	Project Affected Households
PAP	Project Affected Persons
PCM	Public Consultation Meeting
PD	Public Disclosure
PEPC	Pakistan Environmental Protection Council
PMC	Project Management Committee
PPE	Personal Protective Equipment
PS	Performance Standard
RMG	Ready Made Garment Unit
RSA	Remote Sensing Analysis
STP	Sewerage Treatment Plan
TDS	Total Dissolved Solids
USEPA	United States Environmental Protection Agency

EXECUTIVE SUMMARY

A significant industrial concentration in a developing country like Pakistan shall always contributes in the development of the economy. The industrial growth in Pakistan is being aggravated with the advent of CPEC project and its associated development. This growth of economy as a result of CPEC introduced many allied projects such as Industrial zones. However, recent development in this context of China-Pakistan Economic Corridor (CPEC) opens new avenues for industrial growth of Pakistan; Dhabeji Special Economic Zone (DSEZ) is one of the major projects of CPEC.

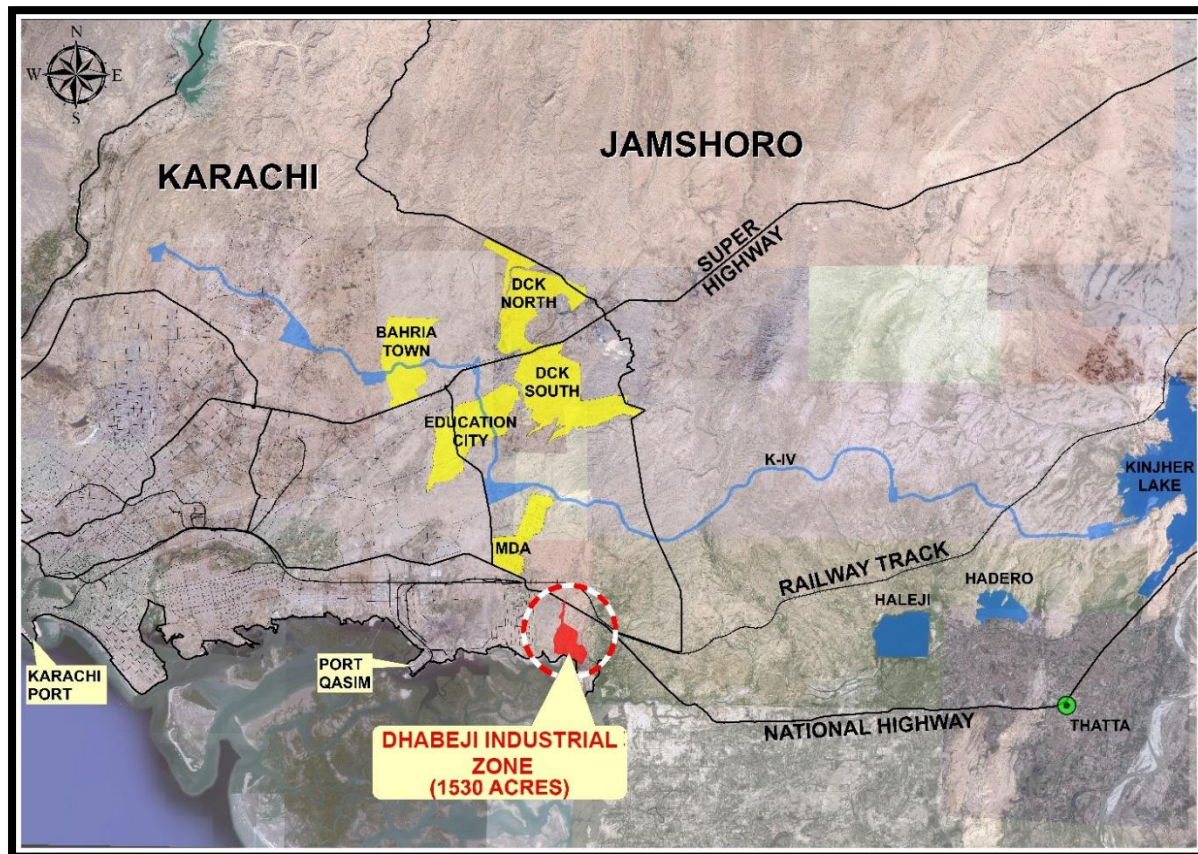
According to the PEA (Pakistan Environmental Act, 1997 modified in 2012 and 2014), EIA is mandatory for the projects which fall in Schedule-I, including the “Urban Development and Tourism - Urban Development Projects (Category: I-3). Hence, this Environmental Impact Assessment has been initiated by ZKB Development & Management Company (ZKBDMC) and conducted by M/S RMJM Osmani - Kaasib Associates (Joint Venture) to evaluate the environmental impacts of the Special Economic Zone project.

Project Location

DSEZ is located at Dhabeji, Thatta (Sindh), 55 km from central Karachi, it shall be connected via the Eastern alignment of CPEC (N-5) or M-9. Approximate 1530 acres is the Area of the Project, allocated by GoS. DSEZ situated near the sea ports of Bin Qasim and Karachi (**Figure ES 1**).

Project Description

The Government of Pakistan (GoP) passed Special Economic Zones (SEZ) Act in July 2012 (and amended over time), which is aimed to attract Direct Foreign Investment. The SEZ Act guarantees a 10 years tax holiday on income in such areas. It also provides one time exemption on all capital goods and machinery for operations and management of the business within the zone. The Act envisages Sindh Economic Zones Management Company (SEZMC), to be the focal point for all SEZ related matters in the province. This idea of setting land aside through this type of industrial zoning is to attract new businesses by providing an integrated infrastructure at one location. Proposed project area is mainly consist of heavy industries, medium industries, light industries and amenities.



ES 1: Location Map of Study Area

Legislative Requirement for EIA

The Pakistan Environmental Protection Act, 1997 requires proponents of all projects involving any change in the environment, to submit an Environmental Impact Assessment (EIA) report, to the Sindh Environmental Protection Agency (SEPA). The amended version of the Sindh Environmental Protection Act, 2014 is also consulted for the consideration of EIA. According to the Sindh Environmental Protection Agency (Review of IEE and EIA) Regulations, 2014, EIA of Special Economic Zone projects fall in Schedule-I, Category-I (3), “Urban Development Projects”.

Objectives of EIA

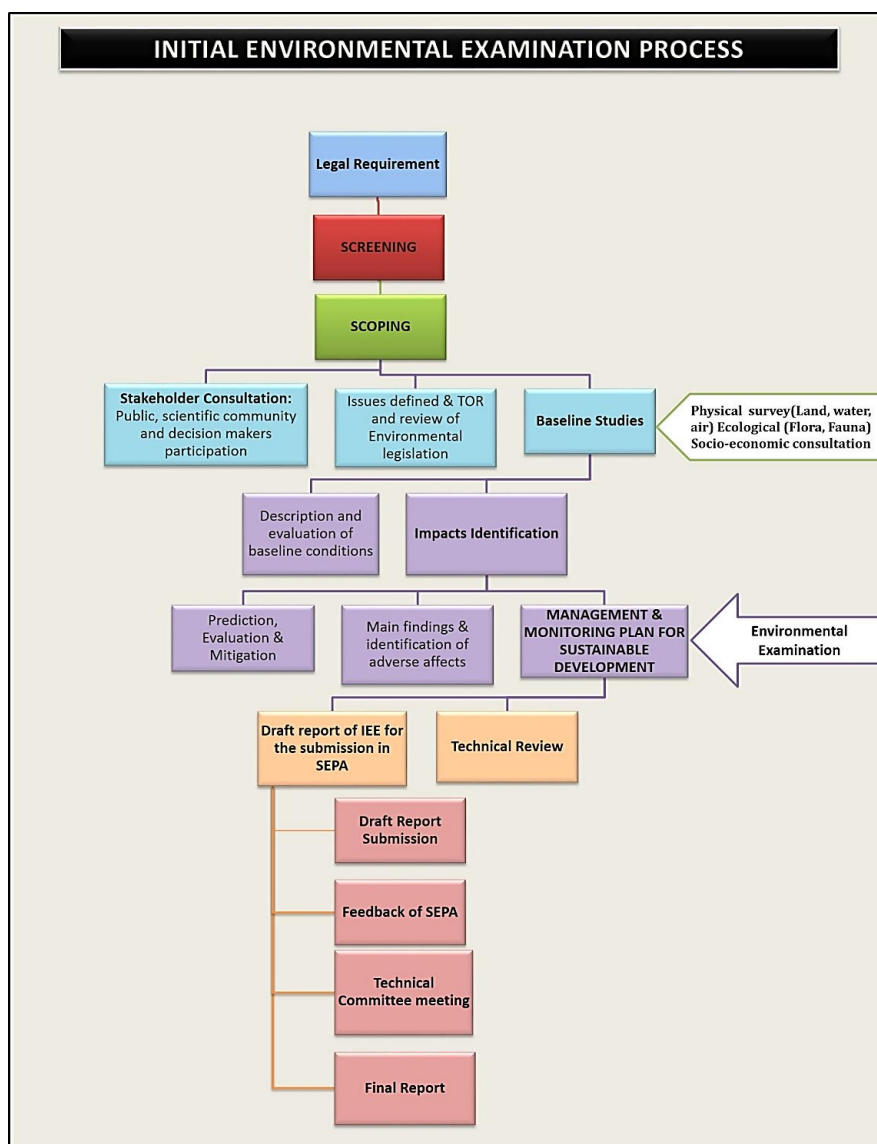
- To evaluate the existing environmental and social baseline conditions of the project site;
- To Identify the likely impacts of the proposed project on the natural and socioeconomic environment, predict and evaluate these quantitatively wherever possible and determine

their significance in the light of technical and regulatory concerns, as well as those related to public perceptions;

- To analyze the design and construction phases of DSEZ project for the adverse environmental impacts;
- To propose mitigation measures for potential impacts of the project during the construction and operational phases;
- To develop an Environmental Management and Monitoring Plan (EMMP) for the adverse environmental impacts; and
- To draft an EIA report for submission to the Sindh Environmental Protection Agency (SEPA) for the final approval.

APPROACH AND METHODOLOGY ADOPTED FOR EIA

The main procedures that have been adopted for the preparation of this EIA is summarized in the following Flow-Chart (**Figure ES 2**). The screening and scoping of the project shall decide the fate of EIA. Scoping shall closely look at the design, construction and implementation phases. The baseline studies shall provide the existing conditions of the project area and record of the environmental characteristics. The probable impacts has been outlined in the mitigation chapter, whereas, at the end a comprehensive Environmental Management Plan (EMP) is also attached. At various stages, the feedback of the proponent and the stakeholders have been sought and incorporated accordingly.



ES 2: Components of DSEZ EIA

Environmental Laws, Policy and Procedures Consulted

For comprehensive review of available literature on environmental issues in the context of Dhabeji Special Economic Zone, following protocols, laws, and regulations were thoroughly consulted and incorporated in the development of proposed economic zone.

International Laws

- World Bank Guidelines On Environment;
- IUCN Red List (2008);
- Convention On Wetlands Of International Importance Especially As Waterfowl Habitat, RAMSAR, 1971 And Its Amending Protocol, Paris, 1982;
- Convention On Conservation Of Migratory Species;

- IFC Performance Standards On Social And Environmental Sustainability; And
- IFC- Environmental, Health, and Safety Guidelines.

National Policies and Plans

- The Pakistan National Conservation Strategy (NCS), 1992;
- Pakistan Environmental Protection Act, 1997;
- Pakistan Environmental Assessment Procedures, 1997;
- National Environmental Policy, 2005;
- National Environmental Quality Standards, 2000 (amended to 2010);
- Pakistan Environmental Act, 2014;
- National Resettlement Policy, 2002;
- National Disaster Risk Reduction Policy, 2013;
- The Land Acquisition Act, 1894;
- Guidelines for Environmental Sensitive and Critical Areas, 1997;
- The Forest Act, 1927; and
- Factories Act.

Provincial Laws

- Sindh Environmental Protection Agency (Review of EIA/IEE) Regulations 2014;
- Sindh Wildlife Protection Ordinance, 1972 and Amendments 2001;
- Sectoral Guidelines for Industrial Estates, 1997;
- Sindh Environmental Quality Standards, 2015; and
- Special Economic Zone (Amendment) Act, 2016.

Baseline Conditions

Baseline conditions covers the existing physical, ecological, and socio-economic environment of the Project Area as well as the Study Area. Information on these aspects has been derived from the available data, field visits to the Project/Study Area and information obtained through consultation of stakeholders such as Government Departments and local public.

Physical Environment

Climate

The general climatic trend of Thatta is quite moderate which has moderate temperatures and a high level of humidity for significant portion of the year; particularly after the monsoon season

(June to September). The peak temperature months are May, June and October. Thatta usually receives more rainfall than Karachi. Wind usually blows from South-West (SW) to North-East (NE). Most of the wind blows from south-southwest to west-southwest direction in Sindh region. District Thatta has one of the strongest wind corridors in Pakistan and has great potential of wind energy.

Topography

The project area is almost a flat land with little variations of contours. *Nullahs* and stagnant rain water bodies are the main watercourses of project area. Important rivers named *Latt and Jhorewalo* which are tributaries of *Gharo* Creek are flowing beside DSEZ boundary. The minimum elevation of project area is 5 m found in Northeastern side whereas, highest elevation value is found in Southern side which is about 30 m. The slope is generally dipping from North to South with some undulating land in South.

Geology

Lithology of the project area comprises of Piedmont and Deltaic plain soil types with rocky land in the Northern part. The composition of soil in south consist of deltaic plain. Sandy, silty, clayey and very high gypsiferous soil types present in it. Rough mountainous rocky soil spreads in the north-eastern side of the project area. Open marshes and tidal flat land is also prominent in the south of the project area.

Seismology

According to Building Code of Pakistan, Seismic Provision 2007, the study area lies in Zone 2A and Zone 2B presents a low to moderate seismic hazard potential for earthquake activity. Eastern side of project area lies in Zone 2A, *i.e.*, Low seismic risk and Western side lies in zone 2B. *i.e.*, moderate risk zone.

Land Use

The most important and significant land cover is barren land followed by quarry area. Human intervention in the form of settlements and *Goths* are not present in study area but outside the boundary. A small portion of water bodies like seasonal streams, stagnant rain water and Marshy land as natural drainage are also found in project area.

Environmental Analysis

Air Quality

The air quality in the area is generally good, with negligible sources of pollution like emission from vehicular traffic and fuel wood which cause smoke and dust emissions with localized effects. Vehicular emission and vehicular noise is the only source of pollution at project site.

Noise Quality

Elevated noise is viably absent in Project proximities due to acute absence of noise causing equipment in the project corridors. Generally, significant sources of noise productions are triggered by transportation and population which is assumed falling extremely short particularly in the project proximities.

Water Quality

The most water samples were found brackish in character except Sample 3 (Dhabeji surface water) and are not complying NEQS regulated guidelines on drinking water from palatability context. Almost all water sources are contaminated with suspended matter.

Ecological Resources

Sampling locations for the identification of floral and faunal assemblages has carefully been selected so that maximum number of species could be observed within the project area. Vegetation in the area is sporadic with few bushes and isolated trees. The study area creek flora indicates a positive indicator for the variety of bird's habitat. Several birds, mammals and reptile species have been observed during the survey in all ecological zones.

Cultural and Environmental Sensitive Sites

As per the Guidelines provided by Environmental Sensitive Areas (ESAs) and Critical Sensitive Areas (CSAs) of 1997, there are no ecological (National Parks, Wildlife Sanctuaries, Protected Areas, Game Reserves etc.) and cultural or archaeological sites within the premises or proximity of the DSEZ project area and hence no impact of the project shall occur on ecological or cultural or archaeological resources.

Socio-economic Environment

As identified on the map, there are many settlements around project area. Most prominent are *Goth Nabi Bakhsh Baloch*, *Goth Gabool*, *Goth Allah Dino* and *Goth Phinnu khan*. Therefore, many communities around the project area were consulted during the fieldwork. The objectives of the consultation were to brief the adjoining community about the proposed development and to note down their views and concerns regarding the same. In this EIA the social impact of the

project reviewed, surveyed and analyzed in detail. For this purpose, public consultations were also carried out with different stakeholders and general public residing near the project area to record their views about the project and the existing environment.

Environmental Impacts and Mitigations

After thorough review of the field notes, collected data, extent of proposed project activities and detailed discussions with the stakeholders and design team, the potential impacts of the project were assessed and measures were proposed to mitigate the negative impacts and to enhance the positive impacts. The potential impacts and mitigation measures were assessed covering the following parameters:

- Environmental problems due to Project location (*i.e.*, location of different components of the Project);
- Environmental problems related with design;
- Environmental problems associated with the construction stage;
- Environmental problems resulting from project operations.

During construction, potential impacts include air quality, surface water quality, noise quality, ecological resources, generation of spoil and disposal, ground water quality, and occupational health and safety risk. Overall, construction-related impacts are localized, short term, and can be effectively mitigated through the application of good construction and housekeeping practices. Implementation of construction phase community and occupational health and safety standards also helps achieve this goal.

During operation, improved road networks shall reduce traffic problems, improve road safety conditions, and facilitate the movement of residents. Land use planning and development controls shall respond to monitored traffic emissions and noise levels.

Environmental Management Plan

An Environmental Management Plan (EMP) for the proposed project activities has been prepared. The EMP provides a framework for implementing and managing the mitigation and monitoring measures recommended in the EIA report. The EMP includes the following:

- A mitigation and monitoring plan;
- Definition of roles and responsibilities of the proponent, contractors and monitoring teams;

- Requirements for communication, documentation and training during the project;
- Restrictions on design, timing and conduct of the project; and
- Change Management Plan to cover unforeseen events/environmental conditions during the project.

The EMMP is a plan of action for mitigation / management / avoidance of the negative impacts of the project and enhancement of the project corridor. For each measure to be taken, its location, timeframe, implementation and overseeing / supervision responsibilities are listed. These components of the EMP have been given in the project EIA document which explains the environmental issues and the avoidance/ mitigation/ minimization or enhancement measures adopted and/or to be adopted during different phases of the project.

Environmental Monitoring Plan

Environmental monitoring is a vital component of the environmental management plan. It is the mechanism through which the effectiveness of the environmental management plan in protecting the environment is measured. The feedback provided by the environmental monitoring is instrumental in identifying any problem and planning corrective actions.

Objective of Monitoring Plan

1. Facilitate the implementation of the mitigation measures identified in the EIA;
2. Define the responsibilities of the project proponent, contractors and other staff;
3. Provide means of effective communication of environmental issues between all the persons associated with the project;
4. Identify monitoring parameters in order to ensure the effectiveness of the mitigation measures;
5. Provide a mechanism for taking timely action in the face of unanticipated environmental situations; and
6. Identify training requirements at various levels.

The detailed monitoring plan shall be finalized prior to commencement of the construction. The monitoring requirements assessed in the EIA are for the construction and operation phases respectively.

Conclusion

It has been revealed from the critical review of Design and Construction phases, Environmental and Field Studies that this Dhabeji Special Economic Zone project is appropriately founded on environmental principles and international standards. Although there are few significant negative impacts but even these would be of short term especially during the construction stages and could be rectified through EMMP. From this study, it has been revealed from this study that this project is highly significant for the economic growth and its development bring prosperity to the region; hence, this EIA recommends the construction of this project strongly.

Recommendations

Comprehensive mitigation measures have been proposed in the report to minimize the adverse impacts and enhance the positive impacts of the Project. Generation of spoil, water contamination, air pollution and high noise levels should be controlled with the use of good engineering practices including effective land management.

1 INTRODUCTION

A significant industrial concentration in a developing country like Pakistan shall always contributes in the development of the economy. The industrial growth in Pakistan is being aggravated with the advent of CPEC project and its associated development. This growth of economy as a result of CPEC introduced many allied projects such as Industrial zones. An industrial cluster (zone) is a group of interconnected firms of common industry localized in one geographical region that encourages the social and economic development of related community. Pakistan also having few successful functional industrial clusters such as; Sialkot Surgical Goods Cluster; Gujrat Ceramic/pottery Industrial cluster; Faisalabad Readymade Garments Manufacturing cluster; Khyber Pakhtun Khwa (KPK) Marble Cluster; Tannery/Leather Industrial Cluster, Karachi cluster and Gujranwala cluster etc. However, recent development in this context of China-Pakistan Economic Corridor (CPEC) opens new avenues for industrial growth of Pakistan; Dhabeji Special Economic Zone (DSEZ) is one of the major projects of CPEC which shall proved to be the game changer in the region, which ultimately be beneficial both for Pakistan and China.

DSEZ is located near Dhabeji in Deh *Gharo*; a coastal creek area near the mouth of Arabian Sea. The total area of DSEZ is about 1530 acres and can easily be accessible from National Highway. This project may generate impacts on the adjoining environment. Under the provision of Pakistan Environmental Protection Act, 1997, the proposed DSEZ project formally requires an Environmental Impact Assessment (EIA). The DSEZ project falls under “Urban Development and Tourism - Urban Development Projects (Category: I-3)’ of Schedule I of SEPA Review of EIA and IEE Regulations, 2014. Thus requiring an EIA, as defined in the Sindh Environmental Protection Act, 2014 as well. The “EIA” means Environmental Impact Assessment review of the adverse environmental effects of the proposed project. Therefore, following EIA has been developed to evaluate the significant environmental impacts of the DSEZ project on the immediate indigenous environment under the guidelines of Sindh Environmental Protection Act, 2014.

1.1 NAME OF THE PROJECT

The name of the project under this EIA Evaluation is “Dhabeji Special Economic Zone (DSEZ)”.

1.2 PROJECT PROPONENT

Keeping in view the success of economic zones and industrial estates in developing specific sectors especially in the context of CPEC, of developed and newly industrialized countries, it has been decided to adopt the identical strategy to uplift the Special Economic Zone (SEZ) in Sindh. Dhabeji Special Economic Zone DSEZ shall have tremendous investment and growth potential for entrepreneurs being based on high end technology, innovation and services. DSEZ seeks to establish an industrial park. In this regard, Sindh Economic Zones Management Company (SEZMC), Government of Sindh (GoS) has already acquired 1530 acres of land area situated in Dhabeji (District Thatta) for the purpose of establishing this Project.

1.3 PROJECT LOCATION

DSEZ located at Dhabeji, Thatta (Sindh), 55 km from central Karachi, it shall be connected via the Eastern alignment of CPEC (N-5) or M-9. Approximate 1530 acres is the Area of the Project, allocated by GoS. DSEZ situated near the sea ports of Bin Qasim and Karachi.

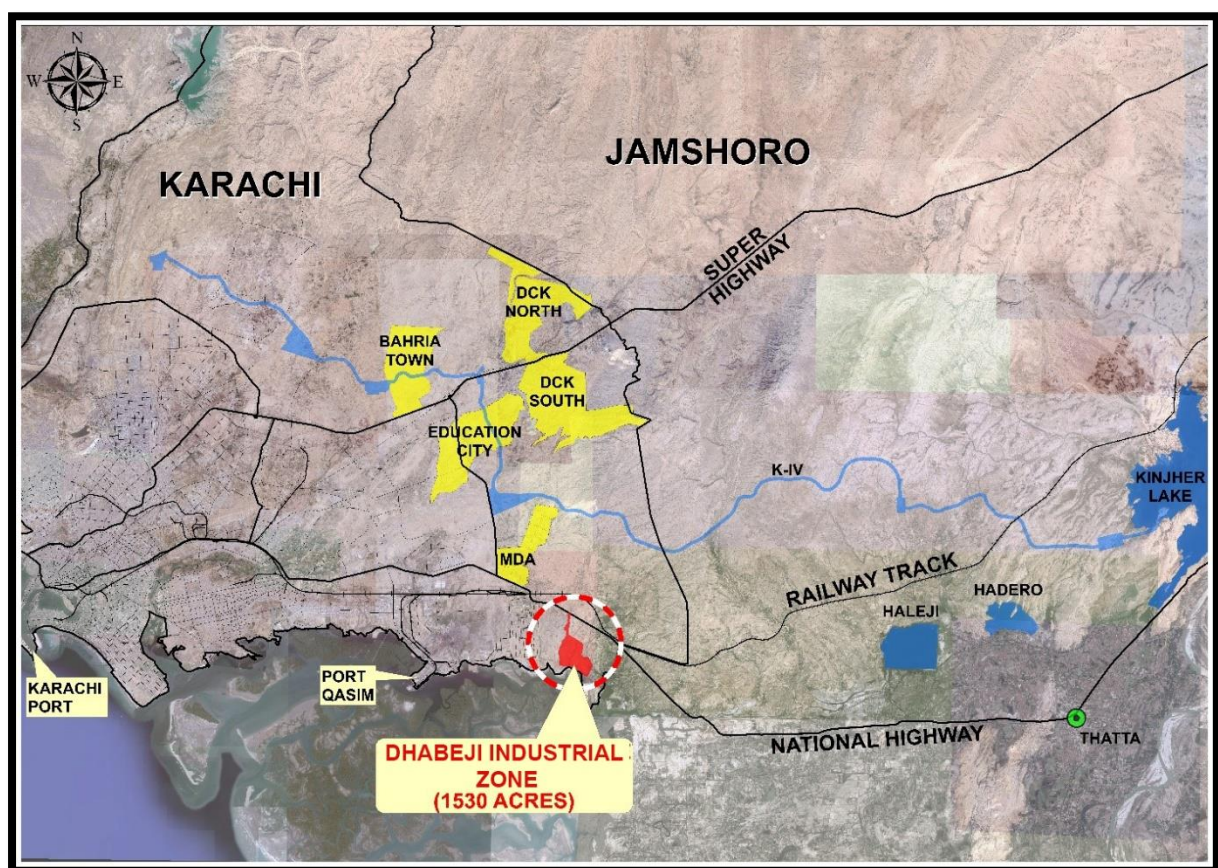


Figure 1-1: DSEZ Regional Location Map

1.4 PROJECT OVERVIEW AND OBJECTIVES

The Government of Pakistan (GoP) passed Special Economic Zones (SEZ) Act in July 2012, which is aimed to attract Direct Foreign Investment. The SEZ Act guarantees a 10 years tax holiday on income in such areas. It also provides one time exemption on all capital goods and machinery for operations and management of the business within the zone. The Act envisages Sindh Economic Zones Management Company (SEZMC) to be the focal point for all SEZ related matters in the province.

This idea of setting land aside through this type of industrial zoning is based on following concepts:

- To be able to provide concentrate dedicated infrastructure in a delimited area to reduce the per-business expense of the infrastructure. Such infrastructure includes roadways, railroad sidings, ports, high-power electric supplies (often including three-phase electric power), high-end communications cables, large-volume water supplies, and high-volume gas lines.
- To attract new businesses by providing an integrated infrastructure at one location.
- Eligibility of Industrial Parks for the benefits of local production.
- To avoid industrial uses from urban areas which shall reduce the environmental and social impact of the industrial uses.
- To implement localized environmental controls that is specific to the needs of an industrial area.

1.5 ADJOINING ENVIRONMENT

DSEZ is located near Dhabeji in Deh *Gharo*; a coastal creek area near the mouth of Arabian Sea. The total area of DSEZ Dhabeji is about 1530 acres and can easily be accessible from National Highway which is approximately 1.8 Km away. Project area land is almost flat with few undulating high land areas and surrounded by industrial areas, creeks and salt quarry ponds. Port Qasim Industrial Area is situated on its Western side and National Highway is located on its Northern side; on its Southern side *Gharo* Creek is highly prominent, Mangroves habitat and salt pans are found, whereas, Dhabeji Pumping station is situated on its South-eastern side.

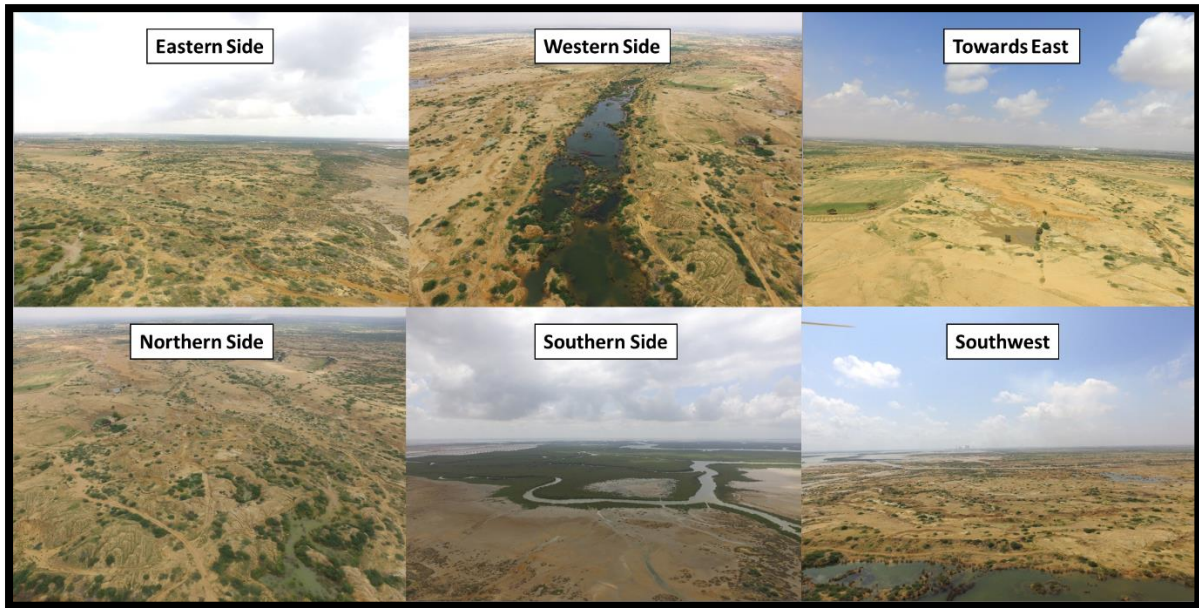


Figure 1-2: Adjoining Environment of DSEZ

1.6 ENVIRONMENTAL IMPACT ASSESSMENT (EIA)

1.6.1 Regulatory Requirement

As identified in Section 12 of Pakistan Environmental Protection Act 1997 and Pakistan Environmental Protection Agency (Review of EIA/IEE) Regulations 2000 require Urban Development project in Pakistan which has to be preceded by an Environmental Impact Assessment (EIA) depending upon the magnitude of the project and severity of impacts anticipated at the time of commissioning of the project. Pakistan EPA (Review of EIA/IEE) Regulations 2000 categorized projects into two separate schedules depending on whether a project requires an;

1. IEE (Schedule-I)
2. EIA (Schedule-II)

The Regulations also require that projects located in or near to Environmentally Sensitive Areas (ESAs) need submission of an EIA. Urban Development and Tourism in the schedule-I, category-I (3) and in the environmental regulation 2014 of Pakistan which recommends a mandatory EIA, hence, this EIA has been initiated.

1.7 OBJECTIVES OF THE STUDY

The main objective of this EIA study is to evaluate the proposed activities in light of the guidelines of Sindh Environmental Protection Agency (SEPA) standards outlined in the Sindh

Environmental Protection Act (2014) in accordance with international environmental guidelines, such as those of the World Bank. The proposed objective is to evaluate whether the development of this DSEZ project and its associated amenities are likely to cause an adverse environmental impact and therefore requiring preparation of an Environmental Impact Assessment (EIA) which is important to identify, monitor and mitigate adverse environment affects.

For this purpose, the following specific objectives of this EIA have been set-forth to achieve the targets as provided in the Pak-EPA Guidelines:

1.7.1 Objectives of EIA

- To evaluate the existing environmental and social baseline conditions of the project site;
- To Identify the likely impacts of the proposed project on the natural and socioeconomic environment, predict and evaluate these quantitatively wherever possible and determine their significance in the light of technical and regulatory concerns, as well as those related to public perceptions;
- To analyze the design and construction phases of DSEZ project for the adverse environmental impacts;
- To propose mitigation measures for potential impacts of the project during the construction and operational phases;
- To develop an Environmental Management and Monitoring Plan (EMMP) for the adverse environmental impacts; and
- To draft an EIA report for submission to the Sindh Environmental Protection Agency (SEPA) for the final approval.

1.8 UNDERSTANDING THE PROJECT ACTIVITIES

Details of the proposed project activities were collected from TOR, Inception report, interim report, stakeholders and public consultation meetings, field visits and final report of the project as well as through verbal discussions with the client and the stakeholders. EIA team has been able to comprehend essential details of the project activities by carefully examining the project's documents. The project details have been described at length in Chapter-3 of this report.

1.9 REVIEW OF THE ALTERNATIVES

All alternatives to the proposed project have been reviewed including the no project option. A brief review and analysis of these alternatives has been provided in Chapter 5 of this report.

1.10 APPROACH AND METHODOLOGY ADOPTED FOR EIA

The main procedures that have been adopted for the preparation of this EIA is summarized in the following Flow-Chart (**Figure 1-3**). The screening and scoping of the project shall decide the fate of EIA. Scoping shall closely look at the design, construction and implementation phases. The baseline studies shall provide the existing conditions of the project area and record of the environmental characteristics. The probable impacts has been outlined in the mitigation chapter, whereas, at the end a comprehensive Environmental Management Plan (EMP) is also annexed. At various stages, the feedback of the proponent and the stakeholders have been sought and incorporated accordingly.

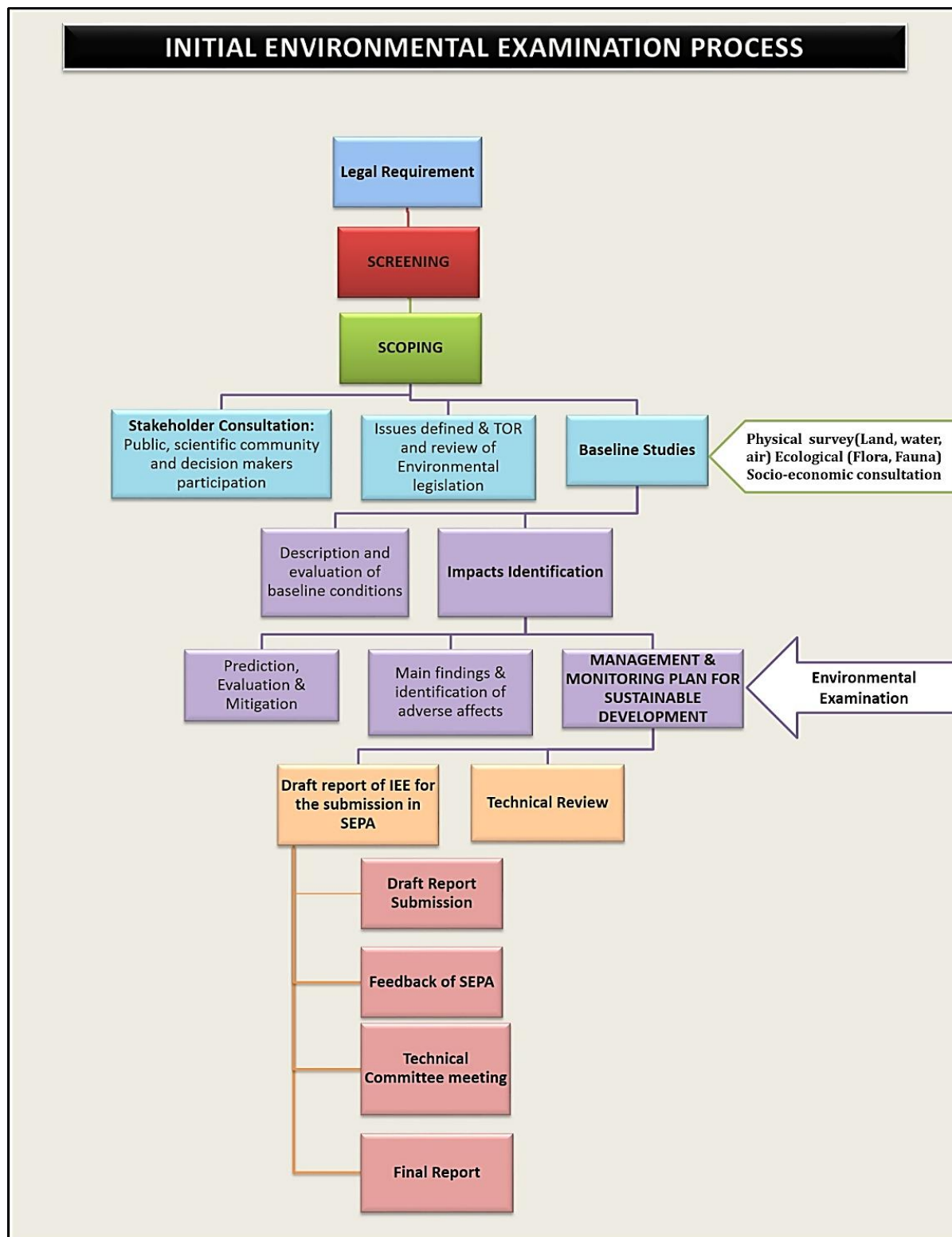


Figure 1-3: Components of DSEZ EIA

The procedural components of EIA illustrate the step-wise stages of EIA, but also the requirement for continuous reappraisal and adjustment (as indicated by above flow chart).

1.10.1 Screening

Screening is a process to allocate the project either in EIA or IEE category. According to the Sindh Environmental Protection Act, 2014, Schedule-I, all the Special Economic Zone projects such as DSEZ project's fall in "Urban Development and Tourism" category-I, hence, EIA is mandatory for such economic zone projects like Dhabeji Special Economic Zone.

1.11 REVIEW OF LITERATURE

The appropriate review of literature has been divided into following two sections:

- General Review

Relevant published literature searched and reviewed and baseline information on climate, soils, geology, drainage, hydrology, water resources, flora and fauna were reviewed and compiled accordingly.

- Review of Legislation

Appropriate information on significant rules, regulations, acts, guidelines, policies and standards were gathered and reviewed rigorously to target the relevant legislation.

1.12 SCOPING

Scoping is an intrinsic part of any EIA, which often identifies the issues that are likely to be important during the environmental assessment and prioritize those according to importance. Scoping is a process of interaction between the interested stakeholders, concerned public, government agencies and the proponent. As provided in the EIA Guidelines; scoping refers to the process of identifying, as early as possible, the following main issues, viz:

- Identification of the appropriate boundaries of the environmental assessment;
- Evaluation of project alternatives;
- The collection of information necessary for decision-making and planning;
- The significant impacts and associated factors to be considered for the conservation of environment;
- Possible mitigation measures;
- Treatment options/disposal of waste water generated by DSEZ construction and operation phase;
- Location of disposal of waste water, alternatives and their cumulative impacts; and
- The identification of important indigenous issues and concerns.

For comprehensive scoping following components were addressed in this report to achieve the objectives.

1.12.1 Establishing Baseline Environmental Conditions

1.12.1.1 Review of Secondary Data

The study of the reports and documents relevant to the project were carried out to generate secondary data on physical, biological and socio-economic and cultural environment of the project area. Policies and legislations relevant to the subproject were also reviewed. The Design Report, Contract Document and other relevant reports were thoroughly reviewed. District Census Report, profile of Thatta, data published by Central Bureau of Statistics, published and unpublished reports, maps and photographs related to the subject of the project were consulted to generate the secondary information. An effort was made to gain a complete understanding of existing baseline environmental conditions in the project area covering following aspects:

- **Physical Environment**

For collecting the information on the physical environment, following main parameters were considered:

- Land Resources;
- Water Resources;
- Water, Air and Noise Quality (especially in streams and creek areas);
- Natural drainage and storm water; and
- Other infrastructure (Public and Private).

- **Ecological Environment**

Under Ecological environment, the following main parameters were covered:

- Flora
- Fauna
- Migratory birds species
- Endangered Species (both flora and fauna)

- **Social and Cultural Environment**

To assess the social and cultural baseline settings of the Project Area, social survey was carried out to accomplish the following specific objectives:

- To assess the socio-economic conditions of the Project Area;
- To map the potential Project Affected Persons (PAPs) in the project demarcated area;
- To identify poor and vulnerable groups, and strategies to ensure that such groups should get benefit from the project;
- To ensure adequate public/stakeholder consultations and participation; and
- To examine the effects on available common resources of the community due to implementation of the Project.

- **Public Consultations**

In addition, to record the baseline conditions of the Project Area, public consultations were also carried out with different stakeholders, general public residing near the project area, management of educational and health facilities and other concerned Departments.

- **Stakeholders Consultation**

Moreover, stakeholder consultations were conducted with the proposed project site during various field visits. This includes meetings with the client and important stakeholders.

- **Remote Sensing Analysis**

Detailed landuse and land cover mapping is conducted with the help of Landsat and high resolution Geo-Eye imageries to document the significant change in the last 12 years.

- **Drone Mapping**

For a high resolution synoptic view of the project area. A Phantom Standard-3 was used to capture the environmental settings of the area and the adjoining.

- **Field Data Collection**

The EIA team comprises environmental engineers, ecologist, sociologist, environmentalist and geographers for the collection of specific primary data. Where required, the secondary data collected were also confirmed by the experts for its authenticity. A detailed account of the baseline environmental conditions in the project area pertaining to physical, biological and socio-economic environment has been provided in Chapters-4 of this EIA report.

- **Community Consultation**

The communities within and around the project area were consulted during the fieldwork. The objectives of the consultation were to brief the community about the proposed

development and to note down their views and concerns regarding the same. A detailed description of these consultations and outcomes has been provided in Chapter-6 of this EIA report.

- **Analysis of Data**

After collection of environmental and social data from both primary and secondary sources a critical analysis was made to assess the existing base line conditions and potential impacts.

- Physical environment – topography, geology, geomorphology, soils, surface and groundwater resources and climate;
- Biological environment – habitat, floral and faunal attributes;
- Socio-economic environment – settlements, socio-economic conditions, infrastructure and landuse, basic amenities; and
- Heritage aspects – sites of cultural, religious, archaeological or historical significance.

1.12.2 Identification and Assessment of Impacts

Potential impacts arising as a result of the project activities during the construction and operating period on the physical, biological, socio-economic, archaeological and cultural environments of the project area have been identified. This identification and assessment of impacts has been carried out on the basis of primary field data, secondary data and expert opinion. A detailed account of these impacts has been provided in Chapter-7 of this EIA report.

1.12.3 Mitigation and Monitoring

1.12.3.1 Mitigation

Mitigation measures to help prevent or minimize all potential adverse Environmental Impacts of the project have been identified based upon a range of options including management options, monitoring practices, physical controls, or compensation. The proposed mitigation measures are based on an appreciation of the sensitivity and behavior of environmental receptors within the project area, past experience, case studies, legislative controls, environmental guidelines, and expert advice.

1.12.3.2 Monitoring

Monitoring measures have been recommended for residual impacts (impacts remaining after applying the recommended mitigation measures) or for impacts that cannot be accurately predicted at the EIA stage being provided in the EMMP chapter- 8.

1.12.3.3 Development of the Environmental Management Plan

An Environmental Management Plan (EMP) for the proposed project activities has been prepared. The EMP provides a framework for implementing and managing the mitigation and monitoring measures recommended in the EIA report. The EMP includes the following:

- A mitigation and monitoring plan;
- Definition of roles and responsibilities of the proponent, contractors and monitoring teams;
- Requirements for communication, documentation and training during the project;
- Restrictions on design, timing and conduct of the project; and
- Change Management Plan to cover unforeseen events/environmental conditions during the project.

1.12.4 Screening Environmental Impacts and Mitigation measures

After thorough review of the field notes, collected data, extent of proposed project activities and detailed discussions with the stakeholders and design team, the potential impacts of the project were assessed and measures were proposed to mitigate the negative impacts and to enhance the positive impacts. The potential impacts and mitigation measures were assessed covering the following parameters:

- Environmental problems due to project location (*i.e.*, location of different components of the Project);
- Environmental problems related with design;
- Environmental problems associated with the construction stage; and
- Environmental problems resulting from project operations.

1.12.5 Preparing Environmental Health and safety Management and Monitoring Plan

An Environmental health and safety Management and Monitoring Program depicting the mitigation measures and monitoring plan has also been developed. Institutional capacity of agencies responsible for implementation and operation and maintenance was also reviewed

and enhancement was proposed for effective implementation of the management and monitoring plan.

1.13 STRUCTURE OF THE REPORT

This document is structured as follows:

- Chapter 1 Presents the background, objectives, scope and approach and methodology adopted for the study;
- Chapter 2 Describes the legislative and policy framework governing the project;
- Chapter 3 Provides an overall description of project;
- Chapter 4 Provides general environmental and social baseline conditions of the project;
- Chapter 5 Analysis of alternatives;
- Chapter 6 Summarizes the main concerns raised by stakeholders during various public consultations;
- Chapter 7 Screening of environmental impacts of the project and appropriate mitigation measures;
- Chapter 8 Provides an environmental health and safety management and monitoring plan;
- Chapter 9 Provides conclusions and recommendations.

1.14 THE EIA STUDY TEAM

#	Name	Position/Responsibility	Qualification	Exp. Yrs.
1.	Dr. Rafey Siddiqui	Project Director	PhD, Water Policy and Management (Hawaii, USA) 2020, MSc Civil Engineering (Colorado, USA) 2016, BSc Civil Engineering (NED, Pakistan) 2010	12
2.	Dr. Jamil Kazmi	Team Leader (Spatial Ecologist)	Post Doctorate (Ecology), USA, 1999 PhD, KU, Pakistan 1997 M.Sc. (Geography), KU, 1988	30
3.	Dr. Shuaib Haroon	Project Head (Senior Executive Director)	Ph.D. (Civil Eng.), University of Illinois, USA, 1980 BE (Civil Eng.), NED University of Eng. Tech, Karachi, 1973	44
6.	Dr. Saima Shaikh	Ecologist	Ph. D. (Spatial Ecology) University of Karachi in 2010 M.Sc. (Geography), University of Karachi in 2005	11

#	Name	Position/Responsibility	Qualification	Exp. Yrs.
7.	Mr. Sheeraz Akhtar	Executive Manager GIS	M.Sc. (Geography), KU, 2001	15
8.	Mr. Asad Yaqoob	Mapping Professional	M.Sc. (Geography), FUUAST, 2009	08
9.	Ms. Ibtasama Tamiz	Environmentalist	M.Sc. (Environmental Sciences), KU, 2012 B.Sc. (Hons.), KU, 2011	04
10.	Mr. Khan Shahbaz	Manager DGPS and Surveying	M.Sc. (Geography), KU, 2006 B.Sc. (Geography), KU, 2005	10
11.	Saad Asif Khan	Public Consultation Meetings	M.Sc. (Geography), KU, 2014	02
12.	Saqib Nazeer	Public Consultation Meetings	B.A. FUUAST	02
13.	Madiha Fatima	Sociologist	M.A. (Sociology), University of Karachi	01

2 NATIONAL ENVIRONMENTAL POLICY, LEGISLATION AND GUIDELINE

Environmental legislation is the key for the sustainable development of any country. ‘Sustainable development’ is a concept that has emerged over the past three decades to describe a new framework aimed at economic and social development while maintaining the long-term integrity of the ecological system. The principles of sustainable development are in the process of being incorporated into national policies and legislation in Pakistan through various statutory instruments. This is important to consider for any project like DSEZ. This chapter describes the current legal responsibilities of the proponent in the context of the environment and sustainable development and of the institutions that exist in the country that may influence the environmental management of the proposed project of DSEZ.

2.1 INTERNATIONAL LAWS

2.1.1 World Bank Guidelines on Environment

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

- 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.
- The first two publications listed here provide general guidelines for the conduct of an EIA, and address the EIA practitioners themselves as well as project designers. While the Sourcebook in particular has been designed with Bank projects in mind, and is especially relevant for the impact assessment of large-scale infrastructure projects, it contains a wealth of information which is useful to environmentalists and project proponents.
- The Sourcebook identifies a number of areas of concern, which should be address enduring 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 impacts on wild lands, wetlands, forests etc. are also identified and mitigation measures suggested. The Source book also highlights concerns in social impact assessment, and emphasizes the need to incorporate socio-economic issues in EIA exercises. The EHS guidelines published by IFC are technical reference documents that address IFC's expectations regarding the industrial pollution management performance of its projects. They are designed to assist managers and decision makers with relevant industry background and technical information. This information supports actions aimed at avoiding, minimizing, and controlling EHS impacts during construction, and operation phase of a project or facility. The World Bank Guidelines for noise were reviewed.

2.1.2 The IUCN Red List (2008)

Some animal species are already extinct in Pakistan, and many are internationally threatened. The 1996 IUCN Red List of Threatened Animals classifies 37 species and 14 sub-species of mammals that occur in Pakistan as internationally threatened or near threatened. The Red List is based on field data that is more than 10 to 15 years old and needs to be reassessed. The country also provides critical habitat to 25 internationally threatened bird species and 10 internationally threatened reptiles.

According to the National Avian Research Centre in Abu Dhabi, with houbara's birth rate of 5 percent a year and if number of houbara keeps decreasing at the same rate with more than 6,000 being bagged by hunting parties and more than 4000 smuggled out of country, the worst scenario is that the houbara bustard would disappear as a species by 2015. There are a number of organizations that were formed to protest the illegal hunting and preserve the wildlife. This includes National Council for Conservation of Wildlife (NCCW), established in 1974 and supported by the UN, which breaks into three groups;

- Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES);
- Convention on Wetland of International Importance Especially as Water fowl Habitat (RAMSAR); and
- Convention on the Conservation of Migratory Species of Wild Animals (CMS).

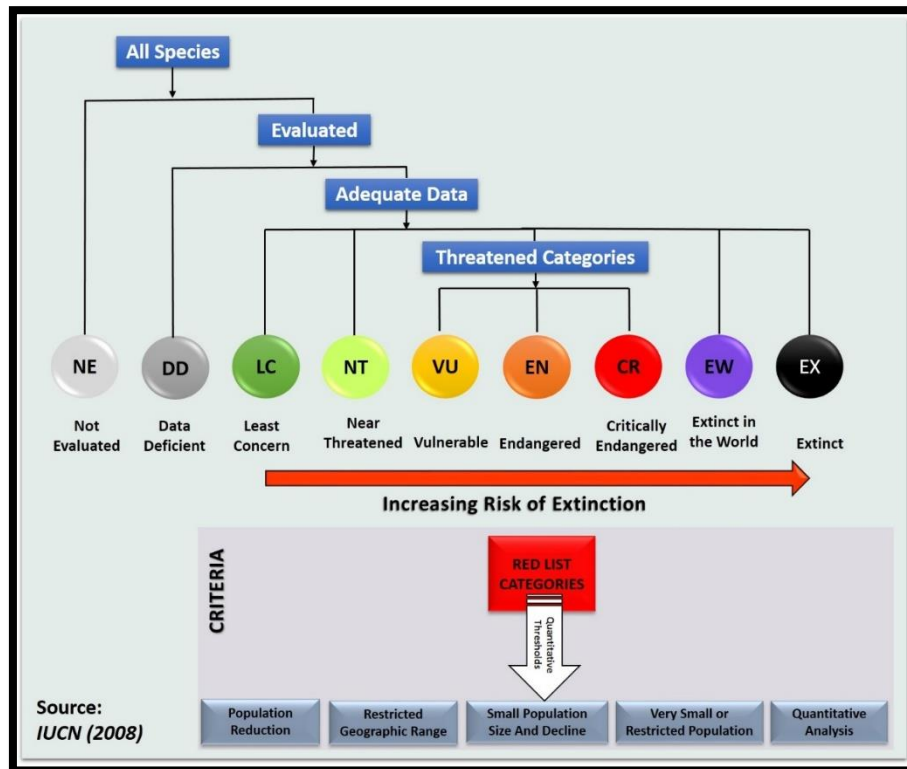


Figure 2-1: Structure of the Red List Categories and the five Red List Criteria

2.1.3 Convention on Wetlands of International Importance Especially As Waterfowl Habitat, Ramsar, 1971 and Its Amending Protocol, Paris, 1982

The Ramsar Convention (formally, the Convention on Wetlands of International Importance, especially as Waterfowl Habitat) is an international treaty for the conservation and sustainable utilization of wetlands, recognizing the fundamental ecological functions of wetlands and their economic, cultural, scientific, and recreational value. It is named after the city of Ramsar in Iran, where the Convention was signed in 1971 and came into force on December 21, 1975.

The Ramsar List of Wetlands of International Importance now includes 2208 Sites (known as Ramsar Sites) covering over 210,734,269.41 ha (520,735,720.3 acres). The country with the highest number of Sites is the United Kingdom at 170 and the country with the greatest area of listed wetlands is Bolivia, with over 140,000 km² (54,000 sq mi). The Ramsar definition of wetlands is fairly wide, including "areas of marine water the depth of which at low tide does not exceed six meters" as well as fish ponds, rice paddies and salt pans.

Presently there are 169 contracting parties, up from 21 initial signatory nations in 1971. The state parties meet every three years as the Conference of the Contracting Parties (COP), the first held in Cagliari, Italy in 1980. Amendments to the original convention have been agreed to in Paris (in 1982) and Regina (in 1987).

2.1.4 Convention on the Conservation of Migratory Species of Wild Animals, Bonn, 1979

The Convention on the Conservation of Migratory Species of Wild Animals - more commonly abbreviated to just the Convention on Migratory Species (CMS) or the Bonn Convention-aims to conserve terrestrial, marine and avian migratory species throughout their range. It is an intergovernmental treaty, concluded under the aegis of the United Nations Environment Programme, concerned with the conservation of wildlife and habitats on a global scale. Since the Convention's entry into force, its membership has grown steadily to include over 100 Parties from Africa, Central and South America, Asia, Europe and Oceania. The Convention was signed in 1979 in Bad Godesberg, a suburb of Bonn (hence the name), and entered into force in 1983. The depositary is the government of the Federal Republic of Germany. The CMS is the only global and UN-based intergovernmental organization established exclusively for the conservation and management of terrestrial, aquatic and avian migratory species throughout their range. CMS and its daughter agreements determine policy and provide further guidance on specific issues through their Strategic Plans, Action Plans, resolutions, decisions and guidelines. All maintain on their websites a list of all decisions taken, guidelines issues and Action Plans adopted by the Member States.

2.1.5 Equator Principles

The Equator Principles are a set of guidelines, promoted by the International Finance Corporation (IFC) that address the environmental and social issues associated with major development projects worldwide. They provide a common baseline and framework for the implementation of internal environmental and social procedures and standards for project financing activities across all industries.

- Principle 1: Review and Categorization (of projects)
- Principle 2: Social and Environmental Assessment
- Principle 3: Applicable Social and Environmental Standards
- Principle 4: Action Plan and Management System
- Principle 5: Consultation and Disclosure
- Principle 6: Grievance Mechanism
- Principle 7: Independent Review
- Principle 8: Covenants
- Principle 9: Independent Monitoring and Reporting
- Principle 10: EPFI Reporting

2.1.5.1 Review and categorization

An EPFI shall categorize a project, based on the magnitude of the potential social or environmental impacts and risks of that project, in accordance with IFC classification criteria.

These categories are:

- Category A: Projects with potential significant adverse social or environmental impacts that is diverse, irreversible or unprecedented.
- Category B: Projects with limited adverse social or environmental impacts that is few in number, generally site specific, largely reversible and readily addressed through mitigation measures.
- Category C: Projects with minimal or no social or environmental impacts.

Industrial Estate projects, by their nature; tend to fall into Categories B or C, being medium or low risk. Certain EPFIs as a matter of policy for example treat every Industrial Estate project as Category B. The Equator Principles apply to projects over 10 million US dollars. The Principles state that adopting financial institutions shall provide loans directly to projects only under the following circumstances. This EIA study has adequately addressed the Equator Principles applicable to risky projects as stated hereunder:

- **Principle 1 (Review and Categorization):** The study has reviewed the National and International Laws and Guidelines on different environmental aspects and has categorized the Dhabeji Special Economic Zone Project in Category B (Medium Hazard).
- **Principle 2 (Social and Environmental Assessment):** The Study has been prepared to respond to the National and International requirements and to satisfactorily address the key environmental and social issues.
- **Principle 3 (Applicable Social and Environmental Standards):** For the purpose of this EIA Study, primary data on the baseline environmental and social conditions have been generated wherever necessary to address the requirements of National laws and regulations; applicable International Treaties and Agreements; sustainable development and use of renewable natural resources; protection of human health, cultural properties, and biodiversity and other physical, ecological and socioeconomic issues required to be addressed under this Principle.

- **Principle 4 (Action Plan and Management System):** A detailed chapter-7 of this study screens the potential environmental impacts and proposes/provides Mitigation Measures to reduce the severity of impact. The study also includes the Environmental Health and Safety Management and Monitoring Plan.
- **Principle 5 (Consultation and Disclosure):** Being a project of Category B, the public consultation is limited to the scoping sessions with stakeholders and an extensive socioeconomic survey of the *Goth Phinnu Khan, Allah Dino, Nabi Bakhsh Baloch and Gabool Goth* around the boundary of the Project area. The surveys and consultation meetings have established that no resettlement or temporary relocation is involved details are given in chapter no.6.
- **Principle 6 (Grievance Mechanism):** This Principle shall not apply since ‘no’ resettlement or temporary relocation or acquisition of land is involved.
- **Principle 7 (Independent Review):** Being placed in Category B, an independent review may be needed.
- **Principle 8 (Covenants):** The EIA study has incorporated Covenants linked to compliance. Moreover, No Objection Certificates are issued to Proponents of Project under conditions of compliance with the Mitigation and Performance Monitoring Plan. Needless to say that if the proponent does not comply with the agreed terms, Sindh EPA is authorized to take corrective and even coercive action.
- **Principle 9 (Independent Monitoring and Reporting):** This Principle shall be applicable to the DSEZ Project since it falls in category of projects requiring an EIA. The proponent shall hire an Independent Monitoring Consultant to monitor the implementation of EMP and make reports for submission to regulatory agency.
- **Principle 10 (EPFI Reporting):** The concerned EPFI may safely commit to report publicly at least annually about its Equator Principles implementation processes and experience.

2.1.6 IFC Performance Standards on Social and Environmental Sustainability

International Finance Corporation (IFC) applies the Performance Standards to manage social and environmental risks and impacts and to enhance development opportunities in its private sector financing in its member countries eligible for financing. The Performance Standards may also be applied by other financial institutions electing to apply them to projects in emerging markets. Together, the eight Performance Standards establish standards that the

Proponent is to meet throughout the life of an investment by IFC or other relevant financial institution.

The objectives of Performance standards are given below:

- To identify and assess social and environment impacts, both adverse and beneficial, in the project's area of influence;
- To avoid, or where avoidance is not possible, minimize, mitigate, or compensate for adverse impacts on workers, affected communities , and the environment;
- To ensure that affected communities are appropriately engaged on issues that could potentially affect them; and
- To promote improved social and environment performance of companies through the effective use of management systems.

2.1.6.1 Performance Standard: Social and Environmental Assessment and Management System

This Performance Standard seeks to:

- Identify and assess social and environment impacts in the project's area of influence;
- Avoid, minimize, mitigate, or compensate for adverse impacts on workers, affected communities, and the environment;
- Ensure that affected communities are appropriately engaged on issues that could potentially affect them; and
- Promote improved social and environment performance of the project through the effective use of management systems.

Under this Standard, the project is required to establish and maintain a social and environmental management system appropriate to the nature and scale of the project and in accordance with the level of social and environmental risks and impacts. The management system is required to incorporate the following elements:

- Social and Environmental Assessment;
- Management program;
- Organizational capacity;
- Training;
- Community engagement;

- Monitoring; and
- Reporting.

This EIA study has been conducted to respond to requirements of national legislation and international Guidelines and just as well fulfills the above requirements of the IFC Performance Standards PS1.

2.1.6.2 Performance Standard: Labor and Working Conditions

This PS seeks to establish, maintain and improve the worker-management relationship; promote fair treatment, non-discrimination and equal opportunity for workers, and compliance with national labor and employment laws; protect the workforce by addressing child labor and forced labor issues; and promote safe and healthy working conditions, and to protect and promote the health of workers. The Sponsors of proposed project and their contractors shall be required to adhere to this PS, in particular with regard to compliance with national labor and employment laws; employment of child labor, and promoting safe and healthy working conditions, besides protecting and promoting the health of workers.

2.1.6.3 Performance Standard: Pollution Prevention and Abatement

The PS 3 seeks to avoid or minimize adverse impacts on human health and the environment by avoiding or minimizing pollution from project activities, and to promote the reduction of emissions that contribute to climate change. The Standard requires the project to consider during its entire lifecycle ambient conditions and apply pollution prevention and control technologies and practices that are best suited to avoid or, where avoidance is not feasible, minimize or reduce adverse impacts on human health and the environment while remaining technically and financially feasible and cost-effective. PS 3 shall be applicable to all stages of the DSEZ Project. Various aspects of pollution prevention and abatement of the proposed project are discussed separately in this report in chapter-8.

2.1.6.4 Performance Standard: Community Health, Safety and Security

The PS 4 seeks to avoid or minimize risks to and impacts on the health and safety of local community during the project lifecycle from both routine and non-routine circumstances, and to ensure that the safeguarding of personnel and property is carried out in a legitimate manner that avoids or minimizes risks to the community's safety and security. The PS requires the project to evaluate the risks and impacts to the health and safety of the affected community during the design, construction and operation of the project and establish preventive measures

to address them in a manner commensurate with the identified risks and impacts. The present assessment addresses the requirement of PS 4 for the proposed project, and has evaluated the impacts of siting the Terminal on health, safety and security of the community in the microenvironment as well as the macro environment. The Environmental Management Plan also addresses community aspects.

2.1.6.5 Performance Standard: Biodiversity Conservation and Sustainable Natural Resource Management

The PS 6 seeks to protect and conserve biodiversity, and promote sustainable management and use of natural resources through adoption of practices that integrate conservation needs and development priorities. The present environmental assessment addresses the potential impacts of the proposed project on the biodiversity. This EIA has recommended measures for the conservation of flora, fauna and other natural resources.

2.1.6.6 Performance Standard: Cultural Heritage objectives have been set in the IFC performance standards to achieve sustainable development

The objectives of this PS are to protect cultural heritage from the adverse impacts of project activities and support its preservation, and to promote the equitable sharing of benefits from the use of cultural heritage in project activities. No sites of cultural heritage are known to exist at or in the immediate vicinity of the project location. As well as no *Goths*/settlements are within the project area. There is not any site covered under the listing of cultural heritage sites. This PS shall therefore not be applicable to the Project.

2.1.7 IFC- Environmental, Health, and Safety Guidelines

Effective management of environmental, health, and safety (EHS) issues entails the inclusion of EHS considerations into corporate and facility-level business processes in an organized, hierarchical approach that includes the following steps:

- Identifying EHS project hazards and associated risks as early as possible in the facility development or project cycle, including the incorporation of EHS considerations into the site selection process, product design process, engineering planning process for capital requests, engineering work orders, facility modification authorizations, or layout and process change plans.
- Involving EHS professionals, who have the experience, competence, and training necessary to assess and manage EHS impacts and risks, and carry out specialized

environmental management functions including the preparation of project or activity-specific plans and procedures that incorporate the technical recommendations presented in this document that are relevant to the project.

- Understanding the likelihood and magnitude of EHS risks, based on:
 - The nature of the project activities, such as whether the project shall generate significant quantities of emissions or effluents, or involve hazardous materials or processes;
 - The potential consequences to workers, communities, or the environment if hazards are not adequately managed, which may depend on the proximity of project activities to people or to the environmental resources on which they depend.
- Prioritizing risk management strategies with the objective of achieving an overall reduction of risk to human health and the environment, focusing on the prevention of irreversible and / or significant impacts.
- Favoring strategies that eliminate the cause of the hazard at its source, for example, by selecting less hazardous materials or processes that avoid the need for EHS controls.
- When impact avoidance is not feasible, incorporating engineering and management controls to reduce or minimize the possibility and magnitude of undesired consequences, for example, with the application of pollution controls to reduce the levels of emitted contaminants to workers or environments.
- Preparing workers and nearby communities to respond to accidents, including providing technical and financial resources to effectively and safely control such events, and restoring workplace and community environments to a safe and healthy condition.
- Improving EHS performance through a combination of ongoing monitoring of facility performance and effective accountability.

2.2 NATIONAL LAWS

2.2.1 National Conservation Strategy

The National Conservation Strategy (NCS) is the primary policy document of the Government of Pakistan (GoP) on national environmental issues. The Strategy approved by the Federal Cabinet in March 1992 was also recognized by International Financial Institutions, principally

the World Bank. The NCS had identified 14 core areas including conservation of biodiversity, pollution prevention and abatement, soil and water conservation and preservation of cultural heritage. It had also recommended immediate attention to the stated core areas in order to preserve the environment of Pakistan.

A mid-term review of the NCS in 2000 concluded that achievements under the NCS were primarily awareness raising and institutional building rather than meaningful improvement of the environment and natural resources and that the NCS was neither designed nor adequately focused as a national sustainable development strategy (GoP, November 2002). Thus the need for a more focused National Environmental Action Plan (NEAP) was formulated and approved by the Pakistan Environmental Protection Council in 2001 to practically improve the national environment with emphasis on poverty reduction, and economic as well as sustainable development.

NEAP now constitutes the national environmental agenda and its core objective is to initiate actions that would safeguard public health, promote sustainable livelihoods and enhance the quality of life of the people of Pakistan. The GOP and United Nations Development Programme (UNDP) have jointly initiated an umbrella support programme called the NEAP-Support Programme that was signed in October 2001 and implemented in 2002. The development objective supported by NEAP Support Programme is environmental sustainability and poverty reduction in the context of economic growth. The objectives of new policy have total 171 guidelines on sectoral and cross sectoral issues. The objectives of new policy include assurance of sustainable development and safeguard of 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

- Biodiversity Action Plan

The key to protection of the biological heritage of Pakistan lies in the involvement of local people and in the support provided by competent institutions for conservation and sustainable use. The Government of Pakistan has recognized the importance of these measures in the preparation of National Conservation Strategy and in becoming a signatory to, and ratifying, the Convention on Biological Diversity (CBD) in 1994. Developing the Biodiversity Action Plan for Pakistan, 2000 has been the most significant direct steps towards addressing the biodiversity loss.

2.2.2 Pakistan Environmental Protection Act, 1997

The Pakistan Environmental Protection Act, 1997 is the basic legislative tool empowering the government to frame regulations for the protection of environment. The Act is broadly applicable to air, water, and noise pollution, as well as to handling of hazardous wastes. Penalties have been prescribed for those who contravene the provisions of the Act. The powers of the Federal and Provincial Environmental Protection Agencies (EPAs) were also considerably enhanced under this legislation and they have been given the power to conduct inquiries into possible breaches of environmental laws either of their own accord, or upon the registration of a complaint. Under section 12 of Act, no project involving construction activities or any change in the physical environment can be commence unless the fulfillment of prerequisite *i.e.*, to conduct an EIA or IEE and a report submitted to the Federal or Provincial EPA.

2.2.3 The Pakistan Environmental Assessment Procedures, 1997

The Pakistan Environmental Protection Agency prepared the Pakistan Environmental Assessment Procedures in 1997. They are based on much of the existing work done by international donor agencies and Non-Governmental Organizations (NGOs). The package of regulations prepared by Pakistan EPA includes:

- Policy and Procedures for Filing, Review and Approval of Environmental Assessments;
- Guidelines for the Preparation and Review of Environmental Reports;
- Guidelines for Public Consultation;
- Guidelines for Sensitive and Critical Areas; and
- Sectoral guidelines for Environmental Reports

2.2.4 National Environmental Policy, 2005

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. Thereafter, it was approved by the Federal Cabinet on 29th June 2005. NEP is the primary policy document of Government of Pakistan that addresses Pakistan's environmental issues. The broad goal of NEP is, "To protect, conserve and restore Pakistan's environment in order to improve the quality of life of the citizens through sustainable development". The NEP also provides the sectoral and cross-sectoral guidelines, listed in following paragraphs, for various sectors to achieve its goal of sustainable development:

A. Sectoral Guidelines - are available in the following areas:

Water Supply and Management; Air Quality and Noise; Waste Management; Forestry, Biodiversity and Protected Areas; Climate Change and Ozone Depletion; Energy Efficiency and Renewable Energy Resources; Agriculture and Livestock; and Multilateral Environmental Agreements.

B. Cross- Sectoral Guidelines

All environment related policies, programs and projects would be gender sensitive, integrate Poverty, Population and Health. Incorporate effective environmental management in Trade, Local Governance and Natural Disaster Management.

In addition to these sectoral and cross-sectoral guidelines, the NEP 2005 also suggests the following policy instruments to overcome the environmental problems throughout the country;

- Integration of environment into development planning
- Legislation and regulatory framework
- Capacity building of various institutions
- Economic and market based instruments
- Public awareness and education
- Public-private-civil society partnership

While NEP 2005 is a policy document and does not regulate individual projects, however, adopting policy guidelines ensure that the project does not add to the environmental problems identified in NEP. Moreover, adopted mitigation measures shall minimize or avoid any contribution to the already existing environmental problems in the project area.

2.2.5 The National Environmental Quality Standards (NEQS)

The NEQS were first promulgated in 1993, 2000 and were last revised in 2010. They comprise the basic guidelines for liquid effluent and gaseous emissions of municipal and industrial origin to comply with. These standards present the maximum allowable concentration for liquid effluent before its discharge into sea, inland water and sewage (total 32 parameters to comply with) and gaseous emissions in the ambient air from industrial sources (total 16 parameters to comply with).

During the construction and operation phase of the project NEQS shall apply to all effluents and emissions. NEQS for municipal and industrial effluents, selected gaseous pollutants from industrial sources, motor vehicle exhaust and noise, ambient air quality and ambient noise and drinking water quality have been provided in the Pakistan EPA 1997 Act.

2.2.6 Pakistan Environmental Act, 2014

The Pakistan Environmental Protection Act, 2014 is the basic legislative tool empowering the government to frame regulations for the protection of environment. However, this legislation is still pending in National Assembly. The Act is broadly applicable to air, water, soil and noise pollution, as well as to handling of hazardous wastes. Penalties have been prescribed for those who contravene the provisions of the Act. The powers of the Federal and Provincial Environmental Protection Agencies (EPAs) were also considerably enhanced under this legislation and they have been given the power to conduct inquiries into possible breaches of environmental laws either of their own accord, or upon the registration of a complaint. Under section 12 of Act, no project involving construction activities or any change in the physical environment can be commence unless the fulfillment of prerequisite *i.e.*, to conduct an EIA or IEE and a report submitted to the Federal or Provincial EPA.

2.2.7 National Resettlement Policy, 2002

In March, 2002 Pakistan Environmental Protection Agency (Pak-EPA), GoP has issued its National Resettlement Policy, which explains the basis for compensation, rehabilitation and

relocation of the affectees. It also explains the requirements and implementation of Resettlement Action Plan (RAP).

2.2.8 National Disaster Risk Reduction Policy (2013)

The NDRRP provides the resilience to shocks from national and manmade hazards with the sense of urgency, creating a solid base to address disaster risk reduction in vulnerable areas while involving an increasingly wider range of stakeholders from government, civil society and private sectors. The basic purpose of the policy is to advocate an approach to disaster management that focuses on reducing risks – the probability of losing one’s life or health, assets and livelihood.

2.2.9 The Land Acquisition Act, 1894

The Land Acquisition Act (LAA) sets out the rules for acquiring needed and other built-up properties affected by a Project, and for compensating the affected owners of the land. It is implemented in order to fulfil the need of government and companies for land required by them for their projects and also to determine and pay compensation to those private persons or bodies whose land is to be acquired. The LAA is limited to a cash compensation policy for the land acquisition and to build-up property, and the damage to other assets such as, crops, trees and infrastructure. The LAA does not take into account the rehabilitation and settlement of displaced population and restoration of their livelihood. In addition to that, LAA only allows comparative to legal title-holders of the land and does not speak about the squatter illegal occupants.

2.2.10 Guidelines for Environmental Sensitive Areas (ESAs) and Critical Sensitive Areas (CSAs), 1997

Protected areas are of crucial and growing importance. This is because properly managed protected areas are based on the establishment of a system which aims to:

- Safeguarding 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, development projects, and mismanaged tourism.

Protected areas in Pakistan can be broadly categorized into two groups; they are:

1. Ecosystems, and
2. Archaeological and cultural sites.

These guidelines apply for development related to protected areas (also referred to as sensitive and critical areas), and have been formulated for two parallel approaches, with almost identical processes. The two approaches have been developed for:

1. Ecosystems (includes protected areas such as wildlife reserves, national parks, game reserves); and
2. Archaeological Sites, Monuments, Buildings and Cultural Heritage (includes world heritage listing).

Protected area notification and management is the responsibility of two distinct authorities who manage the above respective areas. These authorities whether federal or provincial, and dealing with ecosystems or cultural heritage, are referred to in this guideline as “the relevant conservation authority”.

2.2.11 The Forest Act, 1927

The act empowers the provincial forest departments to declare any forest area as reserved or protected. The act also empowers the provincial forest departments to prohibit the clearing of forest for cultivation, grazing, hunting, removing forest produce; quarrying and felling, lopping and topping of trees, branches in reserved and protected forests. No protected forest is situated in the proposed project area. However, it is not just the protected forests that the Forest department needs to attend to; it is equally responsible to protect the forest cover, protected or unprotected, to abate rampant desertification. The process of desertification is linked to availability of firewood, which is now in greater demand than ever because of the exhaustion of all fuel resources in the country. This has led to not just felling, lopping and topping of trees, branches anywhere but to extracting the tree by the roots.

2.2.12 Factories Act, 1934

The clauses of this Act relevant to the project are those that concern the health, safety and welfare of workers, disposal of solid waste and effluent, and damage to private and public property. The Factories Act also provides regulations for handling and disposing of toxic and hazardous materials. Given that construction activity is classified as ‘industry’ these regulations shall be applicable to the project contractors.

2.3 PROVINCIAL LAWS

2.3.1 Sindh Environmental Protection Agency (Review of EIA/IEE) Regulations 2014

The Sindh Environmental protection Act, 2014 requires proponents of all projects involving any change in the environment, to submit an Environmental Impact Assessment (EIA) report, to the Sindh Environmental Protection Agency (SEPA). According to the Sindh Environmental Assessment Procedures, December 2014, Schedule II, Category I, Urban Development projects require an EIA. Therefore, an EIA is mandatory for the proposed DSEZ Project.

- IEE (Schedule-I)
- EIA (Schedule- II)

The Regulations also require that all projects located near an environmentally sensitive areas need submission of an EIA. DSEZ project both in terms of the project and sensitivity of the project demands an EIA (**Annexure-II**).

2.3.2 Sindh Wildlife Protection Ordinance, 1972 and Amendments 2001

This ordinance provides for the preservation, protection, and conservation of wildlife by the formation and management of protected areas and prohibition of hunting wildlife species declared protected under the ordinance. The ordinance also specifies three broad classifications of the protected areas:

- **National Parks;**
- **Wildlife Sanctuaries; and**
- **Game Reserves.**

Activities such as hunting and breaking of land for mining are prohibited in national parks, as are removing vegetation or polluting water flowing through the park. Wildlife sanctuaries are areas that have been set aside as undisturbed breeding grounds and cultivation and grazing is

prohibited in the demarcated areas. Nobody is allowed to reside in a wildlife sanctuary and entrance for the general public is by special dispensation. However, these restrictions may be relaxed for scientific purpose or betterment of the respective area on the discretion of the governing authority in exceptional circumstances. Game reserves are designated as areas where hunting or shooting is not allowed except under special permits.

Two amendments to the Ordinance were issued in January and June 2001 respectively pertaining to oil and gas exploration activities within national parks and wildlife sanctuaries. The first amendment allowed the Government to authorize the laying of an underground pipeline through protected areas. The second amendment allowed exploration and production activities within national parks and wildlife sanctuaries. This amendment is not applicable to other development projects including power generation using wind energy for example.

The ecosystem which includes the Project site does not fall in a protected area or wildlife sanctuary. Legalization of hunting on disappearing creatures in Pakistan and specifically the hunting of houbara bustard has been allowed as the preservation method for local wild animal habitat. However, because of the lukewarm attitude of the authorities that be, this method of conservation has failed in its mission. The wildlife department is hardly able to monitor the actual number of animal or bird killed as against the legally allowed numbers, and that makes it hard to control the trophy hunters.

Big-game hunting is banned in Pakistan vide the above regulations, except in community controlled areas with an existing limitation on exact kinds and numbers of species as well as countries they can be exported in. There is decline in such species as cranes, geese, storks, pelicans, and houbara bustards, which are migratory birds. The illegal hunting has led to continuous loss, fragmentation and degradation of natural habitats that include forests, rangelands, and freshwater and marine ecosystem.

2.3.3 Sectoral Guidelines for Industrial Estates, 1997

Industrial estates are categorized as projects representing a significant threat to the environment. They automatically require full Environmental Impact Assessment (EIA) (Category A Projects). These guidelines cover all new industrial estate proposals where land is developed and managed by a coordinating authority and serviced lots are leased off to smaller

industrial users. Services can include roads, rail link, water, electricity, gas and telephone. Most importantly industrial estates have the opportunity to provide properly managed treatment facilities for liquid and solid wastes.

In Pakistan industrial estates have traditionally been under the control of Provincial Governments. Estates have been developed and managed by Development Corporations or Boards under the Provincial powers. There have been two levels of provision for both small and larger scale establishments. NWFP has a Small Industries Development Board for smaller industries, while the Sarhad Development Authority looks after the land requirements of larger industries. There are similar arrangements in other Provinces such as in Punjab which has a Small Scale Industries Corporation and a Punjab Industrial Development Board.

These guidelines therefore relate to all new public and private industrial estates. They also relate to any extension or new phase of an existing estate. Cumulative impacts shall be discussed later, but, it is important that the site is evaluated on the basis of the combined effects of the existing estate plus the new extension. The incremental increase in atmospheric and effluent discharge may make extension of the site unacceptable or mitigation so costly as to make the choice of a new site preferable.

The guidelines shall assist proponents to identify the key environmental issues that need to be assessed as well as mitigation measures and alternatives that should be considered at all stages in the process of siting, design, construction and operation a new industrial estate. Readers are advised not to apply a mechanistic approach based on these guidelines. No technique can replace the thoughtful consideration of the proposal, its siting and the physical and cultural environment in which it is proposed.

2.3.4 Sindh Environmental Quality Standards (2015)

In exercise of the powers conferred under clause (g) of sub-section (I) of section of 6 of the Sindh Environmental Protection Act, 2014, the Sindh Environmental Protection Agency, with the approval of the Sindh Environmental Protection Council, is pleased to establish the environmental quality standards related to Industrial Waste Water, Effluent, Domestic, Sewerage, Industrial Air Emission and Ambient Airs, Noise for Vehicles, Air Emissions for Vehicles and Drinking Water Quality Standards. This may be called as Sindh Environmental Quality Standards (SEQS) 2015 and attached as **Annexure III** in this report.

2.3.5 Special Economic Zone (Amendment) Act, 2016

The SEZ act of the Parliament received the assent of the president on 12th August, 2012 and later amended on 18th October, 2016. An act to provide setting up and operation of Special Economic Zones in Pakistan. Whereas, it is necessary and expedient to promulgate a law for the creation, development and efficient operation of special operation of special economic zones through provision of a legal and regulatory frame work to encourage domestic and international investors for promotion and establishment of industrial infrastructure and for other matters connected or ancillary thereto.

3 PROJECT DESCRIPTION

3.1 Study Area

The study area is enjoying a coastal climate and comprised of both wetland and terrestrial habitats. Generally, no Environmental Sensitive Areas (ESAs) found within the jurisdiction of DSEZ. As it is located near Dhabeji in *Deh Gharo* which is a coastal creek area near the mouth of Arabian Sea. The area is predominantly surrounded by creeks in south, which is one of the unique habitats of southern Sindh. Project area land is almost flat with few undulating heights and surrounded by industrial zone, creeks and salt quarry ponds. Port Qasim Industrial Area is situated on its Western side and National Highway is located on its Northern side; on its Southern side *Gharo Creek* is highly prominent, mainly mangroves habitat and salt pans are found, whereas, Dhabeji Pumping station is situated on its South-eastern side (**Figure 3-1**).

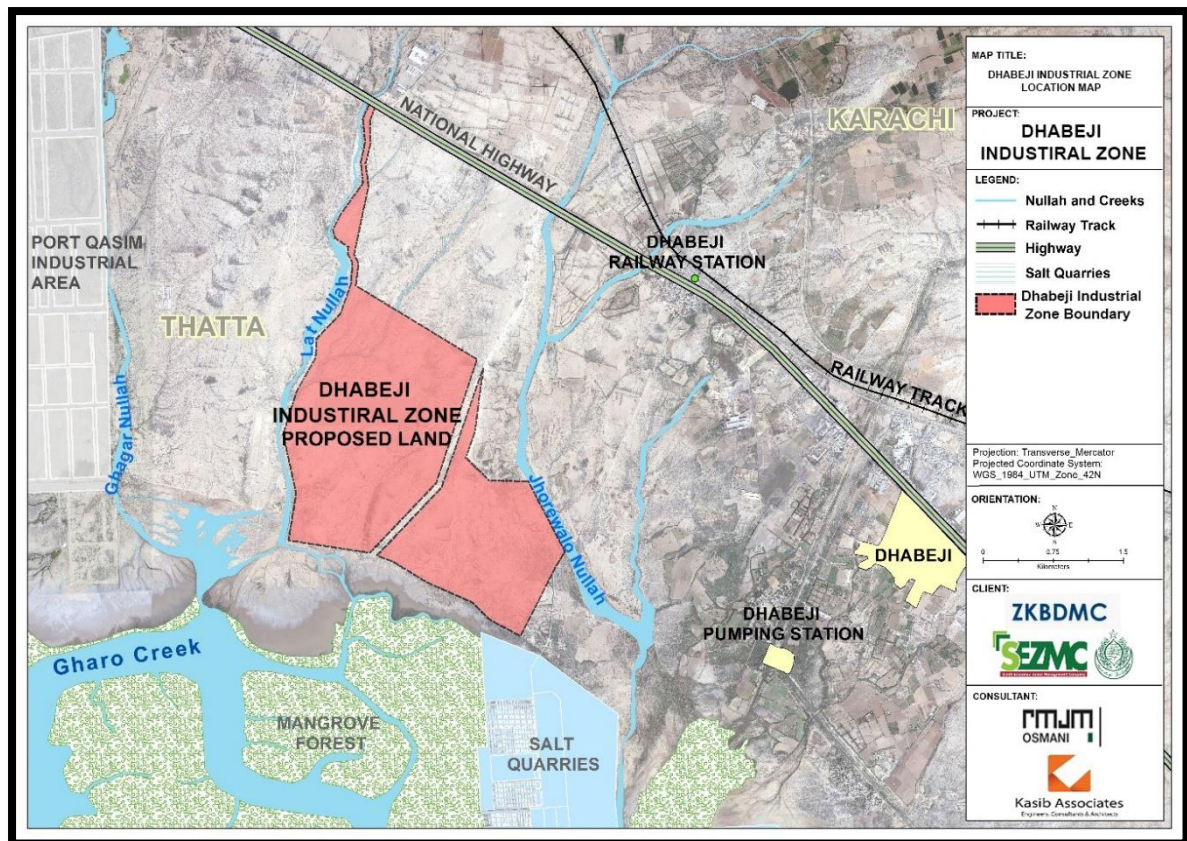


Figure 3-1: Location Map of Dhabeji Special Economic Zone, Dhabeji, Thatta

3.2 Proposed Master Plan of DSEZ

Proposed project area is mainly consist of heavy industries, medium industries, light industries, amenities and roads. Detailed distribution of land is shown in **Figure 3-2** and **Figure 3-3**.

Table 3-1: Industrial Sectors of DSEZ

Sectors	Sub sectors / Products
Automotive & Allied	Bearings, Seals, Head Lights, Car Seats, Steel metal parts
Building Material	Glass, Marble, Paint, Cement Pipes, Pipe Fittings
Chemical & Pharmaceuticals	Fertilizers, Fuel, Ethanol, Glue, Lifesaving drugs, Bleach
FMCGs	Foods (agro-based, processed, dairy), Soft drinks, Toiletries, Personal care
Foundries – Steel Fabrication	Dies, Shafts, Cylinders, Steel sheets, Coil
Light Engineering	Power loom parts, Plug Pins, Oil Pumps, Air Cleaner, Agricultural and Industrial machinery parts
Textile & Garments	Cotton yarn, Knitwear, Bed wear, Towels, Ready-made Garments
Sectors	Primary Raw Materials
Automotive & Allied	Pieces of brass, Steel, Copper, Iron, Chemicals, Plastic and Electrical material cutting
Building Material	Cement, Sands, Marble, Granite, Plastic Pipes, Chemicals and Glass cutting
Chemical & Pharmaceuticals	Different Acids, Oil, Chemical and powders used in making medicine and chemicals
FMCGs	Oil, Liquid paraffin, Preservatives, Active ingredients, Surfactants
Foundries – Steel Fabrication	Rods and sheets of iron, Oil, Scrap, Billets, Zinc, Acid and Steel cutting
Light Engineering	Steel, Metals, Aluminum, Fiber, Glass, Copper, Brass, Acrylic, Zinc and Chemicals
Textile & Garments	Cotton, Cotton yarn

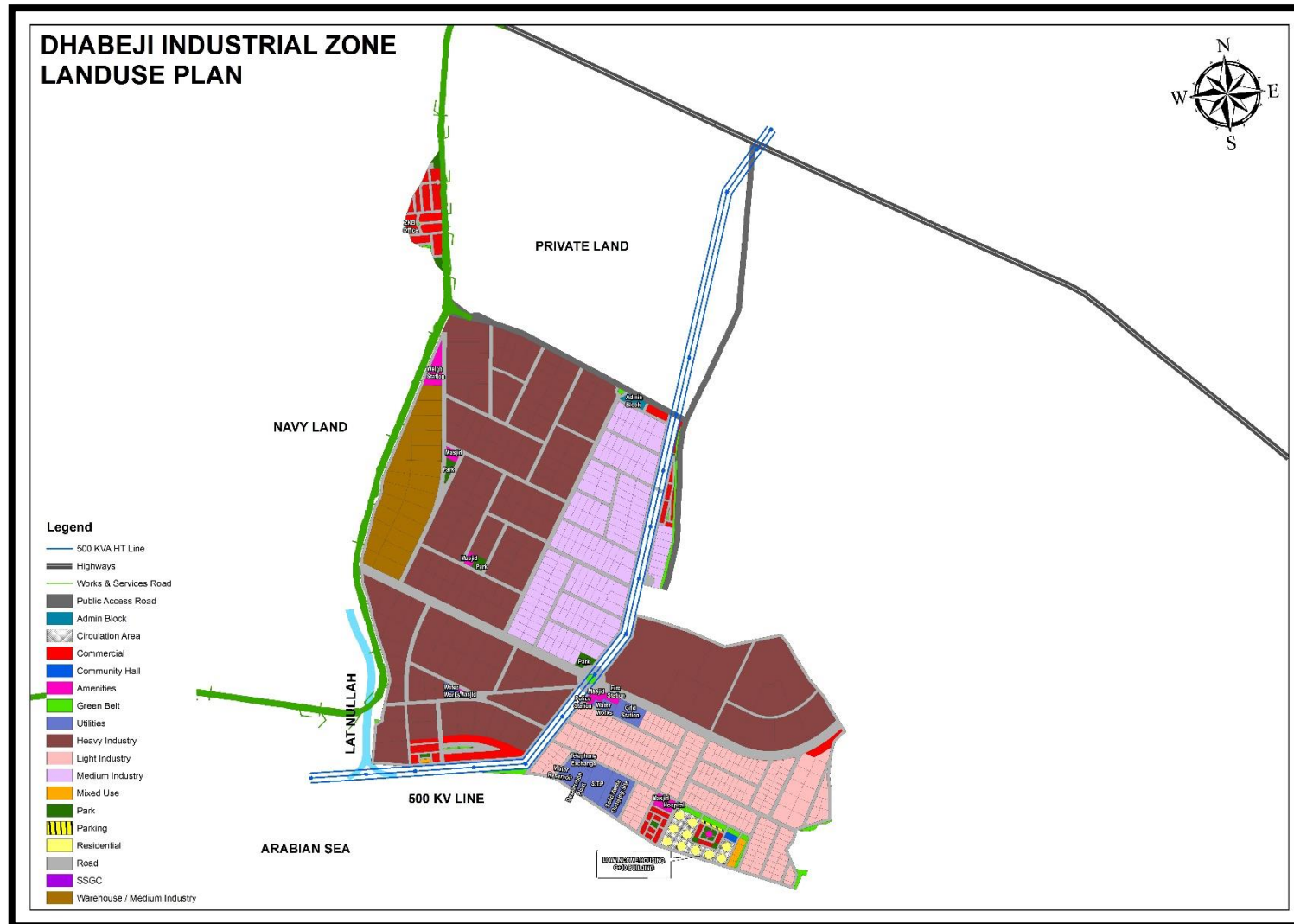


Figure 3-2: DIZ Proposed Master Plan with Type of Industries

3.3 Importance of economic zones

An Economic Zone also known as Commercial Park/ Estate, trading estate, is an area zoned and planned for the purpose of industrial development. An Economic Zone can be thought of as a more "heavyweight" version of a business park or office park, which has offices and light industry, rather than heavy industry.

Industrial parks are usually located on the edges of, or outside the main residential area of a city, and normally provided with good transportation access, including road and rail. This idea of setting land aside through this type of zoning is based on several concepts:

- To concentrate dedicated infrastructure in a delimited area to reduce the per-business expense of that infrastructure. Such infrastructure includes roadways, railroad sidings, ports, high-power electric supplies (often including three-phase electric power), high-end communications cables, large-volume water supplies, and high-volume gas lines.
- To attract new business by providing an integrated infrastructure in one location.
- Eligibility of Industrial Parks for benefits.
- To set aside industrial uses from urban areas to try to reduce the environmental and social impact of the industrial uses.
- To provide localized environmental controls that are specific to the needs of an industrial area.

4 ENVIRONMENTAL BASELINE PROFILE

For any economic zone or industrial cluster project such as Dhabeji Special Economic Zone, the prevailing environmental conditions need to be assessed prior to the preliminary stages of planning, designing and execution of the project. Identification of physical, ecological and social aspects of environment and collection of relevant data is essentially important for the evaluation of impacts as well as for the suggestion of adequate mitigation measures which forms the basis of the Environmental Impact Assessment (EIA) exercise.

The existing physical environmental conditions of the DSEZ project area are described in the following sections. Information have been collected from a variety of sources, including published literature, field observations and surveys conducted for other studies in the area, and those that were conducted specifically for this project have been analyzed for this study.

The description of the environment is focused on both micro and macro environment which includes Dahbeji, Thatta zone while micro-environment includes *Gharo* Creek area. Description of the environment of the Project requires baseline data on the existing resources of its micro-environment and macro environments with main focus on the following resources:

- Physical Resources;
- Ecological Resources; and
- Socioeconomic Resources.

4.1 METHODOLOGY

For the collection of basic ecological parameters, following sequences of techniques has been adopted. These techniques were chosen because of their pragmatic application in very short span of time. Otherwise for EIA detailed studies may be recommended to complete such evaluations.

1. Reconnaissance Survey;
2. Remote Sensing Analysis (Satellite Remote Sensing and Drone Applications);
3. Field Investigations;
4. Meteorological Analysis;
5. Environmental Analysis (air, noise and water quality analysis);
6. Review and Collection of Secondary environmental Analysis Data;
7. Basic parameters collection from published sources; and

8. Assessment of environmental threats.

4.2 RECONNAISSANCE SURVEY

Reconnaissance survey of DSEZ site was conducted for the collection of preliminary information about the flora, fauna and existing human intervention along with ecological characteristics. For this purpose, on August 24, 2017 a reconnaissance survey was carried out that provide the basis to delineate the ecological habitats and to initially explore the diversified environment (**Figure 4-2**).

4.3 PHYSICAL RESOURCES

4.3.1 Climate

The general climatic trend of Thatta is quite moderate which has moderate temperatures and a high level of humidity for significant portion of the year; particularly after the monsoon season (June to September). The peak temperature months are May, June and October. Thatta usually receives more rainfall than Karachi.

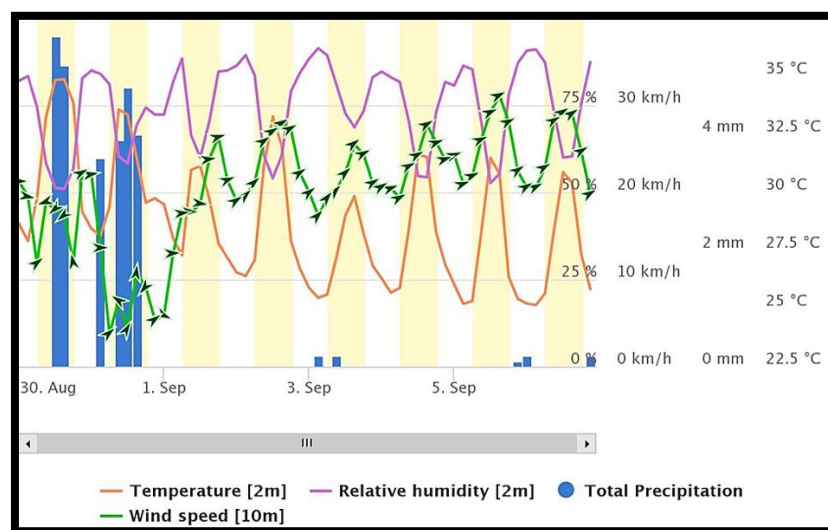


Figure 4-1: Climate of Thatta (30th Aug-5th Sep, 2017)

Source: Meteoblue (2017)

4.3.2 Temperature

The "mean daily maximum" (solid red line) shows the maximum temperature of an average day for every month for Thatta. Likewise, "mean daily minimum" (solid blue line) shows the average minimum temperature. Hot days and cold nights (dashed red and blue lines) show the average of the hottest day and coldest night of each month of the last 30 years. June is the

warmest month of the year. The temperature in June averages 32.4 °C. At 18.2 °C on average, January is the coldest month of the year (**Figure 4-3**).

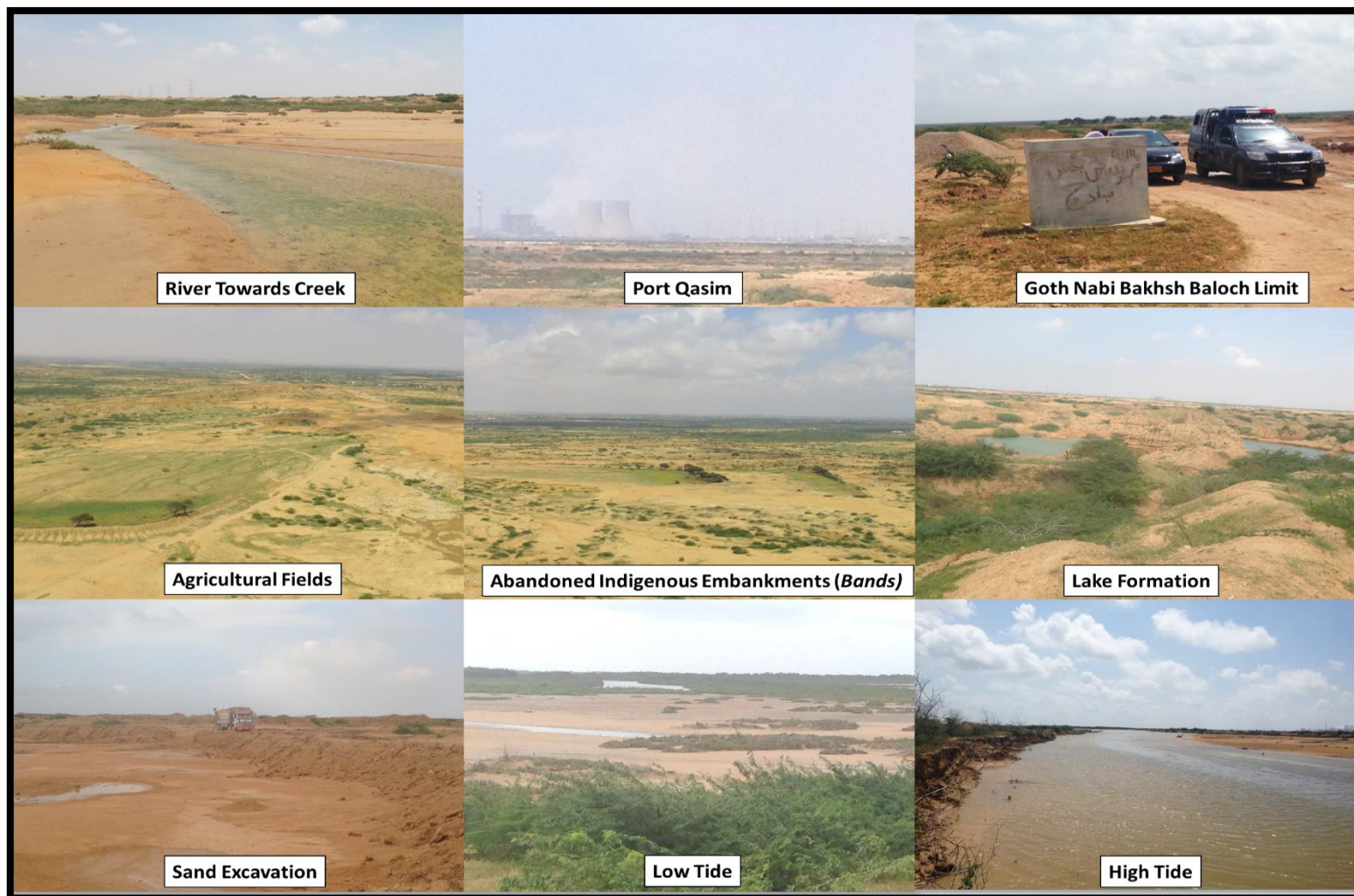


Figure 4-2: Some glimpse of the Baseline Environment of Project Area

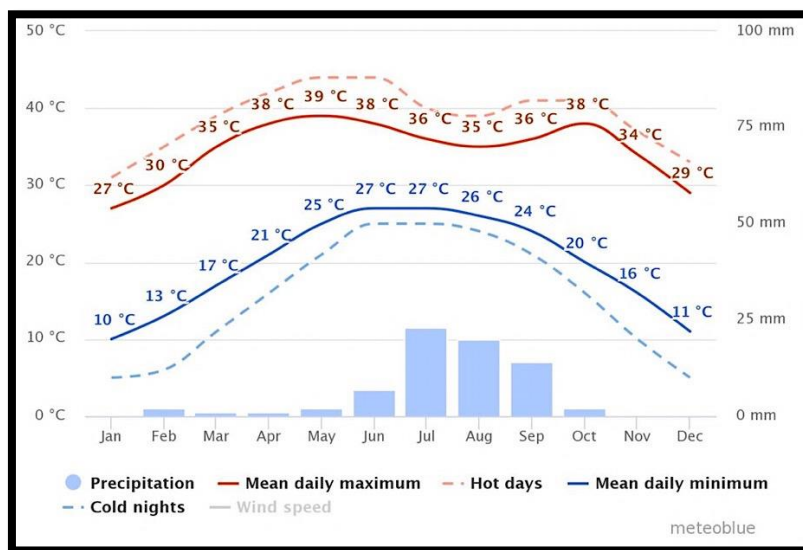


Figure 4-3: Monthly Temperature of Thatta (2016)

Source: Meteoblue (2016)

4.3.3 Rainfall analysis

The precipitation diagram for Thatta shows on how many days per month, certain precipitation amounts are reached. In tropical and monsoon climates, the amounts may be underestimated.

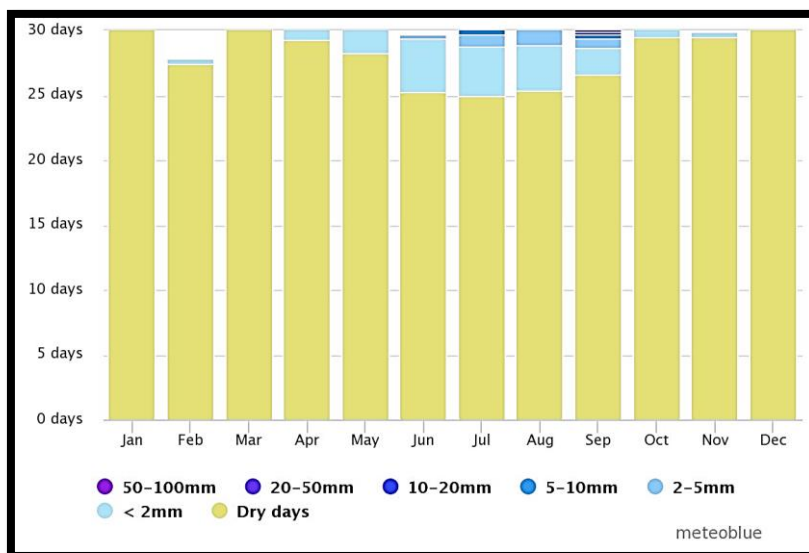


Figure 4-4: Monthly Rainfall Amount (2016)

Source: Meteoblue (2016)

4.3.4 Humidity

The graph shows the monthly number of sunny, partly cloudy, overcast and precipitation days. Days with less than 20% cloud cover are considered as sunny, with 20-80% cloud cover as partly cloudy and with more than 80% as overcast.

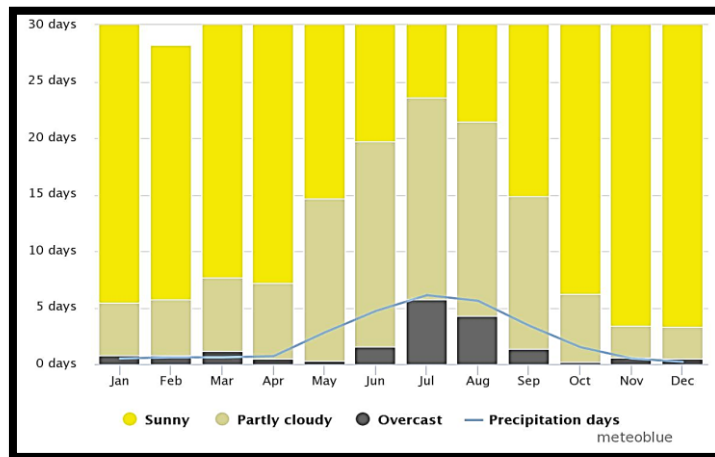


Figure 4-5: Monthly Humidity Range (2016)

Source: Meteoblue (2016)

4.3.5 Wind speed and direction

The diagram for Thatta shows how many days within one month can be expected to reach certain wind speeds. Monsoons create steady strong winds on the Tibetan Plateau from December to April, but calm winds from June to October.

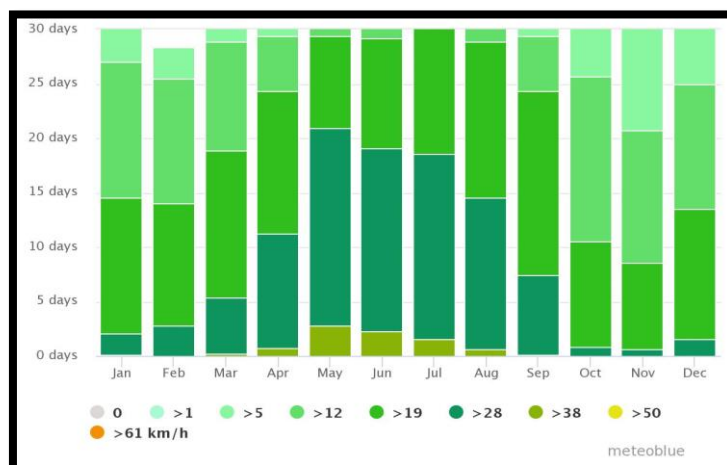


Figure 4-6: Wind Speed (2016)

Source: Meteoblue (2016)

The wind rose for Thatta shows how many hours per year the wind blows from the indicated direction. Wind is blowing from South-West (SW) to North-East (NE). Most of the wind blows from south-southwest to west-southwest direction in Sindh region. However, during summer season, a heat low exists over Balochistan and adjoining areas. Its trough usually extended southeastward causing most frequent wind direction found west northwest at *Keti Bandar*. District Thatta has one of the strongest wind corridors in Pakistan and has great potential of wind energy.

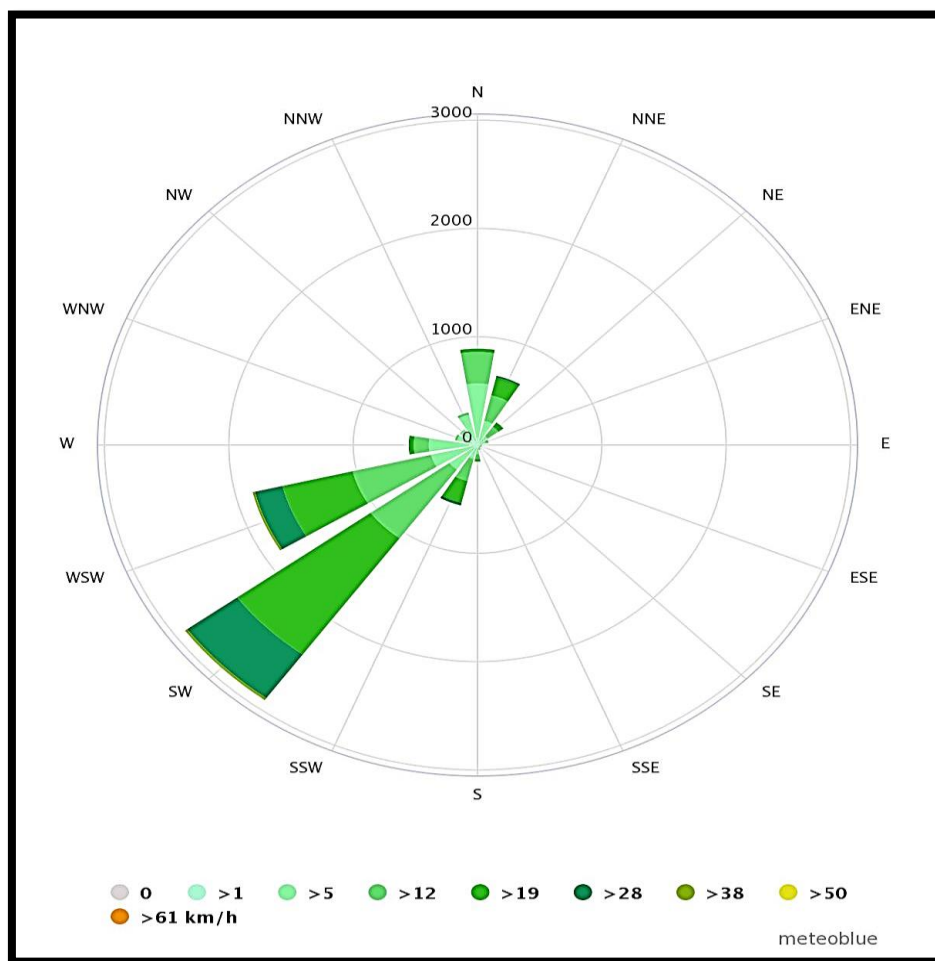


Figure 4-7: Wind Rose Map of Thatta (2016)

Source: Meteoblue (2016)

4.4 FIELD INVESTIGATIONS

4.4.1 Remote Sensing Analysis

Remote sensing technologies along with GIS are the most powerful sources of collecting basic environmental data, which could be obtained with high speed and accuracy. For this study,

high resolution satellite imageries Landsat and GeoEye were used to identify environmental features.

A Remote Sensing Analysis (RSA) was conducted on the high resolution satellite imageries that were clipped from Google-Earth. Four satellite imageries were selected from 2005 to 2022 (**Figure 4-9**), all of these imageries were post-monsoon imageries. These imageries were mainly captured by Landsat and GeoEye satellites. After spatial enhancement of these images were then Georeferenced on local datum and projection system. It was found with RSA assessment that the area was predominantly barren land in 2005, which substantially reduced to marshy area, indigenous *bands*, abandoned agriculture fields and stagnant rain water bodies due to sand excavation activities started in 2009. The sand excavation pits converted into stagnant rain water pools after rains. These images were converted into the vector data through unsupervised classification, also showing the decline of agriculture areas and as well as barren areas.

As it is evident from the RSA that the area was predominantly barren. There is no significant sand excavation activities in 2005-2009. Afterwards sand mining activities got started and it was at peak from 2013 onwards. Several indigenous bands/ check dams were observed during past years in order to store rain water (**Figure 4-8**). Few abandoned fields were observed on the eastern side which were used to grow fodder for the livestock during past years.

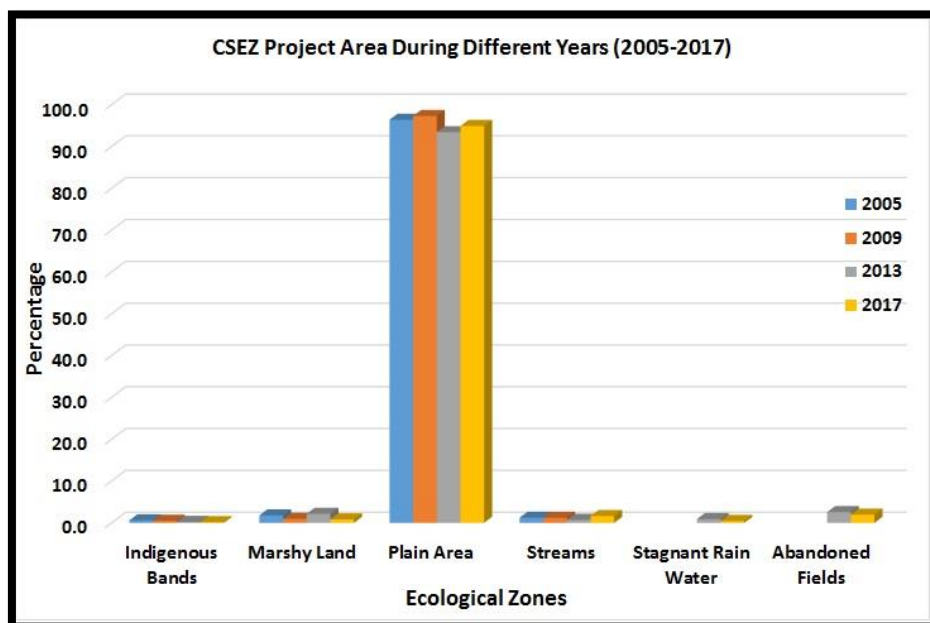


Figure 4-8: Change in land use/land cover of DSEZ Project Area

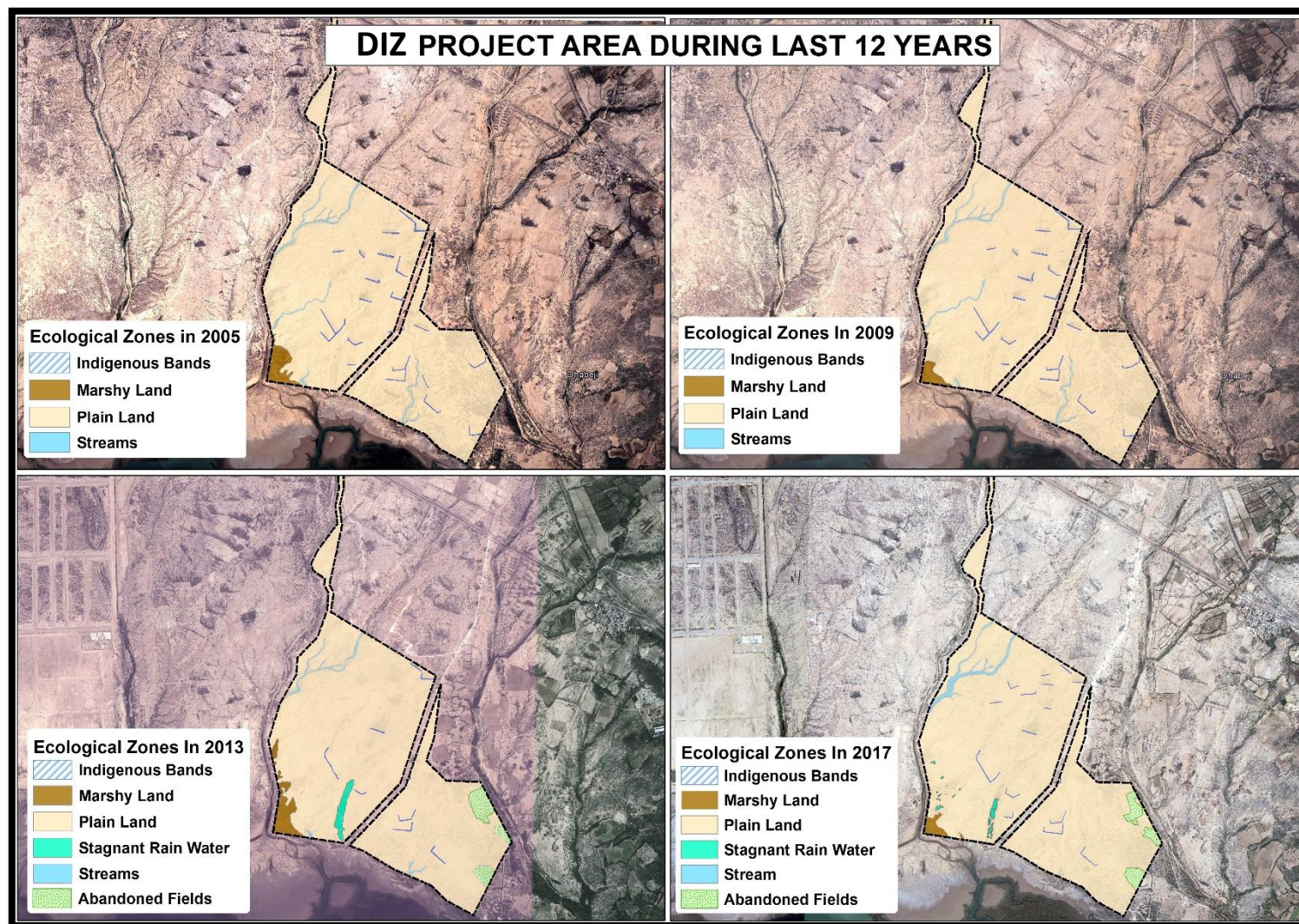


Figure 4-9: Temporal Analysis of DSEZ Project Area

4.4.2 Land Use Capabilities

With the help of Remote Sensing techniques the estimation of land use and land cover are first identified and are produced below in **Figure 4-10**. A hybrid classification approached has been adapted. The most important and significant land cover is barren land followed by quarry area. Human intervention in the form of settlements and *Goths* are not present in the study area. In the form of settlements and *Goths*, *Goth Nabi Bakhsh Baloch*, *Gabool Goth*, *Goth Phinnu Khan* and *Goth Allah Dino* are near to DSEZ site. A small portion of water bodies like seasonal streams, stagnant rain water and Marshy land as natural drainage are also found in project area.

4.4.3 Coastal Morphology

The coastal morphology is characterized by a network of tidal creeks and a number of small islands with sparse mangrove vegetation, mud banks, swamps, and lagoons formed because of changes in river courses. The *Gharo Phitti* Creek System consists of three creeks: *Gharo* Creek, *Kadiro* Creek and *Phitti* Creek. All three are connected in a series starting from *Gharo* Creek at the north-eastern end to the *Phitti* Creek at the south-western end and located at 22.3 km from Karachi. This creek system is about 28 km long and its width ranges from 250 to 2,500 m. The *Korangi* Creek, and *Kadiro* Creeks are connected with it at the north-eastern end while it acts as main waterway connected with the open sea at the south-western end (**Amjad and Khan, 2011**).

4.4.4 Topography

The project area is almost a flat land with little variations of contours. *Nullahs* and stagnant rain water bodies are the main watercourses of project area. Basically, these are the tributaries of *Gharo* Creek that intrudes near to project area. The minimum elevation of project area is 5 m found in Northeastern side whereas, highest elevation value is found in Southern side which is about 30 m. The slope is generally dipping from North to South with some undulating land in South (**Figure 4-11**).

4.4.5 Drainage and Hydrology

In the project area, there is a complex drainage pattern formed due to several seasonal rivers and creeks. It has two important rivers named *Lat* and *Jhorewalo* which are tributaries of *Gharo* Creek, flowing besides the project boundary (**Figure 4-12**). Although, there are few small

seasonal rivers and their tributaries drain through the project area. All of these are active in the rainy season and has significant impact on the land of project area.

Natural drainage of the area consists of small Lakes and dense network of stream channels. Due to the arid and semiarid climatic conditions in the project area most of the channels are dependent on rain water. However, there are few channels which could hold water for long duration. These rivers are running from north to south due to the elevation pattern. Few Rivers reach up to Arabian Sea through Creek System like *Lat*, *Jhorewalo* and *Ghagar Nullah*. When heavy rainfall occurred, these channels drain excessive water into creek systems of Arabian Sea. The topography of the area indicated the provision of small indigenous bands for irrigation purpose.

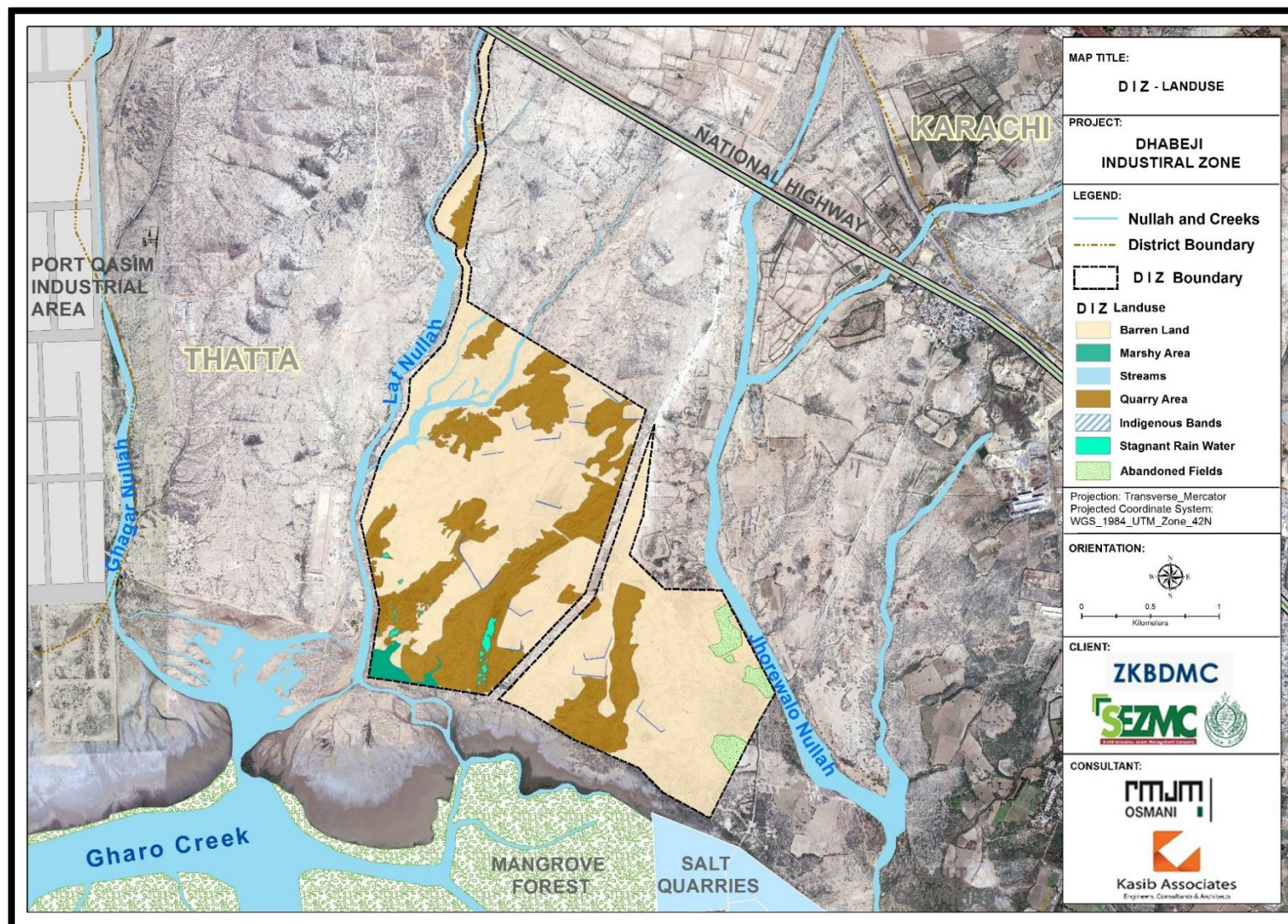


Figure 4-10: Land use Map of DSEZ Area

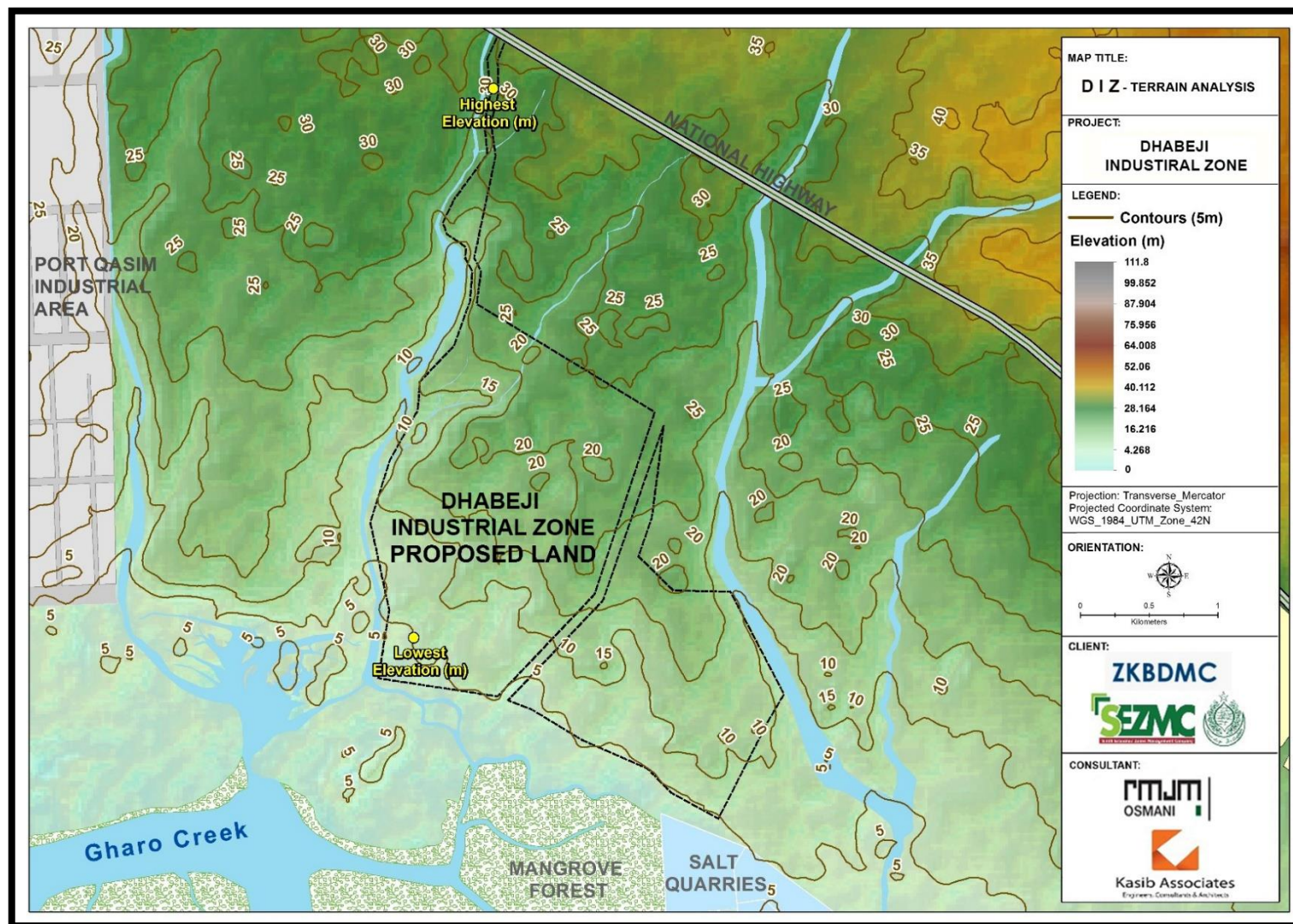


Figure 4-11: Terrain Analysis of DSEZ

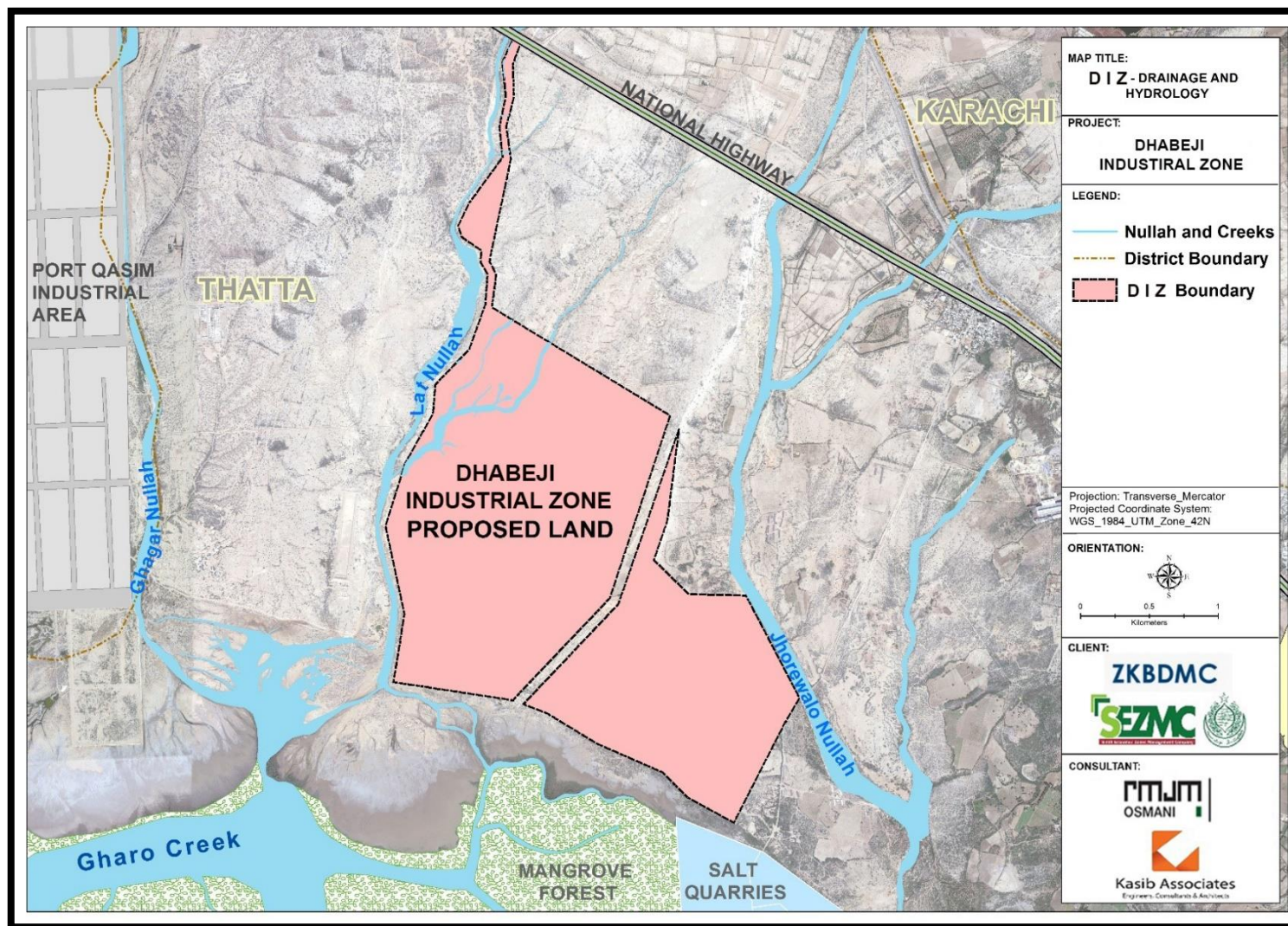


Figure 4-12: Natural Drainage and Hydrology

4.4.6 Geology and Soils

Lithology of the project area comprises of Piedmont and Deltaic plain soil types with rocky land in the Northern part. The composition of soil in south consist of deltaic plain. Sandy, silty, clayey and very high gypsiferous soil types present in it. Rough mountainous rocky soil spreads in the north-eastern side of the project area. Open marshes and tidal flat land is also prominent in the south of the project area (**Figure 4-13**).

Geological investigations for the Bin Qasim area suggest the presence of only Middle and Upper Tertiary rock formations comprising fresh, and slightly weathered recent and sub-recent shoreline deposits. Principal constituents of the deposits are the inter-bedded sandstone and shale together with subordinate amounts of large size gravels or conglomerate.

The creek area is covered with mudflats supporting mangrove vegetation and does not exhibit much geological and pedological diversity. The information, as per Geologic Survey of Pakistan, reveals that in the project area and its adjoining areas only the middle and upper tertiary formations are present. The formation found in the area is fresh and slightly weathered, recent and sub recent shoreline deposits. These deposits are derived from Gaj / Manchhar formations of lower Miocene to Middle Miocene / Upper Miocene to Pliocene age. Similar deposits are found all along the coastal belt of Karachi and adjoining areas. The seabed is predominantly sand and silt while the sediment of the delta is fine grained and resembles the soil from the continental shelf at the mouth of the Indus delta.

The gravels or conglomerates are poorly transfixes with medium to coarse brown sand and are derived from Manchar Formations of Pleistocene age. The Gaj formation consists of mostly limestone with subordinate shales and sandstone. The limestone is hard, sandy and extremely fossiliferous. This formation overlies Nari formation which consist of harder limestone beds and shales.

The mudflats are recent deposits of the delta area while soil cover is the drift type that has been slightly withered with time and marine activity. It seems to have been transferred with the flood flows from Malir River on the west and the Indus on the east.

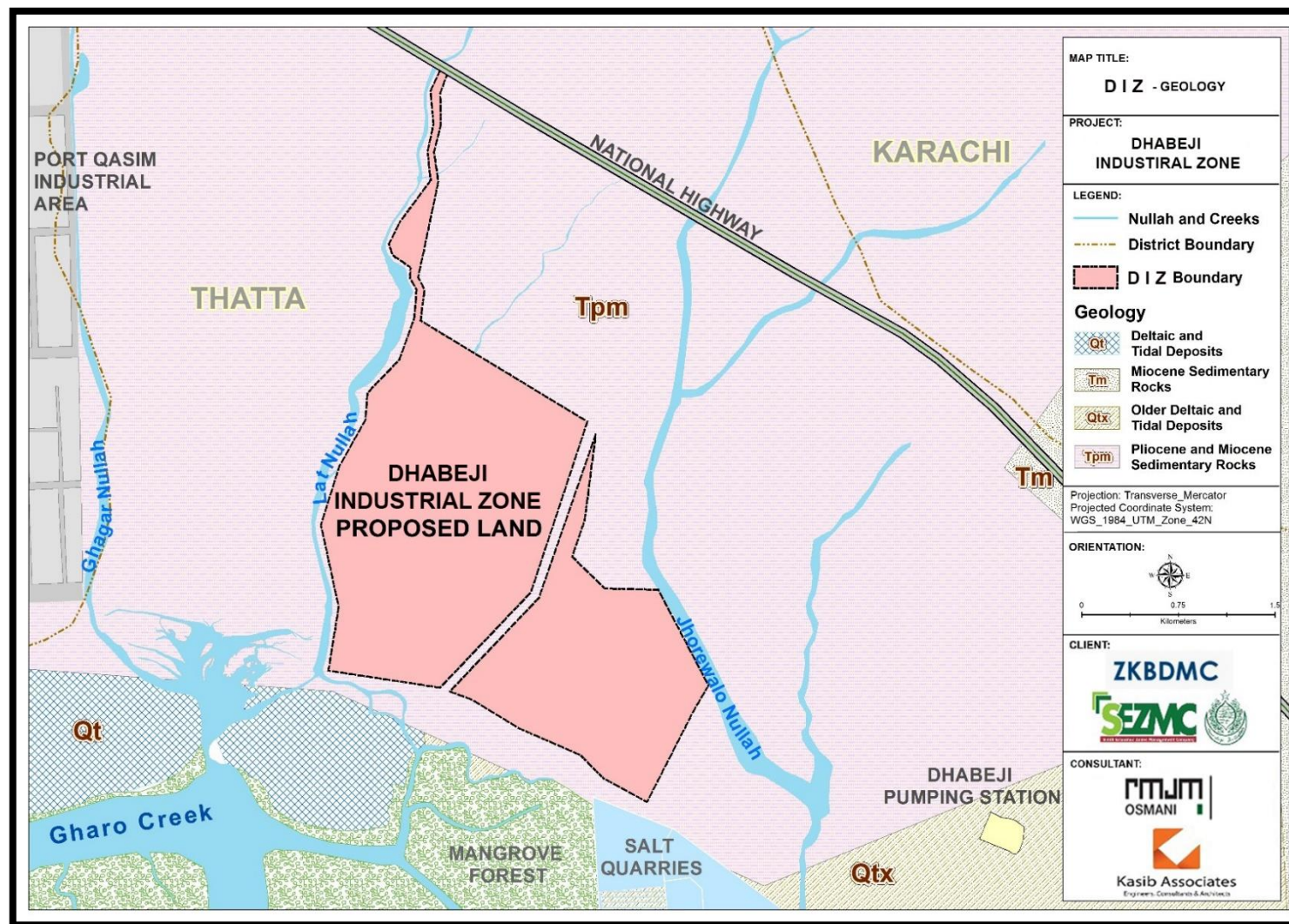


Figure 4-13: Geology of DSEZ

4.4.7 Seismicity

According to Building Code of Pakistan, Seismic Provision 2007, the study area lies in Zone 2A and Zone 2B presents a low to moderate seismic hazard potential for earthquake activity. The developed (after the October 2005 earthquake) seismic zone map of Pakistan has divided the country into four seismic zones ranging in term of major damage with high magnitude, major damage, moderate damage and minor damage zones with respect to ground acceleration values. Under this zoning the proposed project site lies in low to moderate hazard zone. Eastern side of project area lies in Zone 2A, *i.e.*, Low seismic risk and Western side lies in zone 2B. *i.e.*, moderate risk zone (**Figure 4-14**). Thus, no appreciable earthquakes have been recorded in the proposed site and the adjoining areas in the recent past.

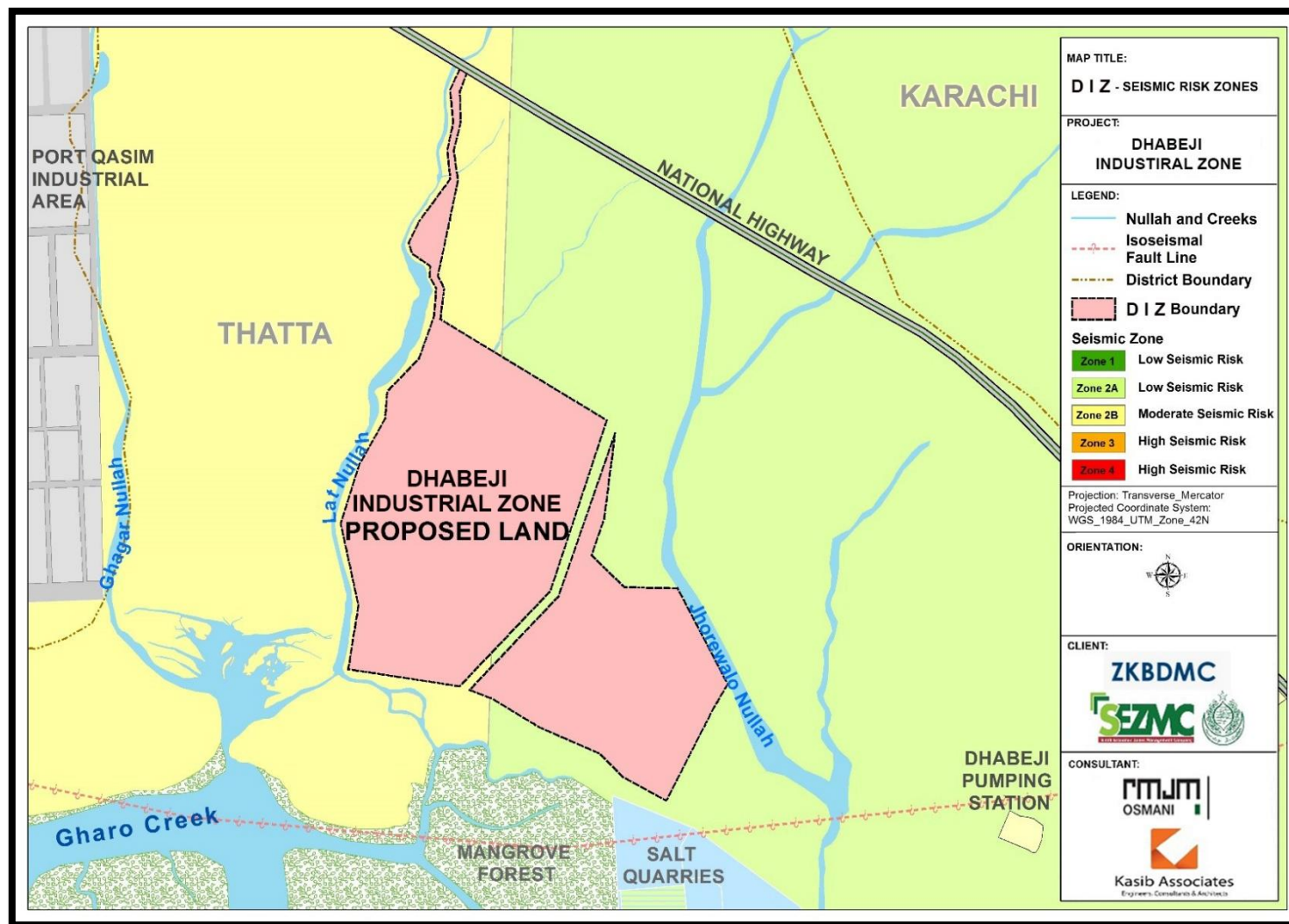


Figure 4-14: Seismic Map of DSEZ

4.5 ENVIRONMENTAL QUALITY ANALYSIS

The datasets for environmental parameters are compiled from secondary sources.

4.5.1 Ambient Air Quality

The air quality in the area is generally good, with negligible sources of pollution like emission from vehicular traffic and fuel wood which cause smoke and dust emissions with localized effects. Vehicular emission and vehicular noise is the only source of pollution at project site.

Criteria pollutants and most suspected monitoring parameters including SO₂, NO_x, NO & CO, were monitored at project site to determine the magnitude of these pollutant gases. Air monitoring pattern conducted on the project site on eight hours monitoring referred above indicates the CO recorded 13.03 mg/m³. Nitrogen oxide (NO) was found at 9.35 µg/m³, nitrogen dioxide (NO₂) was 0.13 µg/m³ and sulphur dioxide was maximum recorded 1.45 µg/m³ respectively. The results of ambient air monitoring are presented in below **Table 4-1**. The overall ambient air quality result shows carbon monoxide concentration is high which is due to vehicular movements as well as Port Qasim industrial area activities contribute in increase the concentration of CO of the project area, while rest of all parameters are well within limits of NEQS.

Table 4-1: Ambient Air Quality

Parameters	Unit	Duration	Average concentration	NEQS Limit
Nitrogen Oxide (NO)	µg/m ³	08 Hours	9.35	40
Nitrogen Dioxide (NO₂)	µg/m ³	08 Hours	0.13	80
Carbon Monoxide (CO)	mg/m ³	08 Hours	13.03	5
Sulphur Dioxide (SO₂)	µg/m ³	08 Hours	1.45	120
Suspended Particulate Matter (SPM)	µg/m ³	08 Hours	163.5	500
PM₁₀	µg/m ³	08 Hours	137	150
PM_{2.5}	µg/m ³	08 Hours	33	35

Source: SGS (2013)

4.5.2 Noise Quality

In the absence of any reliable and established noise data, noise level monitoring was conducted at the same locations where ambient air quality was measured (project site and adjoining area) for continuously 08 hours at project site adjacent to N-5 National Highway. As per NEQS

defined guidelines, the noise measurements were made at a height of 1.5 meters above the ground, and the LAeq was monitored at respective location.

Elevated noise is viably absent in Project proximities due to acute absence of noise causing equipment in the project corridors. Generally, significant sources of noise productions are triggered by transportation and population which is assumed falling extremely short particularly in the project proximities. Noise monitoring results are presented in below **Table 4-2**. Noise monitoring trend conducted at project site indicates the lowest acoustic level 57.0 dB and was highest recorded 60.2 dB. Pakistan EPA has regulated maximum permissible limit at day time is 50 dB and in night hour is 45 dB. As such, the acoustic figure of noise monitored on hourly basis is not complying with NEQS defined limits. This increase in noise level is due to heavy vehicular movement on National Highway.

Table 4-2: Noise Levels

Timings	Average Noise Levels (dB)
9:30-10:30	58.3
10:30-11:30	59.6
11:30-12:30	60.2
12:30-13:30	57.6
13:30-14:30	57.3
14:30-15:30	57.0
15:30-16:30	58.9
16:30-17:30	58.0

Source: SGS (2013)

4.5.3 Water Quality

Five water samples were collected under standard procedures and protocols adapted by APHA/USEPA, from adjoining sites of the project area. The objective of the study was to assess drinking quality of water and to determine criteria water pollutants induced from natural or anthropogenic sources. Five sampling points were identified to cover study objectives, sampling points are depicted below:

1. Sample 1: Ground Water Sample I from Mosque
2. Sample 2: Ground Water from Hotel Juma Khan
3. Sample 3: Surface Water/Municipality water Dhabeji
4. Sample 4: Ground Water Sample II
5. Sample 5: Sea Water

Total 13 criteria (physical and chemical) tests were conducted on 5 aforementioned samples to determine the magnitude of natural borne and anthropogenic borne components in the aquatic systems. Brief discussion on each of 13 parameters is given below. The water quality results are presented in below **Table 4-3**.

The most water samples were found brackish in character except Sample 3 (Dhabeji surface water) and are not complying NEQS regulated guidelines on drinking water from palatability context. Almost all water sources are contaminated with suspended matter. Heavy metal contaminants such as iron, manganese and zinc are present at such low level to cause any sort of environmental damage to these water sources. The elevated figure Of BOD₅ and COD in Sample 5 is indicating contamination of sufficient organic matter in the Sea water. Karachi Sea water is regarded final outfall of highly contaminated and un-treated wastewater drains with the result that near shoreline is flooded with large dissolved and un-dissolved pollutants. As such its BOD₅/COD figures are lingering at elevated levels as compared to ground or surface stream water which is derived from Municipality distribution outlets.

As **Table 4-3** is showing very high TDS, which is reflecting high levels of seawater intrusion, creating issues for the local residents. Values highlighted with red are indicating high levels of water quality parameters that are exceeding from NEQS levels.

Table 4-3: Water Quality Analysis

Sr. #	Parameters	Methods	Unit	NEQS/WHO	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5
1	pH at 25 °C	APHA-4500H ⁺ B	-	6.5-8.5	7.90	<u>8.06</u>	7.49	<u>8.11</u>	7.58
2	Conductivity, Electrical	APHA-2510 B	μS/cm	0.5-650	<u>3150</u>	<u>2010</u>	<u>1027</u>	<u>5270</u>	<u>61400</u>
3	Total Suspended Solid(TSS)	APHA-2540 D	mg/L	150-200	11	9	7	13	16.5
4	Total Dissolved Solids(TDS)	APHA-2540 C	mg/L	<1000	<u>1852</u>	<u>1254</u>	564	<u>3586</u>	<u>44852</u>
5	Alkalinity, Total as CaCO ₃	APHA-2320 B	mg/L	<500	141.29	243.33	113.15	323.75	182.46
6	Chloride(Cl)	APHA-4500 Cl B	mg/L	<250	<u>742.73</u>	<u>459.71</u>	160.32	<u>1492.02</u>	<u>22756.57</u>
7	Iron(Fe)	APHA 3120 A	mg/L	0.1-0.9	0.019	<0.005	<0.005	<.005	0.034
8	Manganese(Mn)	APHA 3120 A	mg/L	≤0.5	<0.005	<0.005	<0.005	<0.005	<0.005
9	Zinc(Zn)	APHA-3120 A	mg/L	5	0.084	<0.005	<0.005	<0.005	<0.005
10	Oil & grease	USEPA1664	mg/L	10	1.25	<01.00	<01.00	<01.00	1
11	BOD ₅	APHA-5120 D	mg/L	80	42	33	23	67	<u>1320</u>
12	COD	APHA-5220 D	mg/L	150	100	84	53	<u>171</u>	<u>3040</u>
13	Hardness Total as CaCO ₃	APHA-2340 C	mg/L	<500	407.87	386.01	198.11	<u>665.27</u>	<u>4285.82</u>

Source: SGS (2013)

4.6 ECOLOGY

4.6.1 Floral Diversity

The vegetation in the project is quite sporadic with few bushes and isolated trees. Flora recorded in the Project macro environment include *Acacia nilotica* (babul), *Acacia senegal* (khor), *Calotropis procera*, *Salvadora oleoides* (khabar) and *Prosopis senegal* (kandi), *Acacia arabica* (kikar), *Capparis aphylla*, *Commiphora wrightii*, *Commiphora stocksiana*, *Prosopis cineraria*, *Tamarix gallica* (lai), *Tamarix aphylla*, *Euphorbia cauducifolia*, *Lasiurus indicus*; *populus euphratica* (shallo or bahan), *Rhazya stricta*, *capparis aphylla* (karil), and *Acacia lebbek* (siris), *Prosopis cineraria*, *Eleusine flagellifolia*, *Salsola foetida*; *Baleria acanthoides*, *Lasiurus indicus*, *Aristida* sp. *Ziziphus nummularia*, *Cordia gharaf*, *Grewia villosa*, *Leptodenia pyrotecneca*, *Lyssium depressum*, *Pterophyllum oliveri*, *Tecoma undulate*. Whereas, flora in **Table 4-4 and Figure 4-15** were observed during extensive field surveys.

Beside this, in the Thatta coastal mangrove ecosystem, there are eight species of mangroves. The dominant mangrove species are *Avicenia marina*. The other mangrove species in the deltaic region such as the *Ceriops tagal* occur in localized patches and there are a few plants of *Rhizophora mucronata*. All other species are rare and have disappeared from most part of the creeks due to adverse environmental conditions.

Table 4-4: DSEZ Dominant Flora

S.No.	Plants	Common Name	IUCN Conservation
1.	<i>Acacia nilotica</i>	Babul	LC
2.	<i>Acacia senegal</i>	Gum Tree	LC
3.	<i>Aerwa javanica</i>	Kapok (cotton)	LC
4.	<i>Avecina marina</i>	Timar	VU
5.	<i>Azadirachta Indica</i>	Neem	LC
6.	<i>Calotropis procera</i>	Apple of sodom	LC
7.	<i>Capparis decidua</i>	Kair	EN
8.	<i>Commiphora wightii</i>	Guggal	EN
9.	<i>Euphorbia cadicifolia</i>	Cactus	LC
10.	<i>Halopyrum mucronatum</i>	-	VU
11.	<i>Lyceum edgeworthii</i>	-	LC
12.	<i>Prosopis cineraria</i>	Jand	EN
13.	<i>Prosopis glandulosa</i>	Honey Mesquite	LC
14.	<i>Prosopis juliflora</i>	Devi	LC
15.	<i>Salsola barymosa</i>	-	LC
16.	<i>Salvadora oleoides</i>	Peelu	EN
17.	<i>Suaeda fruticosa</i>	-	LC
18.	<i>Senna holosericea</i>	Senna	NE
19.	<i>Ziziphus nummularia</i>	Ber	LC

Key	
LC = Least Concern	NT = Near Threatened
NE = Not Evaluated	VU = Vulnerable
EN = Endangered	
EN* = Endangered in the Project Area	

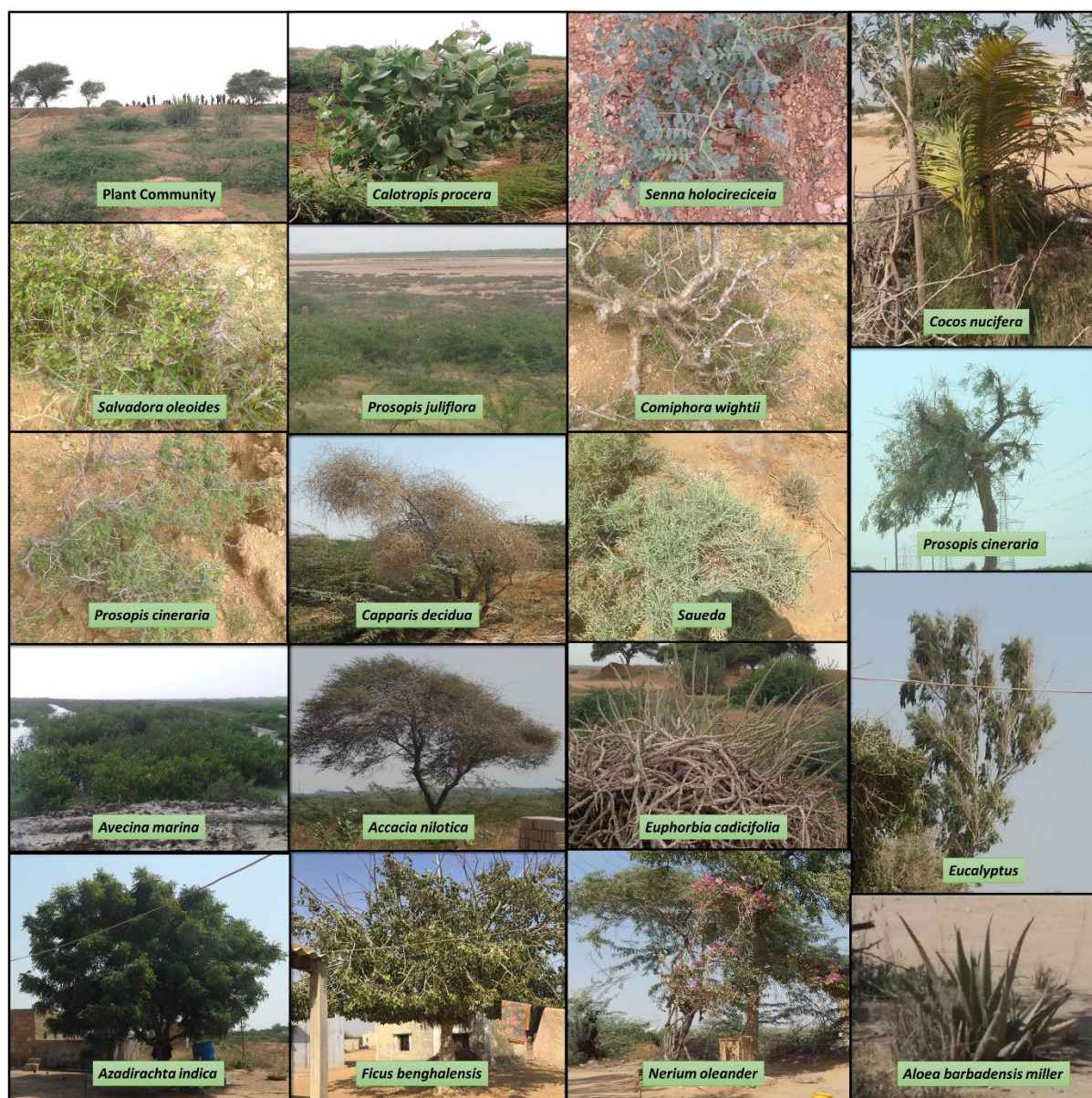


Figure 4-15: Dominant Flora of DSEZ Area

4.6.2 Faunal Diversity

4.6.2.1 Avifauna

The mangroves of Indus Delta as well as mangrove forest in the vicinity of Karachi provide an ideal habitat for many species of birds either migratory or resident. Karim (1988) reported 48 species of birds over a period of one year from mangroves of Sindh coast. Of these 44 percent

were resident and the rest migratory species. Khanum and Ahmed (1988) observed 34 species of birds in the Karachi mangrove while conducting four months survey (July - October, 1985) along Karachi coast from Clifton to Hawks Bay including backwaters. They reported 34 species; of these 12 species were resident and 22 species were migratory. They also observed two predator eagle species which were found in large numbers. Although the migratory birds had started arriving and still they were coming therefore they could not give detail about them in their study. Ghalib and Hasnain (1997) have reported 75 species of water birds belonging to 6 orders and 14 families from Clifton beach. The majority of them are waders or shorebirds such as oystercatcher, avocet, stilt, plovers, whimbrel, curlew, godwit, sandpipers, shanks, turnstones, stint, knot, dunlin, sanderling, etc. Besides the shore birds, egrets, herons, gulls, terns, flamingos are commonly observed at Clifton. Rare water fowls like velvet, Scoter and Red breasted Merganser have also been recorded from this region. IUCN (2005) have reported that there are 57 species of shore birds or waders recorded from Pakistan of which 2 species are vulnerable. These are Sociable plover (*Vancellus Gregarious*) and wood snipe (*Capella memoricola*).

The most common birds found in the macro environment are sparrows, robins and doves. Characteristic bird species that have adapted to the environment and are still to be found in the area, include the Indian grey partridge (*Francolinus pondicertanis*), chest-nut-bellied sand grouse (*Pterocles exustus*), rock pigeon (*Columbia livia*), Indian little button quail (*Turnix sylvatica*) and Eurasian roller (*Coracias garrulous*). Kites and vultures, the high flying birds were spotted but the falcons were conspicuous by their absence during the survey and the several visits to the area. The falcons were reported by the locals to be only occasional visitors.

The study area flora indicates a positive indicator for the variety of bird's habitat. Several bird species have been observed during the survey in all ecological zones. The following avifauna (Table 4-5 and Figure 4-16) is observed during field visits of project area.

Table 4-5: DSEZ Dominant Avifauna

S.No.	Scientific Name	Local Name	IUCN Conservation Status
1.	<i>Acridotheres tristis</i>	Indian Myna	LC
2.	<i>Alaemon alaudipes</i>	Persian Desert Lark	LC
3.	<i>Ardeola grayii</i>	Pond Heron	LC
4.	<i>Coracias bengalensis</i>	Indian Roller	LC

5.	<i>Corvus splendens</i>	House Crow	LC
6.	<i>Dicrurus adsimilis</i>	Black Drongo	LC
7.	<i>Egretta gularis</i>	Reef Egret	LC
8.	<i>Endynamys scolopacea</i>	Asian Koel	LC
9.	<i>Falco Jugger</i>	Laggar falcon	NT
10.	<i>Falco peregrinus</i>	Behri/Kala Shaheen	LC
11.	<i>Francolinus francolinus</i>	Kala Titer, Karo Tittar	LC
12.	<i>Francolinus pondicerianus</i>	Bhura Titer, Achho Tittar	LC
13.	<i>Larus genei</i>	Slender billed gull	LC
14.	<i>Passer domesticus</i>	House Sparrow	LC
15.	<i>Psittacula Krameri</i>	Rose Ringed parakeet	LC
16.	<i>Pycononotus cafer</i>	Red Vented Bulbul	LC
17.	<i>Streptopelia senegalensis</i>	Laughing dove	LC
18.	<i>Upupa epops</i>	Hoopoe	VU

Key	
LC = Least Concern	NT = Near Threatened
NE = Not Evaluated	VU = Vulnerable
EN* = Endangered in the Project Area	

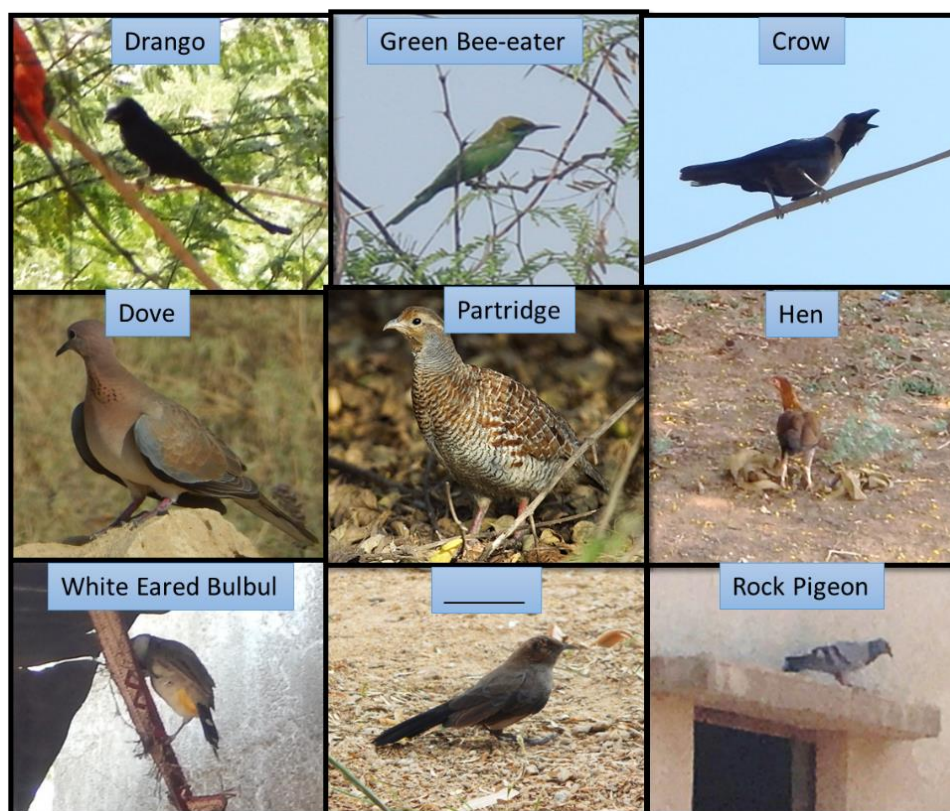


Figure 4-16: Common Avifauna of Study Area

4.6.2.2 Mammals and Reptiles

Mammals and reptiles are observed in the study area due to the presence of wetland and less human interventions. Observed mammals are cows, goats, mongoose, brown rabbit, dogs and jackals, whereas, reptiles are different types of snakes, monitor lizard, scorpion and frogs (Figure 4-17 and Table 4-6).



Figure 4-17: Mammals and Reptiles of Study Area

Table 4-6: Mammals and Reptiles Observed in Project Area

S.No.	Scientific Name	Local Name	IUCN Conservation Status
1.	<i>Bangarus caeruleus</i>	Krait Snake	VU
2.	<i>Bos taurus</i>	Cow	-
3.	<i>Canis lupus familiaris</i>	Dogs	LC
4.	<i>Canis aureus</i>	Jackal	EN*
5.	<i>Capra hircus</i>	Goats	LC
6.	<i>Daboia Russelli</i>	Russell Viper	Common to Rare
7.	<i>Hadrurus arizonensis</i>	Scorpio	NE
8.	<i>Herpestes javanicus</i>	Mongoose	LC
9.	<i>Naja Naja</i>	Cobra	NE
10.	<i>Oryctolagus cuniculus</i>	Rabbit	NT
11.	<i>Rana tigrina</i>	Frogs	LC
12.	<i>Varanus bengalensis</i>	Monitor Lizard	EN*

Key	
LC = Least Concern	NT = Near Threatened
NE = Not Evaluated	VU = Vulnerable
EN* = Endangered in the Project Area	

4.6.3 Ecological Zones

CSZE is ideally located in the North-East of *Gharo Creek* and East of *Lat Nullah*, whereas, *Jhorewalo Nullah* touches its eastern boundary. Ecologically, the area may be divided into six micro-ecological zones (**Figure 4-19**) on the basis of topography and current human interventions:

4.6.3.1 Plain Area

Most of the area of CEZ is dominated by plain terrain, however, at few places, it is quite undulating because of the recent sand mining activities (**Figure 4-18**), which produce the ditches of the depth of 3-10 meters, especially from center to south of the study area.



Figure 4-18: Sand Excavation/Mining

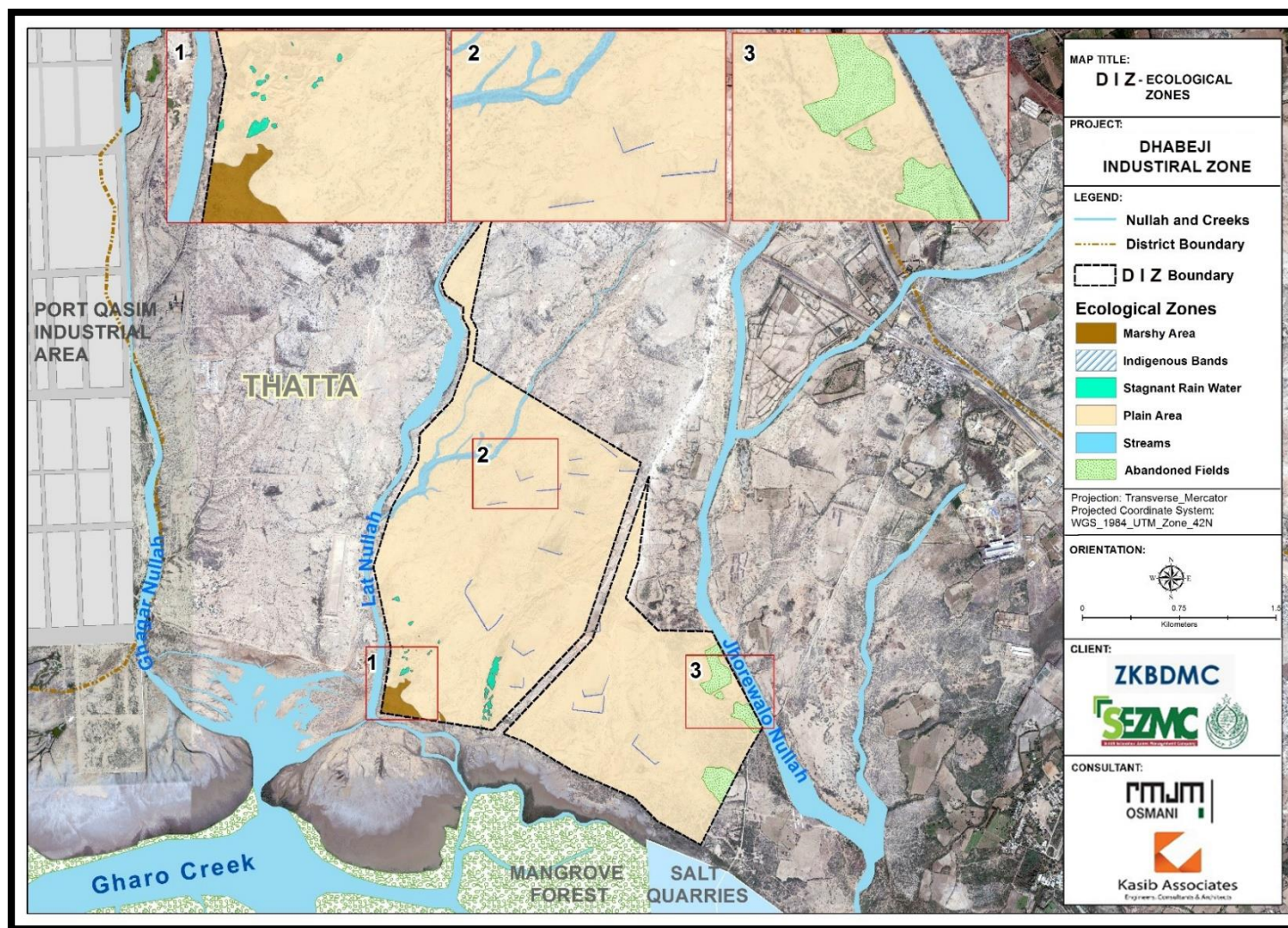


Figure 4-19: Ecological Zones of DSEZ

4.6.3.2 Undulating High Land

The highest elevation in the study area is 25 m, situated in North and the lowest elevation point is 5 m located at South. The relatively highland areas are situated in the South of the DSEZ facing coastal creeks (**Figure 4-20**).



Figure 4-20: Coastal Areas

4.6.3.3 Abandoned Agricultural Fields

The abandoned agricultural fields are scattered in the Southern to Central Zones. Most of these areas were found adjacent to the indigenous *bands* (**Figure 4-21**), these historical *bands* are highly common in Southern Sindh in rain fed areas of Southern Sindh, mostly *barani* (Rain fed). After monsoon rains the water stores in these *bands* and could be used for the irrigation purposes. On top of these traditional *bands* the plantation of *Accacia nilotica* is commonly found (**Figure 4-22**) which protect the *bands* from erosion and also served as wind-blocker to protect crops from the impact of the strong winds. These trees are also habitat of local birds, reptiles and insects.



Figure 4-21: Abandoned Agricultural Fields and Indigenous Bands



Figure 4-22: *Accacia nilotica* Community around Bands

4.6.3.4 Stream Zone

The eastern and western boundaries of DSEZ is compounded with local seasonal streams, namely *Lat* and *Jhorewalo Nullah* (Figure 4-23). These dry beds are quite dominated by many bushes and few trees. The concentration of these plants are relatively higher after the seasonal rains in monsoon.



Figure 4-23: Streams Zone

4.6.3.5 Creek Zone

Not exactly located in DSEZ but quite obvious in the South of the study area is dominated by “*Gharo Creek*” and its distributaries (Figure 4-24). This zone is dominated by *Avicenna marina* mangroves. At the South-east of DSEZ the most of the creek zone is dominated by Salt Quarries (Figure 4-25). As the estuarine zone, this zone is full of aquatic life with many fishes, amphibians, birds and reptiles.

In the West of the DSEZ the “Port Qasim Industrial Estate” is located and the East is dominated by agriculture areas and Dhabeji City. The North of DSEZ the National Highway (N-5) and Pakistan Railways important track is located (Figure 4-26).



Figure 4-24: *Gharo* Creek and its Tributaries



Figure 4-25: Salt Quarries near Qureshi Farms



Figure 4-26: Adjoining Areas of DSEZ

4.7 CULTURAL AND ENVIRONMENTAL SENSITIVE AREAS

As per the Guidelines provided by Environmental Sensitive Areas (ESAs) and Critical Sensitive Areas (CSAs) of 1997, there are no ecological (National Parks, Wildlife Sanctuaries, Protected Areas, Game Reserves etc.) and cultural or archaeological sites within the premises or proximity of the DSEZ project area and hence no impact of the project shall occur on ecological or cultural or archaeological resources.

For the exact measurement and recording of significant environmental impacts of industries, environmental sensitive areas were marked in and around Dhabeji Special Economic Zone (**Figure 4-27**). There is no environmental sensitive areas like Game Reserves, Wildlife Sanctuaries, Ramsar Sites, and Wetlands in the vicinity and around 5-10 Km buffer of project area. Dhabeji Special Economic Zone project would not pose any significant impact over these areas.

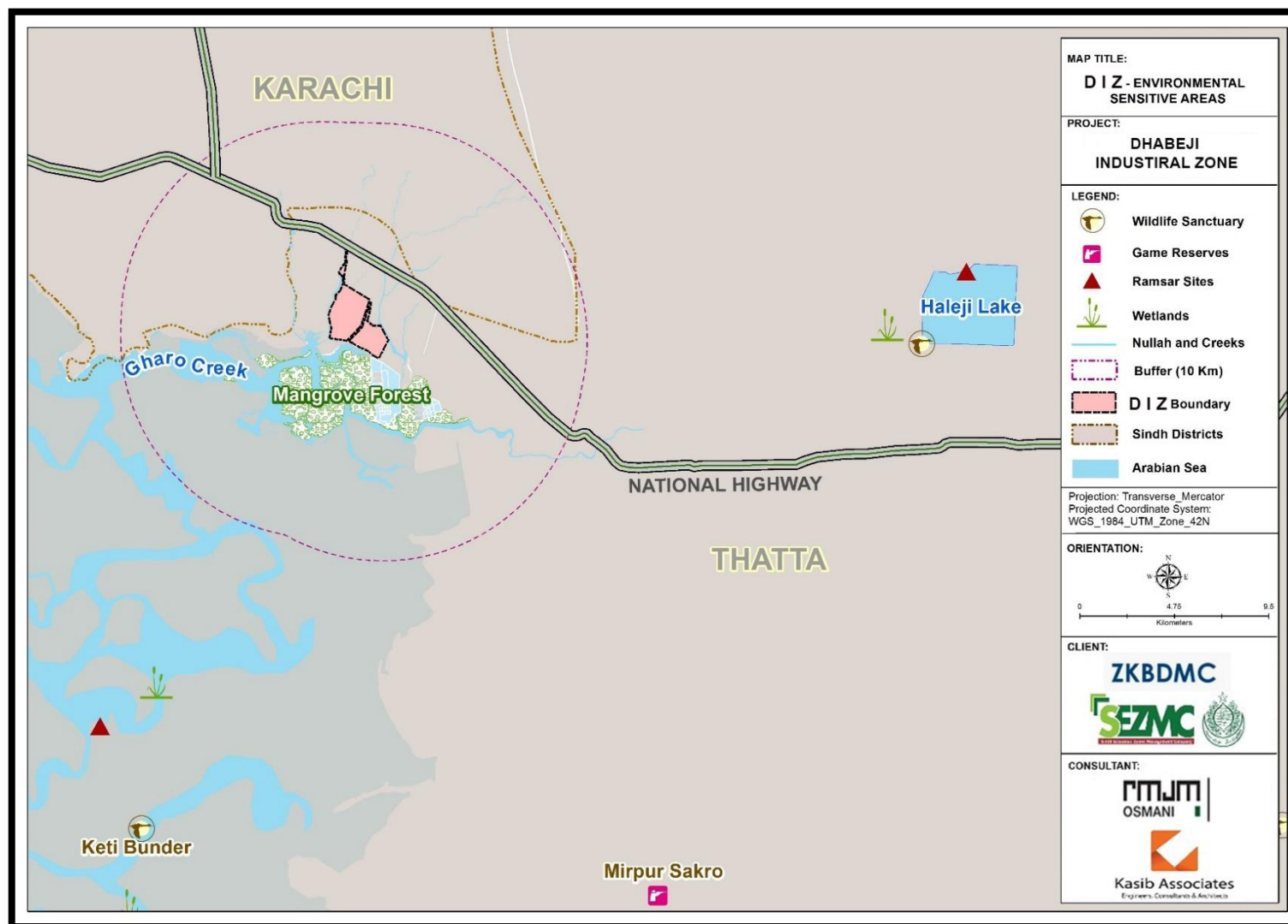


Figure 4-27: Critical and Environmental Sensitive Areas around DSEZ

5 ANALYSIS OF ALTERNATIVES

This section covers the project alternatives which were examined for the proposed Dhabeji Special Economic Zone in *Deh* Gharo, District Thatta, Sindh. An analysis of the available alternatives is necessary to establish that the most suitable management and technology options shall be adopted for the project, while minimizing environmental impacts. This evaluation explains the selection of appropriate option that was required to ensure optimal results within defined set of economic, environmental, health and safety constraints. In particular it outlines the following project options:

1. The "No Development Option";
2. Alternative Site Option; and
3. Master Plan Options.

5.1 No Development Option

Industrial development is considered as one of the most reliable strategies to promote long run growth of an economy. Since the last few decades, many nations are adopting industrial development planning to improve their economic growth. The example of the Asian Tigers has been the obvious one. However, to pursue this goal, one strategy is to specify areas for industrial development such as business parks, industrial estates, export procession zones, special economic zone, etc. We have experience these in various countries around the world. China is the leading example in this regard. Pakistan, like other countries, also endeavored to develop industrial estates, industrial clusters and special economic zone to promote domestic industry and attract foreign direct investment.

A Special Economic Zone (SEZ) is a specific area of the land used to promote industrial growth in a country by providing more lenient economic and tax policies as compare to general economic policies in a country. Planning Commission of Pakistan is expecting 27 SEZs to setup across country under CPEC by introducing Gwadar SEZ as first model based on area of 3000 acres on special discretion of China.

Keeping in view the success of economic zones and industrial estates in developing specific sectors, both in the developed and newly industrialized countries, it has been decided to develop the same strategy to uplift the Special Economic Zone SEZ in Sindh. Dhabeji Special Economic Zone DSEZ shall have tremendous investment and growth potential for entrepreneurs being based on high end technology, innovation and services. DSEZ seeks to

establish an industrial park .In this regard, Sindh Economic Zones Management Company (SEZMC) Government of Sindh (GoS) has already acquired 1530 acres of land area situated in Dhabeji for the purpose of establishing the Project.

National and local authorities may support the promotion and establishment of industrial estates by encouraging foreign direct investment, redistributing employment and production away from densely urbanized regions, and accelerating regional development. Industrial estates may attract industrial facilities by offering an attractive package of services (such as power and water) that can be supplied continuously, reliably, and at a cost that industrial facilities could not achieve on their own.

The 'No-Project' option, if taken, shall prevent the country from exploring its large economic growth to become a major player in the international trade market. Other impacts of the 'No-Project' option would be loss in employment and infrastructure development in the project area, as the project is likely to create jobs and improve the existing infrastructure of the area. From the environmental point of view, this option would result in a loss of opportunity in further improvement of the environmental management of the area, through generation of environmental baseline data and the mitigation and monitoring plans.

5.2 Alternative Site Option

With reference to the Project Site alternatives, several lands were evaluated, covering Port Qasim, Dhabeji and Gharo. The final selection of site is based on following criterion:

5.2.1 Distances from Urban Development

The abattoir should not be located close to dwellings, schools, mosques and other public or commercial buildings due to possible nuisance from noise, smell, congestion etc. Likely future commercial and residential developments should also be taken into account.

5.2.2 Proximity to Port

An important advantage of development of Industrial Zone is the proximity to the port. The proximity of the port shall highly be beneficial in the context of export and import.

5.2.3 Accessibility

The site should be accessible from a major road to allow ready transport of goods and products as well as easily accessible to employees.

5.2.4 Water Supply

Availability of adequate water supply, which should also meets drinking water standards.

5.2.5 Effluent Treatment and Disposal

The site should have a natural slope (free draining and not subject to water logging or flooding). Water outlet quality shall meet legal requirements for irrigation.

5.2.6 Soil Conditions and Civil Structure

Suitability and stability of soil conditions required for the civil structures.

5.2.7 Sufficient Land Availability

Availability of sufficient land to design Master Plan in an appropriate manner with consideration of future expansions. About 1530 acres land parcel with no development is required.

5.2.8 Electricity

Availability of electricity from the Karachi Electric Supply Company for an uninterrupted supply of power, required for the industries.

5.2.9 Conclusion

In view of all above criterion, it was concluded to develop the Dhabeji Special Economic Zone in Gharo, Thatta District. The geographic position of the proposed project is very ideal which connects it to the transportation infrastructure of the country. The proposed project location is very near to Port Qasim and approximately 1.8 Km from Nation Highway, providing direct access to the hinterland through road. Furthermore, there is a railway track at a short distance from the project site. Dhabeji railway station is located at a distance of 3.15 km from the project site, which connect to the national railway network. Remaining proposed sites do not have such a broad spectrum of commercial, industrial and management benefits.

5.3 Master Plan options

In order to explore the potential for the site's development in relation with the land use program, the specifications on industrial plot types given, as well as the site external and internal constraints two alternatives of master plan layout (preliminary layout and zoning plan) for DSEZ were examined.



6 PUBLIC CONSULTATION

6.1 APPROACH OF PUBLIC CONSULTATION

Public consultation meetings (PCM) offer an opportunity for people to participate in the decision making process for project design, development and implementation of the Project. It provides a platform for project-affected persons and different stakeholders to express their views on possible impacts of the proposed intervention on environmental and social parameters. It also built a sense of affiliation and ownership amongst stakeholders. Public consultation was conducted during field visits on 24th August 2021 and 10th October 2021 (**Figure 6-3**). Local people of *Goth Phinnu Khan*, *Goth Allah Dino*, *Goth Nabi Bakhsh Baloch* and *Goth Gabool* (**Figure 6-1 and Figure 6-2**) and concerned Government officials were consulted to record the built environment and social issues of local residents.

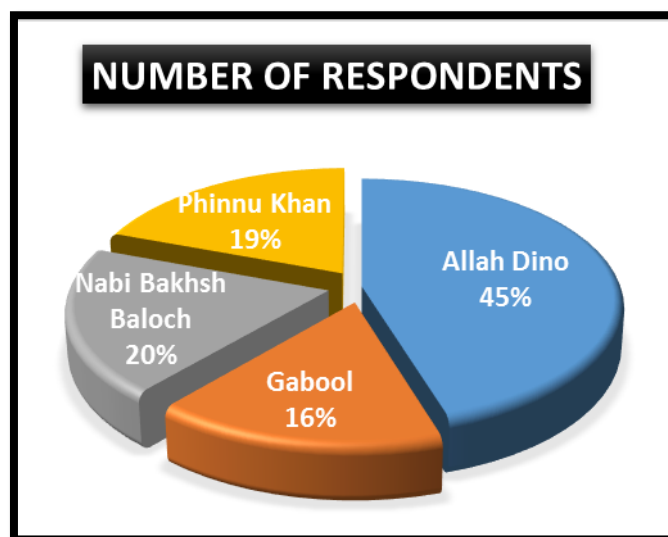


Figure 6-1: Numbers of Samples in Each Goth

Public Consultation Meetings (PCM) for EIA is planned at two different phases (EIA scoping and draft EIA report stages) in order to collect opinions and feedback of the public and to disseminate information on the Project and EIA Study.

6.1.1 EIA Scoping Stage

The first stage of the PCM for EIA is conducted at the time of environmental scoping in the initial stage of the EIA study. Information on the Project and scope of the EIA study is disseminated to the public and then comments and opinions are collected to incorporate into the EIA study.

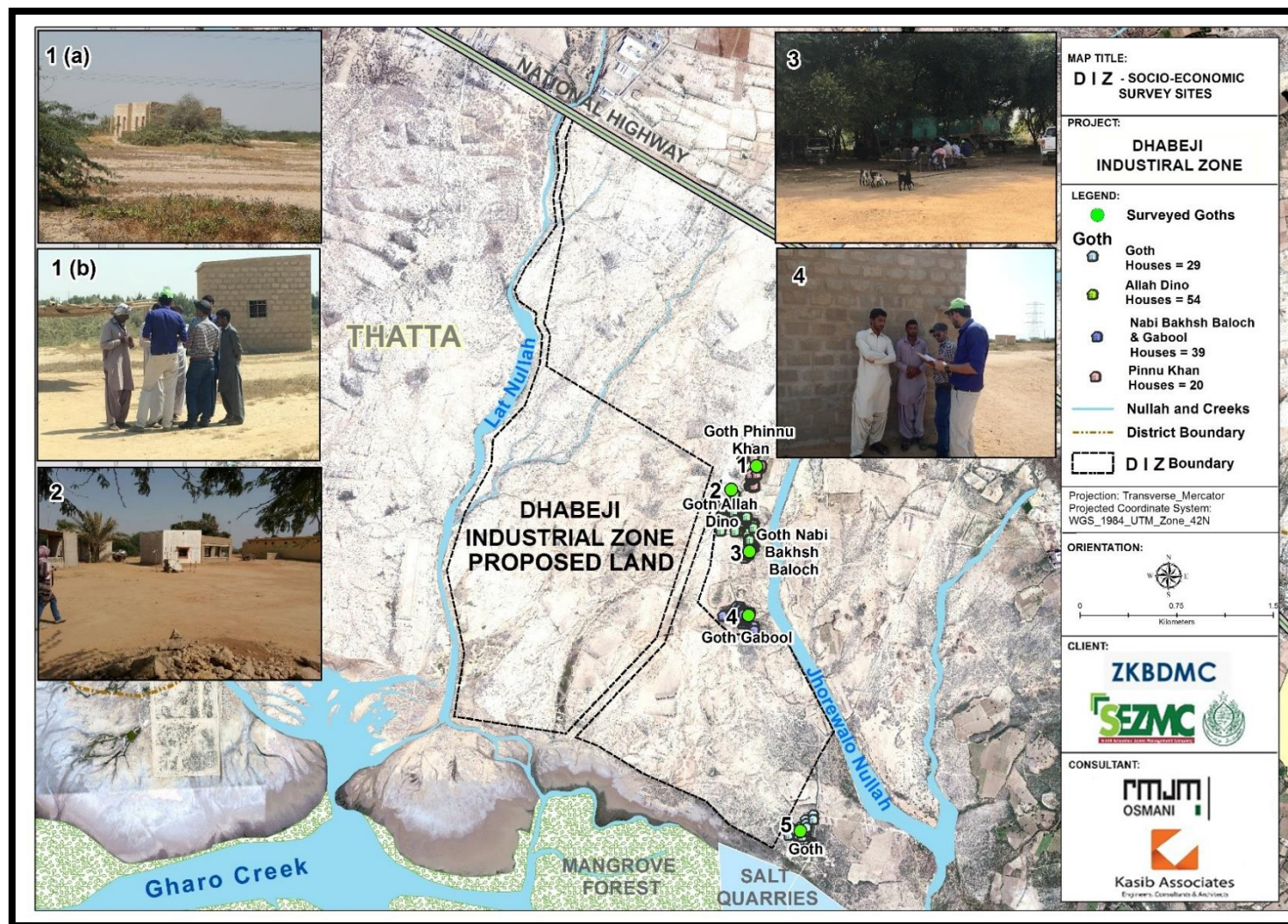


Figure 6-2: Public Consultation Meeting Points



Figure 6-3: Execution of Public Consultation through Structured Questionnaire and Informal Interviews



Figure 6-4: Few Human Interventions in Local Villages

6.1.2 Draft EIA Report Stage

The second phase of the PCM and PD for EIA is conducted at the time of preparations of draft EIA report. Information about findings of draft environmental and social impact assessment study and proposed mitigation measures are disseminated to the general public that are directly or indirectly affected by the Project. In addition, their feedback and opinions are obtained which are reflected in the EIA report together with their comments and request on the environmental and social mitigation measures, Environmental Management Plan (EMP) and Environmental Monitoring Plan (EMoP).

6.2 OBJECTIVES OF PUBLIC CONSULTATION

The primary objective of the Public Consultation Meetings (PCM) is to incorporate the opinion and suggestions of the public and all other stakeholders at the project planning stage to ensure wider acceptability of the Project. The key objectives are as follows:

- 1) To provide information on the economic, environmental and social benefits, the documentation as well as potential negative impacts from the Project;
- 2) To ensure that the potential PAPs, stakeholders and local communities are engaged in a meaningful dialogue and are well informed prior to the decision of the project proponent as to the nature and extent of social and environmental impacts attributable to the proposed project with respect to planning;
- 3) To ensure that the concerns and issues raised by the PAPs, stakeholders, and local communities are incorporated and adequately addressed in the EIA study;
- 4) To engage in a participative exercise with PAPs, stakeholders, and local communities and obtain expertise and local, traditional wisdom and knowledge from them in order to plan the mitigation measures; and

- 5) To facilitate periodic opportunities to the principal stakeholders to offer their inputs on all key components of the Project.

6.3 DEMOGRAPHY OF THE AREA

Public consultation was performed in four Goths of DSEZ project area that are *Goth Phinnu Khan*, *Goth Allah Dino*, *Goth Nabi Bakhsh Baloch* and *Goth Gabool*. Male and female both genders were consulted during the interview from which 74% were male and 26% were females. Most of the respondents belong to age group of 41-50 years and 17-25 years. Majority belongs to *Baloch* clan i.e., 64% and 26% are *Kalmati Baloch* (**Figure 6-2**).

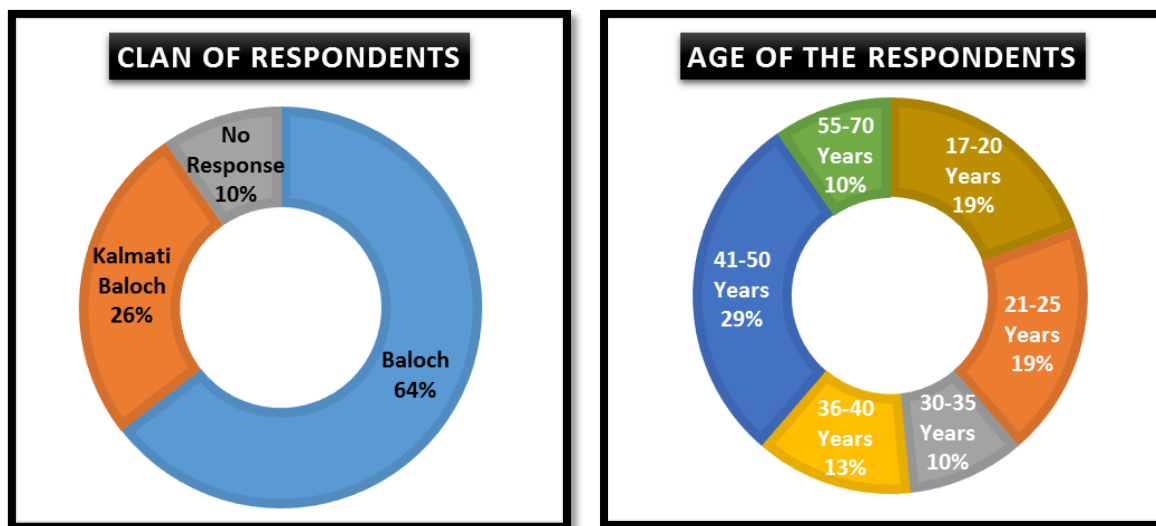


Figure 6-5: Age of Respondents and Clan

Main spoken language in the area is Sindhi (94%) and Urdu. Whereas, Balochi and Saraiki speakers are also found in the area but majority communicate through Sindhi or Urdu (**Figure 6-6**).

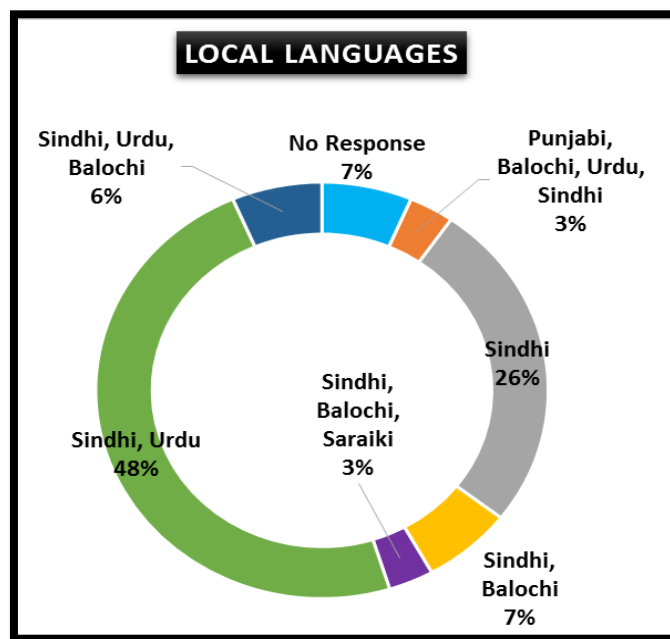


Figure 6-6: Communication Languages Used in the Project Area

The population of the Goths ranges from 40-350 persons. Respondents have been living here since birth as their ancestors have migrated to this area in 1920s. Reason of residence in the area is due to their relatives and availability of arable land. Family size of the respondents ranges from 3-30 persons with males ratio of 2:1 (Figure 6-7).

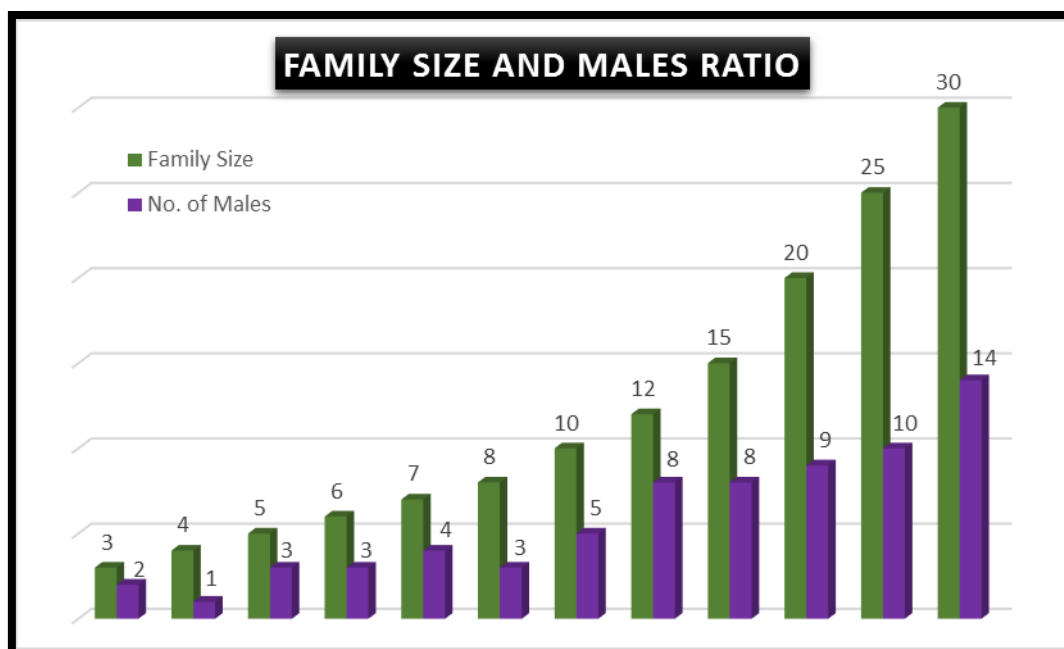


Figure 6-7: Family Size of the Respondents

6.4 ISSUES OF THE CONSULTED RESPONDENTS

In total, 32 questionnaires were conducted with random purposive sampling. Most of the people were high supportive of this project because of the hope of the employment in upcoming industrial units. Respondents' complaint about the basic necessities of life which are electricity, gas, water, communication, education, transportation, health facilities and employment (Figure 6-8).

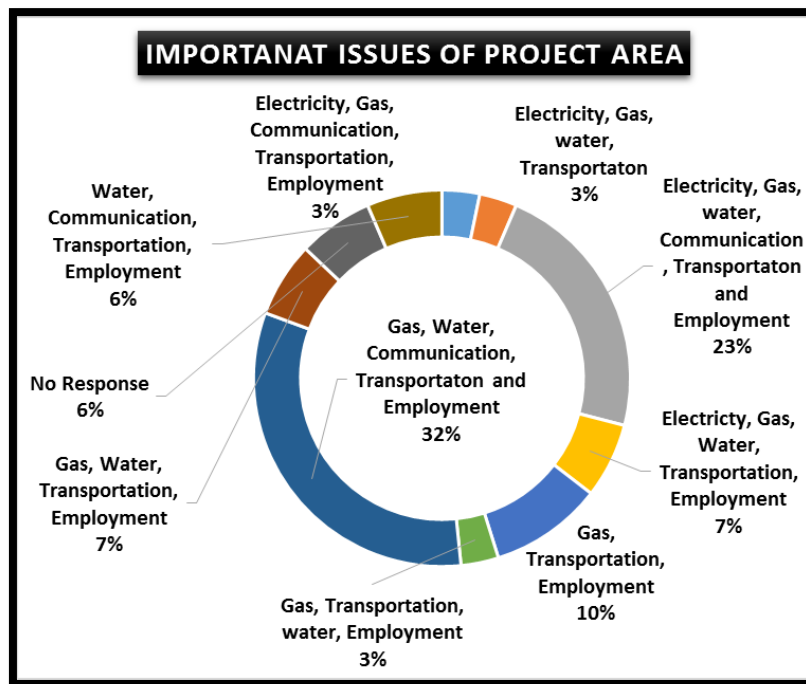


Figure 6-8: Major Issues of the Project Area

- According to most respondents there is a school up to primary level but teachers are not available or only one teacher is conducting all classes from grade one to grade five (Figure 6-9). Few people got education up to primary level and religious education except them nobody is properly educated. Only one person is educated up to grade 8th.

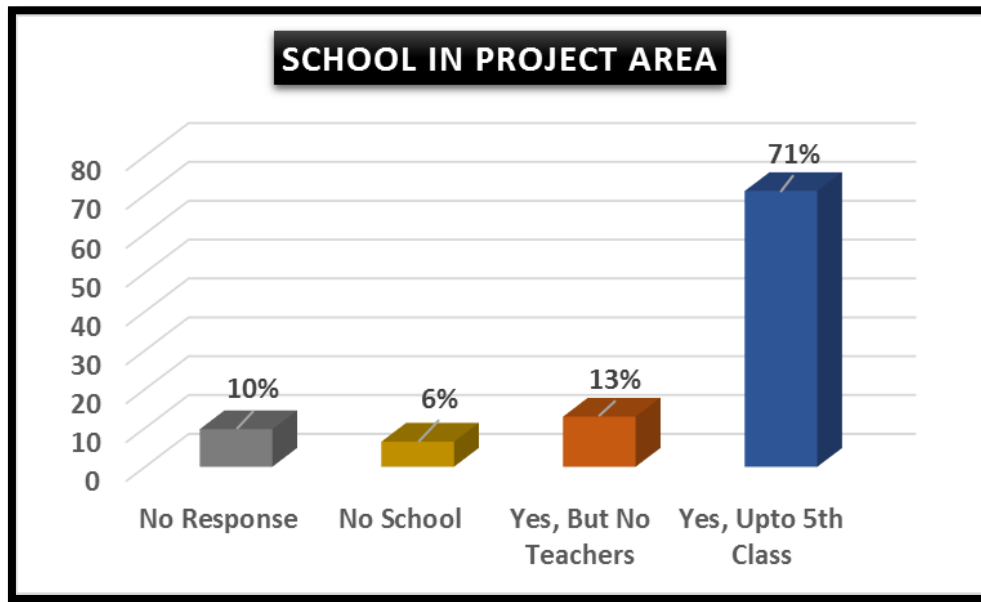


Figure 6-9: Literacy Rate of Project Area

- Electricity and water is also available to well-off families of goths or in other words available only to politically motivated persons (Figure 6-10).



Figure 6-10: Electrical Appliances Observed in Most of the Families

- Gas facility is not available at all so they use fuel wood to cook food and some people make houses (Figure 6-11). Mostly woods of *Prosopis juliflora* (Devi) and *Acacia Spp* (Kikar) is being used for cooking.



Figure 6-11: Fuel Wood of *Devi* and *Kikar*

- Few people have their own transport mostly motorbikes except them, all have to travel to Dhabeji city or any near city by walk. Mostly people earn through labour work on daily basis to nearby areas. Some of them earn through driving rickshaws, QingQis, Suzuki and trucks while some people have their own motorcycles (**Figure 6-12**).
- Stitching clothes, wood logs cutting and selling handicrafts are also bread & butter of those people who don't have any other mode of earnings (**Figure 6-13**).

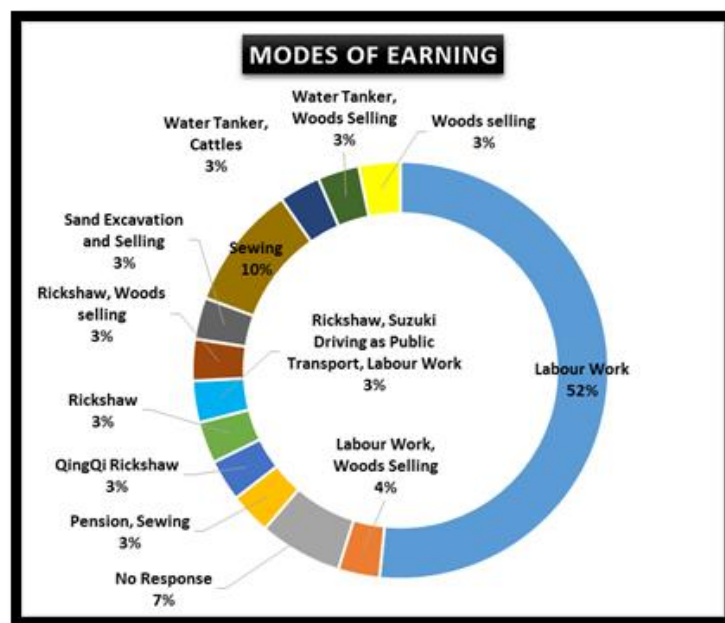


Figure 6-12: Earning Modes of Locals in the Project Area



Figure 6-13: Different Ways of Livelihood

- Health facilities (clinic or dispensary) doesn't exist in the area (**Figure 6-14**), people have to travel to Dhabeji City or Karachi in order to get treatment even for minor diseases. Some of them shared that patients have to face death in the end if, they are not been able to travel to long distances, poor condition of routes and travelling to nearby cities while suffering from some ailments.
- Most common diseases prevailing in the area are Diarrhea, malaria, fever, flu, cholera, jaundice, Hepatitis B & C, Dengue, respiratory problems, Epilepsy, and typhoid.

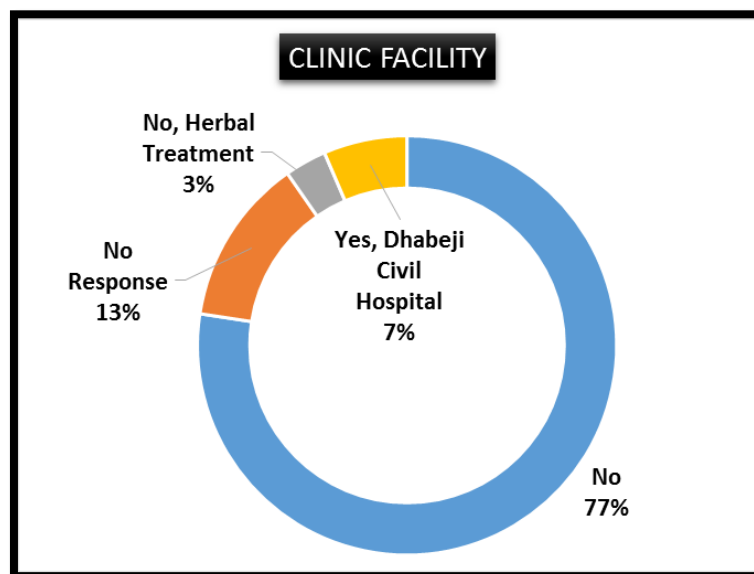


Figure 6-14: Health Facility in the Project Area

- Unemployment is the biggest issue of the area due to this people are compelled to be indulged in illegal works with land mafia like sand excavation, deforestation, water supply through tankers etc.

6.5 SOURCE OF WATER AND ASSOCIATED ISSUES

Most people get water from a piped source which is connected to Dhabeji Pump but water quantity is not sufficient for their daily use. They have to store water in tanks and gallons for their consumption. Water supply is only for 2-3 hours after every two days which is not sufficient for their use (**Figure 6-15**). People are satisfied with the quality of water but complained about the quantity as they have large families to feed. Few respondents also highlighted an issue about no availability of water. They said that water supply through pipe line is available to some families and they have to fetch water in gallons from Dhabeji pump (**Figure 6-16**). During monsoon, there is a danger of flood from seasonal rivers or creeks but no flood has been recorded from the recent history.

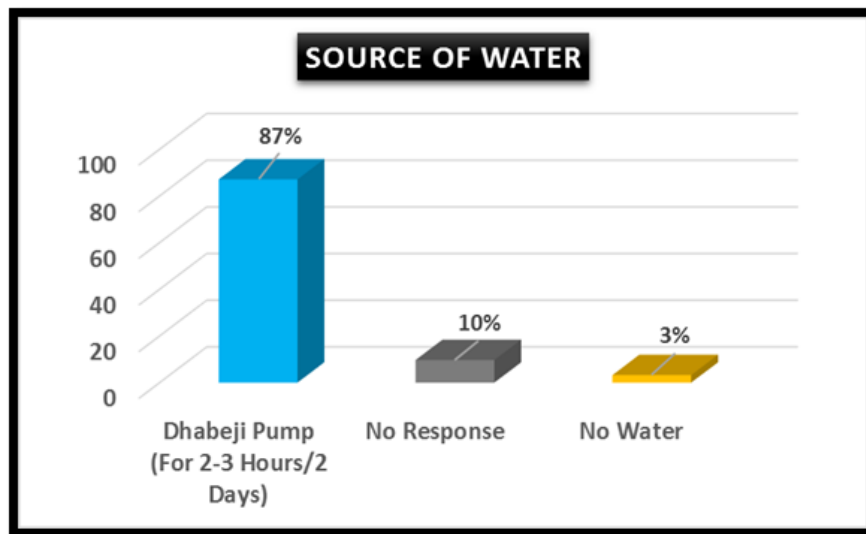


Figure 6-15: Water Source and Supply



Figure 6-16: Water Supply and Storage Facilities in the Project Area

The crops cultivated previously in the area are mostly wheat, sorghum, millet, vegetables, some grains and fodder for cattle (**Figure 6-17**). In current scenario, crops are not being cultivated due to scarcity of water. Respondents highlighted that overall agriculture has been decreased during last 10 years due to non-availability of sufficient water for crops (**Figure 6-18**). They used to keep cattle but decrease in agriculture area, grazing lands and scarcity of water, cattle's population have been decreased and limited to only few families.

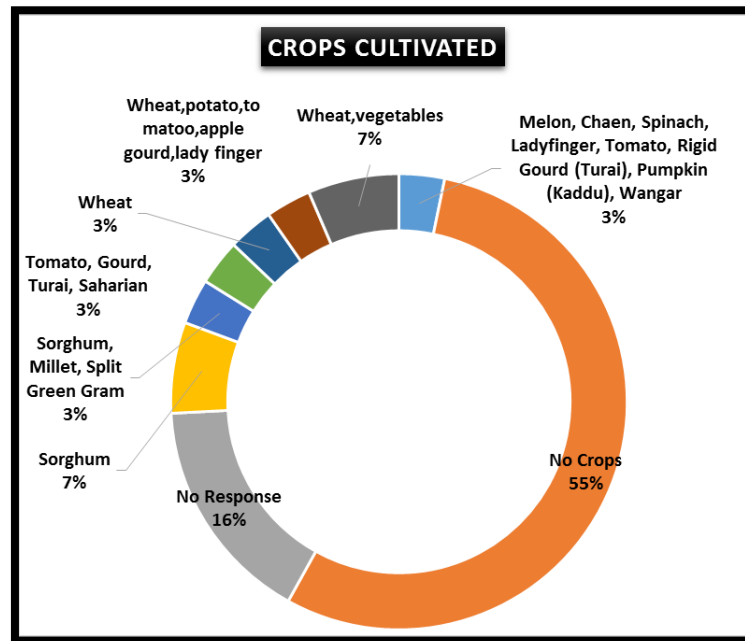


Figure 6-17: Crops Used to Cultivate In and Around Project Area

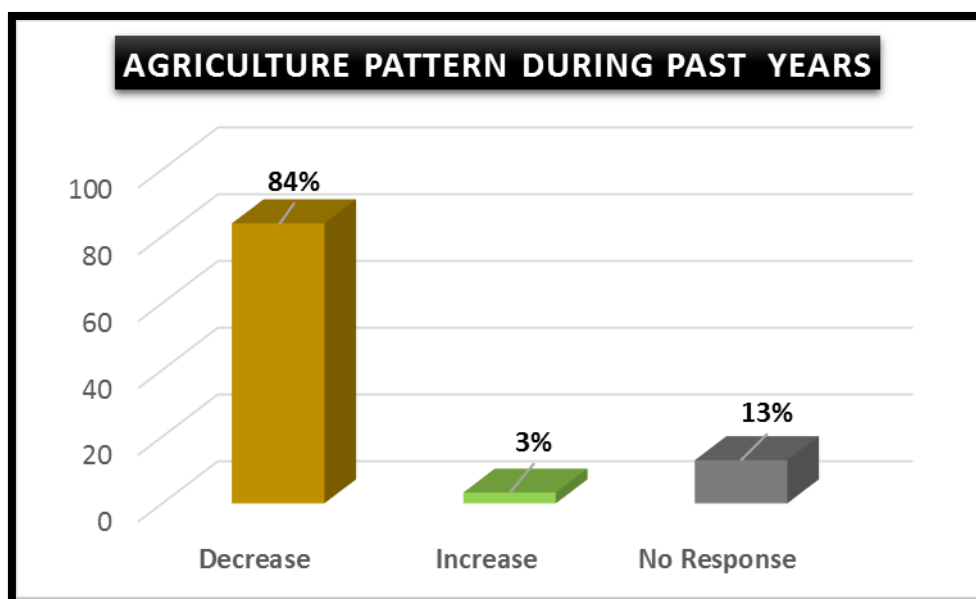


Figure 6-18: Agriculture Area during Last 10 Years

6.6 SAND AND GROUND EXCAVATION ISSUE

Many locals are involved in sand excavation, transportation and selling work (**Figure 6-19**). Respondents reported that due to sand excavation they are facing severe dust issues, respiratory problems, noise pollution, destruction of routes due to heavy vehicle movements, undulating land, loss of arable land and loss of aquifers which ultimately cause the transformation of fresh underground water into brackish water (**Figure 6-20**). According to the people sand excavation should be stopped as this is causing many issues as well as discrimination among locals whereas, those who are involved in this work get different favors from authorities in the form of money, employment and basic needs.



Figure 6-19: Sand Excavation (Left) and Gully Erosion (Right) as Impact of Excavation

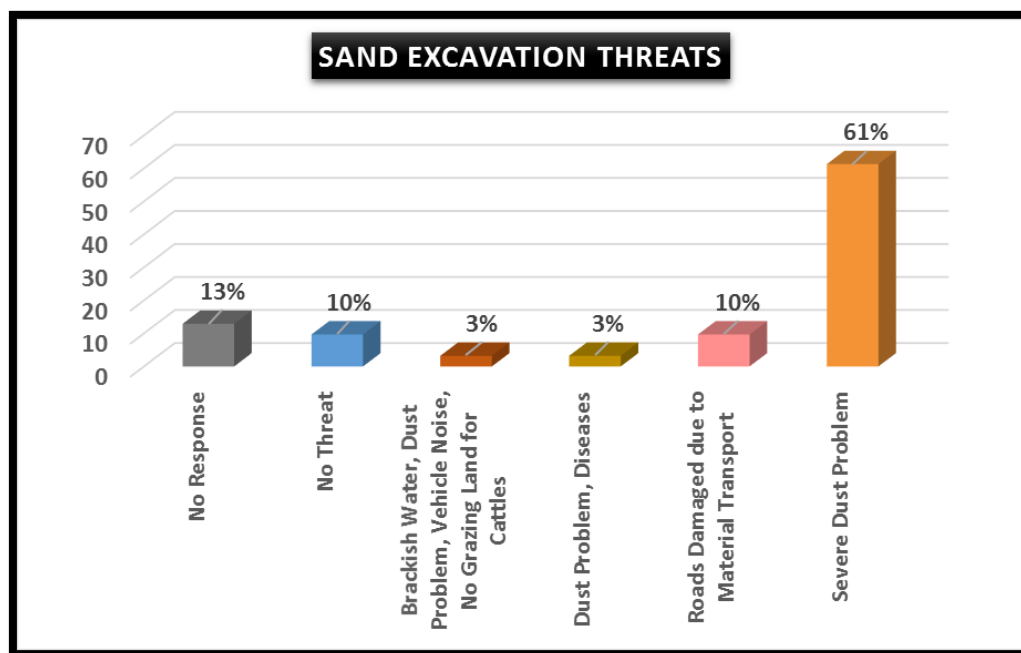


Figure 6-20: Impacts of Sand Excavation

6.7 DEVELOPMENT OF DSEZ AND IMPACTS ON ENVIRONMENT

Majority of respondents said that they were not aware of this development (71%) but few of them were aware (19%). When asked about for or against about this project, 68% were in favor with this project while 19% were against with this development. Those who are happy with this project said that it shall bring a lot of employment opportunities as well as basic necessities and health facilities and we would not have to travel far away for our needs. Some people are not satisfied as they would have to migrate from their native land and skeptical about not getting proper living place and basic necessities (Figure 6-21).

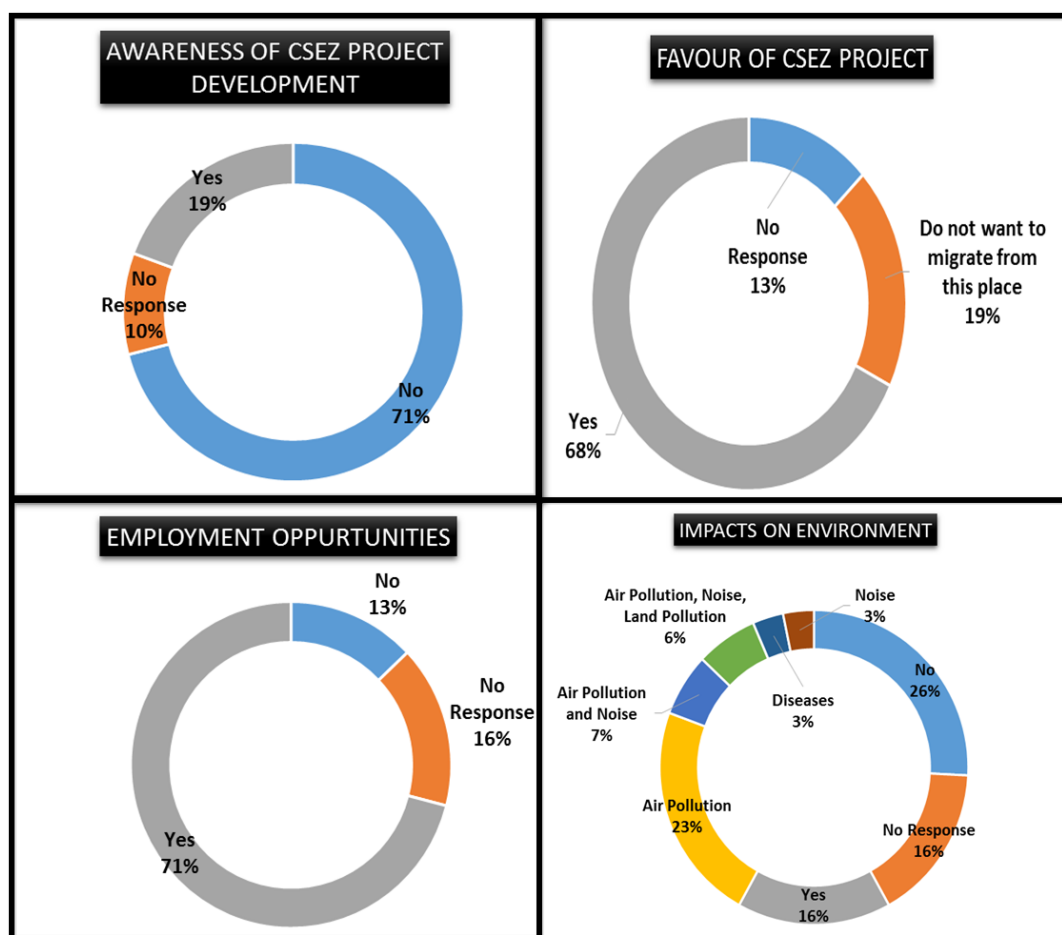


Figure 6-21: Project's Awareness and Environmental Impacts

Most of the locals responded that no impacts would occur on environment due to development of DSEZ but generally they feel that some environmental issues like air pollution, noise pollution, diseases and land pollution would occur due to this development. On the other hand, the local population's perceived benefits of the new development shall be utilities availability and employment opportunities as at present majority of people are unemployed or marginally

employed. Furthermore, they believe that the development of DSEZ may also facilitate them in getting better mode of transportation, gas, education, electricity, water availability and health facilities as a result of the development of the same facilities nearby. It is believed that as DSEZ develops, the solution of most of these issues shall be addressed quite substantially and for the betterment of the local residents.

7 SCREENING OF ENVIRONMENTAL IMPACTS OF THE PROJECT AND MITIGATION MEASURES

The environmental impacts of the DSEZ project has been documented with the reconnaissance survey during project preparation and subsequently through the feasibility study reports and other detailed environmental studies.

This chapter examines the potential construction impacts on physical, biological and socioeconomic environment in DSEZ. The design stages have been very carefully designed with the aim to preserve and protect indigenous plants, animals and people. The DSEZ project may generate different types of impacts on the environment. Based on the studies of different components of the proposed project and the existing conditions of the project area, following environmental impacts are expected which require to be properly mitigated during different phases of the project during construction and operation.

Mitigation is defined as measures or techniques that are used to minimize damages that would otherwise occur, due to a proposed action to the environment. These measures include process alteration to reduce emissions, changing pollution control equipment to render them more effective and adjusting the operation time of a plant. At points it would be difficult to avoid some of the activities which might be harmful for the environment and which need to be minimized. There shall be some negative impacts anticipated during construction and operation of the project shall be minimized / mitigated at different stages of the Project. Following Mitigation / measures shall be adopted to eliminate adverse environmental impacts, off set them, or to reduce them to certain acceptable level within the limits as prescribed in EPA of Government of Pakistan.

The impacts associated with the Project are summarized below, and are described in further detail in the following sections.

7.1 ANTICIPATED IMPACTS DURING PRE-CONSTRUCTION/DESIGN PHASE

7.1.1 Air Quality

Pre-construction phase shall involve site clearance, leveling and filling activities for development of DSEZ. These activities shall lead to dust generation. But these emissions shall be limited to the site only and have impact for short duration only during clearance activity. To

minimize the dust generation, water should be sprinkled regularly at the site and low sulphur diesel should be used in land leveling equipments to control the SO₂ emissions.

7.1.2 Water Quality

Impact of water quality is expected to be limited because discharging muddy water from bare land of construction site shall be temporary events and wastewater from construction camps shall be treated by septic tanks.

7.1.2.1 Mitigation Measures

- Centralized wastewater treatment plant shall be designed to meet requirement of target effluent water quality;
- Connection of retention ponds and outflow of centralized wastewater treatment plant shall be installed to improve water quality by sedimentation, self-purification, and attenuation for mitigation of impact on loss of livelihood of fishery in the downstream of discharging point.

7.1.3 Noise and Vibration

Pre-construction phase shall involve site clearance activity for development of propose off-site facilities and DSEZ. Clearance of site shall involve removal of vegetation and land leveling activities. Operation of different machineries and equipment for construction activities, running of heavy load traffic for construction materials transportation, and regular traffic movement may generate noise during construction period.

7.1.3.1 Mitigation Measures

- Buffer zone for sound-proofing to the residences shall be designed as necessary;
- Workers shall be given PPE (ear plugs), if working in high noise area;
- No noise generating activity shall be carried out in the night.

7.1.4 Impacts on Fisheries

Spillage or disposal of waste or wastewater in the canals and river may impact the aquatic life of the area. No impacts on fisheries due to off-site developments are anticipated during the pre-construction phase.

7.1.5 Drainage and Hydrological Situation

DSEZ site is connected with *Gharo Creek* and Arabian Sea through *Lat Nullah* and *Jhorewalo Nullah*. Dense drainage of *Lat Nullah* and *Jhorewalo Nullah* runs besides the DSEZ site. Construction of DSEZ site shall disrupt this natural drainage pattern on site. To maintain the

drainage at site adequate storm water collection and harvesting system should be developed at the site. Retention ponds shall be designed to equalize amount of storm water.

7.1.6 Social Environment

- Loss or change of livelihood of relocated PAHs;
- Social impact to households that currently occupying the proposed relocation site;
- Impact of loss of livelihood opportunity, especially land-based livelihood such as cereal field and/or vegetable field;
- Loss or change of livelihood;
- Shortage of capacity on the existing infrastructure and service around the proposed relocation site;
- Rehabilitation programme;
- Impact on expenditure and time for commuting;
- Suspension of existing road due to the construction work;
- Impact on accessibility of existing infrastructure and service to relocated PAHs;
- Suspension of using stagnant rain water and indigenous *bands* located inside the project area; and
- Indirect impact on other common asset.

7.1.6.1 Mitigation Measures

- Provision of land compensation (if applicable);
- Preliminary discussion and provision of compensation and assistance for the households in the proposed relocation site as necessary;
- Arrangement of adequate infrastructure and service based on the actual demand;
- Commuting assistance for school for children of relocated PAHs;
- Construction of alternative community road;
- Arrangement of alternative option for infrastructure and service after relocation;
- Arrangement of alternative water resource near the project area;
- Adequate dialogue with local community in order to discuss necessity of relocation of any asset if present;
- Community accessibility shall be secured by improvement in infrastructure facilities like construction of residential road;

- Consideration of working conditions shall be planned based on requirement of Occupational Health and Safety (OHS); and
- Accident-prevention measures inside and outside the Project area shall be planned.

7.2 CONSTRUCTION STAGE

7.2.1 Air Quality

- Impact of air pollution is expected to be limited because sand dust/emission gases by construction work to affect surrounding area are site specific and temporary events;
- Impact on air quality is expected to be limited because dust and emission gases from construction works shall be within narrow area near the construction site. In addition, emission gas effect from construction vehicles travelling around the area shall be little, comparatively limited vehicles are operating;
- Dust and other exhaust atmospheric emissions generated by vehicle movement, concrete mixing machinery, concrete conveyers, bucket conveyers, air blowers, pneumatic vibrators, mechanical vibrators and water tankers.

7.2.1.1 Mitigation Measures

- Provision of spraying water to reduce dust emission on roads;
- Excavated topsoil to be preserved and reused for landscaping;
- The amount of exposed ground and stockpiles shall be minimized so that re-suspension due to wind and subsequent dust fall is prevented;
- Ensuring all vehicles, generators and compressors are well maintained and regularly serviced;
- Regular Monitoring of emissions and control measures to reduce the emission levels.
- The construction workers shall be provided with appropriate protective equipments wherever high particulate emission is expected;
- It is also recommended that the workers shall not be allowed to work over a long exposure period.

7.2.2 Surface Water Quality

- Run-off from the construction site may carry the higher quantity of sediments and oil which may pollute the surface water and impact the aquatic life. Thus measures are required to be taken to minimize the surface water pollution;

- Impact on wastewater quality caused by construction/demolition work is expected to be limited because discharging muddy water from bare land of construction site shall be temporary and wastewater from a construction camp shall be treated by the septic tanks.
- Water during the construction activity shall be required for the domestic water consumption at the construction camp as well as for the construction activities including sprinkling of water for dust suppression; and
- Impact of hydrology shall be expected to be limited because amount of water consumption by construction work shall be small only in case of washing of machines and sprinkling.

7.2.2.1 Mitigation Measures

- To avoid excavation activities during rains;
- To prevent piling up of excavated soil, raw material and construction debris at site by proper management and disposal;
- Minimize run-off by using sprays for curing;
- Maintaining appropriate flow of water sprinklers at site;
- Construction of storm water drains along with sedimentation tanks with sand bags as partition as barrier for direct flow of run off to river;
- Collection and reusing of curing over flow, tyre wash water etc. within the site;
- Construction of adequate nos. of toilets and proper sanitation system to prevent open defecation along the river banks/water supply lines;
- Construction of soak pits/septic tanks to dispose-off the domestic waste water generated from labour camps to prevent disposal of sewage in surface water bodies;
- Proper collection, management and disposal of construction and municipal waste from site to prevent mixing of the waste in run-off and entering the water bodies;
- No debris/construction material should enter the aquaculture ponds and other water body in the area;
- A complete record of water consumption during construction and post development phase shall be maintained;
- If a new water well is to be installed, it shall be designed to abstract water preferably from deep aquifer not being used by local communities;
- Water conservation program shall be initiated to prevent wastage of water; and

- At construction camps, ensure that water efficient sanitary fittings are used throughout the development *e.g.*, low flush toilets, water efficient shower heads, and aerators on faucets.

7.2.3 Ground Water Quality

Ground water is saline in shallow aquifers of the study area. No significant impacts are anticipated on the ground water quality due to development of the off-site facilities for economic zone.

7.2.3.1 Mitigation Measures

- No sewage or waste water should be accumulated in any unlined structure; and
- Timely disposal of the construction/chemical/hazardous waste so as to prevent leaching of any pollutant to ground.

7.2.4 Noise Quality

- Excavation carried out on site through digging, hammering, drilling, boring, etc. produce noise and vibrations that at beyond desirable levels. The movement of heavy mechanical equipment, vehicles and machinery, static as well as mobile generate noise level several times higher above the normal or ambient noise levels. The noise generated is not only nuisance to the living (biotic) components in the project area but also pose a health and safety to the receptors *i.e.*, those in the vicinity such as; labors, worker, operator and nearby community. Hence adequate safety measures which may either be controlling or preventive or both can be adopted to minimize the adverse impacts of noise and vibrations; and
- Impacts of noise and vibration from construction machineries are expected to be limited because noise and vibration caused by construction work are site specific and temporary events.

7.2.4.1 Mitigation Measures

- Reduce equipment noise at source by proper design, maintenance and repair of Construction machinery and equipment;
- Minimize noise from vehicles and power generators by use of proper silencers and mufflers;
- Use noise-abating devices wherever needed and practicable;
- Providing residents with advance warning of construction activities;

- Where possible, confining noisy work to normal working hours in the day;
- Restricting construction traffic movements during the night time;
- Sound levels should be within limits recommended by Pakistan NEQS. The installation of railing around the site is to minimize dust and ensure the safety of construction sites, also contributes to minimization of noise impacts on nearby residential areas. This measure can help reduce noise up to 15 dB;
- Construction motor equipment with low noise are encouraged;
- The construction equipment causing great noise such as hammers, drills, excavators shall not be operational from 10 pm to 6 am;
- If construction at night is required to ensure the work progress, it must be approved by local governments, and temporary noise and dust prevention shields for sensitive areas must be installed;
- Equip with necessary devices for workers to prevent noise such as noise earplugs, and it is mandatory for workers when they are working;
- Providing the construction workers with suitable hearing protection like ear cap, or earmuffs and training them how to use;
- Heavy machinery like percussion hammers and pneumatic drills should not be used during the night without prior approval of the SEZMC;
- The use of modern and well maintained equipment limiting the use of percussive equipment for the excavation works;
- Dampers should be used for engines and vibratory equipment in their foundation to minimize the translation of vibration to the foundation and ground; and
- These measures shall also be included in the contract documents for compliance by the contractor. The executing agency shall ensure that they are carried out as part of its contract supervision function.

7.2.5 Soil Contamination

- During a typical construction project, spill of fuel, lubricants, and chemicals can take place. The spill may take place:
 - During transfer from one container to another or during refueling;
 - During maintenance of equipment and vehicles;
 - Due to leakages from equipment and containers; and
 - As a result of traffic accidents.

7.2.5.1 Mitigation measures

- Fuels, lubricants, and chemicals shall be stored in covered bonded areas, underlain with impervious lining;
- Maintenance of vehicles and equipment shall only be carried out at designated areas. The area shall be provided with hard surface, or tarpaulin shall be spread on the ground to prevent contamination of soil;
- Vehicles shall only be washed at designated areas;
- Regular inspections shall be carried out to detect leakages in construction vehicles and equipment;
- Appropriate arrangements, including shovels, plastic bags and absorbent materials, shall be available near fuel and oil storage areas;
- Contaminated soil shall be removed and properly disposed after treatment such as incineration *etc.*; and
- Waste from labour camps can be segregated at site. Food waste/wet waste should be composted in pits within the camp site. Recyclable waste should be sold to the authorized dealers and the remaining should be disposed off at designated sites through local agencies responsible for waste management in the area.

7.2.6 Impacts on Ecosystem

- There are no ecological (National Parks, Wildlife Sanctuaries, Protected Areas, Game Reserves etc.) and cultural or archaeological sites within the premises or proximity (10 km) of the DSEZ project area and hence no impact of the project shall occur on ecological or cultural or archaeological resources;
- The trees provide nesting and resting places to the fauna. Significant vegetation is observed only around abandoned indigenous *Bands* thus no significant impact shall be occurred. Therefore, cutting of these trees shall not have a negative impact on the fauna as well. During the construction phase, there shall be minor impacts on the mammals and reptiles of the area, due to the construction activities involving excavation, access road, movement of labor, carriageway of goods and machinery to various site locations along the project corridor;
- Based on the field survey, it is observed that biodiversity in the project area is not disturbed because of the fact that the area has not been inhabited and cultivated by local people for a long time. In addition, the area, located near *Gharo* Creek, has not been

urbanized but industrialized because of the presence of Port Qasim Industrial Estate. The project area is a special area in terms of biodiversity and ecosystem because of the presence of mangrove ecosystem and creeks. Similar ecosystem and equivalent level of biodiversity would be found nearby areas. Considering existing marine species, their habitats would remain unchanged as they can keep living in the existing creeks and streams. Though clearing the vegetation due to the implementation of the project, greening of the public space along the main road, sub road and retention pond in the project area shall help to mitigate the change of biodiversity and ecosystem. Therefore, the development of the project would not cause any significant impact on biodiversity and ecosystem of the region; and

- Due to establishment of camp sites, food storage, setting up of kitchens, production of sewage and wastewater may result in multiplication of rodents like rats, mice, and shrews etc. and vectors like mosquitoes, bugs and flies which shall have a negative impact. Birds shall try to find shelter and food somewhere else and shall tend to move away from the project area to the activities mentioned above for fear of being hunted or caught.

7.2.6.1 Mitigation Measures

- Only trees coming along proposed roads, shall be removed and efforts shall be excise the suitable trees along track and to make them, part of the future plantation plan;
- Replantation of trees shall be made according to the master plan for sustaining the natural environment of the area;
- Camp sites shall be established on waste/barren land rather than social and commercial land. However, if such type of land is not available, it shall be ensured that minimum clearing of the vegetation is carried out and minimum damage is caused to trees;
- Construction vehicles, machinery and equipment shall remain confined within their designated areas of movement;
- Contractor shall provide gas cylinders at the camps for cooking purposes and cutting of trees/bushes for fuel shall not be allowed;
- Hunting, poaching and harassing of wild animals shall be strictly prohibited and Contractor shall warn their labor accordingly;
- The camps shall be properly fenced and gated to stop entering the animals in search of eatable and goods;

- Similarly, wastes of the camps shall be properly disposed off to prevent the chances of eating by wild animals, which may become hazardous to them;
- Special measures shall be adopted to minimize impacts on the wild birds, such as avoiding noise generating activities during the critical periods of breeding;
- Staff working on the project should be given clear orders, not to shoot, snare or trap any bird; and
- The Contractor shall make arrangements to minimize the vibration, noise pollution through good engineering practices.

7.2.7 Impacts on Mangrove Ecosystem

Impact on Mangroves Plantation shall not be significant as no mangrove is proposed to be removed or cut for development of the project. Mangroves are planted in areas adjacent to DSEZ site and along the *Gharo* Creek area. These ecosystem are planted to protect the area from cyclone hazard. Mangrove plantation may be impacted due to discharge of exhaust gases from vehicles, pump, and construction machinery and disposal of wastewater and construction debris in mangroves plantation area. Thus air, water and solid waste management plan is required to be prepared for pre-construction and construction phase of the project.

7.2.8 Impacts on Fisheries

Spillage or disposal of waste or wastewater in the canals and river may impact the aquatic life of the area. No significant impacts on fisheries are anticipated during construction of the proposed off-site developments but adequate measures should be taken to prevent any impact on fisheries.

7.2.8.1 Mitigation Measures

- Proper disposal and management of construction waste;
- Wastewater from labor camp and construction site should not be disposed-off in the water bodies;
- Septic tank/soak pits should be provided to dispose-off the wastewater from construction camp;
- Site should be kept clean so as no pollutant from site should enter the water bodies along with run-off;
- Excavation activities should not be undertaken during monsoon season;

- Piling of raw material at construction site should be avoided; and
- Raw material, debris and fuel should be stored on paved surfaces under covered areas.

7.2.9 Soil Erosion

- Much of the activity during the construction phase envisaged is land grubbing, clearing, earth moving, demolition of existing structures, construction of roads new roads and widening and improvement of existing ones. All these activities are requiring exposing soil and disturbing earth and virgin soil. The mechanical disturbance followed by erosion due to wind and in wet season by water is envisaged. Hence, following, mitigation measures shall be taken to minimize the adverse impacts associated with erosion of soil; and
- Soil erosion in the bare area/bank would occur as a result of rainwater.

7.2.9.1 Mitigation Measures

- Restore / stabilize all the freshly disturbed surfaces around the borrow pits and along drainage channels as soon as possible;
- Re-vegetation of erodible surfaces;
- Planning construction activities to avoid cutting of erodible surfaces and earth movement in rainy season;
- Provide proper drainage arrangements at the cut slopes to collect water coming from higher slopes and to drain it away without flowing over erode the faces;
- Frequent removal of all the loose material lying within the right of way; and
- Ensuring timely compliance of suggested measures to minimize soil erosion.

7.2.10 Impacts on Land use

DSEZ site is spread over an area of 1530 Acres. DSEZ land is Government land and thus shall not involve any acquisition, however land use shall change from barren land to Industrial area. Some of the measures are taken to prevent any impact on change in land use.

7.2.10.1 Mitigation Measures

- Tree cutting shall be avoided while construction of road and development of DSEZ;
- If any tree cutting is undertaken then compensatory plantation should be done in minimum ratio of 1:2;
- Measures shall be taken that no structure along the access road to be widened should be affected due to development of DSEZ.

7.2.11 Disaster Risk and Management

- Flood risks such as heavy rain, cyclone, and high tide are expected;
- Risk of fire and Earthquake;

7.2.11.1 Mitigation Measures

- Provision of first aid kit and first aid room and well trained first aid practioner at the site all the time;
- Ambulance facility should be provided at the site;
- Tie-ups with local hospital should be made to handling emergency case, if any;
- Availability of safety officers and supervisors at all the time on the site;
- Workers should be given training for handling construction vehicles, equipment and handling emergency situations like fire, floods, earthquake and cyclone;
- Cautionary signage should be provided in the areas associated with risks like storage of explosives, fuels, heavy construction material etc. Entry for only trained authorized personnel should be allowed in such areas with adequate safety measures;
- Emergency handling cell and room should be developed at the site and should be headed by project and safety manager; and
- Contact no. of nearest fire-station and hospitals should be displayed within the emergency handling room.

7.2.12 Involuntary Resettlement

Involuntary resettlement of three Goths is expected which are within the DSEZ boundary because the land acquisition of uncompensated land shall be required partially for the implementation of the Project. However, the impact shall be minimized by providing assistance for the loss of assets/income source and livelihood/relocation in kind or with cash based on Resettlement Framework. In addition, the relocation of the households currently living in the proposed relocation site is anticipated because of the development of the relocation site. However, ZKBDPMC shall organize an adequate consultation with the households in a timely manner and provide compensation/ assistance as necessary.

7.2.13 Landscape and Aesthetic View

All construction activities for off-site facilities and EZ site shall be carried out within economic zone site and shall not cause any impact on landscape and scenic beauty. A green buffer (rows of trees) shall be developed all around the project site which shall enhance the scenic beauty of

the area. Also avenue plantation shall be developed all along the proposed roads and access roads.

Site clearance activities and piled construction materials, machinery and camp establishment on green field site may impact the scenic beauty. Nevertheless, the impact is for a short duration, and reversible as the project plan includes landscape planning, green belt development as well.

7.2.14 Generation of Employment

Employment opportunities shall be ensured through two channels (i) direct employment for unskilled labor, and (ii) indirect employment to the local community. Direct employment includes site clearance, excavation, loading and offloading of materials and deliveries, mason and construction works. Further, the construction labor force shall be requiring food and other items, which is expected to be supplied by the local eateries, retail shops and the local community. The local community members can take advantage of these opportunities. Employment generation benefits improve the quality of life of the laborers and enhance their productivity and living standards. Employment generation, both direct and indirect, through DSEZ shall have a tremendous impact on human development and poverty reduction in the Dhabeji area.

7.2.15 Health and Safety

- Risks for communicable and vector-borne disease are expected among workers and the surrounding local community due to the influx of labors from outside;
- Impacts on occupational health and safety (OHS) are inevitable due to the construction/demolished work, operation of tenants; and
- As the both skilled and un-skilled labor shall be required during both construction and operation phase of the DSEZ, but Dhabeji nearby area lack the skilled labor due to low literacy rate.

7.2.15.1 Mitigation Measures

- In order to minimize the impact, preventive measures against such diseases, which is stipulated in the Environment, Health, and Safety (EHS) Guidelines of the International Finance Corporation (IFC), should be considered and implemented by construction contractor and each tenant in respective stage;
- Provision of proper training to all workers for handling the construction equipment;

- Provision of cautionary and guiding signage in local and English language indicating the hazard associated with the site;
- Employment should be provided preferable to local and affected people;
- Entry to the fuel storage area and construction equipment rooms should be restricted and should be allowed for trained personnel;
- Wastewater from the toilet should be disposed off in septic tanks and soak pits and should not be allowed to accumulate at labor camp site or construction site
- Dustbins should be provided at labor camps for collection of waste and it should be regularly disposed off through the concerned agency;
- Temporary storm water drainage system should also be provided at camp site so as to drain the storm water and prevent accumulation of storm water at site and thus breeding of mosquitoes/flies;
- Arrangement of fire-fighting should be made at site and workers should be trained to use the system in case of fire;
- Provision of personal protective equipment like safety jackets, helmets, gumboots, gloves, face mask, ear buds, goggles, safety shoes etc as per requirement and nature of job in which they are involved;
- Job rotation should be carried out for workers exposed to high noise and dust areas;
- Provision of First aid facility at the site and the labor camp;
- Labor camps should be located at neat and clean location with no water logging issues;
- Proper sanitation facility including toilets, bathing facility and washing facility should be provided at site and at labor camps for workers;
- Clean drinking water supply should be provided to labor;
- Crèche facility should be provided for kids if female workers are employed;
- Regular inspection for hygiene and safety in labor camps should be done;
- Compensation should be given to the people as per the policy for the planted trees; and
- A major segment of the population on the area is unemployed. Construction activity shall provide employment to huge nos. of people including skilled, unskilled and non-skilled workers. This shall improve the quality of life of people.

7.3 OPERATIONAL PHASE

7.3.1 Air Quality

Post development of the economic zone and setting up of industries, there could be some impacts on the air quality of the area. Industrial development shall involve generation of emissions, and increased vehicular movements. These altogether may have overall negative impact on the air quality of the site and the nearby areas. The industries proposed in line with the industries as anticipated for Dhabeji DSEZ are industries like Automotive & Allied, Building Material, Chemical & Pharmaceuticals, FMCGS, Foundries – Steel Fabrication, Light Engineering and Textile & Garments.

7.3.1.1 Mitigation Measures

- Development of thick green belt (10 m) and organized greens within each industrial plot;
- Power Generators should be provided with stacks of adequate height (higher than nearest building) to allow enough dispersion of emission;
- Process emission if any shall be control with the installation of adequate air pollution control systems;
- All industries should obtain clearance from EPA, Sindh as applicable. Air pollution control measures shall be adopted by respective industries in line with SEPA permission;
- Air pollution monitoring should be carried out quarterly by all industries to check the air pollution level;
- Preference of usage of clean fuel like LPG, low sulphur diesel should be explored;
- Energy conservation should be adopted by adopting the alternate energy options like solar power and wind power;
- Odor should be managed at the site using odor suppressant and planting fragrant flowering trees.

7.3.2 Noise Quality

Noise shall be generated from the construction of individual industries, operation within in industrial units, running diesel generator sets in each units and traffic movement within DSEZ zone and on the proposed access road. Noise pollution is related to several manufacturing phases, including raw material extraction; grinding and storage; raw material, intermediate and final product handling and transportation; and operation of exhaust fans.

7.3.2.1 Mitigation Measures

- Avenue plantation shall be developed along both the side of access road and internal roads which shall act as noise buffer;
- Provision of barricade around construction site (for construction of individual industrial plot);
- Provision of 10 m thick green belt around each industrial plot;
- All industries should obtain clearance from SEPA before establishing industrial unit and should comply with all the conditions mentioned in the letter of environment clearance;
- All industries should install the new machinery of modern make which complies with the noise standards prescribed by EPA in NEQS, 2010;
- Acoustic treatment and temporary noise barrier should be provided in area generating higher noise levels;
- Job rotations should be practiced for workers in industry to prevent prolonged exposure to high noise level as it may lead to deafness, fatigue, head ache, nausea and drowsiness; and
- Honking should be prohibited within the economic zone.

7.3.3 Surface Water Quality

Industries are likely to generate domestic and industrial effluent. Liquid waste which can be generated from light engineering industries shall include waste acid, waste alkali, grease, used/spent oil, liquid metal, spent solvents etc. Wastewater is not generated in significant amount from these industries. Majorly domestic and cleaning waste is likely to be generated.

Pollutants from these industries may be discharged into *Lat Nullah* and carried away to *Gharo Creek* which supports diverse variety of fishes. Run-off may increase post development of economic zone. It is required to manage storm water which shall be generated from DSEZ site post development. Measures should also be taken to prevent contamination of storm water with any industrial pollutant. Following measures should be adopted during operation phase to minimize impacts of development of Economic zone on surface water quality.

7.3.3.1 Mitigation Measures

- Each industry should obtain consent of SEPA before construction and operation and should comply to the conditions laid by them;

- Each industry should treat the effluent and sewage generated by them so as to achieve zero discharge and no untreated effluent should be discharged into any water body;
- Provision shall be made for Common Effluent Treatment Plant (CETP);
- Common STP (in modules) should be constructed within the DSEZ to treat sewage from residential and commercial areas;
- Proper management of waste should be done to prevent any contact between the waste and storm water;
- Common waste disposal sites should also be developed within DSEZ site as per the standards and prior permission of SEPA should be taken before development;
- Each industry should practice rain water harvesting to minimize the water consumption and reduce run-off from the site;
- Storm water drains should be lined separate from effluent drains;
- Storm water system should be inspected and cleaned before monsoon every year;
- Peripheral drain shall also be lined and shall not be connected to internal storm water drainage system;
- The top soil shall be preserved and used for covering the sand layer at DSEZ site. Vegetation turffing shall be made at the side slopes of the DSEZ areas to prevent erosion and siltation in the river;
- River water quality shall be monitored periodically;
- Chlorine should not be used for disinfection but other measures like polyamide membrane, ozone and monochloramine etc. should be used in desalination plant;
- Discharge of the desalination plant should be checked for heavy metal concentration before discharging into sea;
- Filter backwash water could be diluted by continuous blending with the brine or alternatively it could be removed from the filters and transported to a landfill;
- Antifoaming dosage should be regulated and dilution of the discharge should be done; and
- Neutralization of discharge of desalination plant should be carried out before discharging to sea.

7.3.4 Ground Water Quality

No impact on ground water quality is anticipated during operation phase due to off-site developments. After development of economic zone there may be some ground water pollution

due to industrial activities. As there is no fresh water source in the area except ground water to meet the industrial operational demands. Ground water in shallow aquifers is highly saline and its extraction may affect the ground water resources. Following measures should be taken to minimize the ground water pollution.

7.3.4.1 Mitigation Measures

- Each industry should treat the effluents and sewage and should not discharge into ground;
- No leachate, waste water and waste material should be stored in pervious unlined area/pond;
- Adoption of best management practices to prevent water wastage and minimize water loss
 - Usage of water conservation fixtures to minimize water consumption
 - Installation of leakage detection system to minimize the water loss
 - Usage of latest technologies in industries which requires lesser water
 - Provision of dual plumbing system so as STP/CETP treated water can be re-used for various purposes as per suitability of the quality
- Ground water aquifer assessment studies may be undertaken to assess the ground water potential. Piezometer shall be installed to monitor variation in ground water level in the area.

7.3.5 Impacts on Soil Quality

After development of economic zone, disposal of industrial domestic and process waste may contaminate land and soil quality of the area. Improper disposal of waste (hazardous and non-hazardous waste) may degrade soil, water, noise, air quality and ecology of the area. As per the planning for DSEZ, it is planned that industries like Automotive & Allied, Building Material, Chemical & Pharmaceuticals, FMCGS, Foundries – Steel Fabrication, Light Engineering and Textile & Garments shall come up in the economic zone. These industries are not heavily polluting like tanneries, distilleries etc. but generate waste both hazardous and non-hazardous in nature, which can pollute the environment if not managed properly.

7.3.5.1 Mitigation Measures

- Provision shall be made for proper storage and disposal of industrial waste by receptive industries;
- Common waste storage areas shall be designated for industrial domestic waste;

- Waste should be segregated at source into hazardous and nonhazardous waste. Further, the waste should be segregated into recyclable and rejected waste. Recyclable waste should be sent to authorize vendors for recycling and rejected waste should be disposed off as per the norms specified by Solid Waste Management Guidelines for the particular waste;
- Industrial waste generated should be stored on sealed surfaces and should be disposed off as per guidelines of Solid Waste Management;
- No chemical/hazardous raw material should be allowed to spill over the land and should be operated in covered systems;
- Excessive packaging should be reduced and recyclable products such as aluminum, glass, and high-density polyethylene (HDPE) are being used where applicable;
- Organic waste should be resold to value addition industries or can be feed to live stock;
- Advanced wastewater treatment should be adopted by industries;
- Use of advanced techniques to control specific portions of the manufacturing process to reduce wastes and increase productivity;
- Use of radiation to kill pathogenic microorganisms;
- Reduction or total elimination of effluent from the manufacturing process;
- At present no common hazardous waste handling and disposal unit exists in Bangladesh. Industries thus have to install the incinerators in the unit to dispose hazardous waste. The incinerator further should use the clean fuel and required air quality management measures should be adopted; and
- A site for disposal of hazardous waste can be identified within the DSEZ and it should be developed as per the norms of SEPA and Hazardous Waste Management rules of Pakistan.

7.3.6 Impacts on Land Use

Land use of DSEZ site is barren land which shall be changed to industrial land use after development of EZ site. However, post development of economic zone change in land use is anticipated in the near-by area. At present there is no significant infrastructure at the DSEZ site. Majorly land use are indigenous *bands*, wetland, Quarry Area. Development of DSEZ shall attract more infrastructural development around the project site to facilitate industrial growth changing the land use area from barren to industrial land use. Some of the other developments including construction of roads, housing facility, commercial areas including

hotels, hospital, restaurants, schools, ancillary industries, cottage industries, etc. may also occur in nearby areas. This shall lead to change in land use but shall lead to significant development of the area.

7.3.7 Impact on Fisheries

The fisheries may get impacted if untreated industrial effluent or hazardous waste is discharged to river. Therefore effluent management system shall be implemented strictly. Fish kill may happen due to contamination of water due to discharge of untreated effluent. Effluent may contain toxic components like heavy metals etc. which leads to fish poisoning and may lead to large scale fish death. Also fishes contaminated with these pollutants if consumed may affect the consumer health (birds/bigger fishes/humans).

7.3.7.1 Mitigation Measures

- Adoption of adequate wastewater and industrial effluent management technology so no untreated sewage is discharged into surface water body; and
- Industrial, municipal and hazardous waste should be managed such that no waste is dumped or disposed in surface water body.

7.3.8 Impacts on Ecosystem

Post development of the economic zone and setting up of industries, there could be some impacts on the ecosystem of the area. Industrial development shall involve generation of emissions, effluents and increased vehicular movements. These altogether may have overall significant impact on the ecosystem of the site and the nearby areas as the air pollutant shall impact the existing vegetation and avifauna in the area. But the industries proposed as per the pre-feasibility study are industries like Automotive & Allied, Building Material, Chemical & Pharmaceuticals, FMCGS, Foundries – Steel Fabrication, Light Engineering and Textile & Garments. These industries are not heavily polluting. If appropriate measures for preventing air, water, soil and noise pollution are taken there shall be no significant impact on the ecosystem of the area.

7.3.8.1 Mitigation Measures:

- Periodic monitoring shall be carried out as per the monitoring plan for air, water, noise and soil and ensure that no impact shall be occurred;
- No waste shall be discharged in water bodies, *i.e.*, *Jhorewalo Nullah, Lat Nullah, Gharo Creek* etc.;

- All industries should install STP and ETP to treat the effluent generated and to re-use and recycle it completely. No treated and untreated effluent should be discharged in water bodies, *i.e., Jhorewalo Nullah, Lat Nullah, Gharo Creek etc.*;
- Tree survival rate shall be monitored;
- Native species should only be planted in the region; and
- Minimum twice the no. of tree fell (if any) should be planted.

7.3.9 Disaster Risk and Management

- Increase of the impact of flood in and around the projects site as it is near to creek area;
- Impact on the community around the project site by risk of fire;
- Damage due to earthquake in and around the projects site
- During the operation phase, some tenants would use chemical materials to be managed under specific condition. In addition, Material Safety Data Sheet (MSDS) shall be utilized in order to let workers know about requirements and standards of the chemicals. Risk of chemical material is expected to be limited because the tenants shall be required to prepare proper chemical substances management plan and to comply with applicable regulations/laws with reference to usage, producing, storing, disposing and handling of dangerous and hazardous materials as stipulated in the proposed internal regulation.

7.3.9.1 Mitigation measures

- Provision of first aid kits at the site
- Tie-ups with local hospital should be made to handling emergency case, if any
- Regular medical check-ups of the employees
- Training should be given to workers for handling the equipment and managing emergency situations
- Material safety data sheets of chemicals to be used should be displayed on local languages at work station
- Provision of personal protective equipment to the workers as per requirement
- Cautionary signage should be provided in the areas associated with risks like storage of chemicals, explosives, fuels etc. Entry for only trained authorized personnel should be allowed in such areas with adequate safety measures
- Formulation of chemical management plan as necessary
- Training of safety usage and preparation of the emergency response plans

- Implementation of the proper storage and record of usage.
- Applying for the acquisition of the license with management plan in accordance with the relevant law, and compliance with the law.
- Provision of protective equipment and clothes to workers as necessary.

7.3.10 Poverty alleviation and diversification in livelihood

Vast employment opportunities potentially created by the DSEZ shall reduce poverty via increased income through various livelihood options. By means of industrialization and related trades, diversification of livelihood shall occur for all strata of people. Diverse livelihood options for the locals and better wages for the employees of the industrial zone shall reduce poverty for many poor households and shall contribute to reducing the poverty level in the locality. So, this shall enormously benefit cross section of population and both gender.

Employment opportunities are expected to increase throughout the region during the commissioning phase. This shall provide employment to high unemployed population of the area.

7.3.11 Access to civic amenities and communication

The households that shall be settled adjacent to the DSEZ area shall access better civic amenities. However, due to the DSEZ construction overall traffic may be congested over the years. But industrialization shall ensure better livelihood and increase ability to access better civic facilities.

7.3.12 Social mobility

With improved employment opportunities and higher and secured income, impoverished people shall be able to move up the social ladder.

Table 7-1: Environmental Impacts Matrix during Different Stages

Environmental Impacts Matrix for Dhabeji Special Economic Zone				
Environmental Components	Aspect	Impacts and Duration		
		Design	Construction	Operation
PHYSICAL ENVIRONMENT	Air Quality	MA-Interim	HA-Short Term	LA-Long Term
	Noise & Vibrations	MA-Interim	HA-Short Term	LA-Long Term
	Ground & Surface Water	O	LA-Short	MA-Long Term

Environmental Impacts Matrix for Dhabeji Special Economic Zone				
Environmental Components	Aspect	Impacts and Duration		
		Design	Construction	Operation
	Soil Contamination	O	MA-Short Term	MA-Long Term
	Soil Erosion	O	MA-Short Term	O
	Landscape & Aesthetic View	O	LA-Short Term	HB-Long Term
	Disaster Risk & Emergency Response	LA	MA-Short Term	MA-Short Term
	Land use	O	LA-Short Term	HB-Long Term
BIOLOGICAL ENVIRONMENT	Ecosystem	O	MA-Short Term	LA-Long Term
	Fisheries	O	O	LA-Long Term
	Mangroves	O	LA-Short Term	LA-Long Term
SOCIOECONOMIC ENVIRONMENT	Dislocation of People / Resettlement & Compensation	MA-Short/Interim/Long Term	MA-Short/Interim/Long Term	O
	Poverty alleviation & Generation of Employment	O	MB-Long Term	HB-Long Term
	Occupational Health and Safety	O	MA-Short Term	O
	Civic Amenities & Communications	MA-Short Term	LB-Short Term	HB-Long Term

Legend	
O - Insignificant/ No Impact	LB - Low Beneficial
LA - Low Adverse	MB - Medium Beneficial
MA - Medium Adverse	HB - Highly Beneficial
HA - High Adverse	

8 ENVIRONMENTAL MANAGEMENT AND MONITORING PLAN

8.1 INTRODUCTION

The Environmental Management Plan (EMP) is the synthesis of all proposed mitigation and monitoring actions, set to a time frame with specific responsibility assigned and follow-up actions defined. EMP is a plan of actions for avoidance, mitigation and management of the negative impacts of the project. Environmental enhancement is also an important component of EMP. A detailed set of mitigation measures have been compiled in view of the likely impacts associated with the proposed Dhabeji Special Economic Zone (DSEZ).

8.2 ENVIRONMENTAL MANAGEMENT PLAN

The EMP consists of a set of mitigation, monitoring and institutional measures to be taken during the design, construction and operation (post-construction) stages of the project. The EMP has been designed keeping in view the regulatory and other requirements to ensure the following:

- Minimum disturbance to the native flora and fauna;
- Compliance with the air, water, soil and noise quality norms; and
- Conservation of water to the extent possible through rain water harvesting, wastewater recycling.

8.3 MITIGATION PLAN

The proposed EZ development may have some impacts on the environment and society such as change in land use, removal of vegetation, increased dust emissions etc. Health & Safety Plan along with the EMP has been drafted. Details of which are given below. All offsite facilities shall be constructed by CSZA. EMP implementation shall also be CSZA who shall in turn implement it through contractor. EZ shall be developed by the developer appointed by CSZA and shall be responsible for implementation of EMP during development.

A consolidated summary list of environmental, social and health commitments that shall be implemented in the Project in order to manage and mitigate potential impacts associated with the project development is provided in **Table 8-1, 8-2, and 8-3.**

Table 8-1: Environmental Mitigation and Management Plan- Pre Construction/Design Phase

Category	Item	Expected Environmental and Social Impacts	Proposed Environmental Mitigation Measures and Environmental Management	Implementing Organization	Responsible Organization
Pollution	Air Pollution	Site clearance, leveling & filling activities shall result in dust generation	Water should be sprinkled regularly at the site and low sulphur diesel should be used in land leveling equipments to control the SO ₂ emissions.	Contractor	Project Proponent
	Noise & Vibration	• Removal of vegetation; • Land leveling activities; • Operation of different machineries and equipment for construction activities; • Running of heavy load traffic for construction materials transportation; and • Regular traffic movement may generate noise during construction period.	• Buffer zone for sound-proofing to the monastery and residences shall be designed as necessary. • Workers shall be given PPE (ear plugs), if working in high noise area • No noise generating activity shall be carried out in the night.	Contractor	Project Proponent

Category	Item	Expected Environmental and Social Impacts	Proposed Environmental Mitigation Measures and Environmental Management	Implementing Organization	Responsible Organization
Social Environment	Involuntary resettlement, living and livelihood	• Loss or change of livelihood of relocated PAHs; • Social impact to households that currently occupying the proposed relocation site; • Impact of loss of livelihood opportunity, especially land-based livelihood such as paddy field and/or vegetable field; • Loss or change of livelihood; • Shortage of capacity on the existing infrastructure and service around the proposed relocation site; • Impact on expenditure and time for commuting;	• Provision of land compensation (if applicable); • Preliminary discussion and provision of compensation and assistance for the households in the proposed relocation site as necessary; • Arrangement of adequate infrastructure and service based on the actual demand; • Commuting assistance for school for children of relocated PAHs; • Construction of alternative community road; • Arrangement of alternative option for infrastructure and service after relocation;	Project Proponent and DSEZ Management Committee	DSEZ Management Committee

Category	Item	Expected Environmental and Social Impacts	Proposed Environmental Mitigation Measures and Environmental Management	Implementing Organization	Responsible Organization
		• Suspension of existing road due to the construction work; • Impact on accessibility of existing infrastructure and service to relocated PAHs; • Suspension of using pond located inside the project area; • Possibility on the relocation of cemetery; and • Indirect impact on other common asset.	• Arrangement of alternative pond near the project area; • Adequate dialogue with local community in order to discuss necessity of relocation of any asset if present; • Community accessibility shall be secured by improvement in infrastructure facilities like construction of residential road; • Consideration of working conditions shall be planned based on requirement of Occupational Health and Safety (OHS); and • Accident-prevention measures inside and outside the Project area shall be planned.		

Table 8-2: Environmental Mitigation and Management Plan-Construction Phase

Category	Item	Expected Environmental and Social Impacts	Proposed Environmental Mitigation Measures and Environmental Management	Implementing Organization	Responsible Organization
Pollution	Air Pollution	- Impact of air pollution is expected to be limited because sand dust/emission gases by construction work to affect surrounding area are site specific and temporary events; - Impact on air quality is expected to be limited because dust and emission gases from construction works shall be within narrow area near the construction site. In addition, emission gas effect from construction vehicles travelling around the area shall be little,	- Provision of spraying water to reduce dust emission on roads; - Excavated topsoil to be preserved and reused for landscaping; - The amount of exposed ground and stockpiles shall be minimized so that re-suspension due to wind and subsequent dust fall is prevented; - Ensuring all vehicles, generators and compressors are well maintained and regularly serviced; - Regular Monitoring of emissions and control measures to reduce the emission levels.	Contractor	Project Proponent

Category	Item	Expected Environmental and Social Impacts	Proposed Environmental Mitigation Measures and Environmental Management	Implementing Organization	Responsible Organization
		comparatively limited vehicles are operating; Dust and other exhaust atmospheric emissions generated by vehicle movement, concrete mixing machinery, concrete conveyers, bucket conveyers, air blowers, pneumatic vibrators, mechanical vibrators and water tankers.	- The construction workers shall be provided with appropriate protective equipments wherever high particulate emission is expected; - It is also recommended that the workers shall not be allowed to work over a long exposure period.		
	Water Pollution	Run-off from the construction site may carry the higher quantity of sediments and oil which may pollute the surface water and impact the aquatic life. Thus measures are required to be	- To prevent piling up of excavated soil, raw material and construction debris at site by proper management and disposal - Minimize run-off by using sprays for curing	Contractor	Project Proponent

Category	Item	Expected Environmental and Social Impacts	Proposed Environmental Mitigation Measures and Environmental Management	Implementing Organization	Responsible Organization
		taken to minimize the surface water pollution. - Impact on wastewater quality caused by construction/demolition work is expected to be limited because discharging muddy water from bare land of construction site shall be temporary and wastewater from a construction camp shall be treated by the septic tanks. - Water during the construction activity shall be required for the domestic water consumption at the construction camp as well as	- Maintaining appropriate flow of water sprinklers at site - Construction of storm water drains along with sedimentation tanks with sand bags as partition as barrier for direct flow of run off to river. - Construction of adequate nos. of toilets and proper sanitation system to prevent open defecation along the river banks/water supply lines - Construction of soak pits/septic tanks to dispose-off the domestic waste water generated from labour camps to prevent disposal of sewage in surface water bodies		

Category	Item	Expected Environmental and Social Impacts	Proposed Environmental Mitigation Measures and Environmental Management	Implementing Organization	Responsible Organization
		for the construction activities including sprinkling of water for dust suppression. Impact of hydrology shall be expected to be limited because amount of water consumption by construction work shall be small only in case of washing machines and sprinkling.	- Proper collection, management and disposal of construction and municipal waste from site to prevent mixing of the waste in run-off and entering the water bodies - A complete record of water consumption during construction and post development phase shall be maintained; - Water conservation program shall be initiated to prevent wastage of water; and - At construction camps, ensure that water efficient sanitary fittings are used throughout the development e.g., low flush toilets, water		

Category	Item	Expected Environmental and Social Impacts	Proposed Environmental Mitigation Measures and Environmental Management	Implementing Organization	Responsible Organization
			efficient shower heads, and aerators on faucets.		
	Noise and Vibration	- Excavation carried out on site through digging, hammering, drilling, boring, etc. produce noise and vibrations that at beyond desirable levels. - The movement of heavy mechanical equipment, vehicles and machinery, static as well as mobile generate noise level several times higher above the normal or ambient noise levels.	- Installation of sound-proofing sheet; - Avoidance of construction at nighttime; - Advanced notice for construction work time near the monastery and residential area; - Avoidance of intensive operation of construction machineries; and - Speed limit for drivers.	Contractor	Project Proponent
	Soil Contamination	During a typical construction project, spill of fuel,	Fuels, lubricants, and chemicals shall be stored in covered bonded	Contractor	Project Proponent

Category	Item	Expected Environmental and Social Impacts	Proposed Environmental Mitigation Measures and Environmental Management	Implementing Organization	Responsible Organization
		lubricants, and chemicals can take place. The spill may take place: ○ During transfer from one container to another or during refueling; ○ During maintenance of equipment and vehicles; ○ Due to leakages from equipment and containers; and ○ As a result of traffic accidents.	areas, underlain with impervious lining; • Maintenance of vehicles and equipment shall only be carried out at designated areas. The area shall be provided with hard surface, or tarpaulin shall be spread on the ground to prevent contamination of soil. • Regular inspections shall be carried out to detect leakages in construction vehicles and equipment. • Appropriate arrangements, including shovels, plastic bags and absorbent materials, shall be available near fuel and oil storage areas.		

Category	Item	Expected Environmental and Social Impacts	Proposed Environmental Mitigation Measures and Environmental Management	Implementing Organization	Responsible Organization
			Contaminated soil shall be removed and properly disposed after treatment such as incineration etc.		
Natural Environment	Ecosystem	- Clearance of existing vegetation - Due to establishment of camp sites, food storage, setting up of kitchens, production of sewage and wastewater may result in multiplication of rodents like rats, mice, and shrews etc. - Spillage or disposal of waste or wastewater in the creek and river may impact the aquatic life and mangrove of the area.	- Replantation of trees shall be made according to the master plan for sustaining the natural environment of the area. - Contractor shall provide gas cylinders at the camps for cooking purposes and cutting of trees/bushes for fuel shall not be allowed. - Hunting, poaching and harassing of wild animals shall be strictly prohibited and Contractor shall warn their labor accordingly.	Contractor	Project Proponent

Category	Item	Expected Environmental and Social Impacts	Proposed Environmental Mitigation Measures and Environmental Management	Implementing Organization	Responsible Organization
			- The camps shall be properly fenced and gated to stop entering the animals in search of eatable and goods. - Special measures shall be adopted to minimize impacts on the wild birds, such as avoiding noise generating activities during the critical periods of breeding. - Staff working on the project should be given clear orders, not to shoot, snare or trap any bird. - Proper disposal and management of construction waste - Septic tank/soak pits should be provided to dispose-off the wastewater from construction camp		

Category	Item	Expected Environmental and Social Impacts	Proposed Environmental Mitigation Measures and Environmental Management	Implementing Organization	Responsible Organization
			Site should be kept clean so as no pollutant from site should enter the water bodies along with run-off.		
	Soil Erosion	- Land grubbing, clearing, earth moving, demolition of existing structures, construction of roads new roads. All these activities are requiring exposing soil and disturbing earth and virgin soil. - The mechanical disturbance followed by erosion due to wind and in wet season by water is envisaged.	- Restore / stabilize all the freshly disturbed surfaces around the borrow pits and along drainage channels as soon as possible. - Re-vegetation of erodible surfaces. - Planning construction activities to avoid cutting of erodible surfaces and earth movement in rainy season. - Provide proper drainage arrangements at the cut slopes to collect water coming from higher slopes and to drain it away	Contractor	Project Proponent

Category	Item	Expected Environmental and Social Impacts	Proposed Environmental Mitigation Measures and Environmental Management	Implementing Organization	Responsible Organization
			without flowing over erode the faces. • Frequent removal of all the loose material lying within the right of way. • Ensuring timely compliance of suggested measures to minimize soil erosion.		
Social Environment	Landscape and Aesthetic View	• Site clearance activities and piled construction materials, machinery and camp establishment on green field site may impact the scenic beauty. Nevertheless, the impact is for a short duration.	• A green buffer (rows of trees) shall be developed all around the project site which shall enhance the scenic beauty of the area. Also avenue plantation shall be developed all along the proposed roads and access roads.	Contractor	Project Proponent
	Generation of Employment	• Employment opportunities shall be ensured through two channels (i) direct	• Direct employment includes site clearance, excavation, loading and offloading of materials and	Contractor	Contractor

Category	Item	Expected Environmental and Social Impacts	Proposed Environmental Mitigation Measures and Environmental Management	Implementing Organization	Responsible Organization
		employment for unskilled labor, and (ii) indirect employment to the local community.	deliveries, mason and construction works. - The construction labor force shall be requiring food and other items, which is expected to be supplied by the local eateries, retail shops and the local community. - Employment generation, both direct and indirect, through DSEZ shall have a tremendous impact on human development and poverty reduction in the Dhabeji area.		
	Health and Safety	Risks for communicable and vector-borne disease are expected among workers and the surrounding local community due to the influx of labors from outside.	- To provide surveillance for worker's health; - Prevention of illness among workers by undertaking health - awareness and education initiatives and by conducting	Contractor	Project Proponent

Category	Item	Expected Environmental and Social Impacts	Proposed Environmental Mitigation Measures and Environmental Management	Implementing Organization	Responsible Organization
		Impacts on occupational health and safety (OHS) are inevitable due to the construction/demolished work, operation of tenants.	- immunization programs for workers; - Prevention of larval and adult propagation through sanitary improvements and elimination of breeding habitats close to human settlements; [Common] - To provide adequate health care facilities and first aid within construction sites - To provide OHS training program and information of basic site rules of work, basic hazard awareness, site specific hazards, safe work practices, and emergency procedure [Occupational Health]		

Category	Item	Expected Environmental and Social Impacts	Proposed Environmental Mitigation Measures and Environmental Management	Implementing Organization	Responsible Organization
			- To provide adequate lavatory facilities for the number of people expected to work in the facility - To provide adequate supplies and easy access of drinking water with a sanitary means - To provide temporary shelters to protect against heat stroke during working activities or for use as rest areas as needed - To promote the use of repellents, clothing, netting, and other barriers to prevent insect bites and snake bite [Occupation Safety] - Adequate preventive measures from negative factors such as over-exertion, slips and falls,		

Category	Item	Expected Environmental and Social Impacts	Proposed Environmental Mitigation Measures and Environmental Management	Implementing Organization	Responsible Organization
			work in heights, struck by objects, moving machinery, dust, confined spaces and excavations, and other site hazards • To train and license industrial vehicle operators in the safe operation of specialized vehicles • To establish driving and traffic rules • To identify and provide appropriate PPE that offers adequate protection to the worker, co-workers, and occasional visitors • Proper maintenance of PPE and the instruction of proper use.		

Category	Item	Expected Environmental and Social Impacts	Proposed Environmental Mitigation Measures and Environmental Management	Implementing Organization	Responsible Organization
Emergency Risk and Management	Floods, fire and earthquake	- Flood risks such as heavy rain, cyclone, and high tide are expected; - Risk of fire and Earthquake.	- Provision of first aid kit and first aid room and well trained first aid practioner at the site all the time - Ambulance facility should be provided at the site - Tie-ups with local hospital should be made to handling emergency case, if any; - Availability of safety officers and supervisors at all the time on the site; - Workers should be given training for handling construction vehicles, equipment and handling emergency situations like fire, floods, earthquake and cyclone; - Cautionary signage should be provided in the areas associated	Project Proponent	Project Proponent

Category	Item	Expected Environmental and Social Impacts	Proposed Environmental Mitigation Measures and Environmental Management	Implementing Organization	Responsible Organization
			with risks like storage of explosives, fuels, heavy construction material etc. Entry for only trained authorized personnel should be allowed in such areas with adequate safety measures. • Emergency handling cell & room should be developed at the site and should be headed by project & safety manager • Contact no. of nearest fire-station and hospitals should be displayed within the emergency handling room		

Table 8-3: Environmental Mitigation and Management Plan-Operation Phase

Category	Item	Expected Environmental and Social Impacts	Proposed Environmental Mitigation Measures and Environmental Management	Implementing Organization	Responsible Organization
Pollution	Air Environment	Industrial development shall involve generation of emissions, and increased vehicular movements.	• Development of thick green belt and organized greens within each industrial plot; • Power Generators should be provided with stacks of adequate height (higher than nearest building) to allow enough dispersion of emission; • Process emission if any shall be control with the installation of adequate air pollution control systems; • All industries should obtain clearance from EPA, Sindh as applicable. Air pollution control measures shall be adopted by	Proponent's Environment Manager	Project Proponent

Category	Item	Expected Environmental and Social Impacts	Proposed Environmental Mitigation Measures and Environmental Management	Implementing Organization	Responsible Organization
			respective industries in line with SEPA permission; • Air pollution monitoring should be carried out quarterly by all industries to check the air pollution level; • Preference of usage of clean fuel like LPG, low sulphur diesel should be explored; • Energy conservation should be adopted by adopting the alternate energy options like solar power and wind power; • Odor should be managed at the site using odor suppressant and planting fragrant flowering trees.		

Category	Item	Expected Environmental and Social Impacts	Proposed Environmental Mitigation Measures and Environmental Management	Implementing Organization	Responsible Organization
	Noise and Vibration	Noise pollution is related to running diesel generators, several manufacturing phases, including raw material extraction; grinding and storage; raw material, intermediate and final product handling and transportation; and operation of exhaust fans.	• Avenue plantation shall be developed along both the side of access road and internal roads which shall act as noise buffer; • Provision of barricade around construction site (for construction of individual industrial plot); • Provision of 10 m thick green belt around each industrial plot; • All industries should obtain clearance from SEPA before establishing industrial unit and should comply with all the conditions mentioned in the letter of environment clearance; • All industries should install the new machinery of modern make which complies with the noise	Proponent's Environment Manager	Project proponent

Category	Item	Expected Environmental and Social Impacts	Proposed Environmental Mitigation Measures and Environmental Management	Implementing Organization	Responsible Organization
			standards prescribed by EPA in NEQS, 2010; • Acoustic treatment and temporary noise barrier should be provided in area generating higher noise levels; • Job rotations should be practiced for workers in industry to prevent prolonged exposure to high noise level as it may lead to deafness, fatigue, head ache, nausea and drowsiness; and • Honking should be prohibited within the economic zone.		
	Surface Water Quality	• Industries are likely to generate domestic and industrial effluent. Liquid waste which can be generated	• Each industry should treat the effluent and sewage generated by them so as to achieve zero discharge and no untreated	Proponent's Environment Manager	Tenants and Project Proponent

Category	Item	Expected Environmental and Social Impacts	Proposed Environmental Mitigation Measures and Environmental Management	Implementing Organization	Responsible Organization
		from light engineering industries shall include waste acid, waste alkali, grease, used/spent oil, liquid metal, spent solvents etc. • Majorly domestic and cleaning waste is likely to be generated. • Run-off may increase post development of economic zone.	effluent should be discharged into any water body; • Provision shall be made for Common Effluent Treatment Plant (CETP); • Common STP (in modules) should be constructed within the DSEZ to treat sewage from residential and commercial areas; • Proper management of waste should be done to prevent any contact between the waste and storm water; • Peripheral drain shall also be lined and shall not be connected to internal storm water drainage system;		

Category	Item	Expected Environmental and Social Impacts	Proposed Environmental Mitigation Measures and Environmental Management	Implementing Organization	Responsible Organization
			- The top soil shall be preserved and used for covering the sand layer at DSEZ site. Vegetation turffing shall be made at the side slops of the DSEZ areas to prevent erosion and siltation in the river; - Chlorine should not be used for disinfection but other measures like polyamide membrane, ozone and monochloramine etc. should be used in desalination plant.		
	Soil Quality	Improper disposal of industrial domestic and process waste (Hazardous and non-hazardous) may contaminate land and soil quality of the area.	With reference to the process of usage, producing, storing, disposing and handling of oil, chemical, dangerous or hazardous materials in the project area, the tenants shall treat the materials safety on the covered area to	Proponent's Environment Manager	Project Proponent

Category	Item	Expected Environmental and Social Impacts	Proposed Environmental Mitigation Measures and Environmental Management	Implementing Organization	Responsible Organization
			prevent infiltration of the materials to ground, eliminate or dispose of all dangerous or hazardous materials and waste • Solid waste receptacles or trash containers which must be large enough to facilitate storage and collection and which must be installed within the land of tenant.		
Natural Environment	Impact on Fisheries	Fish kill may happen due to contamination of water due to discharge of untreated effluent. Effluent may contain toxic components like heavy metals etc. which leads to fish poisoning and may lead to large scale fish death.	• Adoption of adequate wastewater and industrial effluent management technology so no untreated sewage is discharged into surface water body; and • Industrial, municipal and hazardous waste should be managed such that no waste is	Proponent's Environment Manager	Project Proponent

Category	Item	Expected Environmental and Social Impacts	Proposed Environmental Mitigation Measures and Environmental Management	Implementing Organization	Responsible Organization
			dumped or disposed in surface water body.		
	Impact on Ecosystem	Industrial development shall involve generation of emissions, effluents and increased vehicular movements. These altogether may have impact on the ecosystem of the site and the nearby areas.	- Periodic monitoring shall be carried out as per the monitoring plan for air, water, noise and soil and ensure that no impact shall be occurred; - No waste shall be discharged in water bodies, <i>i.e., Jhorewalo Nullah, Lat Nullah, Gharo Creek</i> etc.; - All industries should install STP and ETP to treat the effluent generated and to re-use and recycle it completely. No treated and untreated effluent should be discharged in water bodies, <i>i.e.,</i>	Proponent's Environment Manager	Project Proponent

Category	Item	Expected Environmental and Social Impacts	Proposed Environmental Mitigation Measures and Environmental Management	Implementing Organization	Responsible Organization
			<i>Jhorewalo Nullah, Lat Nullah, Gharo Creek etc.;</i> • Tree survival rate shall be monitored; • Native species should only be planted in the region; and • Minimum twice the no. of tree fell (if any) should be planted.		
Emergency Risk	Natural disaster and risk of chemical materials	• Risk of chemical materials • Increase of the impact of flood in and around the projects site as it is near to creek area; • Impact on the community around the project site by risk of fire; • Damage due to earthquake in and around the projects site	• Formulation of chemical management plan as necessary • Training of safety usage and preparation of the emergency response plans • Implementation of the proper storage and record of usage. • Applying for the acquisition of the license with management plan in	Project Proponent	Project Proponent

Category	Item	Expected Environmental and Social Impacts	Proposed Environmental Mitigation Measures and Environmental Management	Implementing Organization	Responsible Organization
			accordance with the relevant law, and compliance with the law. • Provision of protective equipment and clothes to workers as necessary.		
Social Environment	Poverty alleviation and diversification in livelihood, access to civic amenities and communication	• Vast employment opportunities potentially created by the DSEZ shall reduce poverty via increased income through various livelihood options. • Access better civic amenities due to DSEZ • Social mobility	• Diverse livelihood options for the locals and better wages for the employees of the industrial zone shall reduce poverty for many poor households and shall contribute to reducing the poverty level in the locality. So, this shall enormously benefit cross section of population and both gender. • Employment opportunities are expected to increase throughout the region during the commissioning phase. This shall	Project Proponent	Project Proponent

Category	Item	Expected Environmental and Social Impacts	Proposed Environmental Mitigation Measures and Environmental Management	Implementing Organization	Responsible Organization
			provide employment to high unemployed population of the area. • Industrialization shall ensure better livelihood and increase ability to access better civic facilities. • With improved employment opportunities and higher and secured income, impoverished people shall be able to move up the social ladder.		

8.4 MONITORING PLAN

The objective of environmental monitoring during the construction and operation phases is to compare the monitored data against the baseline condition collected during the study period to assess the effectiveness of the mitigation measures and the protection of the ambient environment based on national standards. A monitoring schedule has been sketched based on the environmental components that may be affected during the construction and operation of the project and is given below in **table 8-4 and 8-5**.

8.4.1 Monitoring Indicators

The physical, biological and social components which are of particular significance to the proposed project are listed below:

- Air quality;
- Surface (Sea & River) & Ground Water quality;
- Noise levels;
- Solid and Hazardous Waste Management;
- Plantation success / survival rate;
- Soil Erosion;
- Soil Quality;
- Drinking water quality; and
- Sanitation and hygiene at construction labour camps and construction site.

These indicators shall be evaluated periodically based on the monitoring results, baseline conditions, predicted impacts and mitigation measures.

8.4.2 Effective Implementation of EMP during Construction Phase

Pre-construction and construction activities are taken by the contractor to whom work shall be awarded. For implementation of Environmental Management Plan during pre-construction and construction phase, it is necessary that EMP for construction phase for off-site facilities and EZ development should be shared with the contractor so as he is aware of the environmental provision he has to keep during construction phase and he can do budgeting accordingly. This shall ensure effective implementation of the EMP. EMP implementation by contractor can be achieved by following ways:

- Contractor should have full-fledged environment health and safety management cell (EHS Cell) to ensure the implementation of the EMP and the SHE policy aiming at achieving the goals of safety, health and environmental management. The contractor EHS cell should have all the expertise in the field of Environment Health and Safety. The designated EHS officers should have adequate experience for implementing and monitoring the similar nature of EMPs. The contractor EHS cell should function in close coordination with DSEZ authority and PMC to the project. The contractor EHS cell should submit the EMP compliance on monthly basis to PMC and DSEZ Authority.
- Contractor should submit Environment Management Action Plan (EMAP) based on this EIA document including their work methodology, work force involvement, equipment's standard, work scheduling etc.
- Contractor should carry out environmental monitoring as per suggestive environmental monitoring plan in the EMP chapter;
- Mandatory Deputation of environmental and social expert (by contractor) at site;
- Linking payments of the contractor to environmental performance;
- Assigning penalties in case the environmental safeguard measures are not taken up adequately; and
- Appointing PMC to monitor the performance of contractor and compliance of the EMP by contractor. PMC is responsible to communicate the status of compliance/non-compliance of EMP by contractor to project proponent and suggest the measures to be taken to contractor to meet the gaps/non-compliances. PMC can be appointed by DSEZ authority through tendering process again and the company's having experience of managing similar kind of projects should only be appointed for the PMC work only.

8.4.3 Mitigation Measures and Monitoring Costs

The costs of implementing the environmental management and impact mitigation shall be borne by the proponent. Environmental monitoring costs are also included in the in the project. If there are unpredictable environmental impacts found during the implementation of the environmental monitoring, EIA and EMMP should be updated in timely manner and mitigation measures shall be put forward to reduce the impacts to the environment.

The proponent shall bear all monitoring costs and shall ensure the necessary budgets are available for the DSEZ project. Internal monitoring costs shall be borne by the ZKBDMC during operation.

Contractors shall bear the costs for all mitigation measures during construction, which shall be included in the EIA. The ZKBDMC shall bear the costs related to mitigation measures during operation and the costs related to environmental supervision during construction and operation.

Table 8-4: Environmental Monitoring Plan

S.No.	Aspect	Monitoring Methods and Parameters	Impact Source/Location	Frequency	Responsible Organization
Construction Phase					
1.	Common	Monitoring of mitigation measures	Each Location	Once/Month	Contractor
2.	Air Quality	Survey and observations; Levels of NO ₂ , SO ₂ , CO, PM _{2.5} , PM ₁₀	- Transportation of construction materials, road construction, construction of utilities - Construction Site (At least 3 points)*	1week/3months	Contractor
3.	Water Quality	All physio-chemical & biological parameters	- Contamination - Outflow of construction site to the creek (at least 3 sampling points/mixing point: i) discharge water, ii) upstream water, and iii) downstream water)**	Once/2 months	Contractor
4.	Waste Management	Amount and Kind of waste material	Restoration of disposal sites and construction areas	Once/3 months	Contractor

S.No.	Aspect	Monitoring Methods and Parameters	Impact Source/Location	Frequency	Responsible Organization
Construction Phase					
		Status of protection measures			
5.	Noise and Vibrations	- Noise levels compliance with respect to industrial standards - Ambient Equivalent continuous Sound Pressure Levels (Leq) at day and Night time	- At least 6-8 locations - Preservation area such as residence around the proposed construction site - Preservation site such as residence along the route for on-site vehicles (1point for noise and vibration and 2 points for traffic count)	Once (24 hours)/3 months	Contractor
6.	Soil Erosion	- Survey and observation; - Extent and degree of erosion; - Structures for controlling soil erosion	Excavation, disposal, cut & fill and land clearing activities for site levelling and internal roads, disposal	During Rainy Season	Contractor
7.	Hydrology	- Groundwater level - Ground elevation level	Well within or near the construction site	Once/ month	Contractor

S.No.	Aspect	Monitoring Methods and Parameters	Impact Source/Location	Frequency	Responsible Organization
Construction Phase					
		Consumption of groundwater amount			
8.	Living and Livelihood/ Vulnerable Group/ Misdistribution of Benefit	The implementation status for corporate social responsibility activities such as community support program	Around Project Area	Once/year	Project Proponent
9.	Risks for Infectious Disease such as AIDS/HIV	Awareness of infectious diseases	Construction Site	Once/year	Contractor
10.	Occupational Health and Safety	Records of accidents and infectious diseases	Construction Site	Once/year	Contractor

Note: *Air quality monitoring site in the construction area should be selected in consideration of keeping the same location during construction phase.

** Water quality monitoring location should be selected at least three points for one discharge point to confirm the impact of the effluent water from the project site to the existing water bodies.

Table 8-5: Environmental Monitoring Plan (Operation Phase)

S.No.	Aspect	Monitoring Methods and Parameters	Impact Source/Location	Frequency	Responsible Organization
Operation Phase					
1.	Common	Monitoring of mitigation measures	Project Site	Quarterly (3 years after operation) Yearly (after 3 years operation)	Project Proponent
2.	Air Quality	NO ₂ , SO ₂ , CO, PM _{2.5} , PM ₁₀	Representative points within the project area	1 week each in the dry and rainy seasons (first 3 years after starting of the operation stage)	Project Proponent
3.	Water Quality	- All physio-chemical & biological parameters - Heavy Metals and all physio-chemical & biological parameters	Outflow of retention pond to the creek (at least 3 sampling points/mixing point: discharge water, upstream water, and downstream water)	- Quarterly (All Parameters) - Every month: (Water temperature, pH, SS, DO,	Project Proponent

S.No.	Aspect	Monitoring Methods and Parameters	Impact Source/Location	Frequency	Responsible Organization
Operation Phase					
		Heavy Metals and all physio-chemical & biological parameters		BOD ₅ , COD, color and odor)	
4.	Waste Management	Amount of non-hazardous and hazardous waste management	Each plot	Twice/year (submission of the environmental report by the plot owner)	Plot Owner
5.	Noise and Vibrations	Noise levels compliance with respect to industrial standards	- Ambient Equivalent continuous Sound Pressure Levels (Leq) at day and Night time at 6 to 8 locations - Plant periphery and near noise generation sources	One time each in the dry and rainy seasons (first 3 years after starting the operation stage)	Individual Industrial units
6.	Soil Contamination	Status of control of solid and liquid waste which causes soil contamination	Each Plot	Twice/year (submission of the environmental	Individual Industrial Units

S.No.	Aspect	Monitoring Methods and Parameters	Impact Source/Location	Frequency	Responsible Organization
Operation Phase					
				report by the plot owner)	
7.	Biological Environment	Survival rate of plants and shrubs at individual unit and in economic zone	Horticulture/ Greenbelt Development	Quarterly	Individual Industrial Unit and project proponent
8.	Offensive Odor	Status offensive odor control by the tenants	Each Plot	Twice/year (submission of the environmental report by the plot owner)	Individual Industrial Unit
9.	Hydrology	Checking the function of retention pond at heavy rain.	Retention Pond	During heavy rain	Project Proponent
10.	Living and Livelihood/ Vulnerable Group/	The implementation status for corporate social responsibilities	Around project site	Once/year	Project proponent

S.No.	Aspect	Monitoring Methods and Parameters	Impact Source/Location	Frequency	Responsible Organization
Operation Phase					
	Misdistribution of Benefit	activities such as community support program			
11.	Risks for Infectious Disease such as AIDS/HIV	Status of measures against infectious diseases	Each plot	Twice/year (Submission of the environmental report by the plot owner)	Plot owner and project proponent
12.	Occupational health and safety	Record of accidents and infectious diseases	Work site and office	Twice/year (Submission of the environmental report by the plot owner)	Plot owner and project proponent
13.	Usage of chemicals	Record of the type and quantity of chemicals and implementation status of control measures through self-inspection	Each industry that uses chemicals	Biannually	Individual Industrial Unit

9 Conclusion and Recommendation

9.1 Conclusion

As to the results of the EIA study for the industrial estate of Dhabeji Special Economic Zone project, the following items are found:

- In terms of living environment, most of the impacts are controlled and limited in and around the project area. The key significant impacts such as emission of air pollutants and dust, deterioration of water quality, generation of noise and vibration are expected. However, implementation of appropriate mitigation measures and management plan, such as to spray water to bare areas for dust prevention and to avoid the incentive operation of the construction machinery for prevention of emission air pollutants, noise and vibration during construction phase.
- In the context of natural environment, the key negative impact is the clearance of existing vegetation during construction phase, though there is no sensitive ecological protection area. However, implementation of appropriate mitigation measures, such as planting trees, vegetation in public spaces as soon as possible and keeping the environmental conditions along the existing water bodies shall minimize the impact on the ecosystem.
- Reference to social environment, land acquisition and some scale of involuntary resettlement are expected. Impact on livelihood of the Project-Affected Persons (PAPs) including vulnerable people and children is also expected during the pre-construction, construction and operation phase. Toward this issue, the resettlement framework of the Dhabeji Special Economic Zone (DSEZ) (1530 acres) shall be prepared that includes compensation and assistance package and income restoration program for the PAPs and shall be conducted by China SEZ Management Committee (CSMC), that shall mitigate the impacts of the Project on social environment. There are total four villages (*Goths*) are located around DSEZ, viz., *Allah Dino*, *Phinnu Goth*, *Nabi Bakhsh Baloch*, and *Gabool Goth*. The residents must be resettled according to Land Acquisition Act of 1894.

On the other hand, some positive impacts of the Project such as increase in job opportunity and improvement of social infrastructure are also expected.

- In terms of health and safety, some impacts on occupational/community health and safety and increase in number of accidents are expected. However, implementation of appropriate mitigation and management plan, such as to manage working conditions during the construction work and to provide security and maintain safety prevention measures during construction/operation phase shall minimize these impacts.
- In consideration of the result of the EIA study for the Project, the Environmental Management Plans (EMPs) including adequate mitigation measures to reduce the significant impacts and Environmental Monitoring Plan (EMoP) are proposed for each phase of the Project: pre-construction phase, construction/closing phase, and operation phase.

9.2 Recommendations

Recommendations made for the project development on the basis of EIA study are given below:

- The green buffers as proposed should be adequately maintained as they shall be provide aesthetic value to the area.
- *Lat* and *Jhorewalo Nullah* should be retained in its natural position, leaving some space no development zone in both the sides throughout the length of the *Nullah* passing through the site.
- Proposed environment management plan should be implemented strictly both during operation and construction phase of the project.
- Alternative plantation should be carried out in case of termination of trees.
- Old indigenous plants must be protected and if unavoidable to cut a scientific transplantation is required.
- Proper re-compensation must be paid to the legal residents according to current rate. It is better to adjust these villages (*Goth*) as it is or transformed these into legal colonies.
- Suggestions and requests made by local population for employment shall be taken into serious consideration.
- Proper training of maintaining environment, health and safety should be given to Project management unit in both construction an operation phase.
- Provision of thick green belt, CETP, STP, segregated storm water shall be adhered.

- Rain water harvesting should be carried out to reduce the pressure on surface and ground water resources during both construction and operation phase.
- Environmental monitoring should be conducted as proposed in environment management plan.