

Wind Power Project – Sindh
**Environmental
Impact Assessment**

Final updated Report
Ref.: FRT10V09ZEA

April 2010

Prepared for
ZORLU ENERJI

Élan Partners (Pvt) Ltd

239, Street # 35, Sector F-10/1 Islamabad

Tel.: +92 (51) 229 1012- 13 • Email: mail@elan.com.pk , Web: www.elan.com.pk

Report disclaimer:

Élan Partners has prepared this document in accordance with the instructions of WAPDA for its sole and specific use. Any other persons, companies, or institutions who use any information contained herein do so at their own risk.

Executive Summary

ZORLU ENERJI is considered to be one of the experienced members of electricity generation and distribution market of the world. With presence in many countries of the world; ZORLU decided to enter the renewable energy sector of Pakistan by submitting an EOI for installing a proposed with the AEDB (Alternative Energy Development Board) established by Govt of Pakistan.

This executive summary explains the need for the wind farm, describes its location, main components and different stages, as well as summarizing the EIA process and key findings.

The recent interest in wind energy in the world has been attributed to several factors. **First**, a general, international, and scientific consensus of the climate-altering effects of greenhouse gas emissions has renewed interest in development of low- and zero-emission, renewable sources of energy, such as wind. **Second**, volatility has increased in the markets for energy sources upon which most of the countries are reliant. Instability in the world's oil-producing regions has pushed oil prices to record high levels, elevating the cost of petrol, diesel and heating oil. **Third** and perhaps due in part to the foregoing factors, federal and provincial clean energy incentives recently have been established. **Finally**, global demand for energy is projected to increase, while the supply of traditional energy sources—such as fossil fuels—is not. The prospect of energy demand exceeding supply has further motivated the development of alternative energy technologies, including wind turbines in the third world country like Pakistan.

The Pakistani Government is committed to achieving a reduction in 'greenhouse' gas emissions to address global warming and has set a target of 700 MW of the country's energy requirements being met by renewable energy sources by 2010. The higher target of 700 MW for Pakistan is partly a reflection of the greater wind resource. The proposed wind farm at Jhimpir would assist in contributing towards meeting these targets. High wind energy potential, favourable geographical positions, existing transportation network, availability of labour are the most important advantages for the wind farm development in Jhimpir area.

ZORLU ENERJI proposed to develop a wind farm at Jhimpir area of Sindh province with a generation capacity of 50 MW. The proposal involves development of a wind farm in two phases. In the first phase a total of 5 Vensys 1.2 MW turbines will be installed and then in the second phase 29 Vensys 1.5 MW turbines will be installed. All these 34 turbines will be connected to a sub station with an under ground power cable. The sub station is planned to be connected to national grid system of HESCO/NTDC.

During the construction phase, the selected site would be cleared and levelled for installation, temporary storage and storage of wind turbine components and other construction materials. At the start of the construction stage, the site area will be felled in the main development area, leaving the trees on the perimeter to provide noise and dust attenuation during the construction stage. A short length of on-site access track will be formed in the site area, using locally available stone, in order to access the main construction site. The remainder of the on-site access tracks to link the turbines will then be constructed. A temporary construction compound area is likely to be formed adjacent to the existing track to the site, to

accommodate the construction stage site office and provide lay-down and storage facilities. The access tracks will be left in place on completion of the construction stage, to allow access for maintenance and repairs of wind turbines at later stages. During this phase, Impacts will primarily relate to the civil works period, and less intensive impact is expected during erection of the equipment and trial operation.

The wind turbines will have an operational lifespan of 20-25 years. The ZORLU wind farm would be using state of the art remote administration systems of monitoring and controlling the operation of the WF. During the operational phase, the site will require inspection and maintenance visits by operations staff. Extended visits for servicing, typically every six months, will also be required, and it may be necessary to transport heavy equipment and materials to the site during such maintenance works.

If the ZORLU intends to stop their business operations in Pakistan, decommissioning will follow at the end of the wind farm's operational stage, with the removal of the turbines and other above ground structures and subsequent restoration of the ground.

The Pakistan Environmental Protection Act of 1997 is the apex environmental legislation in the country governing the whole process, whereas the Operational Policy (OP) 4.01 provides the WB's safeguard framework, ADB Safeguard Policy and IFC's Performance Standards on Social and Environmental Sustainability relevant to the proposed project. This EIA report incorporates social, environmental and safety guide lines and procedures of Pak-EPA and relevant WB-Ops (Operational Policies) and IFC's PS.

Potential impacts and mitigation measures are suggested as per the activities at the project site. Like at this stage, when only the site survey and base line data have been carried out. Thus, there is no major impact occur this stage. But, during the construction phase, the project is likely to have had a minimal negative impact on the current vegetation at the project area. There is no significant wildlife in the study area; therefore the project is not expected to have any impacts on wildlife.

Air pollution may be generated by exhaust fumes from construction equipment and transport. Therefore, water sprinkling could be used to monitor and control dust problems. The project area is mostly stony; therefore water sprinkling was not required during construction of phase- I. Accordingly it is expected that water sprinkling will not be needed in phase-II as well. All equipment used to transport materials to the site should be regularly inspected and maintained.

A certain degree of noise would be generated from the construction activities such as earth work and heavy vehicles plying the route leading to and from the project site. Therefore, it is recommended to utilize hydraulic piling to minimize the impact from piling activities. The vehicles and machinery used should be properly maintained so that there will be no excessive noise emission. All works should be limited to daylight hour (0700 – 1900 Hrs).

Solid waste management in the site area will require due consideration in all the phases of project construction and operation. The sources of solid waste are from the construction and workers' camp. At the time of the construction when work force mobilizes to the site, plans for solid waste collection should have already been drawn up. For construction waste, proper bins and recycle bins should be provided. A separate holding area should be allocated to accommodate the storage of solid waste. This holding area will serve as the central drop-off

and pick-up point for waste collection throughout the construction period. Burning of waste will not be permitted. Hazardous waste must be segregated for disposal by certified scheduled waste contractors. And that is carefully to be shifted to remote and approved waste disposal site.

Construction site is a dangerous place for public and workers. Health and safety manual should be provided for workers to avoid mishaps and health problems. A health safety manual has been developed by Zorlu that includes an adequate safety plan, and is attached at **Appendix A**. Periodical safety parades and drills are suggested to be the part of the safety management plan of the WF.

The issue that has a pure socio-economic dimension would be the potential for conflict between immigrant workers and the local population. To overcome this issue, local available social capital be utilized and in case of non availability of the required skills, immigrant workers be provided the chances. More over all immigrant workers shall be provided with appropriate residential area (either by the contractor or principal) which may be confined within a restricted area. Estimates of workers expected to be employed is provided in the **Section 6.3** of this report. Public access to this area should be limited to the contractor and relevant government agencies. The movement of workers during their off days should also be monitored and recorded.

An Environmental Management Plan (EMP) has been designed to ensure that all the mitigation measures and guidelines recommended for the project will be adhered to. A detailed EMP plan is at **Section 9** of the report

Public Consultation were made to in and around the project area to ascertain the attitudes and opinions concerning wind farm in the area, attitudes to specific aspects of wind energy, including visual, environmental, social and economic dimensions and ; acceptance of wind farms at local level. The over all results of the public consultations are encouraging. The study indicates that overall attitude towards wind farms is almost entirely positive. Majority of the people are in favour for having a wind farm in their area. The general public was found to be less concerned in terms of environmental impacts of the wind farm. The inhabitants living in nearby villages do not in general consider that there would be any adverse impact on the scenic beauty of the area or on the wildlife. Very few residents raised some concerns over the employment opportunity in the project. However ZORLU is providing employment to local personnel as much as possible (details are in **Section 6.3**) The attitude of the entire community member was very encouraging in terms of talking of ZORLU as a whole; it is perceived by the assessment team that during the initial stages of the wind farm proposal development; visits of the site by the ZORLU officials have created a good rapport among them. They were supportive and were of the view that the wind farm project must go a head. As a whole, community members were welcoming the initiatives by ZORLU ENERJI to establish a wind farm. There is interest among number of local communities in having more wind farm sites developed in the project area; if ZORLU wants it to develop.

Conclusion:

The development of the proposed wind farm will expand the economic activities, create job opportunity, and will be helpful in economic and social up-lift of the area. This report has identified the significant impact that may arise and appropriate mitigation measures have

been suggested. The consultant is of the view that if all the mitigation measures are carried out, there will be no impacts.

A separate ESA is recommended prior the construction of proposed transmission line between WF and HESCO/NTDC system in order to ascertain the environmental and social impacts. However this will be the responsibility of NTDC/HESCO.

Acronyms

| | |
|-----------------|---|
| AD | Anno Domini |
| ADB | Asian Development Bank |
| AEDB | Alternative Energy Development Board |
| AKPBS | Aga Khan Planning and Building Services |
| BC | Before Christ |
| BHU | Basic Health Unit |
| BOD | Biochemical Oxygen Demand |
| CITES | Convention on International Trade in Endangered Species |
| CO _x | Oxides of Carbon |
| CPI | Community Physical Infrastructure. |
| CSR | Corporate Social Responsibility |
| dB | Decibel (unit of sound) |
| DDO | Deputy District Officer |
| DFI | Development Financial Institution |
| DO | Dissolved Oxygen |
| EA | Environmental Assessment |
| EIA | Environmental Impact Assessment |
| ECA | Employment of Child Act |
| EMP | Environmental Management Plan |
| EPA | Environmental Protection Agency |
| ESA | Environmental and Social Assessment |
| FAO | Food and Agriculture Organization |
| FY | Financial Year |
| GAO | Government Accountability Office USA |
| GHG | Greenhouse Gases |
| GWh | Giga Watt Hour |
| HESCO | Hyderabad Electric Supply Company |
| IEE | Initial Environmental Examination |
| IRS | International Ramsar Site |
| KB | Kalri Baghar |

| | |
|--------|---|
| Km | Kilometers |
| KV | Kilo Volt |
| kW | Kilo Watts |
| LAA | Land Acquisition Act |
| LOI | Letter of Interests |
| LOS | UN Convention on the Law of Seas |
| m/s | Meter Per Second |
| MAF | Million Acre Feet |
| MARPOL | Convention for the Prevention of Pollution from Ships |
| MEAs | Multilateral Environmental Agreements |
| MW | Mega Watt |
| NEQS | National Environmental Quality Standards |
| NGOs | Non Governmental Organizations |
| NOx | Oxides of Nitrogen |
| NRSP | National Rural Support Program |
| NTDC | National Transmission and Dispatch Company |
| NWFP | North Western Frontier Province |
| O&M | Operation and Maintenance |
| OP | Operational Policy |
| PAPs | Project Affected Persons |
| PARC | Pakistan Agricultural Research Council |
| PEPA | Pakistan Environmental Protection Agency |
| PEPC | Pakistan Environmental Protection Council |
| PFFF | Pakistan Fisher Folk Forum |
| PM | Particulate Matter |
| POPs | Stockholm Convention on Persistent Organic Pollutants |
| PPAF | Pakistan Poverty Alleviation Fund |
| PPC | Pakistan Panel Code |
| RH | Relative Humidity |
| RHC | Rural Health Centre |
| RPM | Rotations Per Minute |
| SCARP | Salinity Control and Reclamation Project |

| | |
|-----------------|--|
| SO _x | Oxides of Sulphur |
| SPO | Strengthening Participatory Organization |
| SS | Suspended Solid |
| TDS | Total Dissolved Solids |
| UNFCCC | UN Framework Convention on Climate Change |
| US | United States |
| USA | United States of America |
| USAID | United States Agency for International Development |
| WB | World Bank |
| WF | Wind Farm |
| WT | Wind Turbine |
| WTG | Wind Turbine Generator |

Table of Contents

| | | |
|----------|---|------------|
| 1 | Introduction | 1-1 |
| 1.1 | Project Proponent | 1-1 |
| 1.2 | Project Background and Justification | 1-1 |
| 2 | Policy, Legal and Administrative Framework | 2-1 |
| 2.1 | Existing Laws and Regulations | 2-1 |
| 2.2 | Obligations under International Treaties | 2-5 |
| 2.3 | Institutional Setup for Environmental Management | 2-6 |
| 2.4 | Environmental and Social Guidelines | 2-6 |
| 3 | Analysis of Project Alternatives | 3-1 |
| 3.1 | Management Alternatives | 3-1 |
| 3.2 | Technical Alternatives | 3-1 |
| 3.3 | Renewable Based Energy Generation (wind & solar) | 3-2 |
| 3.4 | Wind Energy as Proven Clean Renewable Energy Source | 3-2 |
| 3.5 | Justification of the Project | 3-2 |
| 4 | Project Details | 4-1 |
| 4.1 | Project Proposal | 4-1 |
| 4.2 | Project Site | 4-2 |
| 4.3 | Reason for Selecting Jhimpir Site | 4-3 |
| 4.4 | Use of Land Corresponding to Project Site | 4-3 |
| 4.5 | Environment, Geographical and Cultural Scenario | 4-4 |
| 4.6 | Nearest Water Reservoir-Keenjhar Lake | 4-4 |
| 4.7 | Wind Farm Details | 4-5 |
| 4.8 | Type of Wind turbines to be used at WF ZORLU | 4-8 |
| 4.9 | Cooling System of Vensys WTG | 4-10 |
| 4.10 | Vensys Platform Specifications | 4-11 |
| 4.11 | Construction Phase of Wind Farm | 4-12 |
| 4.12 | Operation Phase of ZORLU Wind Farm | 4-13 |
| 4.13 | Decommissioning Phase of ZORLU wind Farm | 4-14 |
| 5 | Description of the Environment | 5-1 |
| 5.1 | Physical Environment | 5-1 |

| | | |
|----------|---|------------|
| 5.2 | Biological Resources | 5-6 |
| 5.3 | Geographical and Environmental Scenario of Project Area in Particular | 5-10 |
| 6 | Description of the Socioeconomic Conditions | 6-1 |
| 6.1 | Socioeconomic Description of Sindh in General | 6-1 |
| 6.2 | Socio Economic Condition of Project Area | 6-6 |
| 6.3 | Employment Opportunities Associated with the Project | 6-7 |
| 6.4 | ZORLU Wind Farm and Tourism | 6-7 |
| 6.5 | Benefits to women due to the project | 6-8 |
| 7 | Environmental Assessment | 7-1 |
| 7.1 | General | 7-1 |
| 7.2 | Methodology of Environmental Assessment | 7-1 |
| 7.3 | Findings of the Environmental Assessment | 7-2 |
| 7.4 | Environmental Issues Identified | 7-2 |
| 7.5 | Noise | 7-5 |
| 7.6 | Health and Safety | 7-8 |
| 7.7 | Shadow/Flickering Effect | 7-10 |
| 7.8 | Visibility | 7-12 |
| 7.9 | Atmospheric emissions | 7-13 |
| 7.10 | Clearing of land for road and building construction | 7-13 |
| 7.11 | Transportation Route of Equipments at Site | 7-14 |
| 7.12 | Foundations of Tower and Cranes Plate form Construction | 7-15 |
| 7.13 | Tower assembly and installation | 7-15 |
| 7.14 | Wild life Disturbance | 7-16 |
| 7.15 | Maintenance activities at later stages | 7-16 |
| 7.16 | Global environment Issues | 7-17 |
| 7.17 | Historical Heritage | 7-18 |
| 7.18 | Solid Waste Management | 7-18 |
| 8 | Monitoring and Follow-up Measures | 8-1 |
| 8.1 | General | 8-1 |
| 8.2 | Environmental Trainings for Field Staff | 8-1 |
| 8.3 | Environmental and Residual Impacts Classification | 8-1 |
| 9 | Environmental Management Plan | 9-1 |
| 9.1 | Purpose and Objectives of EMP | 9-1 |

| | | |
|-----------|---|-------------|
| 9.2 | Components of the EMP | 9-1 |
| 9.3 | Organizational Structure, Roles and Responsibilities | 9-2 |
| 9.4 | Mitigation Plan | 9-3 |
| 9.5 | Monitoring Plan | 9-4 |
| 9.6 | Communication and Documentation | 9-6 |
| 9.7 | Environmental and Social Trainings | 9-7 |
| 9.8 | Change Management | 9-8 |
| 9.9 | Cost of Environmental Management | 9-9 |
| 10 | Public Consultations | 10-1 |
| 10.1 | General | 10-1 |
| 10.2 | Objectives | 10-1 |
| 10.3 | Identification of the Stake Holders | 10-1 |
| 10.4 | Institutional Consultations | 10-2 |
| 10.5 | Consultation Process | 10-2 |
| 10.6 | Consultation in the Project Area (Grass root level) | 10-3 |
| 10.7 | Participation in Consultations | 10-3 |
| 10.8 | Details of Consultations | 10-4 |
| 10.9 | Summary of Expectation of Stake Holders during Consultation Process | 10-6 |
| 10.10 | Summary of Concerns of Stake Holders during Consultation Process | 10-7 |
| 10.11 | Conclusion | 10-7 |

Appendices

| | | |
|--------------------|---------------------------------------|------------|
| Appendix A: | HSE Plan | A-1 |
| Appendix B: | Details of Public Consultation | B-1 |
| Appendix C: | Photographs | C-1 |
| Appendix D: | Project Team | D-1 |
| Appendix E: | Maps | E-1 |
| Appendix F: | Land Lease Agreement | F-1 |

List of Exhibits

| | |
|--|-------|
| Exhibit 1-1: Projection of Power Demand Growth - Pakistan | 1-3 |
| Exhibit 1-2: Population, Income and Electricity Consumption, HESCO | 1-3 |
| Exhibit 2-1: Selected NEQS for Waste Effluents | 2-12 |
| Exhibit 2-2: NEQS for Industrial Gaseous Emissions | 2-13 |
| Exhibit 2-3: NEQS for Motor Vehicles Exhaust and Noise | 2-14 |
| Exhibit 2-4: WHO Ambient Air Quality Standards | 2-14 |
| Exhibit 2-5: WHO Drinking Water Quality Standards..... | 2-15 |
| Exhibit 4-1: Location of the WF and the Proposed Substation and Transmission Line... | 4-1 |
| Exhibit 4-2: Wind Power Classification Map | 4-2 |
| Exhibit 4-3: Map of Keenjhar Lake..... | 4-7 |
| Exhibit 4-4: Crane Docking Area..... | 4-8 |
| Exhibit 4-5: Main Components of Vensys Wind Tower..... | 4-9 |
| Exhibit 4-6: Turbine cooling system | 4-9 |
| Exhibit 4-7: Vensys Pitch System Maintenance Free | 4-10 |
| Exhibit 4-8: Very Effective Tower Cooling System | 4-11 |
| Exhibit 4-9: Vensys Platform Specifications | 4-11 |
| Exhibit 4-10: Tentative Construction Schedule..... | 4-12 |
| Exhibit 5-1: Land Use in Sindh..... | 5-14 |
| Exhibit 5-2: Meteorological Data – Mean Monthly Maximum Temperatures | 5-14 |
| Exhibit 5-3: Meteorological Data – Mean Monthly Minimum Temperatures | 5-15 |
| Exhibit 5-4: Meteorological Data – Relative Humidity..... | 5-15 |
| Exhibit 5-5: Ambient Air Quality in Urban Centers..... | 5-16 |
| Exhibit 5-6: Indus River and its Tributaries ^a | 5-16 |
| Exhibit 5-7: Key Facts about Indus River ^a | 5-17 |
| Exhibit 5-8: Water Flow in Indus River..... | 5-17 |
| Exhibit 6-1: Literacy Ratio in Project Area (1998 Census Data) | 6-6 |
| Exhibit 7-1: Noise Emission Level and Comparison | 7-7 |
| Exhibit 7-2: ZORLU wind farm Noise Map..... | 7-8 |
| Exhibit 7-3: Shadow Map of ZORLU Wind Farm | 7-12 |
| Exhibit 8-1: Summary of Environmental Impacts (Mitigated)..... | 8-2 |
| Exhibit 8-2: Classification of the Residual Impacts | 8-6 |
| Exhibit 9.1: Organizational Structure for Environmental Management..... | 9-10 |
| Exhibit 9.2: Responsibilities of Zorlu, ESI and Contractors | 9-11 |
| Exhibit 9.3: Mitigation Plan..... | 9-12 |
| Exhibit 9.4: Effects Monitoring Plan for Construction Period | 9-24 |
| Exhibit 9.5: Cost of Environmental Management | 9-25 |
| Exhibit 10-1: Followed Public Consultation Framework..... | 10-9 |
| Exhibit 10-2: Checklist of Diversity Categories of Stakeholders..... | 10-10 |
| Exhibit 10-3: Participation of the Villagers in Consultations | 10-10 |

1 Introduction

The Alternative Energy Development Board (AEDB), established in May 2003 by the Government of Pakistan for harnessing abundant available renewable energy resources has issued a number of letter of interests (LOIs) to perspective national and international investors for development of wind power plants at Jhimpir area of Sindh.

One of such LOIs has also been issued to M/S ZORLU ENERJI (“ZORLU”) Turkey based development, investment and independent Power Production Company. The ZORLU is in the process of development of bankable documents for about 49.5 MW wind farm at Jhimpir area of Sindh costal belt. In line with the prevailing legislation in the country and Development Financial Institutions (DFIs) including the World Bank (WB), International Finance Corporation (IFC), Asian Development Bank’s (ADB) safeguard policies; an Environmental Impact Assessment (EIA) of the project has to be carried out.

Accordingly the report in hand is an EIA of the proposed Wind Farm (WF). However, since all the development is targeted to social benefits to the local population in particular and general public of the country in general, it is essential that those social aspects of the project development are also looked into in detail. That is why during the developmental phase of this EIA, social aspect has also been focused; but its scope has been reduced to the proposed project area and surroundings only.

1.1 Project Proponent

ZORLU ENERJI (“ZORLU”) Turkey based development, investment and independent power production company, provides uninterrupted, high-quality and low-cost electrical energy to nearly 300 industrial and commercial users concerns by three natural gas combined cycle power plants (90 MW in Bursa, 55 MW in Ankara, and 154 MW in Kayseri) and a 66 MW cogeneration plant in Lüleburgaz that together give the company a total installed generation capacity of 365 MW. Two more cogeneration plants that were completed and commissioned in late 2005 increased the total installed generation capacity of ZORLU to 387 MW.

ZORLU decided to enter the global market of wind power by taking the opportunity of Pakistan’s present energy demand and supply situation and the investment friendly initiatives taken by the AEDB¹.

1.2 Project Background and Justification

Pakistan as a whole is an energy-deficient country and per capita electricity generation has traditionally been low (581 kWh as against the World average of 2,657 kWh²). The electricity demand in the country has grown at a rapid pace since 1985. Consumption of electricity increased from 17,608 GWh in 1985 to 55,507 GWh in 2004, representing an annual average growth rate of 6.2%. The growth in the electricity demand has however been uneven over the years. The consumption grew at a rate of 11% during 1985-99, the growth rate slowed down

¹ www.bdi-online.de/Dokumente/Internationale-Maerkte/Pakistan_BD_112007_Praes__Hamid.pdf

² Source: World Bank, Medium Term Development Framework 2005-10.

to 6.9% during 1990-95 and 2.5% during 1996-2000. Since the year 2000 however, the trend has reversed and electricity demand has showed an upward trend, mirroring the overall economic growth in the country.

The country has witnessed an economic boom since last five years. Consequently power demand has also grown at a faster rate of about 10% during the last FY 2006. Preliminary data for current year (not yet published) indicates that this year power demand is expected to grow at an expected rate of more than 11%.

The electricity demand in the country is projected to grow at an annual compound growth rate of 7.9% during the period 2005-10, and increase from 15,500 MW in 2005 to 21,500 MW in 2010, as shown in **Exhibit 1.1**. This growth has been projected on the basis of increase both in population and per capita income; **Exhibit 1.2** presents the linkage between the increasing population, per capita income and electricity consumption.

The proposed power plant is located in the operational jurisdiction of Hyderabad Electric Supply Company (HESCO); and Phase-I of it is connected to 11 kV and Phase- II will be connected with the existing 132 kV transmission line network of HESCO which about 1400 meters from switch room to Jhampir grid station. HESCO is the only distribution company that is solely responsible for the distribution of electricity across Sindh except Karachi

HESCO is also facing shortfall of supply and difficulties in meeting the increasing demand of electricity In order to meet this increasing demand, power generation capacity in HESCO area has to be augmented with addition of new power plants, besides massive capacity addition in the overall system.

The proposed WF has been promoted by the Government of Pakistan through its Alternative Energy Development Board (AEDB) which has proposed the land, which a size of almost 1,148 acres, and issued the development license. The choice of the land is a result of a thorough selection process with respect to wind conditions, grid availability, availability of big consumers etc. It has therefore the full support of the government and is most likely to be one of the first projects in Pakistan. Land lease signed with AEDB is attached at **Appendix- F**

The project site is located about 100 km southeast of Karachi. The site is located in a flat rocky area and is about 50m above sea level. Access to the site is possible through well prepared public roads as well as by using the rail way.

Exhibit 1-1: Projection of Power Demand Growth - Pakistan

| Year | Total Demand (MW) |
|---------|-------------------|
| 2005-06 | 15,500 |
| 2006-07 | 16,600 |
| 2007-08 | 17,900 |
| 2008-09 | 19,600 |
| 2009-10 | 21,500 |

Table borrowed from NEPRA's State of the Industry Report – 2005
(Source: Mid Term Development Framework).

Exhibit 1-2: Population, Income and Electricity Consumption, HESCO

| Year | Population (Million) | Per Capita Income (Rs) | Energy Sale (GWh) | Per Capita Energy Consumption (kWh) |
|---------|----------------------|------------------------|-------------------|-------------------------------------|
| 2000-01 | 24.40 | 18,000 | 3,722 | 151 |
| 2001-02 | 24.90 | 19,440 | 3,871 | 153 |
| 2002-03 | 25.42 | 20,995 | 4,026 | 156 |
| 2003-04 | 25.94 | 22,675 | 4,187 | 159 |
| 2004-05 | 26.47 | 24,489 | 4,354 | 162 |
| 2005-06 | 27.02 | 26,448 | 4,529 | 165 |
| 2006-07 | 27.58 | 28,564 | 4,710 | 169 |
| 2007-08 | 28.14 | 30,849 | 4,898 | 172 |
| 2008-09 | 28.72 | 33,317 | 5,094 | 175 |
| 2009-10 | 29.32 | 35,982 | 5,298 | 178 |

Source: Table-5. PC1 Proforma 6th STG Programme, Sub Transmission Lines and Grid Stations, 2003-04 to 2007-08. HESCO September 2004.

2 Policy, Legal and Administrative Framework

This Chapter discusses the policy, legal and administrative framework as well as institutional set-up relevant to the environmental and social assessment of the proposed project. In this chapter environmental and social guidelines from the national agencies as well as international donors and other organizations are also included.

2.1 Existing Laws and Regulations

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

2.1.1 Pakistan Environmental Protection Act, 1997

The Pakistan Environmental Protection Act, 1997 (the Act) is the basic legislative tool empowering the government to frame regulations for the protection of the environment (*the 'environment' has been defined in the Act as: (a) air, water and land; (b) all layers of the atmosphere; (c) all organic and inorganic matter and living organisms; (d) the ecosystem and ecological relationships; (e) buildings, structures, roads, facilities and works; (f) all social and economic conditions affecting community life; and (g) the inter-relationships between any of the factors specified in sub-clauses 'a' to 'f'*). The Act is applicable to a broad range of issues and extends to socioeconomic aspects, land acquisition, air, water, soil, marine and noise pollution, as well as the handling of hazardous waste. The discharge or emission of any effluent, waste, air pollutant or noise in an amount, concentration or level in excess of the National Environmental Quality Standards (NEQS) specified by the Pakistan Environmental Protection Agency (Pak-EPA) has been prohibited under the Act, and penalties have been prescribed for those contravening the provisions of the Act. The powers of the federal and provincial Environmental Protection Agencies (EPAs), established under the Pakistan Environmental Protection Ordinance 1983,³ have also been considerably enhanced under this legislation and they have been given the power to conduct inquiries into possible breaches of environmental law either of their own accord, or upon the registration of a complaint.

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

³ Superseded by the Pakistan Environmental Protection Act, 1997.

The requirement of conducting an environmental examination of the proposed project emanates from this Act.

2.1.2 Pakistan Environmental Protection Agency Review of IEE and EIA Regulations, 2000

The Pakistan Environmental Protection Agency Review of IEE and EIA Regulations, 2000⁴ (the 'Regulations'), developed by the Pak-EPA under the powers conferred upon it by the Act, provide the necessary details on preparation, submission and review of the IEE and the EIA. Categorization of projects for IEE and EIA is one of the main components of the Regulations. Projects have been classified on the basis of expected degree of adverse environmental impacts. Project types listed in Schedule I are designated as potentially less damaging to the environment, and those listed in Schedule II as having potentially serious adverse effects. Schedule I projects require an IEE to be conducted, provided they are not located in environmentally sensitive areas. For the Schedule II projects, conducting an EIA is necessary.

The development of wind farm is first of its kind in the country therefore it is not included either in Schedule I or Schedule II. However the project is only five kilometers from the environmentally sensitive area (Kinjher Lake) therefore the project developer decided to conduct EIA.

The construction of interconnecting transmission will be the responsibility of NTDC/HESCO and all environmental investigations are their responsibility.

2.1.3 National and International Environmental Standards

National Standards

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

- Maximum allowable concentration of pollutants (16 parameters) in gaseous emissions from industrial sources,
- Maximum permissible limits for motor vehicle exhaust and noise,
- For power plants operating on oil and coal:
 - ▶ Maximum allowable emission of sulfur dioxide,
 - ▶ Maximum allowable increment in concentration of sulfur dioxide in ambient air,
 - ▶ Maximum allowable concentration of nitrogen oxides in ambient air, and
 - ▶ Maximum allowable emission of nitrogen oxide for steam generators as function of heat input.
- Maximum allowable concentration of pollutants (32 parameters) in municipal and liquid industrial effluents discharged to inland waters, sewage treatment and sea (three separate set of numbers).

Selected NEQS for liquid effluents discharged to inland waters, gaseous emission from industrial sources and emissions from motor vehicles are provided in **Exhibits 2.1, 2.2** and

⁴ S.R.O. 339 (1)/2001. Pakistan Environmental Protection Agency, Islamabad. 2000.

2.3, respectively. These standards will be applicable to the gaseous emissions and liquid effluents discharged to the environment from the proposed project.

International Standards

The NEQS do not cover the ambient air quality or water quality standards. The international standards for ambient air quality and drinking water quality are presented in **Exhibits 2.4** and **2.5**, respectively.

For noise, the NEQS are limited to the vehicular noise. For noise generated by other sources, the WB standards are usually applied. The allowable noise limits per these standards are 55 dB(A) for daytime and 45 dB(A) for nighttime, measured at the receptor.

2.1.4 Land Acquisition Act, 1894

The Land Acquisition Act (LAA) of 1894 amended from time to time has been the de-facto policy governing land acquisition and compensation in the country. The LAA is the most commonly used law for acquisition of land and other properties for development projects. It comprises of 55 sections pertaining to area notifications and surveys, acquisition, compensation and apportionment awards and disputes resolution, penalties and exemptions.

Land for the facilities under the proposed project may be acquired using this Act (alternatively, the land may be directly purchased or obtained on lease/rental basis).

2.1.5 National Resettlement Policy / Ordinance

The Ministry of Environment, Local Government and Rural Development formulated a draft policy in 2004 on involuntary resettlement with technical assistance from ADB. The policy aims to compensate for the loss of income to those who suffer loss of communal property including common assets, productive assets, structures, other fixed assets, income and employment, loss of community networks and services, pasture, water rights, public infrastructure like mosques, shrines, schools and graveyards.

The government has also developed a document entitled "*Project Implementation and Resettlement of the Affected Persons Ordinance, 2002*", later referred to as the "*Resettlement Ordinance*", for enactment by provincial and local governments, after incorporating local requirements. The Ordinance, being a new law, shall be supplementary to the LAA as well as other laws of Pakistan, and wherever applicable under this policy. However, if necessary, appropriate amendments to the LAA 1894 will also be proposed to facilitate the application of the Resettlement Ordinance.

There has not been much progress on the enactment of the Resettlement Ordinance; hence this is not relevant for the proposed project.

2.1.6 Sindh Wildlife Protection Act, 1972

This law was enacted to protect the province's wildlife resources directly and other natural resources indirectly. It classifies wildlife by degree of protection, ie, animals that may be hunted on a permit or special license, and species that are protected and cannot be hunted under any circumstances. The Act specifies restrictions on hunting and trade in animals, trophies, or meat. The Act also defines various categories of wildlife protected areas, i.e., National Parks, Wildlife Sanctuaries and Game Reserve.

This Act will be applicable to the construction as well as operation and maintenance (O&M) activities of the proposed project. However since no wild life is effected due to the project therefore for all practical purposes this Act is not applicable to the project.

2.1.7 Canal and Drainage Act, 1873

The Canal and Drainage Act (1873) prohibits corruption or fouling of water in canals (defined to include channels, tube wells, reservoirs and watercourses), or obstruction of drainage. This Act will be applicable to the construction and O&M works to be carried out during the proposed project. However this has no relevance with the proposed project.

2.1.8 The Sindh Irrigation Act, 1879

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

This Act will be applicable to the construction as well as O&M activities of the proposed project. This also has no relevance with the proposed project.

2.1.9 Provincial Local Government Ordinances, 2001

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

2.1.10 Antiquity Act, 1975

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

Under this Act, the project proponents are obligated to:

- Ensure that no activity is undertaken in the proximity of a protected antiquity, and
- If during the course of the project an archeological discovery is made, it should be protected and reported to the Department of Archeology, Government of Pakistan, for further action.

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

2.1.11 Mines, Oil Fields and Mineral Development Act, 1948

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

2.1.12 Factories Act, 1934

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

2.1.13 Pakistan Explosive Act, 1884

This Act provides regulations for the handling, transportation and use of explosives during quarrying, blasting and other purposes.

2.1.14 Employment of Child Act, 1991

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

The project proponent and its contractors will be bound by the ECA to disallow any child labor at the project sites or campsites.

2.1.15 Pakistan Penal Code (PPC), 1860

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

2.2 Obligations under International Treaties

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

- Basel Convention,
- Convention on Biological Diversity, Convention on Wetlands (Ramsar),
- Convention on International Trade in Endangered Species (CITES),

- UN Framework Convention on Climate Change (UNFCCC),
- Kyoto Protocol,
- Montreal Protocol,
- UN Convention to Combat Desertification,
- Convention for the Prevention of Pollution from Ships (MARPOL),
- UN Convention on the Law of Seas (LOS),
- Stockholm Convention on Persistent Organic Pollutants (POPs),
- Cartina Protocol.

These MEAs impose requirements and restrictions of varying degrees upon the member countries, in order to meet the objectives of these agreements. However, the implementation mechanism for most of these MEAs is weak in Pakistan and institutional setup non-existent.

In order to address this state of affairs, the GoP has recently approved a PC1 for the establishment of the National MEA Secretariat under the Ministry of Environment in Islamabad. The Secretariat will handle and coordinate activities, and develop action plans for each MEA vis-à-vis the country's obligation under these agreements. The Secretariat will then be responsible to ensure implementation of these action plans. The Secretariat will also evaluate future MEAs and advise the Government for acceding (or otherwise) these agreements.

2.3 Institutional Setup for Environmental Management

The apex environmental body in the country is the Pakistan Environmental Protection Council (PEPC), which is headed by the Chief Executive of the Country. Other bodies include the Pakistan Environmental Protection Agency (Pak-EPA), provincial EPAs (for four provinces, AJK and Northern Areas), and environmental tribunals.

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

The proposed project is located in the Sindh Province. Hence this ESA report will be sent to the Sindh EPA for review. This report has been reviewed by SEPA and gave its concurrence in March 2009.

2.4 Environmental and Social Guidelines

Following sets of national and international guidelines are reviewed here:

- The Pak-EPA's guidelines
- The World Bank Safeguard Policies
- The ADB Safeguard Policies
- IFC Performance Standards on Social and Environmental sustainability

- IFC/WBG Environmental, Health and Safety Guidelines.

These guidelines address the environmental as well as social aspects relevant to the proposed project. The new versions of the World Bank Group Environmental, Health, and Safety Guidelines (known as the 'EHS Guidelines') are now in use. They replace those documents previously published in Part III of the Pollution Prevention and Abatement Handbook and on the IFC website. (Ref: <http://www.ifc.org/ifcext/sustainability.nsf/content/EnvironmentalGuidelines>).

2.4.1 Environmental Protection Agency's Environmental and Social Guidelines

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

- Guidelines for the Preparation and Review of Environmental Reports,
- Guidelines for Public Consultation,
- Guidelines for Sensitive and Critical Areas,
- Sectoral Guidelines.

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

2.4.2 WB Safeguard Policies⁵

The project has also been analyzed against the WB safeguard policies described in detail:

- OP 4.01 (Environmental Assessment)
- OP 4.04 (Natural Habitat),
- OP 4.09 (Pest Management),
- OP 4.10 (Indigenous People),
- OP 4.11 (Cultural Property),
- OP 4.12 (Involuntary Resettlement),
- OP 4.36 (Forestry),
- OP 4.37 (Safety of Dams),
- OP 7.50 (Projects in International Waters)

These policies are briefly reproduced below

OP 4.01 (Environmental Assessment)

This OP acts like an instrument to determine the nature and extent of all environmental concerns at proposed or existing project likely to be funded by the WB. This OP also deals

⁵ World Bank Operational Manual, September 1986 and June 2001

with the identification and justification of the mitigation measures suggesting the most appropriate measures indicating a time frame. This helps World Bank in ensuring that proposed projects are environmentally sound and sustainable and thus to improve decision making. The OP defines the EA process and various types of the EA instruments.

OP 4.04 (Natural Habitat)

This deals with the conservation of natural habitats, like other measures that protect and enhance the environment, is essential for long-term sustainable development. Through this OP, the Bank therefore supports the protection, maintenance, and rehabilitation of natural habitats and their functions etc. This OP also ensures the natural scenery of the project site to be conserved for a longer periods of project sustainability.

OP 4.09 (Pest Management)

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

OP 4.10 (Indigenous People)

This OP defines the process to be followed if the project affects the indigenous people. The policy requires that the proponents will develop an Indigenous People Development Plan and get it approved by the Bank, if such groups are identified during the project implementation.

OP 4.11 (Cultural Property)

The World Bank's general policy regarding cultural properties is to assist in their preservation, and to seek to avoid their elimination. Under this OP, the Bank normally declines to finance projects that will significantly damage non-replicable cultural property, and will assist only those projects that are sited or designed so as to prevent such damage.

OP 4.12 (Involuntary Resettlement)

If this guide line is left un dealt or met in under development projects, if unmitigated, often gives rise to severe economic, social, and environmental risks. OP 4.12 provides safeguards to address and mitigate these impoverishment risks.

OP 4.36 (Forestry)

The OP bounds the World Bank's borrowers to harness the potential of forests to reduce poverty in a sustainable manner, integrate forests effectively into sustainable economic development, and protect the vital local and global environmental services and values of forests.

OP 4.37 (Safety of Dams)

The OP deals with the appropriate measures to be taken and sufficient resources provided for the safety of dams the World Bank finances.

OP 7.50 (Projects in International Waters)

This OP deals with the safeguard policy of the different countries involved in a single project (over a geographical and or economical aspect), the Bank may proceed with a project in a disputed area if the governments concerned agree that, pending the settlement of the dispute, the project proposed for country X should go ahead without prejudice to the claims of country Y.

2.4.3 ABD Safeguard Policy 2009

The ADB's safeguard policy 2009 sets out the policy objectives scope and trigger, and principles for following three key safeguard areas:

- Environmental safeguard
- Involuntary resettlement safeguard and
- Indigenous people safeguards.

The objective and scope of above three key areas are briefly described as under

Environmental Safeguards

This policy element ensures the environmental soundness and sustainability of projects and supports the integration of environmental considerations into the project decision-making process. Environmental safeguards are triggered if a project is likely to have potential environmental risks and impacts.

Involuntary Resettlement Safeguards

This policy guideline encourages avoiding involuntary resettlement by exploring project and design alternatives; to enhance, or at least restore, the livelihoods of all displaced person in real terms relative to pre-project levels; and to improve the standards of living of the displaced poor and other vulnerable groups.

The involuntary resettlement safeguards covers physical displacement (relocation loss of residential land or loss of shelter) and economic displacement (loss of land assets, access to assets, income sources, or means of livelihoods) as a result of (i) involuntary restrictions on land use or on access to legally designated parks and protected areas. It covers them whether such losses and involuntary restrictions are full or partial, permanent or temporary.

Indigenous People Safeguards

This guides the project proponent to design and implement projects in a way that fosters full respect for indigenous peoples' identity, dignity, human rights, livelihood systems, and cultural uniqueness as defined by the indigenous peoples themselves so that they (i) receive culturally appropriate social and economic benefits, (ii) do not suffer adverse impacts as a result of projects, and (iii) can participate actively in projects that affect them.

The indigenous people's safeguards are triggered if a project directly or indirectly affects the dignity, human rights, livelihood systems or culture of indigenous peoples or affects the territories or natural or cultural resources that indigenous peoples own, use, occupy, or claim as an ancestral domain or asset. The term indigenous peoples are used in a generic sense to

refer to a distinct, vulnerable, social and cultural group possessing the following characteristics in varying degrees: (i) self-identification as members of a distinct indigenous cultural group and recognition of the identity by others; (ii) collective attachment to geographically distinct habits or ancestral territories in the project area and to the natural resources in these habits and territories; (iii) customary cultural, economic, social, or political institutions that are separate from those of the dominant society and culture; and (iv) a distinct language, often different form of the official language of the country or region. In considering these characteristics, national legislation, customary law, and any international conventions to which the country is a party will be taken into account. A group that has lost collective attachment to geographically distinct habits or ancestral territories in the project area because of forced severance remains eligible for coverage under this policy.

2.4.4 IFC-Environmental, Health and Safety Guidelines 2007

The project has also been analyzed against new World Bank Group's Environmental, Health and Safety Guidelines 2007, including:

- IFC/WBG EHS General Guidelines, April 30, 2007
- IFC/WBG EHS General Guidelines for Wind energy, April 30, 2007
- IFC/WBG EHS General Guidelines, for Electric Power transmission and Distribution, April 30, 2007.

These primarily deals with following aspects of EHS and where ever any issues are detected proper mitigation and monitoring mechanism has been suggested:

- Environmental
 - Air Emissions and Ambient Air Quality
 - Energy Conservation
 - Wastewater and Ambient Water Quality
 - Water Conservation
 - Hazardous Materials Management
 - Waste Management
 - Noise
 - Contaminated Land
- Occupational Health and Safety
 - General Facility Design and Operation
 - Communication and Training
 - Physical Hazards
 - Chemical Hazards
 - Biological Hazards
 - Radiological Hazards
 - Personal Protective Equipment (PPE)
 - Special Hazard Environments
 - Monitoring
- Community Health and Safety
 - Water Quality and Availability
 - Structural Safety of Project Infrastructure
 - Life and Fire Safety (L&FS)
 - Traffic Safety
 - Transport of Hazardous Materials
 - Disease Prevention
 - Emergency Preparedness and Response
- Construction and Decommissioning
 - Environment
 - Occupational Health and Safety
 - Community Health and Safety

2.4.5 IFC Performance Standards on Social and Environmental Sustainability 2006

The project has also been in to in the light of following performance standards:

- Performance Standard 1: Social and Environmental Assessment and Management System
- Performance Standard 2: Labor and Working Conditions
- Performance Standard 3: Pollution Prevention and Abatement
- Performance Standard 4: Community Health, Safety and Security
- Performance Standard 5: Land Acquisition and Involuntary Resettlement
- Performance Standard 6: Biodiversity Conservation and Sustainable Natural Resource Management
- Performance Standard 7: Indigenous Peoples
- Performance Standard 8: Cultural Heritage

Exhibit 2-1: Selected NEQS for Waste Effluents

| Parameter | Unit | Standards (maximum allowable limit) |
|--|------|-------------------------------------|
| Temperature increase | °C | < 3 |
| pH value (acidity/basicity) | pH | 6-9 |
| 5-day biochemical oxygen demand (BOD) at 20 °C | mg/l | 80 |
| Chemical oxygen demand (COD) | mg/l | 150 |
| Total suspended solids | mg/l | 200 |
| Total dissolved solids | mg/l | 3,500 |
| Grease and oil | mg/l | 10 |
| Phenolic compounds (as phenol) | mg/l | 0.1 |
| Chloride (as Cl) | mg/l | 1,000 |
| Fluoride (as F) | mg/l | 10 |
| Sulfate (SO ₄) | mg/l | 600 |
| Sulfide (S) | mg/l | 1.0 |
| Ammonia (NH ₃) | mg/l | 40 |
| Cadmium | mg/l | 0.1 |
| Chromium (trivalent and hexavalent) | mg/l | 1.0 |
| Copper | mg/l | 1.0 |
| Lead | mg/l | 0.5 |
| Mercury | mg/l | 0.01 |
| Selenium | mg/l | 0.5 |
| Nickel | mg/l | 1.0 |
| Silver | mg/l | 1.0 |
| Total toxic metals | mg/l | 2.0 |
| Zinc | mg/l | 5 |
| Arsenic | mg/l | 1.0 |
| Barium | mg/l | 1.5 |
| Iron | mg/l | 8.0 |
| Manganese | mg/l | 1.5 |
| Boron | mg/l | 6.0 |
| Chlorine | mg/l | 1.0 |

Source: Government of Pakistan (2000).

Notes:

The standard assumes that dilution of 1:10 on discharge is available. That is, for each cubic meter of treated effluent, the recipient water body should have 10 m³ of water for dilution of this effluent.

Toxic metals include cadmium, chromium, copper, lead, mercury, selenium, nickel and silver. The effluent should meet the individual standards for these metals as well as the standard for total toxic metal concentration.

Exhibit 2-2: NEQS for Industrial Gaseous Emissions

| Mg/Nm ³ unless otherwise stated | | |
|--|--|--|
| Parameter | Source of Emission | Standards (maximum allowable limit) |
| Smoke | Smoke opacity not to exceed | 40% or 2 Ringlemann Scale or equivalent smoke number |
| Particulate matter ¹ | (a) Boilers and furnaces: | |
| | i. Oil fired | 300 |
| | ii. Coal fired | 500 |
| | iii. Cement Kilns | 300 |
| | (b) Grinding, crushing, clinker coolers and related processes, metallurgical processes, converters, blast furnaces and cupolas | 500 |
| Hydrogen Chloride | Any | 400 |
| Chlorine | Any | 150 |
| Hydrogen fluoride | Any | 150 |
| Hydrogen sulphide | Any | 10 |
| Sulphur Oxides ^{2,3} | Sulfuric acid/Sulphonic acid plants | 5,000 |
| | Other Plants except power Plants operating on oil and coal | 1,700 |
| Carbon Monoxide | Any | 800 |
| Lead | Any | 50 |
| Mercury | Any | 10 |
| Cadmium | Any | 20 |
| Arsenic | Any | 20 |
| Copper | Any | 50 |
| Antimony | Any | 20 |
| Zinc | Any | 200 |
| Oxides of Nitrogen ³ | Nitric acid manufacturing unit | 3,000 |
| | Other plants except power plants operating on oil or coal: | |
| | i. Gas fired | 400 |
| | ii. Oil fired | 600 |
| | iii. Coal fired | 1,200 |

Source: Government of Pakistan (2000).

Explanations:

Based on the assumption that the size of the particulate is 10 micron or more.

Based on 1% sulphur content in fuel oil. Higher content of sulphur will cause standards to be pro-rated.

In respect of emissions of sulphur dioxide and nitrogen oxides, the power plants operating on oil and coal as fuel shall in addition to NEQS specified above, comply with the standards provided separately.

Exhibit 2-3: NEQS for Motor Vehicles Exhaust and Noise

| Parameter | Standards (maximum permissible limit) | Measuring Method |
|------------------|---|--|
| Smoke | 40% or 2 on the Ringlemann Scale during engine acceleration mode. | To be compared with Ringlemann Chart at a distance of 6 meters or more. |
| Carbon Monoxide. | New Vehicle = 4.5% Used Vehicle = 6% | Under idling conditions: non-dispersive infrared detection through gas analyzer. |
| Noise | 85 db(A) | Sound meter at 7.5 meter from the source. |

Source: Government of Pakistan (2000).

Exhibit 2-4: WHO Ambient Air Quality Standards

| Pollutant | Maximum Allowable Limit | Units | Averaging Time |
|------------------|-------------------------|-------------------|----------------|
| NO _x | 200 | µg/m ³ | Annual mean |
| SO ₂ | 20 | µg/m ³ | 24 hour mean |
| PM ₁₀ | 50 | µg/m ³ | 24 hours |

Source: World Health Organization.

Exhibit 2-5: WHO Drinking Water Quality Standards

| Element/ Substance | Symbol/ Formula | Normally Found in Freshwater/Surface Water/Groundwater | Health Based WHO Guideline |
|-----------------------|-------------------------------------|--|-------------------------------|
| Aluminium | Al | | 0.2 mg/l |
| Ammonia | NH ₄ | < 0.2 mg/l (up to 0.3 mg/l in anaerobic waters) | No guideline |
| Antimony | Sb | < 4 µg/l | 0.02 mg/l |
| Arsenic | As | | 0.01 mg/l |
| Asbestos | | | No guideline |
| Barium | Ba | | 0.7 mg/l |
| Berillium | Be | < 1 µg/l | No guideline |
| Boron | B | < 1 mg/l | 0.5 mg/l |
| Cadmium | Cd | < 1 µg/l | 0.003 mg/l |
| Chloride | Cl | | 250 mg/l |
| Chromium | Cr ⁺³ , Cr ⁺⁶ | < 2 µg/l | 0.05 mg/l |
| Colour | | | Not mentioned |
| Copper | Cu | | 2 mg/l |
| Cyanide | CN | | 0.07 mg/l |
| Dissolved oxygen | O ₂ | | No guideline |
| Fluoride | F | < 1.5 mg/l (up to 10) | 1.5 mg/l |
| Hardness | mg/l CaCO ₃ | | No guideline |
| Hydrogen sulfide | H ₂ S | | No guideline |
| Iron | Fe | 0.5 - 50 mg/l | No guideline |
| Lead | Pb | | 0.01 mg/l |
| Manganese | Mn | | 0.4 mg/l |
| Mercury | Hg | < 0.5 µg/l | 0.006 mg/l |
| Molybdenum | Mb | < 0.01 mg/l | 0.07 mg/l |
| Nickel | Ni | < 0.02 mg/l | 0.07 mg/l |
| Turbidity | | | Not mentioned |
| pH | | | No guideline |
| Selenium | Se | < < 0.01 mg/l | 0.01 mg/l |
| Silver | Ag | 5 – 50 µg/l | No guideline |
| Sodium | Na | < 20 mg/l | 200 mg/l |
| Sulfate | SO ₄ | | 500 mg/l |
| Inorganic tin | Sn | | No guideline |
| TDS | | | No guideline |
| Uranium | U | | .015 mg/l |
| Zinc | Zn | | 3 mg/l |

Source: World Health Organization, 2008.

3 Analysis of Project Alternatives

This Chapter discusses various project alternatives that were considered during the design phase. The alternatives in this Chapter have been organized in two broad categories: management, and technical alternatives.

3.1 Management Alternatives

3.1.1 No Project Alternative

As described in **Section 1.2**, the electricity demand has been increasing during the past several years, and this trend is expected to continue as a result of the on-going economic uplift in the country. The key factors fueling the increasing power demand include increasing population, rapid urbanization, industrialization, improvement in per capita income and village electrification program of Pakistan's federal and provincial governments.

In order to match the increasing trend in the power demand, regular investments in various segments of the power network – generation, transmission, and distribution – is vitally important. Otherwise, the gap between the supply and demand will keep on increasing.

In case the proposed project is not undertaken, the HESCO will not be able to cope with the increasing demand and the existing system will remain over-loaded, line losses will also remain high, and the system reliability will progressively decrease, with increasing pressure on the system. The Utility will also forego the opportunity of increasing its consumers as well as revenue associated with the system expansion.

In view of the above, the 'no project' option is not a preferred alternative.

3.2 Technical Alternatives

There are a number of alternatives for power generation in the country that includes establishment of power plants based on coal, natural gas, furnace oil, hydro, wind and solar power station. These are discussed briefly in the subsequent paragraphs.

3.2.1 Coal Based Generation

An abundant coal resource is available in the country. These coal resources are mostly in the southern part of the country where the project is located. However coal based power plants would have been very expensive and this could have resulted in tremendous increase in GHG emission. Besides there are other quality issues of the coal found in the area.

3.2.2 Furnace Oil Based Power Generation

It could have proved to be expensive and could have also resulted in significant increase in GHG (Green House Gases) emission. Though there are number of power plants based on furnace oil in the country that are also being converted on other available sources like natural gas etc.

3.3 Renewable Based Energy Generation (wind & solar)

The country has abundant wind potential in the coastal area of Sindh and Balochistan. Further in view of depleting fossil fuel resources in the country and around the world, development of wind power plant at the location where sufficient wind is available is the need of the time.

This project is at the beginning stage of many similar projects throughout the country. The developing and third world country like Pakistan has a significant advantage in the generation of wind energy because of its excellent wind regime. In addition, this project will contribute to Pakistan's overall effort to reduce emissions under the Kyoto Protocol, as virtually no air emissions are associated with wind-generated electricity. Besides the environmental benefits of having more clean power on the system, another major, positive long-term socio-economic impact that may result from this project is the increased opportunity for communities throughout the province to purchase power generated by a local source of renewable energy.

Wind power is the most advanced and commercially available of renewable energy technologies. In recent years it has been the world's fastest growing energy source. Wind power is also among the cheapest of the renewable energy sources. At good wind sites it is already fully competitive with new traditional fossil fuel and nuclear generation. Its cost also continues to fall as the use of individual sites is maximized and the technology improves.

3.4 Wind Energy as Proven Clean Renewable Energy Source

Time has proved that wind energy is a proven and safe technology to use for meeting the escalated demand needs of the country. The development of wind energy as a 'zero emissions' alternative for electricity generation over the last two decades has been dramatic. Every kilowatt-hour of electricity generated by the wind turbine has the potential to displace one kilowatt hour of fossil fuel generated electricity and corresponding GHG, SO_x, NO_x, and VOC emissions⁶. As well, reducing reliance on fossil fuels lowers the environmental impact and risk associated with their extraction, processing, transportation and use.

3.5 Justification of the Project

ZORLU's initiative to install 34 state of the art wind turbines at Jhampir site is an appropriate scale of infrastructure for rural and arid settings and an appropriate application of wind technology. This project can be an example for the rest of the potential investors and interested local intenders. This project has significant advantage in the production of wind energy because of its excellent wind regime.

We usually take the availability of electricity for granted. We do not take into account the permanent damage to our environment caused by the production of electricity from natural gas, peat, oil or coal. When burning these fossil fuels harmful gases are emitted, such as the greenhouse gas CO₂, which leads to changes in our climate and nitrogen and sulphur oxides, which cause air pollution and acid rain. In Pakistan, we import major portion of fossil fuels and, furthermore, these fuel supplies will run out eventually. Hence dependence on these fossil fuel sources makes our energy supply vulnerable.

⁶ Black River Wind Ltd. Wind energy project; Rear site

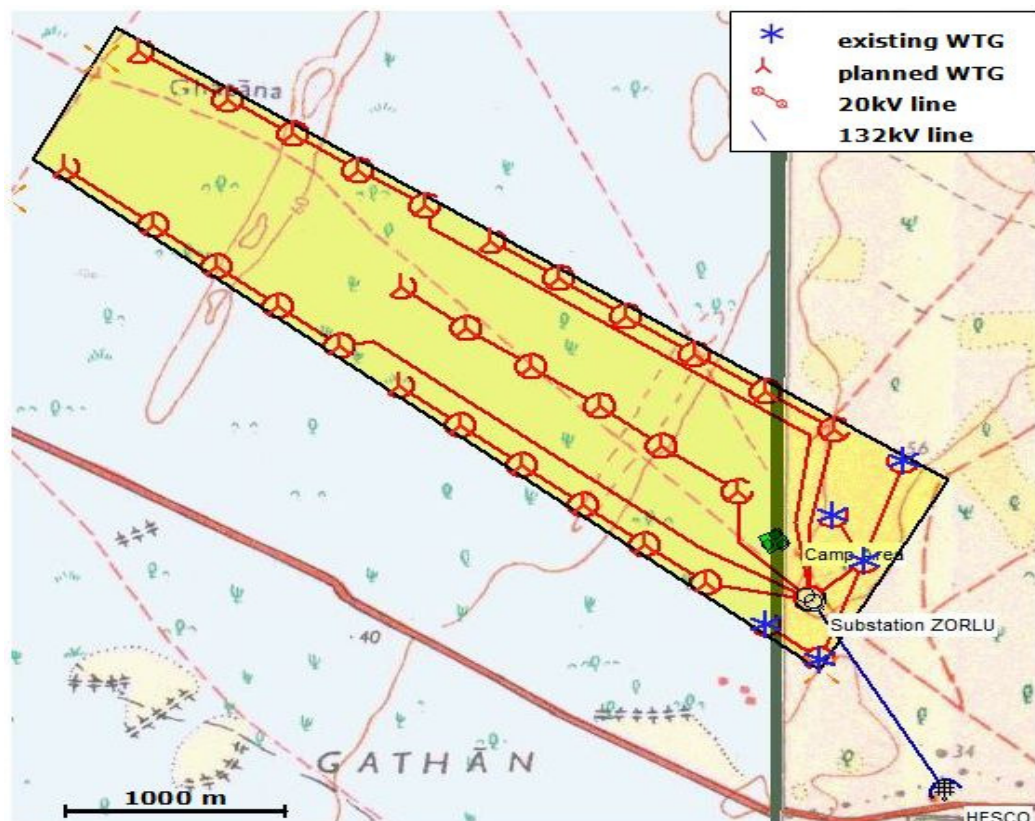
4 Project Details

4.1 Project Proposal

The proposed project involves installation and operation of a wind farm in the project area. The project is also aimed to develop an infrastructure that includes a high voltage transmission line. The main aim of that transmission line would be to connect the WF with the local grid system of HESCO. Initially generation capacity of the wind farm is expected to be 50 MW.

Exhibit 4-1 show that proposed location of the wind farm indicating the proposed sub stations and transmission line.

Exhibit 4-1: Location of the WF and the Proposed Substation and Transmission Line



The development of the wind farm is proposed in two stages up to a maximum of 34 turbines using Vensys 1.2 and 1.5 MW turbine generators.

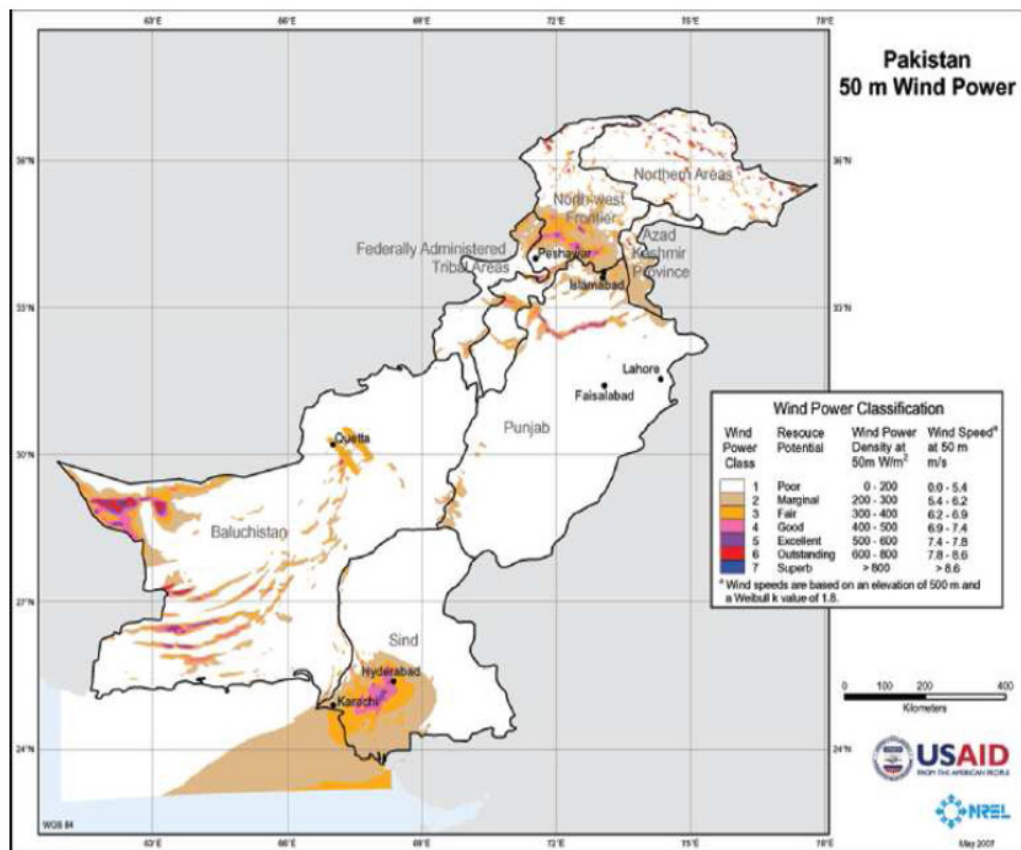
Stage 1: During the first stage, five 1.2 MW Vensys type wind turbine generators (WTG) shall be installed. These WTGs shall be connected to Jhimpir grid station on 11 kV supply system.

Stage 2: During the next phase 29 wind turbine generators will be installed at the wind farm. Second stage also includes the construction and commissioning of wind farm's own sub station at 20 kV. After the construction of the sub station at the wind farm, all the wind turbine generators 5+29; making the grand total of 34 shall be connected to 20/132 kV sub station at ZORLU wind farm site with the national grid.

4.2 Project Site

The proposed ZORLU wind farm is situated in one of the best air corridors of the world; Gharo air corridors along the coastal belt. The average wind speed of the Gharo air corridor is more than 7 m/s⁷. Pakistan has 1046 Km coastline in south. **Exhibit 4-2** shows the air availability area wise in Pakistan (based on the study conducted by USAID and SARI, USA)

Exhibit 4-2: Wind Power Classification Map



⁷ www.bdi-online.de/Dokumente/Internationale-Maerkte/Pakistan_BD_112007_Praes__Hamid.pdf

4.3 Reason for Selecting Jhimpir Site

Jhimpir site was selected mainly due to the following realities:

- It is situated in one of the best air corridors of the world
- Easy access to the site through already available roads network and by train; thereby reducing the environmental impact as well as costs and risks of project delivery and future support
- There are no topographical barriers or features located in or around the site that may influence air movement;
- The location is close to the HESCO Jhimpir Grid station point, which can accommodate additional supply of electricity from the WF
- The site is large enough to accept an appropriate scale of wind generation capacity for a remote rural setting;
- There are no potential wetlands or watercourses in the project area of influence of the site (nearest wetland is about five kilometre away from the site), therefore there is no environmental impact;
- There are no any archaeological sites in or around the WF site;
- The site is situated at a distance of 3 km from the population of the local villages, decreasing any chances of potential threat to local dwellers;
- There are no nesting habitats for any large or significant avian populations located in the project area of influence;
- Initial micro readings have confirmed the availability of wind in the site area round the year;
- The community has confirmed an interest in exploring the use of renewable energy.

4.4 Use of Land Corresponding to Project Site

The proposed power plant is to be located on an area of about 1148 acres. Topographically the area is flat, stony and barren. Due to its location close to the Arabian Sea the area is hot and humid with very low precipitation. This has made the area as barren. Since basic amenities are not available in the area therefore most of the local population residing in the area migrate to nearby villages which are more than 3 km from the project site, where better facility is available. Some of such migrated population come back with their cattles in summer when there is plenty of rain and enough grass has grown for grazing of their animals. Land in the project boundary area are stony in nature therefore there is grazing cattle are not effected. However the project developer do not intend to fence the boundary, in any cattle come for grazing it will not get disturbed.

The physical survey of entire area and information collected from local population shows that there are no permanent structure / houses. Accordingly no person or family who is residing will need to be relocated as nearest population is about three kilometres away from the site. At the time of survey two hamlets ware noticed. Inquiry with the residents showed that some of them had migrated to the area a couple of weeks back whereas some of them have

migrated around a week back. All these people have their houses in the near by locality called Drao which is about 3 km from the wind farm site

Apparently it seems that no crop could be cultivated. However in the rainy season if there is enough precipitation, the area becomes green as a lot of grass can grow that is used for grazing of cattle. In addition a small piece of land is in agricultural use which is outside the wind farm boundary. Photographs are at **Appendix B.1**

4.5 Environment, Geographical and Cultural Scenario

Initial environment study has revealed that there are no environmentally or culturally sensitive or significant sites/marks in close proximity to this project site. Based on screening information from the folk wisdom and local dwellers, the packets of population is scattered in a very large area, consisting 3-4 house holds and 8-10 members. However these are about three kilometres away from the area of project influence.

The people are very sociable and cooperative. People of Jhimpir defined it as an old town of historical significance, rich in minerals and natural resources and a population of about 35000 – 40000 scattered in several goths (villages) / paras⁸. Among its resources people counted the nearby hills that produce limestone, gypsum, dolomite stone, coal, etc. (of significance for industrial use including the steel mill). Jhimpir has variable topography e.g. Esso is mountainous with more stones than trees. Dependence on natural resources is determined, as much by available natural resources as by the occupations of the tribes/castes living in each of the paras, for instance the residents of Palari graze animals, get their firewood from the trees and work as wage labourers in the nearby coal mines⁹. In village Sulaiman Brohi and Muhammad Arab Chang, people depend on livestock and graze, do agricultural labour (in rains) and rely on agrarian commercial activities.

4.6 Nearest Water Reservoir-Keenjhar Lake

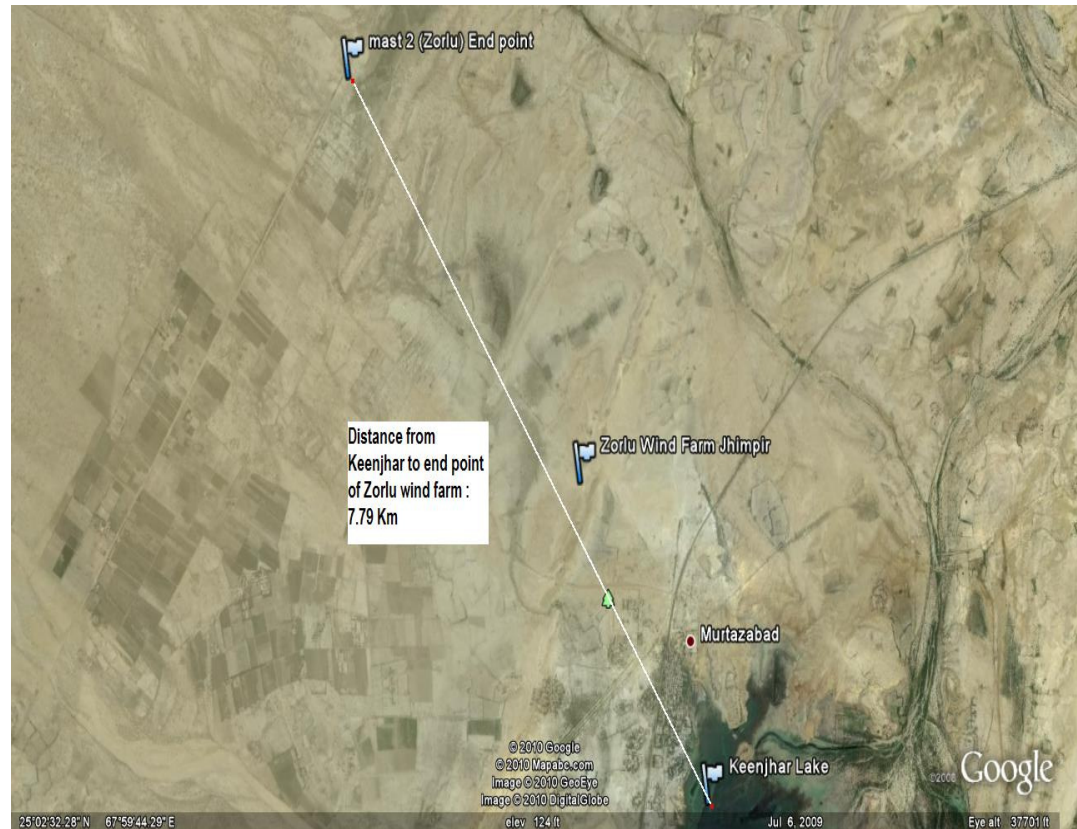
Keenjhar Lake which is at a distance of more than 5 km (precise distance from Keenjhar lake to end point of WF is 7.79 Km) Figure from the project site, is one of the 103 (out of 230) public waters in Thatta District that is controlled by the provincial government. The sweet water Lake Keenjhar, also known as Kalri Lake, is located in the dry and stony desert at a distance of about 20 km north and north-west of Thatta. It is 24 km long and 6 km wide and has an area of 14000 ha. The lake is fed by the Kalri Bagar feeder canal from the north-west as well as by small seasonal streams entering it from the north and the west. The feeder is also the conduit for the industrial wastes of Kotri town. The only outlet is the Jam branch canal in the south-east end of the lake. Keenjhar is a wild life sanctuary and a Ramsar site. Jhimpir town, on the northern banks of the lake is the main town on Keenjhar besides twelve large and twenty small villages scattered around it. About 50,000 people are said to be dependent on the lake and in 2005-06 about 800 boats of different size are said to be

⁸ Social Policy and Development Center. 2001. Social Development in Pakistan: Growth, Inequality and Poverty. Oxford University Press. Karachi.

⁹ Preliminary Socio Economic Baseline Assessment by Shirkat Gah, WWF-Indus for All, March 2007

operating in it (declining from 2200 in 1988-89 and 1710 in 1998-99). There are four fish landing centres at Chilya, Sonahri, Jhimpir and Khumbo¹⁰.

Figure 4.3 Distance from lake to WF



4.7 Wind Farm Details

According to the technical details of the project, the proposed ZORLU wind farm includes the following principal elements

- Wind turbines placed on the 4 parted modular conical steel tower of 85 meters for Vensys 77 model WTG giving it a peak height of 123.5 meters. For Vensys 62 the tower will be of 3 parted modular conical steel tower placed at height of 69 meters and the peak height of the tower would be 100 meters
- Crane stand base at the site of every wind turbine. For the installation of the wind turbines an area of approximately 20m x 30m has to be levelled and compacted at each turbine site for the cranes. In total an area of around 24,000m² are planned for the crane and parking places. (**Exhibit 4-4** showing the crane site and roads is attached)
- Installation of underground cables from one wind turbine to another and then from wind turbines to proposed sub station

¹⁰ Preliminary Socio Economic Baseline Assessment by Shirkat Gah, WWF-Indus for All, March 2007; p. 43.

- Construction of 11 kV transmission line (only for Phase-1 on temporary basis)
- One proposed sub station of 20/132 kV. This substation will be built with in the boundary of wind farm
- Temporary buildings for storage of building materials
- Access roads to wind turbine towers

There may be other civil and electrical infrastructure that is not been made part of this assessment; like any civil work of masonry nature at the site.

Exhibit 4-3: Map of Keenjhar Lake

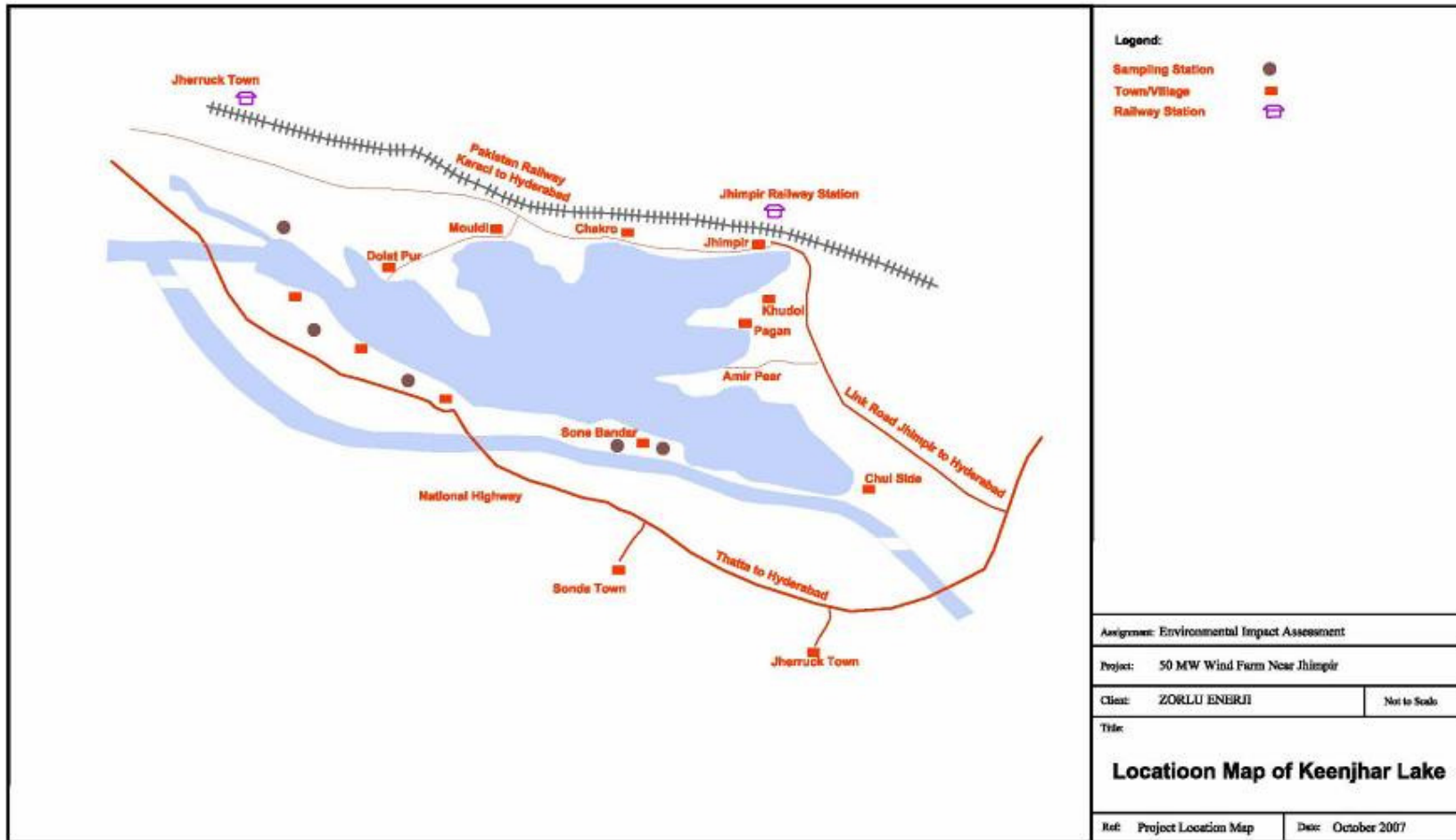
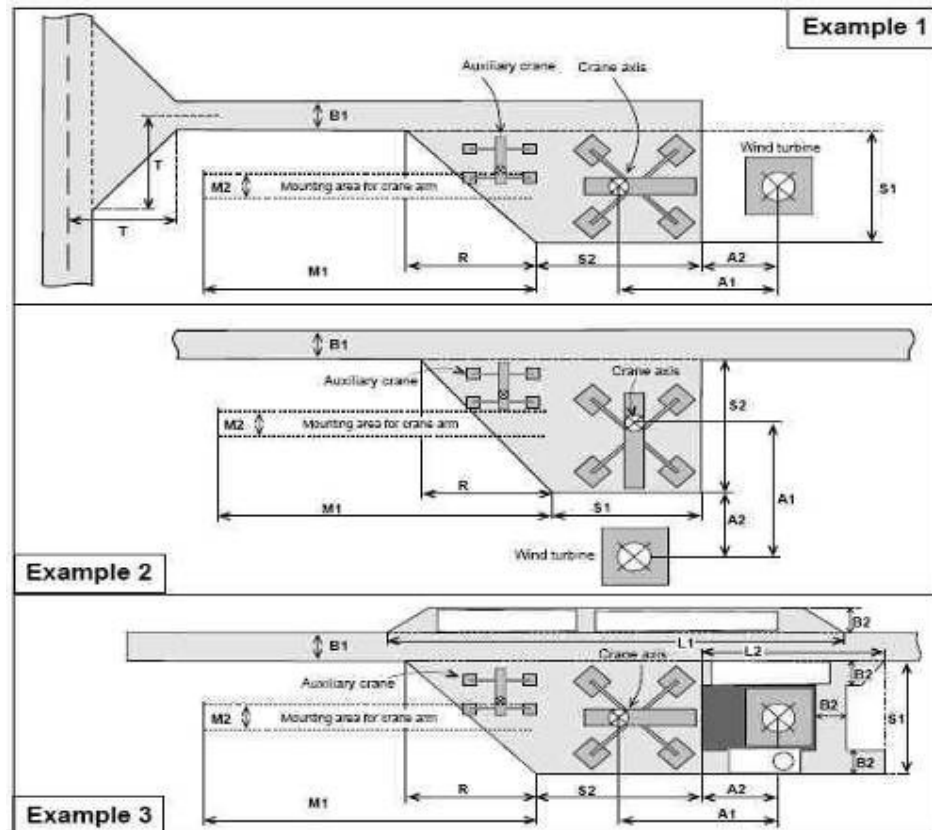


Exhibit 4-4: Crane Docking Area

4.8 Type of Wind turbines to be used at WF ZORLU

The project involves the installation of five Vensys 62 (1200 kW) and 29 Vensys 77 (1500 kW) wind turbines and ancillary equipment. The total capacity will be 49500 kW, and will be interconnected to HESCO local utility grid. The turbines will operate when wind speeds are within their operating range of 5 m/s to 25 m/s.

The main generator characteristics:

- Output range: 1.5 MW
- Stator voltage: 690 V
- Rated speed: 19.0 or 17.3 rpm
- Cooling method: Passive stack cooling with backside cooling fins
- Degree of protection: IP 23
- Insulation class: Class F
- Stator dimensions: $D < 5\text{m}$, $L < 1.5\text{m}$

- Generator mass: < 40 tons

All VENSYS turbines stand for simplifying the design by reducing it to what is really essential: using the smallest possible number of high-quality and tested components: no gear, no generator bearings, no couplings, no generator excitation. Variable speed is achieved by an air-cooled frequency converter designed especially for the VENSYS wind turbines, feeding the entire power output of the generator into the grid. The pitch system is maintenance-free based on synchronous belt drives and uses ultra capacitors instead of lead-acid-batteries for emergency stops. Various components of a typical Vensys wind turbine is in **Exhibits 4-5, 4-6 and 4-7**.

Exhibit 4-5: Main Components of Vensys Wind Tower

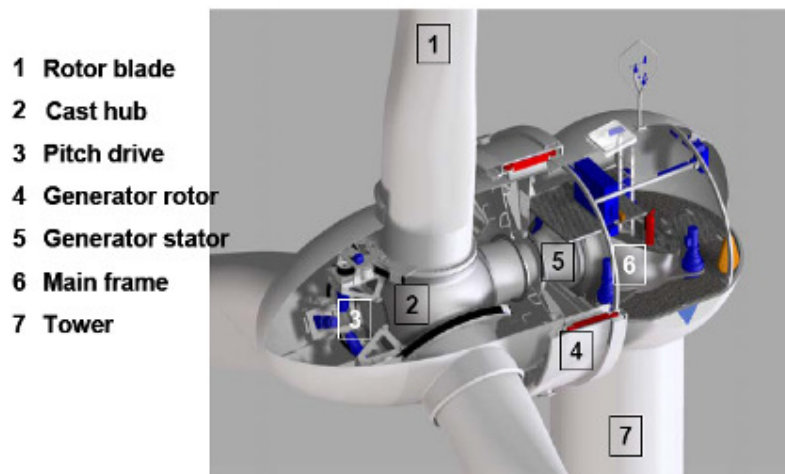


Exhibit 4-6: Turbine cooling system

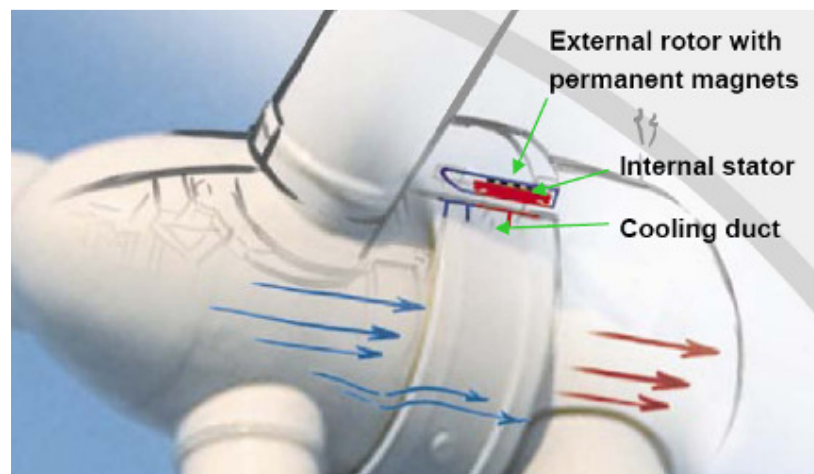
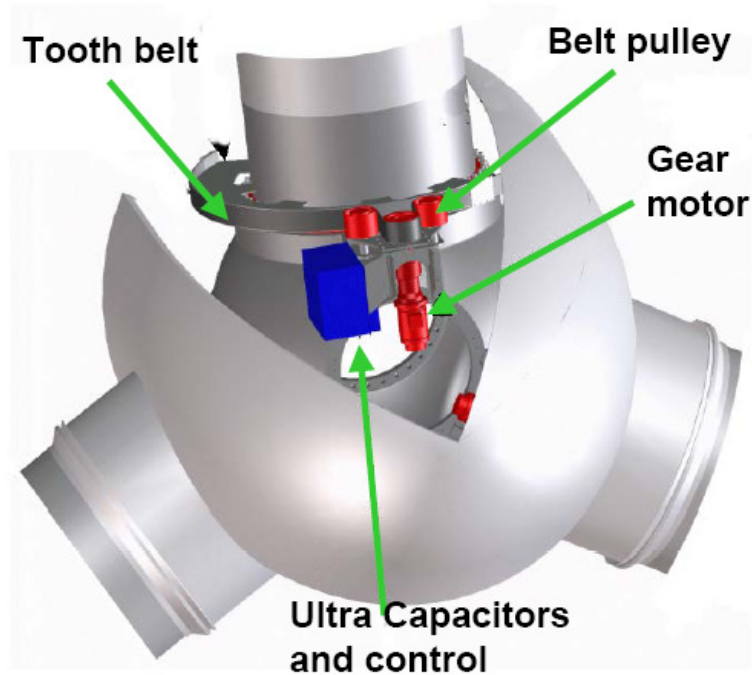


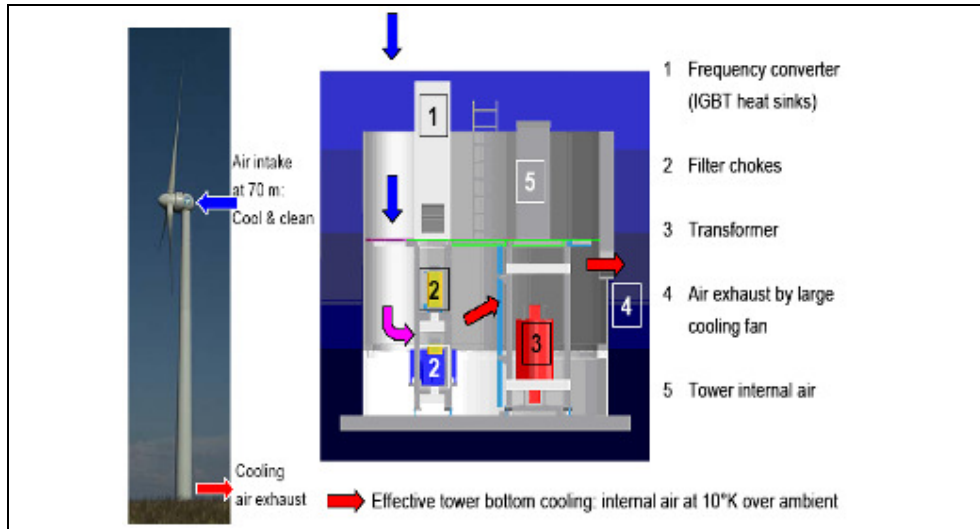
Exhibit 4-7: Vensys Pitch System Maintenance Free

4.9 Cooling System of Vensys WTG

To achieve high reliability and easy serviceability, both frequency converter and the cast-resin transformer are located inside the tower bottom. However, because of an optimised cooling concept with prioritisation of the cooling air flow, the ambient operating temperature range will be the largest in its class.

The system works with a large fan in the tower bottom area, blowing out the hot air underneath the tower door. Cooling air intake is at hub height, where the ambient air is as cool and as clean as possible. The excellent cooling performance has been demonstrated at the Vensys 1.2 MW prototype in the trails at wind farm, in an extremely dusty and dry desert-type climate. **Exhibit 4-8** illustrates the cooling system of wind turbine.

Exhibit 4-8: Very Effective Tower Cooling System



4.10 Vensys Platform Specifications

Comparison of technical specification for Vensys 77 and 62 is shown in **Exhibit 4-9**.

Exhibit 4-9: Vensys Platform Specifications

| Turbine Type | Vensys 77 | Vensys 62 |
|---------------------------------------|--|--|
| Rated out put | 1.5 | 1.2 |
| Used number of turbines | 29 | 5 |
| Cut-in wind speed (m/s) | 3 | 3 |
| Nominal wind speed (m/s) | 13 | 12.1 |
| Cut-out wind speed (m/s) | 22 | 25 |
| Survival wind speed (m/s) | 52.5 | 59.5 |
| Generator | Multipole Synchronous Generator, 50Hz, 620V | Multipole Synchronous Generator, 50Hz, 620V |
| Gearbox type | Gearless | Gearless |
| Rotor diameter (m) | 77 | 62 |
| swept area of Rotor (m ²) | 4.875 | 3.019 |
| Number of Blades | 3 | 3 |
| Speed range (1/min) | 9-17.3 (variable) | 10-20 (variable) |
| Tower | 4 parted modular conical 85m tower, giving a tip height of 123.5 m | 3 parted modular conical 69m tower, giving a tip height of 100 m |
| Control and Safety Systems | Microprocessor controlled remote monitoring | |
| Control of output | Pitch | |
| Speed control | variable, microprocessor-controlled speed | |
| Primary brake system | individual blade pitch control for each blade | |
| Remote control | Dial-up connection, visualization via web-browser | |

4.11 Construction Phase of Wind Farm

The principal construction activities for wind farm installation are typically:

- Site access, internal roads, crane hard stand and other allied structures construction at site;
- Control and maintenance building and sub station construction;
- Excavation of cable trench and cable laying or ploughing
- Construction of turbine foundations including hardening
- Erection of WTG, commissioning and testing of turbines

The tentative construction schedule is illustrated in **Exhibit 4-10**.

Exhibit 4-10: Tentative Construction Schedule

| Steps (in months) | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 |
|--|---|---|---|---|---|---|---|---|---|----|----|----|----|----|
| Construction of internal roads and crane hard standings | | | | | | | | | | | | | | |
| Construction of control building and substation+ grid | | | | | | | | | | | | | | |
| Excavation of cable trench and cable laying or ploughing | | | | | | | | | | | | | | |
| Construction of turbine foundations including hardening | | | | | | | | | | | | | | |
| Erection of WTG, commissioning and testing of turbines | | | | | | | | | | | | | | |

4.11.1 Construction of Internal Roads and Crane Hard Standings

The basic purpose of these roads would be to have an access for the one time installation of equipment and to have a good access for the future maintenance and physical monitoring of the wind farm site.

4.11.2 Construction of Control Building and Substation+ Connection with National Grid

An appropriate control building and sub station would be constructed at the site for smooth operation and monitoring of the wind farm. This may include (not necessarily at the first stage) construction and installation of a sub station that will again be connected to the national grid of HESCO.

A separate site will be prepared for the control building in the project land at an appropriate location (to be decided at later stages).

4.11.3 Excavation of Cable Trench and Cable Laying or Ploughing

Individual wind turbines will be interconnected by underground cable to the proposed sub station on the site using standard trench construction methods. The laying work of cable does not require any blasts or involvement of heavy earth moving machines; so there is no any

environmental aspect to be taking in consideration. Extreme care will be taken into account in connecting the cable joints in order to minimize the risks of short circuiting and hot spots.

4.11.4 Construction of Turbine Foundations Including Hardening

Excavation and construction of turbine foundation involves great deal of accuracy in terms of structural designing and concrete filling. The work is to be completed as per the specification laid down in conformity of environmental standards thus reducing the danger of any environmental issue.

4.11.5 Erection of WTG, Commissioning and Testing of Turbines

For the installation of the wind turbines an area of approximately 20m x 30m has to be leveled and compacted at each turbine site for the cranes. In total an area of around 24,000m² are planned for the crane and parking places.

The towers, turbines and components will be delivered by flat deck trailer and assembled on site. The crawler crane used to raise the turbine and mount blades requires a 20 m x 30 m level pad located approximately 20 m from the centre of the tower foundation. Any topsoil stripped for leveling the assembly area or creating the crane pad will be retained on site for reclamation at the end of project construction. Reclamation will be undertaken at the assembly site, foundations and where trenching for a cable has occurred.

4.12 Operation Phase of ZORLU Wind Farm

Once the construction and commissioning of the wind farm turbines is complete and in service, arrangements shall be made for the periodical inspections of the turbine tower's sites (electrical and mechanical). For getting these important tasks done experienced professionals, either a locally trained technicians/operators or a manufacturer's technicians shall provide regular service and maintenance reviews. Scheduled maintenance and servicing checks are usually carried out two times per year and includes an inspection, calibration and adjustment of the mechanical and electrical components. The frequency of inspections can be increased keeping in view the over all maintenance trouble shooting at WF. Any waste products of maintenance will be disposed of as local and provincial waste management regulations. As well these professionals will perform periodical repairs, however because of the sophistication of the Vensys (77/62) design; this is predicted to happen rarely. Proper training and fall safety equipment will be used during both the construction and operational phases.

4.12.1 Wind turbine Operation

The turbines operate continuously at wind speeds greater than 3 m/s. At speeds greater than 25 m/s (depending on the specifications) the turbines automatically shut off for safety reasons. During the operation phase a telecommunication link will be established to the wind turbines to enable high-speed data transfer and long distance site monitoring.

This will enable ZORLU ENERJI to provide supervisory control of the wind energy project and to monitor and control operations of the wind turbines. The telecommunication link will be a leased line telephone line or a wireless/GSM broadband connection. The wind turbine control systems will continuously monitor key operating parameters, and will ensure that the turbines

are safely disconnected in the event of a problem within the turbine array or within the utility system area.

4.12.2 Installation of Energy Meters

Proper energy measurement equipments will be installed on the wind farm to measure the energy produced and sold/provided to NTDC/HESCO. This will help in gross calculation of the wind farm's capacity to produce and sale electricity to potential buyers like NTDC/HESCO.

4.13 Decommissioning Phase of ZORLU wind Farm

4.13.1 Expected Life Cycle of Project

The life of the project is expected to be of 20-25 years. Proper maintenance and timely repair may enable the ZORLU ENERJI to go beyond this time frame. There are WF in the world that are still functional after completing their life span by a proper maintenance plan.

4.13.2 Future Expansions

In all over the world it has been proved that the wind farms are considered to be of permanent in nature. The only thing that matters in its life is replacement of older versions of wind turbine with newer ones and with latest control mechanism.

As ZORLU win farm would farm would be using the latest and most advanced available designs presently available on the globe, so it seems a bit far that these would very soon be replaced. Generally it takes more than 15-25 years for a new design to pass the tough tests after being installed; this exactly is the life span of the wind turbine of ZORLU. Till the time newer and advanced models are available, these turbine would already have completed their life span and will be ready to be replaced it ZORLU wants to go a head with the business in Pakistan.

4.13.3 Decommissioning of the Wind Farm

Later on at any stage if circumstances make the continuation of the wind installation unfeasible, the structures would be disassembled and removed with the turbines, towers and ancillary equipment being recycled or disposed of in a manner meeting existing regulatory requirements. Underground cables would be left in place. The excavation hole re-filled with subsoil. Vegetation along the access roads will be allowed to regenerate by natural means.

The civil structures would be left untouched as they may involve heavy earth moving machines and dust.

5 Description of the Environment

This Chapter describes the environmental conditions of the project area before the commencement of the proposed project activities. The environmental baseline in this Chapter addresses the physical and biological aspects of the project area.

Since the proposed project is located in Sindh; a generic overview of the environmental conditions of this area is presented. In view of the absence of any major development activities underway at or around the project sites or any other natural/anthropogenic phenomenon except a number wind farms, the environmental conditions of the project sites are unlikely to experience any significant change before the project commencement.

5.1 Physical Environment

5.1.1 Physiography, Topography and Geology ¹¹

On the basis of the physical environment and geology, the project area falls in the Indus Basin, which is briefly described below.

The Indus Basin essentially forms the western extension of Indo-Gangetic Plain, and has been made up of the silt brought by the Indus and its numerous tributaries, such as Jhelum, Chenab, Ravi and Sutlej on the east bank, and Kabul, Kurram, Tochi, and others on the west bank. The Indus Plain is known for its agricultural fertility and cultural development throughout history.

The left bank tributaries of the Indus River all meet at Panjnad and flow as one large stream for about 75 km before joining the Indus at Mithankot, and south of it, the Indus flows almost alone up to the Arabian Sea without receiving any noticeable tributary.

The average annual discharge of the Indus – 92 million acre feet (MAF) at Attock Khurd – is much higher than the combined discharge of its tributaries. There is a great fluctuation in their seasonal discharge, especially in the hot summer and rainy season. Almost all of its tributaries and the Indus itself have their sources in snow and glaciated areas of Himalayan, Karakoram and Hindukush mountain systems.

On the basis of hydrology and land form, the Indus Plain can be divided into the Upper and Lower Indus Plains. The Upper Indus Plain differs from the Lower Indus Plain (where the project area is located) primarily because of the major tributaries (Jhelum, Chenab, Ravi and Sutlej) divide the land surface into several interfluves or 'doabs'. The two plains are separated by a narrow corridor near Mithankot where the Sulaiman range approaches the Indus River. The Lower Indus Plain is very flat, generally sloping to the south with an average gradient of 95 mm per km (6 inches per mile). The Lower Indus Plain can be divided in five distinct micro-relief land forms: active flood plain; meander flood plain; cover flood plain; scalloped interfluves; and the Indus delta. In the northeast, the meander flood plain is

¹¹ Sources: Atlas of Pakistan, Government of Pakistan, 1997. Sindh State of Environment and Development, IUCN, 2004.

more extensive, while in the central and lower Indus Plain, the cover flood plain is more prominent.

Topographically, Sindh can be divided into four distinct parts with the dry and barren Kirthar Range in the west, a central alluvial plain bisected by the Indus River, a desert belt in the east, and the Indus delta in the south.

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

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

The hilly region of western Sindh consists almost entirely of rocks belonging to the tertiary system of geological nomenclature. It is only along the Laki Range and in its neighborhood that there are some exposures of rocks belonging to the next older system, the Cretaceous. With the exception of some volcanic beds associated with these Cretaceous strata, all the rock formations of western Sindh are of sedimentary origin. All of the more important hill masses consist of limestone. A great majority of these limestone deposits belong to the Nummulitic period and are largely built up of the accumulated shells of foraminifera, principally those belonging to the genus Nummulites.

5.1.2 Soils¹²

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

5.1.3 Land Use¹³

Agriculture, followed by forestry, is the main land use in the central alluvial plain. Although more than 50 percent of the total geographical area is cultivable, only 26 percent of it is actually located in the central plain. The land inside the Indus embankments is almost equally employed by agriculture and forestry, while that outside the embankments is more extensively utilized for agriculture in the form of sparsely distributed irrigated plantations. The land use in Sindh is given in **Exhibit 5-1**.

¹² Source: Sindh State of Environment and Development, IUCN, 2004.

¹³ Source: Sindh State of Environment and Development, IUCN, 2004.

5.1.4 Meteorology and Climate

Meteorology

The climate of most parts of the Sindh is arid characterized by four distinct seasons in a year, that is, winter from Mid-November to February, spring during March and April summer from May to Mid-September and autumn from Mid-September to Mid-November except coastal belt where mostly dry and humid condition persists round the year. There exist several meteorological stations in Sindh; data recorded at some of these stations is provided in the following sections.

Temperatures

June is the hottest month in most parts of Sindh, with mean daily maximum temperature recorded as 44.33 °C.¹⁴ January is the coldest month in the area, with the mean daily minimum temperature recorded as 5.42 °C.¹⁵

Mean daily maximum and mean daily minimum temperatures of various districts in the project area are presented in **Exhibits 5-2** and **5-3**, respectively.¹⁶ In view of the very small differences among these temperatures, this data can be taken as representative for the entire project area.

Rainfall

Average annual rainfall in the project area ranges between 110 mm (Jacobabad) and 222 mm (Badin). Maximum rainfall (about 60% of the total annual) occurs during the Monsoon season (July, August and September), while the period of minimum rainfall or drier period is October and November.

Humidity

July, August and September are the most humid months in the area, whereas May and June are the least humid months. Average monthly relative humidity (RH) values at various locations in the project area are provided in **Exhibit 5-4**.¹⁷

Climate

Pakistan's latitudinal and longitudinal extents and its northern rim of lofty mountains, are the two factors, which have a great bearing not only on the temperature and rainfall patterns, but also on the general circulation of the atmosphere on the southern Asia.

Climate of Pakistan according to Koppen's classification¹⁸ falls under the following five types:

¹⁴ Recorded at Jacobabad (see **Exhibit 4.2**).

¹⁵ Recorded at Chor (Umerkot) (see **Exhibit 4.3**).

¹⁶ *Temperature Normal* recorded for the period 1961 to 1990. Source: District Census Reports. (*Normal* for the period subsequent to 1990 are not published yet.)

¹⁷ *Humidity Normal* recorded for the period 1961 to 1990. Source: District Census Reports. (*Normal* for the period subsequent to 1990 are not published yet.)

¹⁸ *Climatic Regions of West Pakistan*, Pakistan Geographical Review. Kazi, S. A., 1952.

Tropical Semi-arid with Dry Winter: This climate type prevails in Karachi, Hyderabad, and southern Khairpur Division. The mean annual temperature is above 18 °C.

Tropical Arid: This is characterized by average annual temperature of about 18 °C with dry winters. This includes southern Kalat and whole of the Indus Plain.

Cold Semi-arid With Dry Summer: This climate type covers central Kashmir, Peshawar, D.I. Khan, Quetta and northern half of Kalat Division.

Snow Forest Climate: This climate type is characterized by average temperature of coldest month below 0 °C. Mean temperature of the warmest month is between 10 and 22 °C. It includes northern mountainous areas and parts of Kashmir.

Extreme Cold: This climate type is characterized by average temperature of the warmest months between 10 and 0 °C. It comprises eastern and northern parts of Kashmir, Chitral, Gilgit and Laddakh.

Based upon the above classification, most parts of the proposed project area are included in the Tropical Arid climate zone, while some southern parts of Sindh are located in the Tropical Semi-arid with Dry Winter climate zone.

Ambient Air Quality

The project sites are located not very far from the roads experiencing vehicular traffic, which causes air pollution. .

Since the primary source of air pollution at the site is the vehicular emissions, the key pollutants likely to be found at these locations include carbon monoxide (CO), oxides of nitrogen (NO_x), sulfur dioxide (SO₂), and particulate matter (PM). A typical air quality data for some urban centers in the country is presented in **Exhibit 5-5**, which can be used as a generic ambient air quality baseline for the project site.

5.1.5 Surface Water Resources

The River Indus is the prime surface water resource of Sindh. Salient information of this river is provided below.

Indus River: The Indus River is the main source of surface water in the project area (and in the country). The Indus rises in Tibet, at an altitude of about 18,000 feet (5,486 m) amsl, and has a total catchment area of 654,329 km². Length of the Indus River in the country is about 2,750 km. Five main rivers that join the Indus from the eastern side are Jhelum, Chenab, Ravi, Beas and Sutlej. Besides these, two minor rivers - Soan and Harrow also drain into the Indus. On the western side, a number of small rivers join Indus, the biggest of which is River Kabul with its main tributaries i.e. Swat, Panjkora and Kunar. Several small streams such as Kurram, Gomal, Kohat, Tai and Tank, also join the Indus on the right side. **Exhibit 5-6** shows Indus River and its tributaries; **Exhibit 5-7** presents key facts about the river. .

The Indus River exhibits great seasonal variations, with more than 80% of the total annual flow occurring during the summer months, peaking in June, July and August. **Exhibit 5-8** presents flow data of the Indus.

The Indus River and its tributaries on an average bring about 154 MAF of water annually. This includes 144.9 MAF from the three western rivers and 9.14 MAF from the eastern rivers.

Most of this, about 104.7 MAF is diverted for irrigation, 39.4 MAF flows to the sea and about 9.9 MAF is consumed by the system losses which include evaporation, seepage and spills during floods. The flows of the Indus and its tributaries vary widely from year to year and within the year. As is the case with the water availability there is significant variation in annual flows into sea.

The Indus Delta: Historically, the Indus Delta has formed in an arid climate under conditions of high river discharge to the proportion of 4 billion tons of sediment per year. In the past, this has contributed to a prograding seaward of the delta as a result of interaction of fluvial and marine processes and a moderate tide range of approximately 2.6 meters. Progradation has occurred in spite of extremely high wave energies of the order of 1,400 million ergs/sec. During the past six decades, however, the construction of dams and barrages and extensive engineering works upstream has reduced the sediment load to 100-650 million tons per year (based on different studies). This decrease in sediment load together with the extremely high wave energies is expected to cause rapid reworking and transgression of the Indus delta.

What makes Indus delta unique is the fact that it experiences the highest wave energy of any river in the world. During the monsoon season, from May-September, the delta front receives more wave energy in a single day than the Mississippi delta receives in the entire year.

The Indus delta is triangular in shape and occupies a large part of the province of Sindh, covering about 30,000 km². It is about 240 km in length along the axis of the river and 220 km at its widest, from Karachi to the great Rann of Kutch.

River Water Quality: The water quality of Indus River is generally considered excellent for irrigation purposes. The total dissolved solids (TDS) range from 60 mg/l in the upper reaches to 375 mg/l in the lower reaches of the Indus, which are reasonable levels for irrigated agriculture and also as raw water for domestic use. The disposal of saline drainage from various irrigation projects has been a major factor in the increased TDS in the lower reaches of the rivers in the Indus Plain. There is progressive deterioration downstream and the salinity is at its maximum at the confluence of the Chenab and Ravi rivers, where the TDS ranges from 207 to 907 mg/l. A slight improvement in water quality is noted further downstream at Panjnad due to dilution from the inflow from Sutlej River. The quality of the Indus water at Guddu, however, is within acceptable limits for agriculture; TDS being in the range of 164-270 mg/l.

In the upper reaches of the Indus River, the Dissolved Oxygen (DO) content remains above 8.5 mg/l which is well above the acceptable levels of 4 mg/l. The Biochemical Oxygen Demand (BOD) downstream of Attock has been recorded as 2.9 mg/l. At Kotri, it has a suspended solid (SS) content of 10 to 200 mg/l. Indus River water quality has been studied at the Dadu - Moro Bridge and Kotri Barrage, with nitrate levels at 1.1 and 7.5 mg/l, phosphate at 0.02 and 0.3 mg/l, BOD at 2.4 and 4.1 mg/l, faecal coliforms at 50 and 400 per ml, and aluminum at 1.8 and 0.2 mg/l respectively. Due to industrial waste discharges from Punjab and Sindh, a high content of heavy metals such as nickel, lead, zinc and cadmium have also been found in Indus water.

Lakes: There exist several fresh water and brackish lakes in the Sindh province. The salient among these include Manchar, Keenjhar and Haleji lakes. In addition there exist a large

number of small lakes and ponds in the irrigated areas of Sindh, most of which have been created as a result of extensive irrigation and very shallow groundwater.

5.1.6 Groundwater Resources

The Indus Basin was formed by alluvial deposits carried by the Indus and its tributaries. It is underlain by an unconfined aquifer covering about 15 million acres (60,700 km²) in surface area. In Sindh, about 28% of the area is underlain by fresh groundwater. This is mostly used as supplemental irrigation water and pumped through tube-wells. Some groundwater is saline. Water from the saline tube-wells is generally put into drains and, where this is not possible, it is discharged into large canals for use in irrigation, after diluting with the fresh canal water.

Before the introduction of widespread irrigation, the groundwater table in the Indus Basin varied from about 12 m in depth in Sindh and Bhawalpur areas to about 30 m in Rechna Doab (the area between Ravi and Chenab Rivers). After the introduction of weir-controlled irrigation, the groundwater table started rising due to poor irrigation management, lack of drainage facilities and the resulting additional recharge from the canals, distributaries, minors, water courses and irrigation fields. At some locations, the water table rose to the ground surface or very close to the surface causing water-logging and soil salinity, reducing productivity.

5.2 Biological Resources

This section provides an overview of the ecozones, wild flora and fauna, and the habitat conditions prevailing in the project area. The description in this section has been prepared on the basis of secondary literature review, and field visits carried out in the area during this ESA and earlier assignments.

5.2.1 Original Ecozones of Project Area

Tropical Thorn Forest Ecozone

This habitat was the most extensive ecozone of the Indus plain, and currently exists only in places where the land has not been converted for habitation or cultivation. This habitat comprises low forests of thorny and hard-wooded tree species, dominated by *Acacia* spp. The trees of such forests have short boles and low branching crowns. These are usually not close-growth trees hence their canopies touch each other in exceptionally favorable spots. The usual height of the trees is 20-30 feet (6-9 m). Other plants that grow mixed with *Acacia* include *Salvadora*, *Prosopis*, *Capparis*, and *Tamarix*. The shrubs of the ecozone included *Calotropis*, *Zizyphus*, *Suaed*, while herbs of the area included *Chenopodium*, *Calligonum*, *Haloxylon* and various species of grasses.

The major wildlife mammal species of this ecozone was Long-eared Hedgehog, Desert Hare, Porcupine, Desert Wolf, Jackal, Bengal Fox, Desert Fox, Honey Badger, Small Indian Civet, Grey Mongoose, Small Indian Mongoose, Striped Hyena, Indian Desert Cat, Caracal, Jungle Cat, Wild Boar, Nilgai, Blackbuck and Chinkara Gazelle.

Birds of the ecozone included Grey Partridge, Peafowl, Common Quail, Ring Dove, Red Turtle Dove, Little Brown Dove, Green Pigeon, Hoopoe, Spotted Owlet, Barn Owl, Dusky

Horned Owl, Indian Nightjar, Wryneck, Golden-backed woodpecker, Pied Woodpecker, Wood Shrike, Great Grey Shrike, Rufous-backed shrike, Fantail Flycatcher, Common babbler, Jungle babbler, Houbara Bustard, Great Indian Bustard and many other species of passerine birds.

Riverine Tract Habitats

Originally the riverine habitats used to have heavy, seasonal floods. Since forecasting and prior warning were not available to the rural people, these habitats were not occupied for agriculture and habitation. Natural resource exploitation was also not extensive. As a result, this natural flora along the rivers flourished. These included: *Tamarix*, *Saccharum*, *populus* and *Acacia*. *Typha* growth was common wherever the water was stagnant or slow moving.

5.2.2 Modified Nature of Habitat

Major parts of the original habitats described above have been modified into new habitats, primarily as a result of extensive cultivation and expanding urban centers as well as rural settlements. These new habitat types are briefly discussed below.

Agricultural Habitats

Most parts of Sindh are under very intensive irrigated cultivation. In addition, livestock rearing is also practiced extensively, and milk animals are common. The use of the chemical fertilizers and pesticides is very common. Several species of wildlife have adapted to the changed habitat. These include: Jackal; Jungle Cat, Bengal Fox, Small Indian Mongoose, Shrew, Rodent pests including Porcupine, Fruit Bats and Wild Boar. The avifauna which survived the modified habitat include Doves, Black Partridge, Cuckoos, Koel, Woodpeckers, Parakeets, Bulbuls, Babblers, Black Drongo, Bee-eaters, Finches and House Sparrow. The reptilian species of this modified habitat include Krait, Cobra, Saw-scaled Viper, Rat Snake and Monitor Lizard.

In these modified habitats, the winter bird species from Himalayas have reduced due to the extensive use of pesticides in these areas, since these species feed on the insects. These birds play an important role in controlling insects particularly in the forests.

Almost all of the project components are located in this type of habitat.

Rural and Urban Habitats

These include human habitations within agriculture areas, as well as the urban centers. Scavengers like Jackals are attracted to the garbage dumps and human feces for food. House Sparrows breed in the houses. Bank Mynas and Cattle Egrets feed on grasshoppers in the rangelands with cattle and buffalos. Banyan and Peepal trees still grow in villages. Green Pigeons and barbets feed in these trees.

Migratory Birds

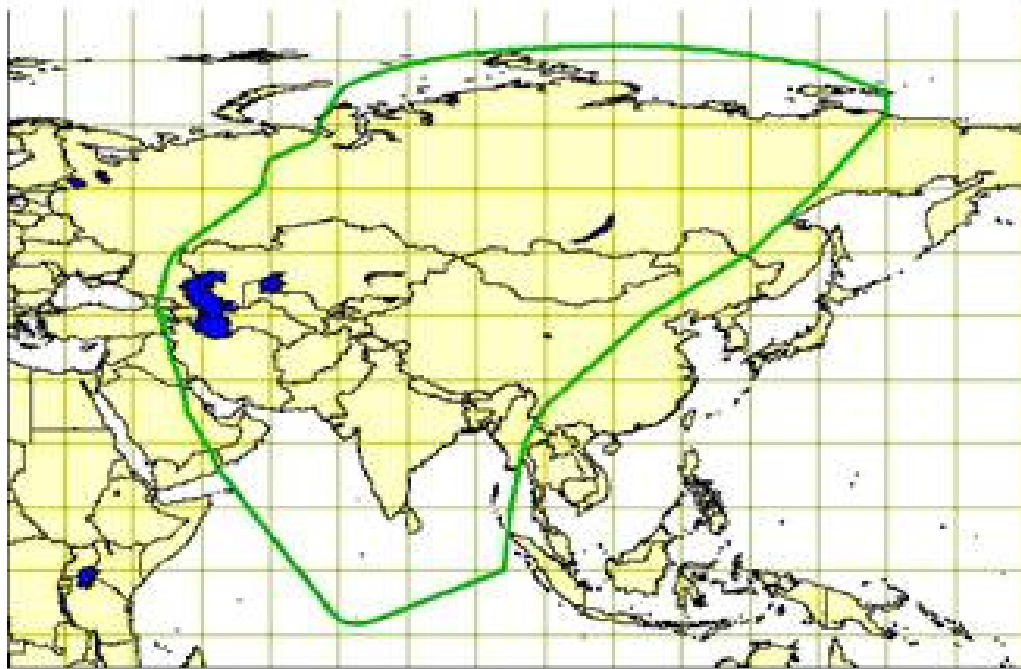
There are total 660 birds species found in Pakistan. Out of the total checklist of birds, 30 % of the birds are species which visit the country for a significant period of the year's long distance migrants, while 43 % of the total checklist are either Palearctic or Oriental Species which come to Pakistan only for breeding. 28 % of the total numbers of species are regular winter

visitors which breed extortionate and mainly in trans-Himalayan northern regions, If Himalaya is taken as a separate and distinct zoogeographic region and only those species which do not breed widely north of Himalaya, are excluded then 19.5 per cent of all species are endemic.¹⁹

5.2.3 Wetlands²⁰

Wetlands are among the most productive ecosystems in the world. Since Pakistan is situated on the flyway to Central Asia and South Asia, the birds breeding in Central and Northern Asia, migrate through Afghanistan to the Indus Valley, particularly to the wetlands across Sindh which are major wintering grounds of migratory water birds. Some of the important wetlands are briefly described below.

Indicative Map of the Central Asian Flyway Region



The boundaries depicted on the map do not imply official endorsement or acceptance by UNEP/CMS

The Indus Dolphin Reserve is spread over 135 km from the Sukkur upstream to the Guddu Barrage. In 1974, the entire area was declared the home of the endangered Blind Dolphin. The major threats it faces include split populations of the dolphins due to dams and barrages

¹⁹ Source: wwfpak.org

²⁰ Source: Sindh State of Environment and Development, IUCN, 2004.

on the River Indus, reduction in habitat size during dry season, high turbidity, pollution, and hunting. The number of dolphins at the site has increased from 150 in 1974 to 620 in 2001.

Manchar Lake, a threatened wetland dying from pollution and mismanagement, was once considered the largest freshwater lake in Asia. It is located about 12 miles west of the town of Sehwan Sharif and spread over an area of 100 square miles that was once renowned for its beauty and the large population of migratory birds and wild fowl. The water supply for Manchar Lake depends on water flows from River Indus via Aral Wah and Danistar Wah, storm water and hill torrents from Kirthar Hills and effluents from drainage units via Main Nara Valley Drain. Over the last two decades, the fresh water intake of the lake has declined significantly relative to the saline and toxic effluents discharged into it.

Keenjhar (Kalri) Lake Keenjhar also known as Kalri Lake is one of the largest freshwater lakes in Pakistan. It is located on 24° 56 N, 068°03'E coordinates. It has length of about 24 km, width 6 km and capacity of 0.53 million acre feet. It is located at a distance of about 122 km east from Karachi and 19 km north-east of Thatta town. The lake was created in 1930s from the two smaller lakes Keenjhar and Kalri by the construction of a dam at Chilya and a 12 km embankment on the eastern side. Indus provides Keenjhar, the required water through Kalri Baghar (KB) Feeder. KB Feeder starts from Kotri Barrage. Since the area is arid and receives less than 200 mm annual rainfall, hence Indus is the only source of water for this lake.

The lake has extensive reed-beds, particularly in the shallow western and northern parts and rich submerged and floating vegetation. The natural vegetation of the surrounding area is tropical thorn forest. The climate is dry subtropical monsoonal.

The lake is internationally important for a wide variety of breeding, staging, passage and wintering water birds. The wintering birds include ducks and geese, shorebirds, flamingos, cormorants, herons and egrets, ibises, coots, gulls, terns etc. The breeding birds reported from this wetland are Cotton Teal, Night Heron; Pheasant tailed Jacana and Purple Moorehen²¹. This lake has rich submerged and floating aquatic vegetation. The natural vegetation of the surrounding area is tropical thorn forest. The Lake is rich in fish fauna and supports the livelihood of about 50,000 local people. Main activities at the site are commercial fishing, nature conservation and public recreation. The site serves as a major source of drinking water for Karachi. Keenjhar Lake was declared a Game Sanctuary in 1971 and designated as a Wildlife Sanctuary in 1977.

Drigh Lake: It lies 18 km west of Larkana. It is located on 27° 34 N, 068°06'E coordinates. Drigh is a small, slightly brackish lake, with extensive marshes, situated in the Indus floodplain. The lake is fed by water from the nearby canal system and by local run-off from monsoon rains. The lake is situated in an area of cultivated plains, generally divided into small fields for rice cultivation. It is a semi-natural wetland, supporting rich and diverse aquatic vegetation. The climate is arid and sub tropical, with hot summers and cool winters.

The site regularly hosts over 20,000 water birds, mostly ducks, geese and coot in winter. It is a breeding and wintering area for a wide variety of water birds and an important roosting site

²¹ An article written by Mr Ali Raza abd published in the wide circulation news paper "The News"

for night-heron. The wintering birds also include shorebirds, cormorants, pelicans, flamingos, jacanas, gulls and terns. This lake was designated as a Wildlife Sanctuary in 1972.

Haleji Lake is a perennial freshwater lake with marshes and a brackish seepage lagoon. Considered a game reserve in 1971, this lake was declared a wildlife sanctuary and in 1976, the lake proceeded to become a Ramsar site. Haleji serves as an important source of water for Karachi besides being a popular recreational destination. The Lake is located in Thatta district on 24° 47' N, 067° 46' E coordinates.

Jubho Lagoon is a shallow, small brackish water lagoon with mudflats and marshes that support a large concentration of migratory birds including flamingos and endangered Dalmation pelicans, a rare species in the world. This was declared a Ramsar site in 2001 because of the efforts made by IUCN Pakistan. The lagoon is located in Thatta district on 24° 20' N, 068° 40' E coordinates.

Nurri Lagoon is also a brackish, privately owned lagoon with barren mudflats that is visited by large concentrations of migratory water birds. It was also declared a Ramsar site in 2001. Increased salinity, sea intrusion, population pressures, agricultural and industrial pollution are major threats to this site. The lagoon is located in Badin district 24° 30' N, 068° 47' E on coordinates.

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

Other lakes of the province include Badin and Kadhan Lagoons, Charwo Lake, Ghauspur Jheel, Hadiero Lake, Hamal Katchri Lake, Khango Lake, Khipro Lakes, Langh Lake, Mahboob Lake, Phoosna Lakes, Pugri Lake, Sadhori Lake, Sanghriaro Lake, Shahbuder and Jaffri Lake, Soonhari Lake and Tando Bago Lake.

Important Point: All the above wetlands are beyond the project area of influence.

5.3 Geographical and Environmental Scenario of Project Area in Particular

5.3.1 Physical Resources

The total area of the district is 17,355 square kilometers. In its physical aspects the Thatta District has very varied features which range from coastal swamps to fresh water marshes and lakes and from river islands to coastal deltas. However, this wide variation has diminished as a result of the lack of water in the Indus River. The current terrain of the district consists of the Makli Hills close by the Thatta Town. These hills are 32 kilometers in length and are well known on account of the ancient tombs which are located here. The north western part of the district consists of hilly tracts known as Kohistan. The hills are bare and mostly composed of limestone while the valleys are covered with grass or brushwood. Southwards, the area degenerates into sandy wastes, uncultivated and almost devoid of vegetation.²²

²² Socioeconomic Study of Badin/Thatta-A document of World Bank

There are short ranges of low stones, hills and intersected by nals or torrent beds which carry the drainage of the Kohistan to the Indus. To the west, wind has blown sand over large tracts of land. In the south eastern quarter of the delta, there is a wide expanse of salt waste, embracing a large part of the Shah Bander and Jatti Talukas. Between Sir and Khori Creeks lie the great Sirganda salt deposits which consist of many square kilometers of solid salt.

5.3.2 Wetlands of Area

There are many lakes in the district. The most famous are Kalri and Haleji. The Kalri Lake is a reservoir for feeding canals in the Thatta sub-division. During winter it is an ideal spot for fishing and duck-shooting. There have been many ecological changes in the district, which have changed the nature of the delta. The lack of water below Kotri has damaged the ecology of the delta. The old branch of Indus, which used to run past it into the Gharo Creek, has silted up. The district also comprises fierce torrents most important of them is Nai-Barun which rises in the Keerthur Range. The other important Nais in the district are Gagar and Ranpathani.²³

5.3.3 Climate

The climate of the district is moderate. The mean maximum and minimum temperature recorded during this month is about 40°C and 25°C respectively. The winter season starts from November when the dry and cold northeast winds replace the moist sea breeze. As a result there is an immediate fall in temperature. January is the coldest month. The annual average rainfall of the district is about 200 mm.²⁴

5.3.4 Flora of the project area

The flora of the area is governed by the type of soil and the amount of moisture available. The Thatta District has a wide range of soil types due to its diverse land forms which include sandy, deltaic, alluvial, gravel, coastal and mountainous. In the Kohistan region the dominant trees and shrubs are hubul (acacia arabica), kaneli (prosopis spicegra) Pi (salvadora olioides), Karil (capparis aphylla), rhazya stricta, daemia extensa and many others. The dominant trees, shrubs and under shrubs of sand dunes are represented by ak (calotropis procerra), lai (tamerix diocia) besides babul, kandi and karil, etc. The plants found cultivated or wild near villages in the alluvial tracts are neem (azadirachta indica), ber (zizyphus jujube), and serrel (albizzia lebbeck) etc.

5.3.5 Fauna of the project area

The wildlife in the area has been affected by colonization of the area and many wild life species have either diminished or vanished. At present hyenas and wolves are hardly ever seen. Jackals are fairly common and foxes are seen in the rapidly contracting area of dry waste. Hog deer which were once seen along the bank of River Indus are uncommon and pigs though diminished are still found in small numbers. Hare and deer are fairly common. The Keenjhar, Haleji and Hadero lakes are locate on the international flying routes of the ducks. However normally they fly at a very high altitude (about 400 to 500 meters). The only

²³ Ibid

²⁴ Ibid

environmental disturbance to them could be the sound of installation in their flying route. Maximum sound of the plant at ground will be 100 dB, and with respect to height/distance it will continue to decrease to about 45 dB at a distance of 200 m. At 400 to 500 meters, which is a normal flying height therefore it is not going to disturb the normal flying of birds. Among birds both grey and black partridges are very common in the forest plantation. Most of the common kind of wild duck and water fowl are seen in the cold season. Geese are also found penetrating the fields of gram and wheat. Kunj are also regular winter visitors. Sand grouse of various kinds visit the district in the cold weather, but the expansion of the cultivated area has driven them away. This also applies to the houbara which was quite common in former times. Quails are common.

The other birds found in the district are Indian cursor, small Indian swallow plover, asian open bill stork, black and glossy ibris, sirkeer malikoha or cuckoo, Indian scoops owl, dusky horned owl, etc. Black or Eurasian coot is also found in the district. The Talukas of Sujawal, Shah Bander, Thatta, Mirpur Sakhro were known for the shikar of deer, ducks and partridges. The water fowl census revealed the biggest concentration in the whole of Pakistan on Keenjhar Lake.

5.3.6 Birds

Pakistan gets a large number of guest birds from Europe, Central Asian States and India every year. The birds from North spend winters in different wetlands and deserts of Pakistan, which are distributed almost throughout the country, from the high Himalayas to coastal mangroves and mud flats in the Indus delta. And, after winters they go back to their native habitats.

This famous route from Siberia to various destinations in Pakistan over Karakorum, Hindu Kush, and Suleiman Ranges along Indus River down to the delta is known as International Migratory Bird Route Number 4. It is also called as the Green Route or more commonly Indus Flyway.



Endowed with a remarkable geology, Pakistan spans several of the world's ecological regions and is spread over broad latitude. The rich Indus delta and the highlands in Pakistan are a great attraction for the guest birds. This is why the Indus Flyway is one of the busiest in the world.

The birds start on this route in November. February is the peak time and by March they start flying back home. These periods may vary depending upon weather conditions in Siberia and or Pakistan. There are a total of seven identified flyways in the world: from Northern Europe to Scandinavian countries, Central Europe to Mediterranean Sea, Western Siberia to Red Sea, Green Route from Siberia to Pakistan, Ganga Flyway from Eastern Siberia to India, Manchuria to Korea and one from Chakotaka to California. Besides these there are many regional and smaller routes all over the world.

The Indus Flyway is important due to the diverse species and large number of birds that take this itinerary: different species of water fowls, cranes, teals, pintail, mallard and gadwall, the list goes on. Some extinguishing species like white-headed duck, houbara bustard and Siberian crane also travel on this route.

As per an estimate based on regular counts at different Pakistani wetlands, between 700,000 and 1,200,000 birds arrive in Pakistan ²⁵through Indus Flyway every year. Out of which over 70 per cent of the admirable visitors stay in Thanedar Wala Game Reserve (International Ramsar site number (IRS) 97 where Crane Refuge has also been constructed), Tenda Dam (IRS98), Kinjhar Lakes (IRS 99), and Drigh (IRS 100). Haleji Lake (IRS 101) where in the past, over 100,000 migratory birds of more than 222 species had been reported. There are 45 sanctuaries and reserves spread over an area of about 0.90 million hectares in Sindh alone. Some of the birds that come to our country from northern latitudes arrive at coastal creeks. The remaining birds land up in lakes, which are fondly and proudly maintained by landowners. Only a few places in the world have such plentiful variety of winged life as the wetlands of Pakistan.

In different Pakistani habitats the guest birds live like "Pairs of Saras" — using the metaphor from romantic literature. As a host it is our responsibility to provide them comfortable and peaceful environment, which can be done by efficiently managing the wetlands particularly those listed as International Ramsar sites — natural resource reservoirs. All wetlands are active agents for recharging water tables and aquifers besides being home to birds. The nearest wetland to the wind farm Zorlu site is at a distance of 5 km and is beyond the project influence area.

²⁵ Allvoices.com,

Exhibit 5-1: Land Use in Sindh

| Land Use | Area (Million Ha) | Percentage |
|---------------------------------|----------------------|----------------|
| Not Sown | 3.022 | 21.446 |
| Current Fallow | 1.439 | 18.935 |
| Cultivable Waste | 2.688 | 10.212 |
| Total Available for Cultivation | 7.149 | 50.593 |
| Not Available for Cultivation | 5.830 | 41.374 |
| Forest | 1.125 | 7.984 |
| Unreported | 0.007 | 0.049 |
| Total | 14.091 | 100.000 |

Source: Sindh State of Environment and Development, IUCN, 2004.

Exhibit 5-2: Meteorological Data – Mean Monthly Maximum Temperatures

| Month | Degrees Celsius | | | | |
|---------------|------------------------|----------------------|----------------------|--------------|--------------|
| | Hyderabad ^a | Umerkot ^b | Sanghar ^c | Badin | Jacobabad |
| January | 25.04 | 26.49 | 24.31 | 25.78 | 22.60 |
| February | 28.15 | 29.16 | 27.06 | 28.59 | 25.24 |
| March | 33.38 | 34.52 | 33.29 | 34.02 | 31.28 |
| April | 38.87 | 39.12 | 39.25 | 38.40 | 38.00 |
| May | 41.62 | 41.49 | 43.53 | 39.85 | 43.08 |
| June | 40.15 | 39.72 | 43.23 | 38.02 | 44.33 |
| July | 37.40 | 36.19 | 40.37 | 35.11 | 40.56 |
| August | 36.30 | 34.51 | 38.60 | 33.61 | 38.24 |
| September | 36.84 | 35.70 | 38.14 | 34.36 | 37.00 |
| October | 37.19 | 37.12 | 37.14 | 35.80 | 35.32 |
| November | 31.95 | 32.98 | 31.59 | 31.87 | 30.06 |
| December | 26.27 | 27.95 | 25.53 | 26.68 | 24.11 |
| Annual | 34.47 | 34.52 | 35.19 | 33.48 | 34.15 |

Source: Data Processing Centre, Pakistan Meteorological Department, Karachi

^a Measured at Hyderabad Air Port. ^b Measured at Chor. ^c Measured at Nawabshah.

Exhibit 5-3: Meteorological Data – Mean Monthly Minimum Temperatures

| Month | Degrees Celsius | | | | |
|---------------|------------------------|----------------------|----------------------|--------------|--------------|
| | Hyderabad ^a | Umerkot ^b | Sanghar ^c | Badin | Jacobabad |
| January | 11.08 | 5.42 | 5.92 | 8.73 | 7.68 |
| February | 13.62 | 8.71 | 8.72 | 11.60 | 10.48 |
| March | 18.50 | 14.29 | 14.22 | 16.80 | 16.30 |
| April | 22.98 | 20.12 | 19.71 | 21.80 | 22.33 |
| May | 26.16 | 24.50 | 24.59 | 25.47 | 26.74 |
| June | 28.07 | 27.17 | 27.67 | 27.46 | 29.38 |
| July | 27.81 | 26.82 | 27.60 | 27.04 | 29.22 |
| August | 26.71 | 25.73 | 26.33 | 26.06 | 28.25 |
| September | 25.34 | 23.88 | 23.77 | 24.87 | 25.85 |
| October | 22.27 | 18.54 | 18.18 | 21.70 | 20.29 |
| November | 17.29 | 11.89 | 12.23 | 15.86 | 14.08 |
| December | 12.50 | 6.62 | 7.39 | 10.10 | 8.74 |
| Annual | 21.03 | 17.84 | 18.00 | 19.76 | 19.95 |

Source: Data Processing Centre, Pakistan Meteorological Department, Karachi.

Exhibit 5-4: Meteorological Data – Relative Humidity

| Month | % | | | | |
|---------------|------------------------|----------------------|----------------------|--------------|--------------|
| | Hyderabad ^a | Umerkot ^b | Sanghar ^c | Badin | Jacobabad |
| January | 47.90 | 45.52 | 59.98 | 50.38 | 50.88 |
| February | 45.38 | 44.45 | 56.00 | 48.81 | 48.23 |
| March | 42.40 | 42.55 | 50.62 | 48.36 | 42.76 |
| April | 41.88 | 42.73 | 44.66 | 48.97 | 33.01 |
| May | 46.96 | 46.81 | 42.63 | 53.10 | 30.93 |
| June | 56.35 | 56.40 | 51.81 | 60.70 | 41.16 |
| July | 63.42 | 67.23 | 62.10 | 69.61 | 56.18 |
| August | 65.26 | 70.15 | 66.06 | 72.55 | 62.20 |
| September | 61.37 | 64.76 | 62.38 | 69.78 | 59.38 |
| October | 47.65 | 50.78 | 55.16 | 59.15 | 48.87 |
| November | 46.40 | 44.58 | 59.48 | 53.88 | 45.75 |
| December | 49.26 | 46.84 | 62.47 | 52.46 | 52.73 |
| Annual | 51.19 | 52.11 | 56.03 | 57.56 | 47.70 |

Source: Data Processing Centre, Pakistan Meteorological Department, Karachi

^a Measured at Hyderabad Air Port. ^b Measured at Chor. ^c Measured at Nawabshah.

Exhibit 5-5: Ambient Air Quality in Urban Centers

| Pollutant | Units | Rawalpindi | Lahore | Karachi | Quetta | Peshawar |
|--|-------------------|------------|--------|---------|--------|----------|
| Total suspended particles (TSP) | µg/m ³ | 435.0 | 886.0 | 390 | 680 | 489 |
| Particulate matter of size less than 10 micron (PM ₁₀) | µg/m ³ | 230.0 | 300.0 | 280 | 310 | 310 |
| Sulfur dioxide (SO ₂) | Ppb | 37.0 | 55.7 | 44 | 45.5 | 42 |
| Carbon monoxide (CO) | Ppm | 16.5 | 26.8 | 22.8 | 18.0 | 16.5 |
| Oxides of nitrogen (NO _x) | Ppb | 40.0 | 55.0 | 42 | 41 | 42.5 |
| Ozone | Ppb | 42.0 | 51.0 | 48.0 | 44.4 | 48.0 |

Source: Ambient air quality tests carried out by SUPARCO, 2004.

Exhibit 5-6: Indus River and its Tributaries ^a

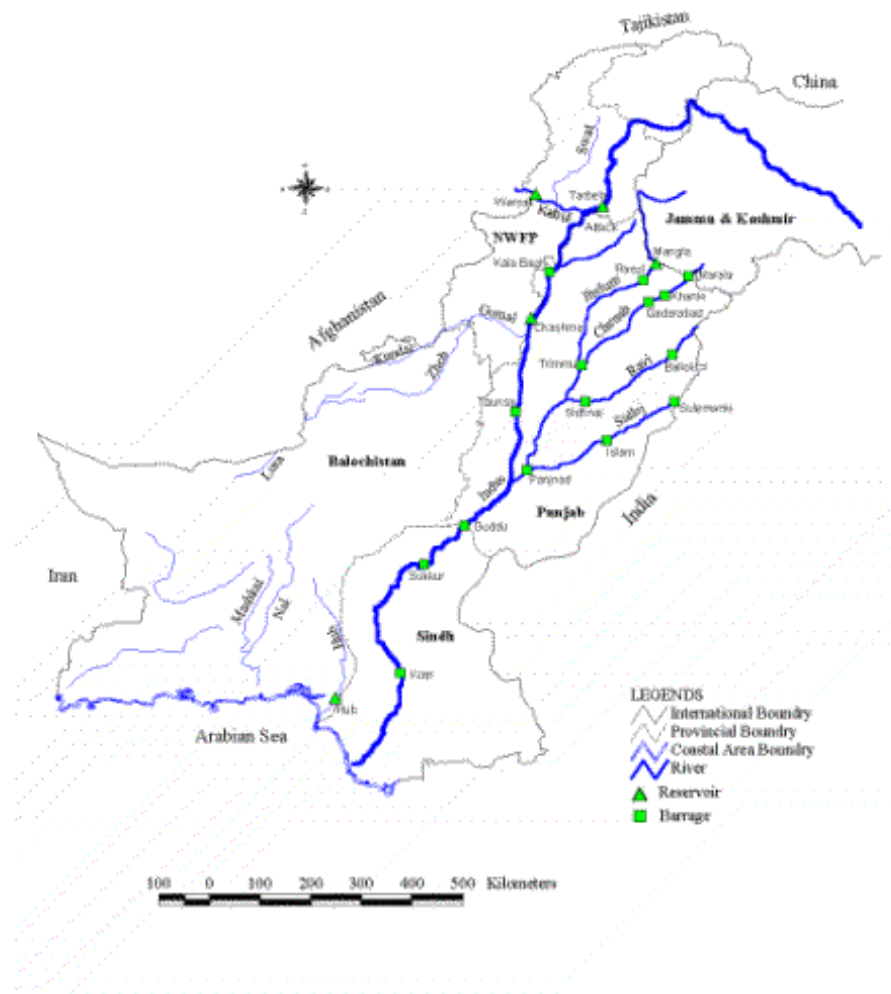


Exhibit 5-7: Key Facts about Indus River ^a

| | |
|--|---|
| Length of River Indus in Pakistan: | 1,708 miles (2,767 km) |
| Important Engineering Structures on the River: | Tarbela Dam and Ghazi Barotha Hydro Power Project |
| | Jinnah Barrage (950,000 cusecs), |
| | Chashma Barrage (1.1 million cusecs), |
| | Taunsa Barrage (750,000 cusecs), |
| | Guddu Barrage (1.2 million cusecs), |
| | Sukkur Barrage (1.5 million cusecs) and |
| | Kotri Barrage (750,000 cusecs) |
| Catchment Area: | 252,638 miles ² (663,023 km ²) |
| Annual Average Flow: | 48.0 MAF (41.41 Kharif and 6.61 Rabi) |

^a Source: Pakistan Water Gateway.

Exhibit 5-8: Water Flow in Indus River

| Average Annual Flow - 1922-61 (MAF) | Average Annual Flow - 1985-95 (MAF) | Average Annual Flow - 2001-02 (MAF) |
|-------------------------------------|-------------------------------------|-------------------------------------|
| 93.00 | 62.70 | 48.00 |

Source: Pakistan Water Gateway.

6 Description of the Socioeconomic Conditions

This Chapter describes the general socioeconomic conditions of Sindh in general and of project area in particular.

6.1 Socioeconomic Description of Sindh in General

6.1.1 Overview

Sindh is the second largest province of Pakistan. The neighboring regions are Balochistan to the west and north, Punjab in the north, Rajasthan (India) to the east and the Arabian Sea and Gujarat (India) to the south. The province forms the lower Indus basin and lies between 23° and 28° North latitudes and 66° and 71° East longitudes. It is about 579 km in length from north to south and nearly 442 km in its extreme breadth (281 km average). It covers an area of 140,914 km² and is about as large as England.

6.1.2 Historical Background

Known by various names in the past, the name 'Sindh' comes from the Indo-Aryans whose legends claimed that the Indus River flowed from the mouth of a lion or *Sinh-ka-bab*. In Sanskrit, the province was dubbed *Sindhu* meaning "ocean". The Assyrians (as early as the seventh century BC) knew the region as Sinda, the Persians Abisind, the Greeks Sinthus, the Romans Sindus, the Chinese Sintow, while the Arabs dubbed it Sind. It is mentioned to be a part of *Abhirradesh* (Abhira Kingdom) in Srimad Bhagavatam. The origin of the name is from the Sanskrit 'Sindhu' or 'the sea', because of the size of the Great River on the West. In ancient times, there were two regions in this area ('Sindh' on the west, extending up to the city of Multan and 'Hind' (modern India) on the east). Sindh was the first place where Islam spread in South Asia. As a result, it is often referred to as "Bab-al-Islam" (Gate of Islam).

The earliest authentic history of Sindh dates from the time when Alexander the Great abandoned his scheme of conquest towards the Ganges alarmed at the discontent of his soldiers. He embarked a portion of the army in boats, floated them down the Jhelum and the Chenab, and marched the remainder on the banks of the river till he came to the Indus. There he constructed a fleet, which sailed along the coast towards the Persian Gulf with part of his forces, whilst Alexander himself marched through southern Balochistan and Persia to Seistan or Susa. At that time Sindh was in the possession of the Hindus, the last of whose rulers was Raja Sahasi, whose race, as is reported by historians, governed the kingdom for over two thousand years. In the sixth century BC, the Persian monarchs invaded Sindh. They defeated and slew the monarch in a pitched battle and plundered the province and then left. Eight years after his accession to the Persian throne, Darius I, son of Hystaspes, extended his authority as far as the Indus. This was about 513 BC.

The Arab conquest of Sindh by Muhammad Bin Qasim in 712 AD gave the Muslims a firm foothold on the sub-continent. The description of Hiun Tsang, a Chinese historian, leaves no doubt that the social and economic restrictions inherent in the caste differentiations of Hindu society had however, gradually sapped the inner vitality of the social system and Sindh fell

without much resistance before the Muslim armies. According to Al-Idreesi, the famous city of Al-Mansura was founded during the reign of Mansur (754-775 AD) the second Khalifa of the Abbasid dynasty. Khalifa Harun-al-Rashid (786-809 AD) was able to extend the frontiers of Sindh on its western side. For nearly two hundred years since its conquest by Muhammad Bin Qasim, Sindh remained an integral part of the Umayyad and the Abbasid caliphates. The provincial governors were appointed directly by the central government. History has preserved a record of some 37 of them.

The Arab rule brought Sindh within the orbit of the Islamic civilization, Sindhi language was developed and written in the *naskh* script. Education became widely diffused and Sindhi scholars attained fame in the Muslim world. Agriculture and commerce progressed considerably. Ruins of Mansura, the medieval Arab capital of Sindh (11 km south east of Shahdadpur) testify to the grandeur of the city and the development of urban life during that period.

In the 10th century, native people replaced the Arab rule in Sindh. Samma and Soomra dynasties ruled Sindh for long. These dynasties produced some rulers who obtained fame due to judicious dispensation and good administration.

Sindh was partially independent and the scene of great disorders till late in the sixteenth century when it fell into the hands of Emperor Akbar, and for a hundred and fifty years the chiefs paid tribute, but only as often as they were compelled to do so, to the Moghal Emperors in Delhi. Later the Kalhora clan claiming descent from the house of Abbas and long settled in Sindh produced religious leaders of whom Main Adam Shah attained prominence in the 16th century. His descendants continued to gather large following and this enabled them to capture political power in the north western Sindh under the leadership of Mian Nasir Muhammad. This happened in the 2nd half of the 17th century. By the turn of that century, foundations of the Kalhora power were firmly laid in the northern Sindh under the leadership of Mian Yar Mohammad. During the reign of his son, Mian Noor Muhammad, lower Sindh with Thatta as its capital also came under the Kalhora administration.

Under the banner of Mir Fateh Ali Khan Talpur, the Balochis defeated the last Kalhora ruler Mian Abdul Nabi in the battle of Halani in 1782 AD. Talpur Amirs regained the parts of Sindh (Karachi, Khairpur, Sabzal Kot and Umar Kot) which the last Kalhora chief had conceded to the neighboring rulers. By eliminating the foreign interference, which had plagued the Kalhora rule, and by their essentially democratic way of governance, the Talpurs were able to take the people into confidence and thus achieved great many things within a short period of 60 years. They built up an excellent system of forts and outposts guarding the frontiers, extended the irrigation system, encouraged scholarly pursuits and educational institutions, and promoted trade and commerce internally as well as with the neighboring countries.

The British who came to Sindh as traders became so powerful in rest of the sub-continent that in 1843 Sindh lost its independence to the British regime. The Talpurs were defeated on the battlefields of Miani, Dubba and Kunhera and taken prisoners. Charles Napier who commanded the troops subsequently became the first Governor of the province of Sindh, which was annexed to the Bombay Presidency in 1843. It was after a long struggle that the cause of Sindh was supported by the Quaid-e-Azam Mohammad Ali Jinnah when he brought in his famous 14-points the demand of Sindh's separation from Bombay Presidency. Sir

Agha Khan, G. M. Syed, Sir Abdul Qayyum Khan and many other Indian leaders also played their pivotal role in getting Sindh separated from the Bombay Presidency in 1936.

6.1.3 Culture and Customs

Sindh province has rich culture, customs and traditions. Being traditional Muslims there is a greater influence of the Arabian culture; however, the traces of Hindu, Buddhism and other religious thoughts are also present in the cultural attitudes and approaches of the local communities. The *Pirs* and *Murshids* (religious leaders, saints) are held in high esteem and confidence amongst the Muslims particularly in the uneducated and poor class of the rural areas. Annual festivals at the shrines of saints are regularly held in which people very enthusiastically take part. Similarly, the Hindus also hold great confidence and reverence in Thakurs and Brahmans (the higher castes). The Brahmans usually perform spiritual rites of Hindus on special occasions.

6.1.4 Ethnicity and Castes

Generally society in Sindh including the project area is heterogeneous and highly complex. The distribution of power is along the lines of clan, tribe, religion, gender, political affiliation, and origin. It follows traditional rules, which define the relationship between the poor and the ruling class. Stratification along poverty lines is low with the majority of the village population poor or very poor and consisting of *haris* (share-croppers), agricultural laborers, and marginal owners-cum-tenants. Besides sedentary groups, an unknown number of nomadic and semi-nomadic groups follow well-established migration patterns and respond to seasonal labor demands in the agricultural areas of the province. They settle temporarily at the fringes of villages, on public or private land, where water, grazing grounds, or work opportunities allow them to survive for limited periods of time.

6.1.5 Poverty

Historically Sindh was a prosperous and rich province. However, presently Sindh is largely witnessing poverty and destitution. According to a recent study (ADB: Sindh Rural Development Project, 2000), poverty levels are high in Sindh: 37% of the population lives below the poverty line; 20% of the urban and 53% of the rural population is poor. The ADB study covering four districts - Thatta, Badin, Mirpur Khas and Sanghar - claims that poverty is widespread throughout the region. Health and education indicators are very poor in these areas. According to the report a majority of rural households in the area do not own land. Tenant farms alone represent 44% of all private farms. Of those who do own land in rural areas, fewer than 20% are large landlords but this group owns about 60% of the private farms.

According to the ADB Sindh Coastal and Inland Community Development Project Interim Report, the poverty figures in Badin and Thatta districts are higher, perhaps as high as 70 percent. According to this report, 54 percent of the population was found among the poorest category while 79 percent were poor. According to the report poverty was highly correlated with household economic characteristics such as land ownership and employment opportunities. Land owners are usually among the non-poor. The sea intrusion has badly affected the agricultural activities in these areas. According to the community perception of poverty, the poorest are those who have no capital or other resources of their own, mostly

depend on the land and fishing grounds of others for their livelihood, and usually work on daily basis.

6.1.6 Main Occupations

Cultivation and the related businesses are the main occupations in the project area. The other key economic activities include fisheries, livestock rearing, and government as well as private sector jobs. In the coastal areas of Thatta and Badin, fisheries are among the prime livelihood activities of the majority of the people.

Livestock is also one of the key livelihood sources for the rural population of the area. The farmers in these districts traditionally keep a few heads of livestock, ranging from bullocks for draught to cows and buffalos for milk, and poultry for eggs and meat. There have been many traditional communities in the area exclusively dependent on livestock for their livelihood, however, the importance of livestock as a source of income has declined over the years. Good breeds of buffalos and cows are found in these districts.

6.1.7 Gender Perspectives

Sindh has been the land of Sufism strongly believing in the equity and equality irrespective of race, religion and gender. However, with the passage of time, the Sindhi society has accepted the impact of different cultures, traditions and customs. Presently the gender based approaches and attitudes are generally not favorable for women in the project area.

There are slight differences in the gender perceptions, attitudes, roles and responsibilities in lower, central and upper Sindh. In these aspects, the coastal districts are less conservative compared to the upper and central Sindh areas. The tribal clans in the upper Sindh, as well as in Sanghar and Mirpur Khas districts of central Sindh are more conservative with regard to women and their status, roles and responsibilities.

The women particularly in the rural areas have fewer rights in all the aspects of their lives. The literacy data clearly corroborates this, and indicates that compared to men, the women are far behind in education, which is a key development indicator.

6.1.8 Education

The overall literacy of Sindh as shown in **Exhibit 6-1** is 45.29 percent (1998 census data). The urban literacy is 63.72 percent which is substantially higher than the rural literacy which is 25.75 percent. In the project area, Hyderabad has the highest urban literacy (61%), whereas Jacobabad has the lowest urban literacy (44%). Larkana enjoys the highest rural literacy of almost 28 percent, whereas Jacobabad is again at the bottom of the list in the project area in terms of the rural literacy. Thatta is most backward in terms of the overall literacy (22%) compared to the other districts in the project area.

6.1.9 Agriculture

Agro-ecological Zones

The use of land is governed by several interacting factors, which are physical, biological, social and economic in nature. A clear vision of these factors is essential for increased agricultural production in any given region. The Pakistan Agricultural Research Council

(PARC) in 1980 divided Pakistan in ten agro-ecological zones, based on a survey carried out by FAO and review of the available literature on physiography, climate, soils, land use and other factors affecting agriculture production.

Agricultural Production

Agriculture is the key source of livelihood in Sindh since the majority of population is associated with this sector. The total land area of Sindh, 14.1 million hectares (or 34.84 million acres), represents 18% of total geographical area of Pakistan. Out of this, nearly 50 percent or 7 million ha is available for cultivation. More than 80% of the rural population depends on agriculture and its allied businesses. Agriculture is the dominant economic activity in the province.

About 80% of the agriculture land of the province is cultivated through controlled irrigation system. The irrigation system of Sindh comprises of three barrages at Sukkur, Guddu, and Kotri, having a gross command area of 15 million acres. However, cultivation takes place on only 8 million acres. The major crops of Sindh include rice, wheat, cotton, sugarcane and oilseeds. Sindh is also known for its orchards; mango, banana, guava and dates being some of the key fruits.

6.1.10 Irrigation System

Irrigated agriculture is the major user of both, surface and groundwater resources of Pakistan. The average annual river diversions for irrigation in the Indus Basin are of the order of 104.7 MAF, to irrigate over 14.6 million hectares. Of this, 67.11 MAF on average is diverted during the *kharif* period (summer crop), while 37.63 MAF is diverted during the *rabi* period (winter crop).

During the *kharif* periods of the last ten years, Punjab used 34.3 MAF annually; while Sindh and Balochistan used 31.4 MAF and NWFP used 2.35 MAF. During the *rabi* periods of the last ten years, average withdrawals by Punjab, Sindh and Balochistan and NWFP were 19.87 MAF, 16.06 MAF and 1.46 MAF, respectively.

Groundwater Irrigation

An estimated 41.6 MAF of groundwater is pumped annually in Pakistan. According to a study, more than 90% of the extracted groundwater is used for irrigation purposes. Groundwater reservoirs are recharged from the rivers as well as the seepage losses from the canals, watercourses, farm channels and the fields.

Salinity and Water Logging

Before the introduction of the irrigation system, the water table was sufficiently deep. However, due to a lack of drainage facilities and improper water management, the water table rose, resulting in water logging and salinity.

About 25% of the irrigated area of Pakistan is affected by water logging and salinity/ sodicity problems. In addition to other measures like the Irrigation System Rehabilitation, Command Water Management and On-Farm Water Management programs taken up by different government departments, WAPDA completed 57 Salinity Control and Reclamation Projects (SCARPs). These cover a gross area of 7.81 million hectares. Surveys have indicated that

water logging has reduced from 42% in the 60s to about 25% in 1977-79. Similarly, saline, saline-sodic and sodic soils were reduced from 6, 27 and 11% to 11, 24 and 3% respectively, in the same period of time.

Exhibit 6-1: Literacy Ratio in Project Area (1998 Census Data)

| District | Urban | Rural | Total |
|-------------|-------|-------|-------|
| Thatta | 45.92 | 18.99 | 22.14 |
| Badin | 44.76 | 20.52 | 24.63 |
| Hyderabad | 61.30 | 24.84 | 44.25 |
| Mirpur Khas | 59.80 | 23.13 | 35.97 |
| Sanghar | 53.15 | 23.94 | 30.87 |
| Larkana | 51.95 | 27.68 | 34.95 |
| Shikarpur | 55.33 | 23.92 | 31.94 |
| Jacobabad | 43.86 | 16.86 | 23.66 |
| Sindh | 63.72 | 25.75 | 45.29 |

Source: District Census Reports, 1999 and 2000.

6.2 Socio Economic Condition of Project Area

6.2.1 Population Characteristics of Project Area

Jhimpir being in the administrative control of Thatta district is unique in terms of population sensibility and characteristics. The total area of Thatta district is 17,355 square km. The total population consists of 1,113,194. Gender wise distribution shows a figure as 589,341 are male and 523,853 are of female. The population density of Thatta is 64.1 per sq/km. The percentage of total population residing in urban settings is 11.2%. The average house hold size is of 5.1 persons. The average growth rate of population has remained from 1981-98 as 2.26.²⁶

6.2.2 Other Socio Economic Indicators

Literacy rate for Thatta is amongst the lowest in Sindh. Total literacy rate stands at 22%. There are marked urban and rural and male-female differentials in Thatta as 46% urban and 19% rural.

The health infrastructure in Thatta is scant. In the six coastal Talukas, three do not have any Rural Health Centre (RHC) or any veterinary dispensary. The BHUs and dispensaries are also in small number 27 The Thatta District is also very poor in terms of the indicator of piped water, which is available to only about 14% of the housing units. About 13% of rural

²⁶ District Census Report of Thatta 1998

²⁷ Preliminary Socio Economic Baseline Assessment by Shirkat Gah, WWF-Indus for All, March 2007

households have hand pumps inside the housing units, while 16% use outside ponds for fetching water and 6% of housing units use dug wells.²⁸

6.2.3 NGOs Working in the Area

Different national and international NGOs are working in the Thatta district with the help of their local partners. Their scope of work ranges from relief operations in coastal areas of the Thatta to social welfare and livelihood improvements initiatives. Some are working on CPI (Community Physical Infrastructure). Some have found their way in providing micro finance to local communities through social collateral. Few of these are also working on awareness and advocacy.

Names of different NGOs and institutions like NRSP (National Rural Support Program), Aga Khan Planning and Building Services (AKPBS), PPAF (Pakistan Poverty Alleviation Fund), IUCN, WWF, SPO and Pakistan Fisher Folk Forum.²⁹

6.3 Employment Opportunities Associated with the Project

The proposed project will offer limited employment opportunities, primarily during the construction phase. In 1st Phase about 137 persons were employed. Out of this 27 (22 local and 5 foreigners) had been directly employed and rest including 10 non locals had been hired by the contractor for construction and 7 persons (5 locals and 2 non locals) will be employed for operation of phase 1.

In construction of Phase 2 a total of 300 persons are expected to be employed. Out of this 50 (35 local and 15 foreigners) will be directly employed and rest including 50 non locals will be hired by the contractor for construction and 14 persons (12 locals and 2 foreigner) will be employed for operation.

Since the area is backward and limited opportunity of education is available, therefore it is expected that mostly labor force could be employed during construction and operation phase. This project will have a relatively short construction period, and will require a relatively small number of skilled and semi-skilled workers, including crane and heavy equipment operators, engineers, electricians, electronic technicians, mechanical technicians, concrete workers and laborers. The project developer should accommodate as much local labor as possible from the local area.

Short-term positive economic impacts to area businesses may result from increased expenditures for meals, motels, fuel, etc. However, given the small number of employees involved and the temporary nature of the work, it is not anticipated that there will be significant positive or negative impacts at the community level. .

6.4 ZORLU Wind Farm and Tourism

The wind farm project is unlikely to have any impact on tourism as the site is on a remote arid area which is not a direct route to any common tourist destination. The turbines are not likely

²⁸ Figures based on the 1998 Housing Census in World Bank study, "Socioeconomic Study and proposal for Livelihood Improvements: Badin and Thatta Districts, Sindh, Pakistan." Mimeo. 2005. p.16

²⁹ Data collected through Public Consultations

to be well noticed in any view plane which would make them a destination in and of themselves. Since the Keenjhar lake is about 5 km away from the project therefore there are remote chances that the visitors visiting the Keenjhar Lake may come to visit the wind farm site while going back to their destination if they chose to go by super high way route.

If this is the case then there may be the some business opportunities as the site access has already been made possible during the initial construction phase of site development. This will help the local people in improving their living standard.

6.5 Benefits to women due to the project

When some one thinks of development and physical change in vulnerable area, he must think of the infrastructure and machines moving in it. Weather, it can be a large industry in big/small cities or just bringing electricity in the area. Development can be just lighting in rural areas. What will be the first need that shakes your mind for bringing about immense change in a place; of course it will be availability and significance of energy, which is a basic need and start point of development at grass root level. The inhabitants of far flung areas of Pakistan do not have access to this basic and modern amenity of life. Consequently, such population has minimum opportunity for development. The same is the case for the residents of the area under discussion.

Like, generally in the third world countries, one of the main drawbacks of this society is that females' home management is not recognized as a productive activity whereas the fact is other way round; women at home are working for very high value cause of society building.

However, during public consultation process, it was noted that females generally work for maintaining livestock, helping male members in agriculture related activities. Some women also work as a labor as well. As for as male members are concerned, some of them who have some education have moved to cities for jobs whereas most of them work as a laborer, maintain their agricultural land and look after their livestock.

Traditionally, women are more skilled and hard workings due to local norms like female have to fetch water and keep themselves busy in other nonproductive activities in community. Another difference made by local cultural between man and woman which force them to wear special dresses that should be different from man and must show specific sign of specific community, so that woman from every community is recognized from their dress.

The women in the area have a lot of potential for development of economic activities that can lead to income generation and improve their livelihood. Migrating activities by men (who are by and large head of the family) for getting economic resources during drought in the area is also necessitated for woman to involve in economic activities to fulfill families' immediate necessities. However they have to be provided with necessary infrastructure including adequate facilities of electricity, access to market, appropriate training, credit facilities etc..

Main activities performed by the woman which can be developed as source of income after energy intervention.

- Block print clothing, bed sheet sets, and Chunris (Scarf)
- Hand made embroidery

- Tailoring
- Rali Making (traditional bed sheet made of with the pieces of cloths)
- Livestock partially
- Agriculture partially

How the electricity intervention can be significant in their economical empowerment

- Lighting after evening in their homes can increase productive working hours
- They can easily make an end product at one place to market it creating more opportunities for quality products that can easily be taped.
- Children can continue there studies in evening time to get good educated
- Light also help woman during there emergency situations like during delivering birth

7 Environmental Assessment

7.1 General

This section of the report deals with following parts of the EIA report:

- Categorization of environmental threats
- Collective impacts on the environment of the area
- Most likely impacts of the project on the area
- Possible out break of any emergency situation at wind farm site

This section of the report has been prepared in conformity of the guide lines for EIA .This process is described here to ensure that:

- Most likely impacts can be identified and properly assessed
- The interaction between the project components and environment are adequately described

Possible project activities that can lead to an environmental disturbance are identified separately and described along with the level of intensity.

7.2 Methodology of Environmental Assessment

This environmental assessment was carried out using a standard methodology, in line with the national regulations and WB, ADB and IFC safeguard policies described above in section 2. The assessment was initiated with review of the project information. Subsequent meeting with major stake holders followed. This environmental assessment was performed to determine the project's prospective environmental effects, so as to ensure that these are given consideration in minimizing the effect of the proposed project's activities on the physical, ecological and socioeconomic environments. These activities have been summarized for the construction, operational and decommissioning phase of the project. The effects of these activities at or near the site are summarized in Section 7.3 of this report. These activities are any part of the environment that is considered important by the proponent, public, scientists and government involved in the assessment process. Importance may be determined on the basis of cultural value or scientific concern. The information needed to complete the environmental assessment has been compiled from the following sources:

- Consultation with civil society organizations;
- Consultation with local elected representatives and community notables;
- Published research and data;
- Consultation with local people;
- Consultation with Sindh Wild Life Department;
- Consultations with Pak-EPA

- Consultation with experts of WWF Pakistan;
- A survey of birds at the site;
- A survey of vegetation at the site;
- Email communication with the manufacturer, Vensys, Germany
- Email communication with IPEK-Germany

7.3 Findings of the Environmental Assessment

After a detailed and extensive environmental study it is observed that none of the project intervention can be of the magnitude that can cause potential environmental degradation in the project area. Though there are some of the project components that involve low to moderate environmental degradation, but these can be minimized or gradually can be avoided in due course of time. These are discussed in detail in the following section.

7.4 Environmental Issues Identified

The most significant environmental issues associated with the proposed ZORLU wind farm are evaluated separately. The key environmental issues relevant to the proposal that were identified for detailed evaluation in this report are:

- Migratory Birds collision/Avian Impact
- Noise
- Health and Safety
- Shadow
- Visibility
- Atmospheric emissions
- Clearing of land for road and building construction
- Delivery of Equipments at site
- Foundations of Tower and Cranes Construction
- Tower assembly and installation
- Wild life disturbance
- Maintenance activities at later stages
- Global environment Issues
- Historical Heritage
- Solid Waste Management

7.4.1 Migratory Birds Collisions/Avian Impact

Background

The most significant environmental issue associated with the project could have been the potential for migratory birds' mortalities through collision with the wind turbines and associated infrastructure. Non-collision impacts on birds such as site avoidance and disruption of migratory behavior could also have been significant. However since, according to a survey conducted by WWF in 2009, number of birds in and around Keejhar Lake has reduced drastically in recent years, besides these birds have tendency to fly at an altitude of 400 to 500 meters therefore there is no chance of collision with wind towers at this specific site.

Wind farm technology is little bit new in Pakistan but this is the technology that was being used in the western and developed countries a decade ago. A study report (Sept. 2005) by the US Government Accountability Office (GAO) on the effects of wind energy development on wildlife determined many fewer birds fly into wind turbines than is generally thought. "Although several hundred utility-scale wind farms currently operate across the (US), such problems appear to be limited to two project areas, according to the report. In the context of other sources of avian [mortality], it does not appear that wind power is responsible for a significant number of bird deaths," the report states in its conclusion³⁰.

The impact of wind energy development on bird populations came to prominence due to the high number of mortalities associated with one of the world's largest wind farm developments in California's Altamont Pass³¹. This wind farm had up to 5,600 wind turbines in operation and is located in a year-round, high activity area for raptors. Additional factors including prey abundance, high-speed rotor blades, and lattice tower structures with supporting guy wires appear to contribute to increased risk of collision³².

The following sources of avian collision mortality in the United States have been estimated³³:

- Vehicles: 60 – 80 million
- Building and Windows: 98 – 980 million
- Power lines: tens of thousands – 174 million
- Communication Towers: 4 – 50 million
- Wind Generation Facilities: 10,000 – 40,000

The above figures show that there will be very little effect of proposed wind farm on the avian mortality and migratory birds. Though the project area is not in the immediate vicinity of any of the parking area for the migratory birds but according to the available sources, the assessment team has come to know that the some flocks of migratory birds have been

³⁰ <http://www.gao.gov/new.items/d05906.pdf>.

³¹ American Wind Energy Association: Facts about Wind Energy & Birds, 5pp.-Internet Article

³² Wally Erickson, WEST Inc., Bird and Wildlife Monitoring: presentation at National Wind Power and EA Workshop, Environment Canada: May 12, 2004, Moncton, New Brunswick.

³³ Ibid

observed crossing 400 to 500 m high above the proposed wind farm site at night or after the sun set³⁴.

An other research cited by the European Wind Energy Association shows that the risk of bird deaths through collision with wind turbines is low. For example, it is estimated that 33,000 birds are killed annually by wind turbines operating in the USA, an average of 2.2 fatalities for each of the 15,000 turbines³⁵. In Spain, a study showed 0.13 dead birds per year per turbine. By comparison in the USA, over 100 million birds are estimated to die each year from colliding with vehicles, buildings, power lines power lines and other structures, with wind power responsible for just 1 out of every 5,000 - 10,000 avian fatalities.

Birds Flying by the Wind Turbine³⁶



Mitigation /Management Measures to Avoid Avian Collision

The assessment team is of the view that the following mitigation measures be adopted in the due course of time to avoid the avian collision.

³⁴ Local public consultations in the project area by the assessment team

³⁵ <http://www.windpower-monthly.com>

³⁶ <http://www.reio.ie>

- The wind towers to be erected minimum at a distance of 300 meters to avoid the avian collision and to give the birds a wider corridor for the access in the project area;
- Regular checking of the vacuums or holes in the towers to avoid nesting facility of any of the birds;
- Placement of power and communication cable (if any) under ground would reduce the chances of any avian collision;
- Bird mortality count in the immediate vicinity is proposed to establish a strong link between the wind turbines and birds mortality for two years starting from the commissioning of the wind farm;
- WT towers to be colored identical and are to be equipped with flashing lamp to avoid avian collision at night;
- ZORLU ENERJI to work with the local partners involved in the conservation efforts of threatened species. The Zorlu Enerji is in touch with local office of WWF located at Thatta in this regard.

Severity of Environmental Threat from the Subject

The ZORLU wind farm is not supposed to be having any significant impact on birds of area.

7.5 Noise

Background

Wind turbines do make some noise. The carefully designed rotor blades with low rotational speed along with good noise insulation generator help limit noise emission. Typically, at 200m the sound from a modern, medium-sized wind turbine would be about 45 dB, quieter than a typical living room. At 400m, the sound would be no louder than leaves rustling in a gentle breeze. By keeping enough distance from built-up or other noise sensitive areas, noise pollution is avoided.

Existing ambient noise levels are typical for a rural area with a small population. Noise sources may include wind, birds, tractors, motor bike start and diesel engine loaded vehicles on the road. Most of the homes in the project area are located far and wide in terms of their location.

Wind turbine noise typically increases with increasing wind speed, as does the background noise levels. At low wind speeds, when background noise levels are low, the turbines do not operate. The critical period for noise impacts is likely to be at low wind speeds when turbines cut-in and when background noise levels are still relatively low.

Noise emissions associated with the wind farm can be separated into the construction and operation phases of the project.

Construction activities generating noise emissions include:

- Excavation activities for turbine and building footings including drill and blasting;
- Excavation of cable trenches;

- Crane activities associated with tower erection.
- Transportation movements associated with delivery of machine and construction material
- Concrete batch plant;
- Construction of access roads, including use of rock breakers and blasting;

Operational phase noises include:

- Wind turbine generator and blade movement;
- Substation transformers; and
- Maintenance equipment noise

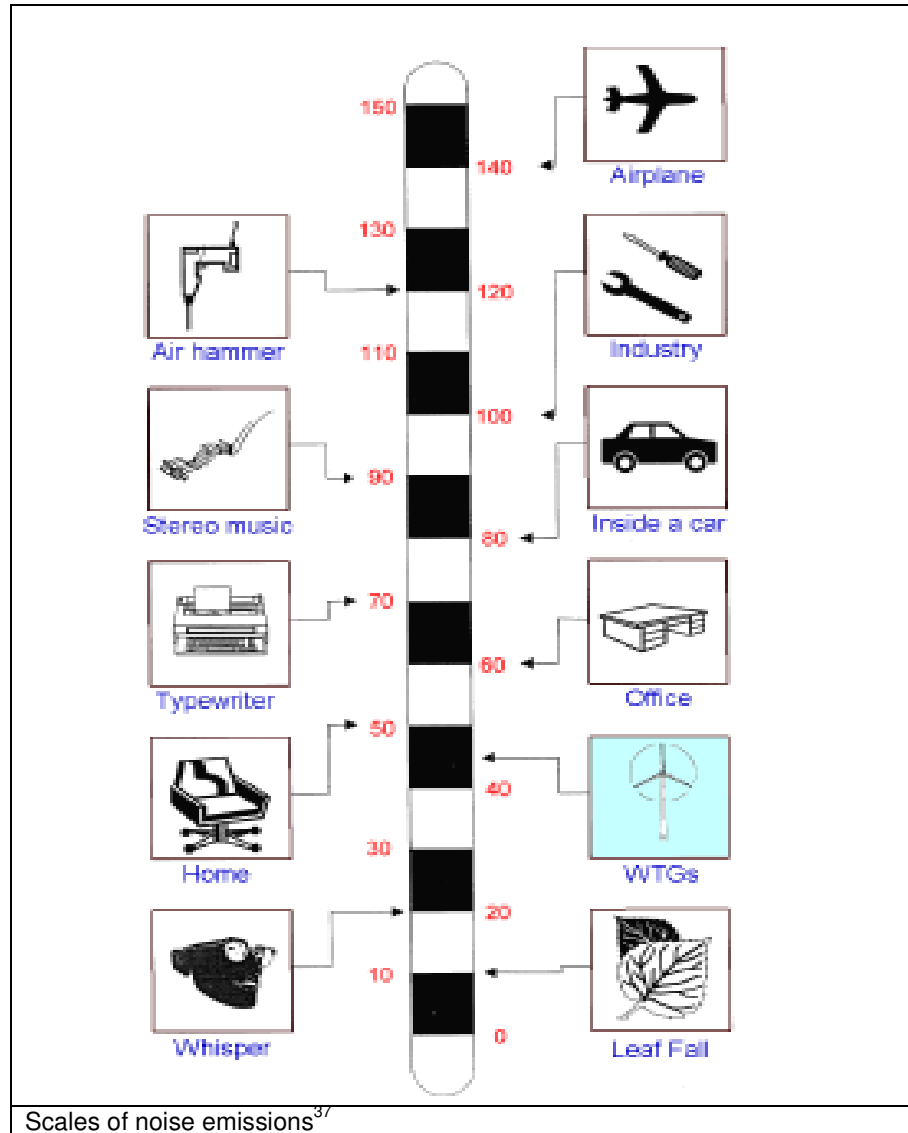
Management Measures/Mitigation Measures

No measures are recommended for this as ZORLU wind farm would be using state of the art low noise emission turbines that are with out gear boxes. The noise produced by the wind turbine is mainly because of the gear boxes and its auxiliaries. When there is no gear box; so there is no excessive noise that crosses the permissible limits. But keeping in view the statutory requirement the proponent is asked to during the sitting of the turbines, the proponent has to take care to ensure that all turbines are configured so as to be the maximum distance from residences.

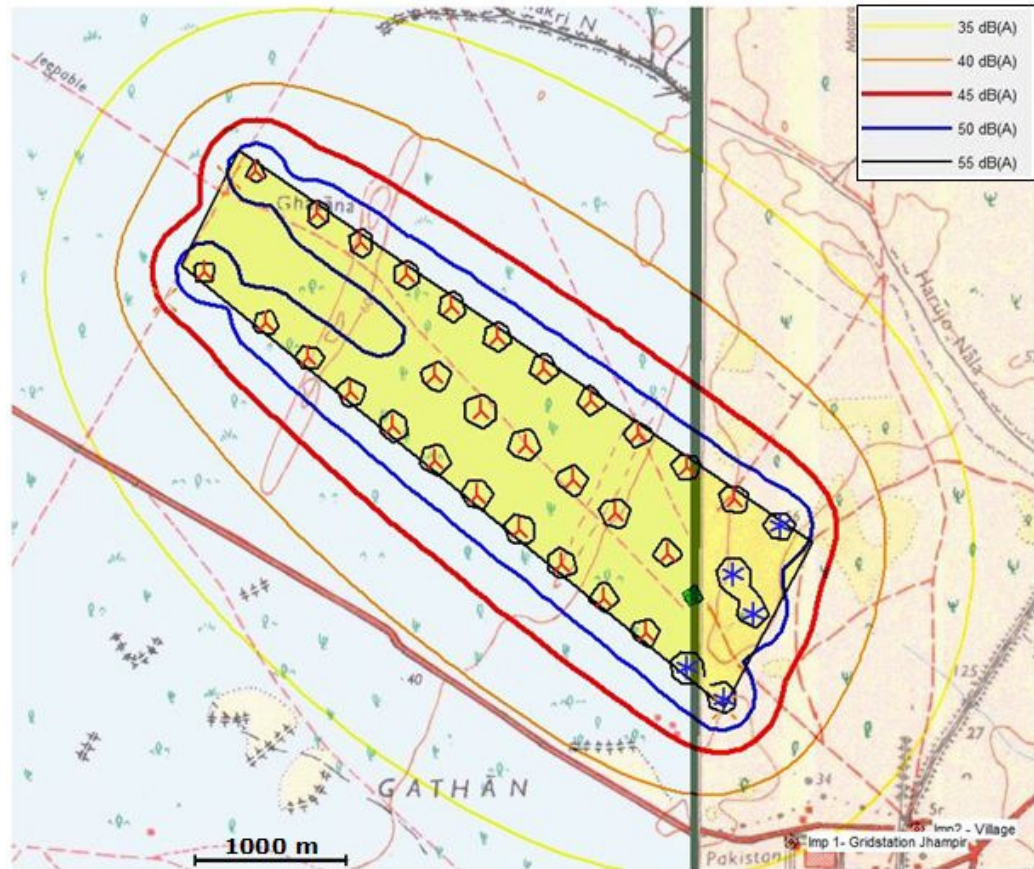
Severity of Environmental Threat from the Subject

Noise generation of most wind turbines is around 100 dBA (running at full swing), as the distance between the source and receptor increases, the noise also diminishes and is to ambient outdoor noise. No potential threat is established. Comparison of noise emission level is provided at **Exhibit 7-1** whereas noise expected from wind farm is provided at **Exhibit 7-2**.

Exhibit 7-1: Noise Emission Level and Comparison



³⁷ Danish Wind Turbine Manufacturers Association (www.windpower.org)

Exhibit 7-2: ZORLU wind farm Noise Map

7.6 Health and Safety

Background

The risks of any potential health and safety hazard are always there at any where in wind farm. The assessment team has identified following few health and safety hazards that may be experienced at any time during the construction and operational phase of wind farm. There are very remote chances of all these.

- Accidental or controlled fires;
- Falling turbine blade or damaged turbine
- Damage to turbine components due to high winds;
- Turbine blade failure;
- Vehicle accident;
- Exposure to high voltage;

- Accidents while accessing area;
- Public access;
- Accidental access of public inside the turbine or on the turbine tower
- Construction accidents during access and foundations preparation

Management Measures/Mitigation Measures

The wind farm is situated far from the scattered packets of population living around. The minimum distance of a population packet is about 3000 meters. So, it will be literally impossible for the general public to access the wind farm area or climb the turbine tower.

More over the wind farm will be equipped with the latest safety alarm that can break the silence in the event of any irregularity at the site. Each and every turbine will be connected to a network of safety instruments and communication devices that can be used for remote monitoring.

Control systems will continuously monitor key operating parameters, and will ensure that the turbines are safely disconnected in the event of a problem within the turbine array or within the utility system.

Further more it is recommended that the monitoring staff of the wind farm be equipped with latest communication devices that may enable them to transmit the information of any incident or accident of any nature that has already been described and identified without any delay to concerned generics.

Access to general public can not be avoided due to the open nature of wind projects all over the world and Zorlu is also not installing any fence around the wind farm site to allow the locals grazing of their animals in case they want to do so. In addition people can not simply access the wind turbine as they are more than 80 meters tall and in some cases the length can go beyond this.

The land has been leased to Zorlu therefore no body is expected to migrate in the project land. In addition the project company will keep its check through their security personnel deputed at site.

The volume of transportation can be expected at large scale as there will be tons and tons of construction material coming towards the site; during all this phenomenon; major or minor vehicle fault can not be overlooked. Special care is recommended while transporting the hazardous chemicals or spill characteristics to the project site.

The wind turbine tower is properly insulated and every possible care be taken into account while connecting the tower to proposed sub station and with remaining turbine towers.

Fire extinguishers (both powder and liquid type) must be made available during the assembling and installation phase of sub station transformers and wind turbine generators.

An adequate supply of spill prevention and emergency response equipment will be kept on-site at all times during the construction phase, as well as when maintenance is performed on the turbines. Site personnel will be trained in hazardous materials handling and emergency response procedures. Used oil, filter and grease cartridges, lubrication containers and other

equipment maintenance products will be collected and disposed of at the nearest waste disposing facility.

Mechanical safety will be a priority throughout all phases of the project, and all personnel working above ground level will be outfitted with fall restraint equipment and trained in its use.

Severity of Environmental Threat from the Subject

It is observed where ever there has been the strict monitoring and compliance of "Work place health and safety regulations" is followed; fewer were the chances of accidents or incidents. It is advised that these should be followed strictly at every level of construction of wind farm.

7.7 Shadow/Flickering Effect

Background

When the sun shines, the rotating rotor blades make moving shadows. Normally this effect is only visible very close to the turbine. However, on a sunny winter day, with the sun low in the sky, shadows may be cast over some distance. This may be inconvenient, particularly if the shadow is cast onto a house window. Correct positioning of wind turbines, and a minimum distance from dwellings should be sufficient to avoid this problem.

Shadow flicker occurs where the blades of a wind turbine cast a moving shadow over a window in a nearby house. This effect lasts only for a short period and happens only under very specific and rare conditions³⁸. Careful site selection, design and planning, and good use of relevant software, can help avoid the possibility of shadow flicker in the first instance. However, where shadow flicker could be a problem, developers should provide calculations to quantify the effect and where appropriate take measures to prevent or ameliorate the potential effect such as turning off a particular turbine for a certain number of hours. The shadow and flickering effect is shown in **Exhibit 7-3**.

The calculation times of the shadow/flickering were calculated by using state of the art software "WindPRO Ver.2" and assuming the "worst case" scenario given by the following assumptions:

- The sun is shining all the day, from sunrise to sunset
- The rotor plane is always perpendicular to the line from the WTG to the sun
- The WTG is always operating.

Management Measures/Mitigation Measures

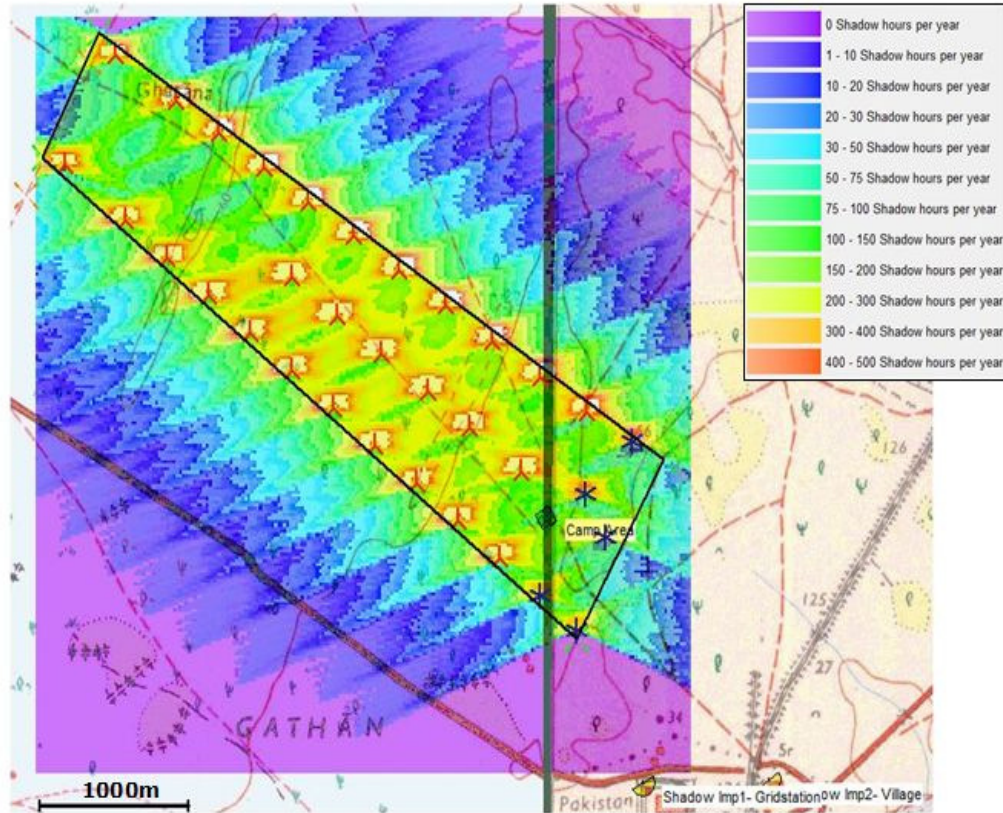
Alternatively, if shadows cause inconvenience for only a small number of hours a year, the wind turbine can be deactivated at those times without too much loss of production. Larger wind turbines rotate more slowly and reduce further any potential shadow flicker effects.

³⁸ <http://www.sei.ie>

Severity of Environmental Threat from the Subject

The proposed wind farm is situated far from any population so this issue does not require any special attention as there is no population settings directed directly towards the wind turbine towers.

Exhibit 7-3: Shadow Map of ZORLU Wind Farm



7.8 Visibility

Background

Wind turbines are large machines and cannot be hidden in the landscape. Human activity has shaped the countryside for thousands of years. Opinion polls show that most people support wind energy and would like to see it developed further. They find wind turbines attractive and interesting. However, any person’s attitude towards, and understanding of, clean sustainable energy is likely to influence their opinion³⁹.

The proposed wind farm will add a new visual dimension to the area and will be visible from at a distance of about 5-8 km. The scattered residents of the area are used to the already erected mast data towers that were installed to record the micro readings of the area. So they are used to the visibility of the tower and they usually cross by the tower un-noticed. Same

³⁹ <http://www.jxj.com/rew/>

will be the case with the wind turbine towers. Much of the land scape in or around the project area is not developed.

Management Measures/Mitigation

As the project is located in the area where there is no any potential natural scenery. The proposed project site is surrounded by the barren pieces of land combined with rocky character of sub soil.

Severity of Environmental Threat from the Subject

The severity of this issue can be categorized as low.

7.9 Atmospheric emissions

Background

The most significant change to air emissions resulting from the project is likely to be an increase in particulate emissions from construction phase vehicle movements and disturbance of soil during road and foundation construction. Providing that dust suppression methods are implemented if required during the construction phase, air emissions from the proposal are considered unlikely to cause environmental nuisance.

Management Measures/Mitigation

Proper dust suppression methods be followed during the construction phase of the project. Cleared vegetation for the developmental purposes should not be simply disposed of by burning unless no other reasonable and practicable disposal methods are available. If burning does occur, it should be undertaken in such a way so as to prevent emissions from causing an environmental nuisance. Regular watering of construction sites and access tracks will be carried out to control fugitive dust emissions.

Severity of Environmental Threat from the Subject

The severity of this issue can be categorized as low.

7.10 Clearing of land for road and building construction

Background

Clearing of the entire site will not be necessary: bush and shrub vegetations will only be removed along surveyed rights-of-way, in foundation sites and work areas. The existing vegetation may be covered by the fill material and piling up of construction material storage. The already available road may require broadening in order to accommodate heavy traffic that is expected for delivery of equipment. This may lead to a potential destruction of flora mostly shrubs and bushes to be cleared for the purpose.

Management Measures/Mitigation

It is suggested that the existing vegetation of the site may only be removed after an extensive survey of the area where there is a need of road or foundation. By doing this the disturbance

to vegetation elsewhere will be minimal. No seeding or re vegetation will be required. Construction activities may be strictly restricted to the site area.

Severity of Environmental Threat from the Subject

The severity of this issue can be categorized as low.

7.11 Transportation Route of Equipments at Site

Background

The proposed transport routes for components from port Qasim Karachi to project site are shown in the following figure with **red line**.



Many of the components to be transported will be long and heavy. The port Qasim will be used to import turbine components such as generators, blades and hubs.

Two different modes of transport were considered - road and rail. Rail transport was rejected on the basis of technical limitations. Available roads presently have the infrastructure in place to accommodate the expected traffic. Limited upgrading of existing roads and bridges may be required along the designated route. This upgrading is likely to involve road widening and realignment in some sections. During construction phase of the project, there will be an increase in vehicle movements on public roads.

Management Measures/Mitigation

A main trunk road through the site and a series of spur ways to individual turbines is suggested to regulate the traffic and minimize the operational loss to environment. It is highly advisable to install temporary reduced speed limits marks on the sides of the roads to minimize the chances of any fatal accident.

Severity of Environmental Threat from the Subject

The severity of this issue can be categorized as moderate to low.

7.12 Foundations of Tower and Cranes Plate form Construction**Background**

For the installation of the wind turbines an area of approximately 20m x 30m has to be leveled and compacted at each turbine site for the cranes. In total an area of around 24,000m² are planned for the crane and parking places.

Depending on the nature of the soil and specifications of the wind turbine, work of excavation of wind turbine foundation footprint will be carried out in order to enable formed-in-place reinforced concrete foundations to be poured. Topsoil will be stripped and stored for reuse during post-construction reclamation. Subsoil will be stored separately from the topsoil and replaced before the topsoil; once the work is done.

The cranes of special kind shall be used to lift the approximately 40 tons wind turbine generator up to a maximum height of 80-100 meters (depending on the type of WTG). During the construction of the foundation of tower and crane plate form, there will be increased risk of soil disturbance and relocation, chances would be higher for admixing of top soil with sub soil. There would be coverage or removal of vegetation and temporary increased heavy traffic including that of trucks and heavy earth moving machines.

Management Measures/Mitigation

Assessment team is of the view that these displaced soil be retained for re use as road surfacing material. The chances of soil admixing can be minimized by keeping the soils separately. Removing the vegetation only targeted area where the foundation is to be laid down. In order to maintain a maximum safety at work, best management practices to be followed.

Severity of Environmental Threat from the Subject

The severity of this issue can be categorized as moderate to minimal.

7.13 Tower assembly and installation**Background**

Delivered turbines will be assembled on site in the temporary portion of project area very near where these are to be erected. Heavy and most sophisticated cranes would be used to mount the wind turbines for placement on the towers.

Management Measures/Mitigation

The construction work for the proposed activity is of very short duration, so potential threat to environment can be avoided by limiting the access to working area strictly. During all this mechanical safety will be of high value and every possible safety and pre cautionary measures would be taken to maintain working safety.

Severity of Environmental Threat from the Subject

The severity of this issue can be categorized as moderate to minimal.

7.14 Wild life Disturbance

Background

Wind turbines may interfere with bird behavior, and may result in increased fatalities. However, as discussed in Section 7.1.1, as noted previously, there are no known wild reserves or game area in the project influence area. As the first phase of the project will involve 5 turbines only, so the proponent will be conducting mortality figure till the time second phase of the project comes to commissioning.

In general, wind turbines are not a hazard to wildlife. Cattle can graze next to them, and sufficient clearance between the blades and ground prevents injury to cattle and other animals. There have been reports of bird kills in a few areas of the world where large numbers of wind turbines are concentrated. However there is little evidence that single installations or small clusters of wind turbines kill birds in significant numbers. By nature, local birds avoid wind turbines by flying around them, and migrating birds tend to fly well above wind turbine height. Some concerns may be warranted in areas where birds concentrate, such as in wildlife refuges or shoreline feeding and nesting areas⁴⁰.

Management Measures/Mitigation

No special status bird species or nests were observed during the assessment field survey. The use of tubular towers and elimination of any perching/nesting locations minimizes the risk of bird collisions. Mortality monitoring program till the start of the second phase of the project area will help in ascertaining the actual status of this environmental concern. Zorlu is in contact with local office of WWF located at Thatta for collaboration in this regard

Severity of Environmental Threat from the Subject

The severity of this issue can be categorized as low.

7.15 Maintenance activities at later stages

Background

Regular maintenance will ensure safe and reliable operation of the turbines. Scheduled maintenance will be conducted two times per year (need based), and will include inspections and adjustments of the mechanical and electrical components.

Management Measures/Mitigation

Maintenance staff will be equipped with and trained in the use of fall-restraint equipment and proper handling and storage of hazardous materials. The design of Vensys WTG is literally a safe and minimum maintenance⁴¹ requiring machine.

⁴⁰ http://www.energy.iastate.edu/renewable/wind/wem/wem-12_enviro.html

⁴¹ <http://www.vensys.de>

Severity of Environmental Threat from the Subject

The severity of this issue can be categorized as low.

7.16 Global environment Issues**Background**

Today, wind energy is the vanguard of clean energy technologies. It is the most viable energy option if we are to meet our future electricity needs without causing global warming and climate change. Wind energy can save the environment from the damage associated with conventional fossil fuel generation, such as coal and oil.

Global climate change is now believed to be the most serious environmental threat faced by human race. The globally averaged surface temperature is projected to increase by between 1.4 and 5.8°C by the end of this century, much larger than the observed changes during the 20th century and very likely to be without precedent during at least the last 10,000 years. Global mean sea level is projected to rise by 0.09 to 0.88 meters between 1990 and 2100, causing flooding to low-lying coasts and islands. Larger year-to-year variations in temperature and rainfall are very likely over most areas leading to problems for biodiversity, agriculture and the wider economy. The development of renewable energy, including wind energy, is one of the main ways of mitigating climate change.

The local impact of wind farms must be given proper consideration, but that should always be balanced against the global benefits of avoiding greenhouse gas emissions and air pollution. Remember, a 1 MW Wind Turbine can provide enough electricity for 650 homes and will avoid 175 tonnes of slag and ash and the emission of 2,700 tonnes of the greenhouse gas CO₂, 30 tonnes of Sulphur Dioxide and 10 tonnes of Nitrous Oxide per year, helping us to meet our Kyoto Protocol targets and to preserve our environment⁴².

As a whole wind farms are supposed to be one of the safe sources of electricity generation, but there are still chances of any leakage of ozone depleting gas from the refrigerator units of cooling system of monitoring buildings and from the vehicles.

Management Measures/Mitigation

Nevertheless, it is clear that the project will provide a substantial reduction in greenhouse gas emissions compared to generating an equivalent amount of energy from fossil fuels. The project has the potential to make a significant contribution to providing an alternative energy source to fossil-fuel derived electricity, particularly once the ZORLU wind farm is operational in full swing.

The assessment team considers the wind farm initiative as a step a head towards a better tomorrow and does not propose any mitigation measure in relation to this issue.

Severity of Environmental Threat from the Subject

The assessment team has so far not been able to evaluate any of the substances that contain ozone depleting substances, so the severity of this issue is categorized as low.

⁴² Sustainable Energy Ireland, Renewable Energy Information Office, Ireland publication

7.17 Historical Heritage

Background

During the preliminary assessment, no any significant area or site was observed that has any historical importance in the project area.

Management Measures/Mitigation

When there is no such site, so there is no need for any mitigation measure.

Severity of Environmental Threat from the Subject

Not applicable

7.18 Solid Waste Management

Background

During the construction phase, a significant volume of plastic, cardboard and timber packaging wastes are likely to be generated from the supply of equipment to the site. Other solid wastes are likely to include general construction materials and packaging.

Management Measures/Mitigation

The recyclable waste should be sold to the recycling contractors; the biodegradable waste should be buried at an appropriate place; the left-over construction material should be sold to other users; and the remaining waste should be burnt at safe place and at distance from the settlements. Appropriate waste disposal mechanism should be followed to ensure that the area can not be contaminated.

Severity of Environmental Threat from the Subject

The severity issue associated with this component is categorized as low.

8 Monitoring and Follow-up Measures

8.1 General

Given the minimal and low impact classifications for all activities associated with this project, two year mortality monitoring program for birds is proposed. The proponent will maintain a file and respond to written concerns about environmental impacts of the project on an ongoing basis. Upon completion of the construction phase, the site will be inspected to ensure that any areas that require re-seeding, restoration of surface drainage, erosion control, or other reclamation measures have been adequately addressed. As turnkey operator of the project, the manufacturer will ensure that all site personnel adhere to general environmental protection measures and specific mitigation measures proscribed for development of this site. Although the project is expected to have no long-term impact on local bird populations, the proponent will document cases of avian injury and mortality for one year.

These documented readings can be used for study purpose of future expansion of ZORLU Wind farm in the area.

8.2 Environmental Trainings for Field Staff

It is necessary that the working force responsible for the operation of the wind farm is well aware of their role in adopting an environmental friendly approach while working in the project area. The environmental trainings will help enhance awareness level of the proposed wind farm staff and contractor staff on all matters relating to the environment. These trainings will ensure that the requirements of the Pak EPA are clearly understood and followed by the wind farm staff and contractors throughout the project period.

It is suggested that these training programs be planned before going for any major construction phase to inculcate the environmental awareness among the employees. The scope of the training will cover environmental guidelines, general environmental and social awareness, and waste disposal during the construction as well as operation activities, in order to minimize the environmental as well as social concerns of the project. These training will be provided to all the staff to be engaged in the project development from initial stage to later stages.

8.3 Environmental and Residual Impacts Classification

The classification of environmental and residual impacts with respect to various project activities that includes the construction, operation & maintenance and accident & malfunctioning phases are summarized under **Exhibit 8-1** and **Exhibit 8-2**. Analysis of these impacts indicates that no severe impact is expected as result of implementation of the project.

Exhibit 8-1: Summary of Environmental Impacts (Mitigated)

| Project Activities | Environmental Areas Exposed to Impacts | Impacts Description | Management/Mitigation Measures | Residual Environmental Effects | Level of Residual Impact (Grading) |
|---------------------------------|--|--|--|---|------------------------------------|
| Construction Phase | | | | | |
| Land Clearing | Flora | Removal/ Disturbance /Coverage of vegetation | Clear work and road areas only. Care should be taken while accessing the graze lands | None; vegetation will recover after construction. | Minimal |
| | Fauna | Habitat alteration in limited areas | Proper site survey during all the stages of project to avoid nesting | Some impact, but limited area | Low |
| | Employment opportunities | limited short term employment | None; no long-term in-migration or added burden on local services. | None anticipated | Minimal |
| | existing noise level | chain saw and equipment noise | natural distance attenuation | None anticipated | Minimal. |
| Road construction/ modification | Soil quality air quality (dust) | soil compaction; surface disturbance; soil erosion; admixing; lubricant spills | avoid steep slopes; minimize grading; stockpile topsoil and subsoil; avoid wet periods; restrict vehicles to work area; retain and stockpile soil for use; erosion and dust control measures | Some impact, but short duration | Minimal |
| | Flora | removal or coverage of vegetation by fill | Minimize grading; limit vehicles to existing and approved work areas | Some impact, but of short duration | Minimal |
| | Surface hydrology surface water quality | alteration of existing drainage patterns | avoid steep slopes; avoid wet periods; stockpile soil away from drainage channels; restore drainage where necessary | Some impact, but short duration | Minimal |
| | existing noise levels | construction related noise | natural distance attenuation | None anticipated | Minimal |
| | soil quality; surface water quality | accidental lubricant discharge | Best Management Practices, immediate clean-up, daily equipment inspection | None anticipated | Minimal |
| | Vehicular traffic safety issues | temporary re-direction of traffic | standard traffic control and safety measures | None anticipated | Minimal |
| | employment opportunities | limited short term employment | None; no long-term in-migration or added burden on local services. | None anticipated | Minimal |
| | Safety issues | temporary disruption of local traffic | None; short period, limited number of deliveries, low traffic area, General Line has two exits | None anticipated | Minimal |
| Temporary Storage Facilities | Soil quality groundwater surface hydrology surface water quality flora | fill coverage; soil erosion | use previously disturbed area, minimize vegetation removal, low slope site, restore surface drainage, stockpile soil away from drainage channels | Some impact, but limited area | Minimal |
| | Soil quality; surface water quality | accidental lubricant discharge | Best Management Practices, daily equipment inspection | None anticipated | Minimal |
| | Safety issues | potential for injury to trespassers on stored equipment | contractor responsible for safe storage of construction equipment, tools and lubricants | None anticipated | Minimal |

...Continued, Exhibit 8-1

| Project Activities | Environmental Areas Exposed to Impacts | Impacts Description | Management/Mitigation Measures | Residual Environmental Effects | Level of Residual Impact (Grading) |
|---|--|---|--|---------------------------------------|------------------------------------|
| Foundation Construction | Soil quality; flora | soil disturbance or relocation; admixing; removal or coverage of vegetation by fill | limit soil removal, vegetation removal or coverage to areas where necessary; retain and stockpile soil for use; keep soil and subsoil separate; erosion control measures | Some impact, but limited area | Low |
| | Surface water quality groundwater | erosion, groundwater seepage into excavations | Pump, filter and discharge seepage; contractor responsible for erosion control; keep soil away from drainage channels | Some impact, but limited area | Minimal |
| | Existing noise level | construction related noise | natural distance attenuation | Some impact, but short duration | Minimal |
| | Safety issues | temporary traffic increase | standard traffic control and safety measures | None anticipated | Minimal |
| | Soil quality; surface water quality | accidental lubricant discharge | Best Management Practices, daily equipment inspection | None anticipated | Minimal |
| Tower and Turbine Assembly / Installation | Soil quality | Compaction | limit crane operation to approved work areas | Minor impact, limited area | Minimal |
| | soil quality; surface water quality | accidental lubricant discharge | Best Management Practices, Daily/weekly/monthly equipment inspections | None anticipated | Minimal |
| | Existing noise level | power tool noise during assembly | natural distance attenuation | None anticipated | Minimal |
| Tower /Turbine Assembly Installation | Safety issues | safety of employees working above ground | outfit and train employees with fall restraint equipment | None anticipated | Minimal |
| Interconnection from Turbines | Soil quality; surface water quality | soil erosion due to trenching and excavation | install erosion control measures and best practices are recommended | None anticipated | Minimal |
| Transmission Line to Power Line | Soil quality; flora | minor disturbance during pole installation | utility standard practices for installation of poles and lines | None anticipated | Minimal |
| | Existing noise level | minor construction related noise | natural distance attenuation | None anticipated | Minimal |
| | Safety issues | temporary disruption of local traffic | standard traffic control and safety measures | None anticipated | Minimal |
| Operational Phase | | | | | |
| Land use | Land use | potential limitations on future use; concerns about land value | adjacent lands are unoccupied forest resource or commercial blueberry operation; research indicates no negative impact on land value | Long term, but no monitoring required | Low |
| | Safety issues | safety issues related to trespassing | site is on private land, public access restricted | Long term, but no monitoring required | Low |
| Visual Impact | visual landscape | visual intrusion | public consultation; plant located away from community; small number of turbines; local residents supportive | Long term, but no monitoring required | Low |

...Continued, Exhibit 8-1

| Project Activities | Environmental Areas Exposed to Impacts | Impacts Description | Management/Mitigation Measures | Residual Environmental Effects | Level of Residual Impact (Grading) |
|--------------------------------|--|--|---|---|------------------------------------|
| Noise Impacts | Existing noise level | aerodynamic and mechanical noise | Plant located away from community; natural attenuation | Long term, but no monitoring required | Low |
| Wildlife Disturbance | Birds mammals | potential injury or mortality | Avian avoidance instincts; avian field survey; no special status species encountered (special colors on WTG suggested) | Long term, one year mortality monitoring proposed | Low |
| Safety Issues | Safety issues | site security, electrical and mechanical safety | trespassing prohibited; remote location; standard utility electrical safety practices; warning signage; employees outfitted and trained with fall restraint equipment | Long term, but no monitoring required | Low |
| Safety Issues | Safety issues | aircraft safety | Flashing lights will be installed on the top of the WTGs | Long term, but no monitoring required | Low |
| Maintenance Activities | | | | | |
| Maintenance Activities | soil quality; surface water quality | accidental lubricant discharge | Best Management Practices, immediate clean up | None anticipated | Minimal |
| | safety issues | electrical and mechanical safety of employees | employees outfitted and trained with fall restraint equipment | Long term, but no monitoring required | Low |
| Decommissioning Phase | | | | | |
| Turbine / Equipment Removal | Soil quality; surface water quality | accidental lubricant discharge, soil compaction | Best Management Practices, immediate clean up, daily equipment inspection, limit activities to work area | None anticipated | Minimal |
| | Existing noise level | demolition and power tool noise | natural attenuation | None anticipated | Minimal |
| | Safety issues | electrical and mechanical safety of employees | employees outfitted and trained with fall restraint equipment | None anticipated | Minimal |
| Removal of Buildings and Waste | Soil quality; surface water quality | discarded materials / waste on site | all fluids and solid waste collected and transported to an approved disposal facility | None anticipated | Minimal |
| Removal of Power Line | Soil quality flora | minor vegetation disturbance during pole removal | utility standard practices for pole removal | None anticipated; vegetation will recover. | Minimal |
| | Existing noise level | minor construction noise | natural attenuation | None anticipated. | Minimal |
| | Safety issues | temporary disruption of local traffic | standard traffic control and safety measures | None anticipated | Minimal |
| Site Remediation | Soil quality surface water quality flora | disturbance of vegetation and soil surface, admixing of soil | remove vegetation only where necessary; excavation holes filled with stockpiled soil; erosion control measures; stockpile topsoil and subsoil separately | Some impact, but short term | Low |
| | Safety issues | temporary increase in truck traffic | standard traffic control and safety measures; short period, limited number of deliveries, low traffic area, road has 2 exits | None anticipated | Minimal |

...Continued, Exhibit 8-1

| Project Activities | Environmental Areas Exposed to Impacts | Impacts Description | Management/Mitigation Measures | Residual Environmental Effects | Level of Residual Impact (Grading) |
|-----------------------------------|--|--|--|-------------------------------------|------------------------------------|
| Site Remediation | Soil quality; surface water quality | accidental lubricant discharge | Best Management Practices, daily equipment inspection | None anticipated | Minimal |
| | Existing noise level | demolition noise | natural attenuation | None anticipated | Minimal |
| Accidents and Malfunctions | | | | | |
| Accidents / Malfunctions | Safety issues | electrical and mechanical malfunctions and failures, blade throw | turnkey operation and performance monitoring by manufacturer; automatic shut down; separation from nearest residence | Potential impacts requiring repairs | Minimal |
| | Safety issues | electrical and mechanical safety of employees | employees outfitted and trained with fall restraint equipment | None anticipated | Minimal |
| Extreme Events | Soil quality surface water quality | accidental lubricant discharge | Best Management Practices, immediate clean up; units self-contained | None anticipated | Minimal |
| | Safety issues | lightning strikes/wind gusts | automatic shutdown | None anticipated | Minimal |
| | Safety issues | Broken Blade shedding/fire | automatic shutdown and separation from nearest residence | None anticipated | Minimal |

Exhibit 8-2: Classification of the Residual Impacts

| Level | Classification Explanation |
|--------------|---|
| High | Potential impact could threaten sustainability of the resource and should be considered a management concern. Research, monitoring and/or recovery initiatives should be considered. |
| Medium | Potential impact could result in a decline in resource to lower-than-initial but stable levels in the study area after project closure and into the foreseeable future. Regional management actions such as research, monitoring and/or recovery initiatives may be required. |
| Low | Potential impact may result in slight decline in resource in study area during life of the project. Research, monitoring and/or recovery initiatives would not normally be required. |
| Minimal | Potential impact may result in slight decline in resource in study area during construction phase, but should return to baseline levels. |

9 Environmental Management Plan

This Chapter outlines the environmental management plan (EMP) and defines the institutional arrangements required for the implementation of the plan. The EMP consolidates the environmental as well as socioeconomic mitigation measures identified during the present EIA. The Chapter also presents the environmental and social monitoring requirements for different phases of the project.

9.1 Purpose and Objectives of EMP

This EMP provides the delivery mechanism to address the adverse environmental and social impacts of the proposed project during its execution, to enhance project benefits, and to introduce standards of good practice to be adopted for all project works.

The primary objectives of the EMP are to:

- Facilitate the implementation of the mitigation measures identified in this report
- Define the responsibilities of the project proponents, contractors, and environmental monitors, and provide a means of effectively communicating environmental issues among them,
- Define a monitoring mechanism and identify monitoring parameters in order to:
 - ▶ Ensure the complete implementation of all mitigation measures, and
 - ▶ Ensure the effectiveness of the mitigation measures.
- Provide a mechanism for taking timely action in the face of unanticipated environmental or social situations,
- Identify environmental training requirements at various levels.

9.2 Components of the EMP

The EMP consists of the following:

- ▶ Organizational structure; roles and responsibilities
- ▶ Mitigation plan
- ▶ Monitoring plan
- ▶ Change management plan
- ▶ Communication and documentation
- ▶ Environmental training.

These are discussed in the subsequent section

9.3 Organizational Structure, Roles and Responsibilities

This section describes the organizational structure required for managing the environmental as well as social aspects of the proposed project. Also defined in this section are the roles and responsibilities of the various role players during the project.

9.3.1 Management Approach

Construction Phase

The organizational roles and responsibilities are summarized below:

Zorlu: The overall responsibility for compliance with the environmental management plan rests with the project developer (Zorlu).

Environmental Cell (EC): An environmental cell (EC) will be established at the project developer's office who will supervise the contractor(s) for the implementation of the EMP and EIA requirements.

Contractor(s): The contractor(s) will be responsible for the construction activities of the project. The contractor(s) will be responsible for the complete implementation of the EMP and the mitigation measures detailed in the EMP and EIA. The contractor(s) will also be subject to certain liabilities under the environmental laws of the country, and under its contract with project developer.

Other essential features of the institutional arrangement proposed for the project are:

- Zorlu will appoint an Environmental and Social Inspector (ESI) for overseeing the entire implementation of the EMP.
- The EMP as well as environmental management requirements and specifications will be included in all contracts amongst Zorlu and its contractor(s).
- Contractors will be required to appoint a dedicated field Environmental and Social Officer (ESO) at the project site.
- The Company, through the EC, will cooperate with regulatory agencies (such as the SEPA) and other stakeholders who may want to send their own teams in to monitor the project activities.

Operation Phase

During the operation phase of the proposed project, environmental management will become a routine function, as an integral part of the O&M activities. Various environmental management roles and responsibilities will be distributed among the staff assigned to operate and maintain the installation. The EC will continue providing supervisory and advisory services during this phase as well.

9.3.2 Organizational Structure and Responsibilities

Construction Phase

The organizational structure for the construction phase EMP is shown in **Exhibit 9.1** and its salient features described below.

1. Primary responsibilities:
 - ▶ Project Director (PD) will be responsible for the project's compliance with the EIA and EMP throughout the project. The EC will assist PD and will provide policy support on all environment and socioeconomic-related matters.
 - ▶ The PD will assume the main responsibility for all environmental matters pertaining to their work.
 - ▶ The PD will coordinate with relevant government departments (SEPA) and other stakeholders.
1. Field management and quality control:
 - ▶ Carrying out construction activities in an environmentally and socially sound manner during the construction phase will be the responsibility of the site managers of the contractor(s).
 - ▶ The site in-charge will be responsible for the environmental and social soundness of all construction activities.
2. On-the-job supervision and monitoring:
 - ▶ The ESO of contractors will be responsible for the implementation of the EMP during construction works. He will also be responsible for communication with and the training of their respective construction and camp crews in all aspects of the EMP.
 - ▶ The ESI will ensure implementation of the environmental management plan in the field. He will also coordinate with the PD, the contractor's project management and ESO of contractors.
 - ▶ If any monitoring teams from government departments or from NGOs visit the field during the field activities, the ESI will be responsible for coordinating their visits.

The responsibilities of various role players are summarized in **Exhibit 9.2**.

Operation Phase

As stated above, the environmental and social management will be integrated in the O&M system; no dedicated environment personnel will be required in view of the environment-friendly nature of the project. Expertise will be instituted in the EC to support the O&M staff and the communities for the environmental and social management of their respective activities.

9.4 Mitigation Plan

The mitigation plan is a key component of the EMP. It lists all the potential effects of each activity of the project and their associated mitigation measures identified in the EIA. For each project activity, the following information is presented in the plan:

- A listing of the potential impact associated with that project activity,
- A comprehensive listing of mitigation measures (actions),

- The person(s) responsible for ensuring the full implementation of the action,
- The person(s) responsible for monitoring the action,
- The timing of the implementation of the action to ensure that the objectives of mitigation are fully met.

The mitigation plan for the construction phase of the proposed project is presented in **Exhibit 9.3**

It should be emphasized that the mitigation measures will have to be translated into environmental requirements and specifications to be made part of the contracts for the construction activities, with legal binding.

9.5 Monitoring Plan

The objective of environmental and social monitoring during the various phases of the proposed project will be as follows:

- Ensuring that the mitigation measures included in the EIA are being implemented completely.
- Ensuring the effectiveness of the mitigation measures in minimizing the project's impacts on social and environmental resources.

To achieve these objectives the following monitoring program will be implemented.

9.5.1 Compliance Monitoring

The compliance monitoring of the project activities is principally a tool to ensure that the environmental and social control measures required in the EIA are strictly adhered to during the project activities.

Various aspects of the EIA compliance monitoring will be to:

- Systematically observe the activities undertaken by the contractors (and sub-contractors) or any other person associated with the project
- Verify that the activities are undertaken in compliance with the EIA and EMP
- Document and communicate the observations to the concerned person(s) of the contractors, and EC, so that any corrective measures, if required, can be taken in a timely fashion
- Maintain a record of all incidents of environmental and social significance and related actions and corrective measures
- Prepare periodic reports of the environmental and social performance of project.

The mitigation plan discussed in above **Section** will be used as a management and monitoring tool for compliance monitoring. Inspection will be done using checklists prepared by the respective contractors, on the basis of the **Exhibit 9.3**, during the construction phase.

Compliance monitoring will be the responsibility of all organizations involved in the field activities. It will be carried out by the following:

- Environmental and Social Inspector
- Contractors' Environmental and Social Officers.

9.5.2 Effects Monitoring

The EIA predicts the impacts of the proposed project on the basis of information available on the environment and the natural processes that link various environmental parameters. Based on this prediction, mitigation measures are introduced such that the predicted residual effects do not exceed acceptable levels. However, there is always an element of uncertainty in such predictions due to an insufficient grasp of the processes, limitations in prediction techniques, or inadequate data on the environment. This is true for the physical, biological, as well as socioeconomic environment. Consequently, it is possible that even if the mitigation measures are implemented fully, the negative impacts of the project will exceed acceptable limits.

In order to address the above concerns, effects monitoring is undertaken during the project activities, with the overall objective of proper management of environmental risks and uncertainties. Broadly, effects monitoring has four objectives:

- To verify that the impacts of the proposed project are within acceptable limits, thus establishing credibility (public assurance)
- To immediately warn the project proponents (and the regulatory agencies, if required) of unanticipated adverse impact or sudden changes in impact trends so that corrective actions can be undertaken, which may include modifications in the proposed activities, or the inclusion of modified or additional mitigation measures
- To provide information to plan and control the timing, location, and level of certain project activities so that the effects are minimized.
- To facilitate research and development by documenting the effects of the proposed project that can be used to validate impact-prediction techniques and provide a basis for more accurate predictions of future projects.

The effects monitoring plan is provided in **Exhibit 9.4**. The detailed methodologies will be developed during the detailed design phase of the project, when the specific information on field activities will be known. The effects monitoring will comprise the following:

- Soil erosion
- Water quality
- Water consumption and availability
- Air quality
- Noise
- Socioeconomic aspects.

9.6 Communication and Documentation

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

- Recording and maintenance of all information generated during the monitoring in a predetermined format.
- Communicating the information to a central location.
- Storing raw information in a central database.
- Processing the information to produce periodic reports.

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

9.6.1 Data Recording and Maintenance

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

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

9.6.2 Meetings

The following environmental meetings will take place during the project:

- Kick-off meetings (one each for each of the contractors).
- Fortnightly meetings.⁴³

The purpose of the kick-off meetings will be to discuss the EMP, and ensure full commitment from concerned parties for its implementation.

A periodic meeting will be held at site during the construction phase. The purpose of the meetings will be to discuss the conduct of the operation, non-compliances noted by the ESI or Contractors' ESOs. The remedial measures will also be discussed and agreed during these meetings. The meeting will be recorded in the form of an environmental report (ER) prepared by the ESI.

9.6.3 Reports

The ESI will produce periodic reports based on the information collected. These will include reports for:

⁴³ Frequency of meetings may be adjusted per the situation.

- Kick-off meetings with each contractor,
- Fortnightly meetings,
- Non-compliances,
- Effects monitoring.

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

9.6.4 Grievance Redressal Mechanism

A grievance redressal system (GRS) will be put in place at the project sites. Under this system, the ESI will maintain a social complaint register at the site to document all complaints received from the local communities. The information recorded in the Register will include date of the complaint, particulars of the complainant, description of the grievance, actions to be taken, the person responsible to take the action, follow up requirements and the target date for the implementation of the mitigation measure. The register will also record the actual measures taken to mitigate these concerns.

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

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

All community complaints received will also be sent to the PD for his information and further action.

9.7 Environmental and Social Trainings

Environmental and social trainings will help to ensure that the requirements of the EIA and EMP are clearly understood and followed by all project personnel throughout the project period. The primary responsibility for providing training to all project personnel will be that of the ESI. The environmental and social training program will be finalized before the commencement of the project, during the detailed design phase. The training will be provided to the Zorlu staff, the construction contractors, and other staff engaged for the project. Training will cover all staff levels, ranging from the management and supervisory to the skilled and unskilled categories. The scope of the training will cover general environmental awareness and the requirements of the EIA and the EMP, with special emphasis on sensitizing the project staff to the environmental and social aspects of the area.

During the O&M phase of the project, these trainings will continue to be conducted by EC for all relevant staff of the Company.

9.8 Change Management

The present EIA has been carried out on the basis of the project information available at this stage. This is however possible that changes are made in some components of the project, during the design and construction phases. In order to address the environmental and social implications of these changes, a simple framework has been devised, which is described in this section.

The change management framework recognizes the following three broad categories of the changes in the project:

- Category A changes,
- Category B changes, and
- Category C changes.

These categories are defined below.

9.8.1 Category 'A' Change

The category 'A' change would be the project modification which have least effect on the environmental and social parameters of the area. Some examples of such changes during the proposed project are listed below.

- Change in the type of the towers.
- Change in the project site within 500 m of the location studied during the EIA.
- Changes in the tower configuration within the project.
- Change in total number of turbines

For the changes such as above, a new environmental and social assessment will not be required. The only action that will be required in these instances will be to document the exact nature of the change.

9.8.2 Category 'B' Change

The category 'B' changes will have some environmental and social implications, but limited to the extent that a fresh EIA would not be required. Some examples of such changes are provided below.

- Changes in the project location by more than 500 m of the original location, but not exceeding 2 km.

Such changes will necessitate site surveys by the environmental and socioeconomic experts. A site specific assessment for any additional environmental as well as socioeconomic issues will need to be carried out. Complete record of the surveys and assessment will be maintained.

9.8.3 Category 'C' Change

This type of change will have the potential of having significant environmental and/or social implications, hence necessitate fresh EIA to be carried out. Examples of such changes are provided below.

- Changes in the location of project by more than 2 km of the original location.
- Increasing the number of towers to be installed.

9.9 Cost of Environmental Management

The primary component of the environmental management cost pertains to the personnel dedicated for EMP implementation. The other component relates to the environmental effects monitoring as discussed above and tabulated in. The cost of mitigation measures is completely integrated with the construction costs, and cannot be separated. The mitigation measures should be made part of the project design and hence included in the overall project cost.

Exhibit 9.5 provides the cost estimates for the environmental management of proposed project.

Exhibit 9.1: Organizational Structure for Environmental Management

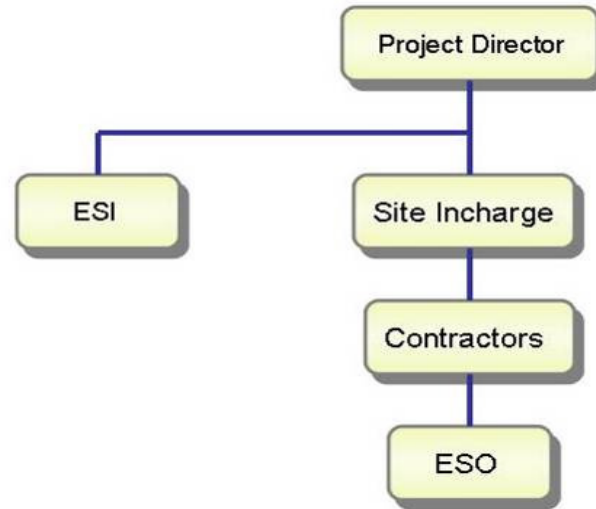


Exhibit 9.2: Responsibilities of Zorlu, ESI and Contractors

| Organization | Designation | Responsibilities |
|---------------------|--|--|
| Project developer | PD and PM | Fulfill obligations as laid out various project documents. Ensure that the construction is carried out within the agreed timeframe according to satisfactory HSE and technical standards. |
| | Environmental and Social Inspector (ESI) | Ensure that the entire project is conducted in an environmentally friendly manner. Ensure compliance with all relevant environmental laws. Facilitate full implementation of EMP and EIA requirements during the project. Assist the PD and Project Manager in fulfilling environmental responsibilities and keep them updated on environmental matters relating to the construction. Review environmental reports (ER), and ensure implementation of corrective measures, if any. Coordinate with other stakeholders, including relevant EPAs. |
| | Site Incharge | Facilitate field management of contractors; Report regularly to the Project Manager and PD. |
| Contractors | Site Manager | Manage construction activities, manage construction crew, camp crew and other site personnel, in an environmentally responsible manner; Liaise with Project Manager/Director; Liaise with Site Incharge. |
| | Environment and Social Officers (ESO) | Manage the implementation of mitigation measures given in the EIA and EMP; Manage implementation of entire EMP; Report regularly to Site Manager; Liaise with ESI; Provide environmental training to construction crew. |

Exhibit 9.3: Mitigation Plan

| | Project Activities | Impact | Action | Responsibility | | Timing | |
|---|--|--------|--------------------------------|--|-------------|--------|--------|
| | | | | Execution | Monitoring | | |
| 1 | Contractor Mobilization and Demobilization | 1.1 | Soil Erosion and Contamination | <ul style="list-style-type: none"> • Vehicular traffic on unpaved roads will be avoided as far as possible. Operation of vehicles and machinery close to the water channels, water reservoir will be minimized. • Vehicles and equipment will not be repaired in the field. If unavoidable, impervious sheathing will be used to avoid soil and water contamination. | Contractors | ESO | BC; AC |
| | | 1.2 | Air Quality Deterioration | <ul style="list-style-type: none"> • Construction machinery and vehicles will be kept in good working condition and properly tuned, in order to minimize the exhaust emissions. • Fugitive dust emissions will be minimized by appropriate methods, such as spraying water on soil, where required and appropriate. • Project vehicles will avoid passing through the communities, farms and orchards as far as possible. If unavoidable, speed will be reduced to 15 km/h to avoid excessive dust emissions. | Contractors | ESO | BC; AC |
| | | 1.3 | Noise | <ul style="list-style-type: none"> • Vehicles will have exhaust mufflers (silencers) to minimize noise | Contractors | ESO | BC; AC |

| Project Activities | Impact | Action | Responsibility | | Timing |
|---|----------------------------------|--|----------------|------------|-----------|
| | | | Execution | Monitoring | |
| | | <p>generation.</p> <ul style="list-style-type: none"> Nighttime traffic will be avoided near the communities. Local population will be taken in confidence if such work is unavoidable. Vehicular traffic through the communities will be avoided as far as possible. Vehicle speeds will be kept low, and horns will not be used while passing through or near the communities. | | | |
| | 1.4 Safety Hazards | <ul style="list-style-type: none"> Road signage will be fixed at appropriate locations to reduce safety hazard associated with project-related vehicular traffic. Project drivers will be trained on defensive driving. Vehicle speeds near / within the communities will be kept low, to avoid safety hazard and dust emissions. | Contractors | ESO | BC; AC |
| | 1.5 Damage to Infrastructure | <ul style="list-style-type: none"> All damaged infrastructure will be restored to original or better condition. | Contractors | ESO | DC; AC |
| 2 Construction Camp Establishment and Operation | 2.1 Soil Erosion / Contamination | <ul style="list-style-type: none"> Construction camp will be located in a stable and flat area, requiring minimal devegetation and leveling. ESI's approval will be obtained for camp location. | Contractors | ESO | BC; DC |

| Project Activities | Impact | Action | Responsibility | | Timing |
|--------------------|--------|---|----------------|------------|--------|
| | | | Execution | Monitoring | |
| | | <ul style="list-style-type: none"> Land clearing, leveling and grading will be minimized, and carried out in a manner to minimize soil erosion. Vehicular traffic on unpaved roads will be avoided as far as possible. Operation of vehicles close to the water channels, water reservoirs will be minimized. Contractors will prepare a waste disposal plan and submit to ESI for his approval. For the domestic sewage, appropriate treatment and disposal system will be constructed having adequate capacity. Waste oils will be collected in drums and sold to the recycling contractors. The inert recyclable waste from the site (such as card board, drums, broken/used parts, etc.) will be sold to recycling contractors. The hazardous waste will be kept separate and handled according to the nature of the waste. Domestic solid waste from the construction camp will be disposed in a manner that does not cause soil contamination. | | | |

| Project Activities | Impact | Action | Responsibility | | Timing |
|--------------------|-----------------------------|--|----------------|------------|-----------|
| | | | Execution | Monitoring | |
| 2.2 | Air Quality Deterioration | <ul style="list-style-type: none"> Construction camp will be established about 500 m from communities. Generators and vehicles will be kept in good working condition and properly tuned, in order to minimize the exhaust emissions. Fugitive dust emissions will be minimized by appropriate methods, such as spraying water on soil, where required and appropriate. Waste water from kitchen and washing area of the construction camp may be used for water spraying. Project vehicles will avoid passing through communities, farms and orchards. If unavoidable, max speed of 15 km/h will be observed to avoid excessive dust emissions. | Contractors | ESO | BC; DC |
| 2.3 | Surface Water Contamination | <ul style="list-style-type: none"> For the domestic sewage, appropriate treatment and disposal system will be constructed having adequate capacity. Waste oils will be collected in drums and sold to the recycling contractors. The inert recyclable waste from the site (such as card board, drums, broken/used parts, etc.) will be sold to recycling contractors. The hazardous waste will be kept separate and | Contractors | ESO | BC; DC |

| Project Activities | Impact | Action | Responsibility | | Timing |
|--------------------|--------------------|---|----------------|------------|-----------|
| | | | Execution | Monitoring | |
| | | <p>handled according to the nature of the waste.</p> <ul style="list-style-type: none"> Domestic solid waste from the construction camp will be disposed in a manner that does not cause soil contamination. | | | |
| 2.4 | Water Consumption | <ul style="list-style-type: none"> Water will be obtained from the source approved by the ESI. Astute planning will be employed to conserve water at the construction sites and camp. Water will be procured in a manner that least affects the local communities. Waste water recycling will be carried out for sprinkling and gardening purposes. | Contractors | ESI | DC |
| 2.5 | Loss of Vegetation | <ul style="list-style-type: none"> Clearing natural vegetation will be avoided as far as possible. The camp will be established in a natural clearing, outside forested areas. Complete record will be maintained for any tree cutting. The construction crew will be provided with LPG as cooking (and heating, if required) fuel. Use of fuel wood will not be allowed. | Contractors | ESO | BC; DC |

| Project Activities | Impact | Action | Responsibility | | Timing | |
|--|--------|--------------------------------|--|-------------|--------|-----------|
| | | | Execution | Monitoring | | |
| | 2.6 | Noise | <ul style="list-style-type: none"> Generators and vehicles will have exhaust mufflers (silencers) to minimize noise generation. | Contractors | ESO | BC; DC |
| | 2.7 | Safety Hazards | <ul style="list-style-type: none"> Protective fencing to be installed around the Camp to avoid any accidents. | Contractors | ESO | BC; DC |
| | 2.8 | Social and Gender Issues | <ul style="list-style-type: none"> Construction crew will avoid entering the villages and settlements. | ESO | ESI | BC DC |
| 3 Transportation of Equipment and Construction Materials | 3.1 | Soil Erosion and Contamination | <ul style="list-style-type: none"> Vehicular traffic on unpaved roads will be avoided as far as possible. Operation of vehicles and machinery close to the water channels, water reservoir will be minimized. Vehicles and equipment will not be repaired in the field. If unavoidable, impervious sheathing will be used to avoid soil and water contamination. | Contractors | ESO | DC |
| | 3.2 | Air Quality Deterioration | <ul style="list-style-type: none"> Vehicular traffic on unpaved roads will be avoided as far as possible. Operation of vehicles and machinery close to the water channels, water reservoir will be minimized. Vehicles and equipment will not be repaired in the field. If unavoidable, impervious sheathing will be used to avoid soil and water contamination. | Contractors | ESO | BC; DC |
| | 3.3 | Noise | <ul style="list-style-type: none"> Vehicles will have exhaust mufflers | Contractors | ESO | BC; |

| Project Activities | Impact | Action | Responsibility | | Timing |
|--------------------|------------------------------|--|----------------|------------|-----------|
| | | | Execution | Monitoring | |
| | | (silencers) to minimize noise generation. <ul style="list-style-type: none"> Nighttime traffic will be avoided near the communities. Local population will be taken in confidence if such work is unavoidable. Vehicular traffic through the communities will be avoided as far as possible. Vehicle speeds will be kept low, and horns will not be used while passing through or near the communities. | | | DC |
| | 3.4 Safety Hazards | <ul style="list-style-type: none"> Road signage will be fixed at appropriate locations to reduce safety hazard associated with project-related vehicular traffic. Project drivers will be trained on defensive driving. Vehicle speeds near / within the communities will be kept low, to avoid safety hazard and dust emissions. | Contractors | ESO | BC; DC |
| | 3.5 Damage to Infrastructure | <ul style="list-style-type: none"> All damaged infrastructure will be restored to original or better condition. | Contractors | ESO | BC; DC |
| 4 Construction | 4.3 Blocked Access | <ul style="list-style-type: none"> In case of the blockage of the existing routes, alternate routes will be made available in consultation with affected communities. | Contractor | ESO | BC; DC |

| Project Activities | Impact | Action | Responsibility | | Timing |
|--------------------|--------------------------|---|----------------|------------|-----------|
| | | | Execution | Monitoring | |
| 4.4 | Noise and Vibration | <ul style="list-style-type: none"> Working hours for construction activities within the communities will be limited to between 8 am and 6 pm. | Contractor | ESO | DC |
| 4.5 | Safety Hazards | <ul style="list-style-type: none"> The construction sites will have protective fencing to avoid any unauthorized entry. Before commencing the testing commissioning of the system, the nearby communities will be informed. Protective fencing will be used where appropriate/possible. | Contractor | ESO | DC |
| 4.6 | Damage to Infrastructure | <ul style="list-style-type: none"> All damaged infrastructure will be restored to original or better condition. | Contractor | ESO | DC |
| 4.7 | Gender Issues | <ul style="list-style-type: none"> Bypass routes to be provided to communities, if required, especially along routes frequented by women folk, such as route to the local well or water source. Construction crew will avoid in entering villages and settlements. | Zorlu | ESI | BC; DC |

| Project Activities | Impact | Action | Responsibility | | Timing |
|--------------------|--|--|----------------|------------|-----------|
| | | | Execution | Monitoring | |
| 4.8 | Sites of Historical, Cultural, Archeological or Religious Significance | <ul style="list-style-type: none"> In case of discovery of any sites or artifacts of historical, cultural, archeological or religious significance, the work will be stopped at that site. The provincial and federal archeological departments will be notified immediately, and their advice will be sought before resumption of the construction activities at such sites. | Zorlu | ESI | BC; DC |
| 4.9 | Soil Erosion | <ul style="list-style-type: none"> Cut and fill at the proposed site will be carefully designed, and ideally should balance each other. The surplus soil, if any, will be disposed at places approved by ESI. Such sites will be selected after surveying the area and ensuring that soil deposition will not have any significant impacts, such as loss of productive land, blocked access, natural vegetation and disturbance to drainage. If necessary, fill material for excavated sites will be obtained from appropriate locations approved by ESI. Such locations will be selected after surveying the area and ensuring that soil extraction will not have any significant impacts, such as soil erosion, loss of natural vegetation and | Contractors | ESO | DC |

| Project Activities | Impact | Action | Responsibility | | Timing |
|--------------------|--------------------|---|----------------|------------|--------|
| | | | Execution | Monitoring | |
| | | disturbance to drainage. <ul style="list-style-type: none"> The excavation for the fill material will be limited to approximately 50 cm depth. The fill material will not be obtained from any cultivation fields or orchards. Areas from where the fill material is obtained or surplus soil deposited, will be landscaped to minimize erosion and hazard for people and livestock. Embankments and excavated slopes will not be left untreated/unattended for long durations. Appropriate slope stabilization measures will be taken per the design (eg, stone pitching). After the completion of the construction works, campsites and other construction sites will be completely restored. No debris, surplus construction material or any garbage will be left behind. Photographic record will be maintained for pre-project, during-construction and post-construction condition of the sites. | | | |
| 4.10 | Soil Contamination | <ul style="list-style-type: none"> Vehicles and equipment will not be repaired in the field. If unavoidable, impervious sheathing will be used to | Contractors | ESO | DC |

| Project Activities | Impact | Action | Responsibility | | Timing |
|--------------------|--------|--|----------------|------------|--------|
| | | | Execution | Monitoring | |
| | | <p>avoid soil and water contamination.</p> <ul style="list-style-type: none"> For the domestic sewage, appropriate treatment and disposal system, such as septic tanks and soaking pits, will be constructed having adequate capacity. The contractor(s) will submit to ESI the plans for the camp layout and waste disposal system, and obtain approval. Waste oils will be collected in drums and sold to the recycling contractors. The inert recyclable waste from the site (such as card board, drums, broken/used parts, etc.) will be sold to recycling contractors. The hazardous waste will be kept separate and handled according to the nature of the waste. Domestic solid waste from the construction camp will be disposed in a manner that does not cause soil contamination. The waste disposal plan submitted by the contractor(s) will also address the solid waste. | | | |

| Project Activities | Impact | Action | Responsibility | | Timing |
|--------------------|---------------------------|--|----------------|------------|--------|
| | | | Execution | Monitoring | |
| 4.11 | Air Quality Deterioration | <ul style="list-style-type: none"> Construction machinery, generators and vehicles will be kept in good working condition and properly tuned, in order to minimize the exhaust emissions. Fugitive dust emissions will be minimized by appropriate methods, such as spraying water on soil, where required and appropriate. Since water availability is an issue in some of the areas, it is recommended that the waste water from kitchen and washing area of the construction camp may be used for water spraying. | Contractors | ESO | DC |
| 4.12 | Aesthetic Value | <ul style="list-style-type: none"> Tree plantation will be carried inside and at the periphery of the plant without compromising the safety aspects (ie, required clearances will be maintained). | Zorlu | ESI | AC |

ESI: Environmental and Social Inspector;
 ESO: Environment and Social Officer;
 PM: Project Manager;

BC: Before Construction;
 DC: During Construction;
 AC: After Construction;

Exhibit 9.4: Effects Monitoring Plan for Construction Period

| No. | Monitoring Parameter | Monitoring Locations | Frequency ^a | Responsibility | Resource Requirement | Documentation |
|-----|---|--|--|----------------|---------------------------|--|
| 1 | Visual observation of soil erosion | Construction sites, campsites | During routine monitoring | ESI | - | Record of observations. |
| 2 | Groundwater quality | Selected local wells | Monthly | ESI | Sampling bottles | Complete record of sampling and analyses. |
| 3 | Surface water quality | Selected locations | Monthly | ESI | Sampling bottles | Complete record of sampling and analyses. |
| 4 | Water consumption | Construction sites, campsite | Daily | ESI | - | Complete record |
| 5 | Visual checks for any damage to water course, groundwater wells | Construction sites | During routine monitoring | ESI | - | Record of observations. |
| 6 | Visual check for exhaust emissions from generators, equipment and vehicles. | Construction sites, camp site | During routine monitoring | ESI | - | Record of observations. |
| 7 | Visual check for dust emissions from equipment and vehicles. | Construction sites, camp site, project roads | During routine monitoring | ESI | - | Record of observations. |
| 8 | Noise | At nearby communities | Fortnightly or during the construction activities causing noise. | ESI | Noise meter | Complete record of noise measurements, locations, etc. |
| 9 | Public Grievances | At nearby communities | Throughout the field activities. | ESI | Social Complaint Register | Complete record to be maintained in the form of the Social Complaint Register. |

^a Frequency may be adjusted in the field according to the situation and results of the monitoring.

Exhibit 9.5: Cost of Environmental Management ⁴⁴

| | Description | Cost (Pak Rs.) | Basis |
|----|--------------------------------|---------------------------|---|
| 1 | Environmental Personnel | | |
| | ESI | 600,000 | 12 months × 50,000 PM |
| | ESO (3) | 1,080,000 | 12 months × 30,000 PM |
| 2 | Overheads | 648,000 | 30% of the above |
| 3 | Environmental Monitoring | 360,000 | 6 water samples per month; Rs. 5,000 per sample; 12 months. |
| 4 | Environmental Trainings | 1,200,000 | 2 trainings per month of one- day duration; 25 personnel to be trained per training; Rs 50,000 per training. |
| 8 | Development of Plantation Plan | 520,000 | 26 days × 20,000 per day. |
| 10 | Miscellaneous Expenses | 600,000 | Rs 50,000 per month. |
| | Total | 9,508,000 | |

⁴⁴ The duration of the proposed project has been assumed as one year.

10 Public Consultations

10.1 General

The success of any project largely depends on the social acceptance of the people of area; it is situated in. The social acceptance is largely viewed as the mode of making the projects sustainable in long terms. Without this, the project constructed in the project area is nothing but few meaning less structures that are force fully erected. The larger the social acceptance of the project in the project area; greater are the chances of the project success and future expansion.

Getting the social approval of the people of the project area has proved to be very sensitive and time taking task. That is why it has been made compulsory in all the existing laws of local and international origins to involve the local stake holders in the decision making process by asking their views, their concerns and their suggestion for the potential components of the project directly or indirectly related with them.

10.2 Objectives

The purpose of the consultation is to receive and consider views around the aspirations and objectives for all aspects of the proposed ZORLU WF, including the issues of sustainability, integration, environmental improvement and quality of life. It is important that the consultations reflect the expectations, fears, apprehensions and general views of the people of the area and that through this consultation process; comments can be received, issues can be prioritized and changes can be made where appropriate during the project implementation.

There is also a need to ensure that the obligations for social inclusion are fulfilled by specifically targeting key groups, for example, people from ethnic minority communities, people with disabilities, children and young people, and the disenfranchised, who are often under represented or whose views are often not heard.

Extra efforts were made to involve the females in the stake holder's consultation process. Special in house and corners meeting were arranged with the support of the local influential and residents. Besides all these, other important need of the consultation was also to fulfill the statutory requirement of the project.

10.3 Identification of the Stake Holders

It is very important to establish which of the many stakeholders are important for the consultation and evaluation, and whose needs and interests are needed to be heard and incorporated. This will ensure that all relevant factors are identified at the early stages of the work and the consultation process can be designed accordingly. Resultantly stake holder's identification and careful analysis leads to those potential stake holders that can affect and influence the project activities at all stages of project implementation.

There is a long list of the potential stake holders to be consulted in the consultation process. The identification of the stake holders was made in the light of Pak-EPA's⁴⁵ and WB⁴⁶ guide lines. But special emphasis was made to incorporate the views and ideas of those who are or in future will be in a position to affect the project activities (either positively or negatively). The details of the followed framework of consultation are exhibited in **Exhibit 9.1**.

A detailed checklist⁴⁷ shown in **Exhibit 9.2** was followed. This approached literally ensured that none sector of the society is left un-heard and un-touched in the consultation process.

During the consultation process at all levels, following key stake holders were identified, contacted and their ideas, views, concerns and expectation were incorporated in the this section of the report:

- Host communities around the project influence area
- Elected Representatives of the Area
- NGOs (National a& International) working in the area
- EPA officials
- Other Potential Communities
- HESCO Officials
- Other potential groups (like suppliers, traders and service providers in project area)
- Cross Cutting / Horizontal Theme Advisors (Environmental Sustainability, Innovation, Equal Opportunities etc)

10.4 Institutional Consultations

The civil society organizations have their major role to play for the change every body is talking about today. Changes are of many types, social change, cultural change, economical change, behavioral change etc. It was equally important to know what civil society organizations have to say for the proposed project.

Different policy formulating and implementation organizations and individuals were also examined and contacted. Their expressed views are also incorporated in this report.

10.5 Consultation Process

Consultation process was completed by adopting an interactive and participatory method; ensuring that each and every participant expresses what he thinks or perceives to be right and beneficial with the proposed WF in the project area.

During this process a total of 112 consultations (including that of Institutional Consultations) were made and the data collected from all these was analyzed. Extra efforts were made to

⁴⁵ Pak EPA Guide Lines for Public Consultation ,October 1997

⁴⁶ Source: Social Analysis Sourcebook: Incorporating Social Dimensions into Bank-Supported Projects. The World Bank. December 2003.

⁴⁷ Ibid

maximize the female participation during the process. Separate female consultations were also made and for this a dedicated female consultant was also engaged.

The issues, expectations, apprehensions and possible outcomes (good or bad) from the proposed WF were the focus of the consultative discussion. All the details of the discussion of consultation are incorporated in report. (Please see the **Appendix B** of the report for Public Consultation complete details)

10.6 Consultation in the Project Area (Grass root level)

The grass root level consultations were carried out in the following project adjoining areas and villages:

- Village Bachal Jakhro (Approx: 4 Km away from Project Site)
- Village Dad Muhammad Chang (Approx: 6 Km away from Project Site)
- Village Faqeer Muhammad Palari (Approx: 3 Km away from Project Site)
- Village Godar Chang (Approx: 3 Km away from Project Site)
- Village Ladho Ganjo (Approx: 3 Km away from Project Site)
- Village Marak Jakhro (Approx: 8 Km away from Project Site)
- Village Muhammad Arab Chang (Approx: 6 Km away from Project Site)
- Village Muhammad Yousuf Panhwar (Approx: 3 Km away from Project Site)
- Village Nawaz Ali Brohi (Approx: 2 Km away from Project Site)
- Village Raheemdad Chang (Approx: 6 Km away from Project Site)
- Village Shafoo Palari (Approx: 6 Km away from Project Site)
- Village Sulaiman Brohi (Approx: 5 Km away from Project Site)
- Village Umer Chang (Approx: 4 Km away from Project Site)
- Village Hassan Jamari (Approx: 4 Km away from Project Site)
- Village Wallo Palari (Approx: 3 Km away from Project Site)
- Village Yar Muhammad Chang (Approx: 6 Km away from Project Site)

10.7 Participation in Consultations

It was ensured that the maximum number of residents or PAPs attend the consultation activities. Door to door and village assembly methods were also used. The number of the participants may seem to be low; as a matter of fact it is very high in the project area where there are thinly populated and the male members usually busy in jobs at nearby city and at working places; these figures may be treated as the representation of the community living in and around the villages mentioned in **Exhibit. 9.3**.

10.8 Details of Consultations

In the public consultation process it was observed that, though these villages are not far beyond the national grid still most of the villages are without electricity. As a matter of fact the villages where consultation was conducted there is no electricity, facility of safe drinking water etc. In other words most of the basic amenities are not available to the inhabitants of these villages. Accordingly they are facing a lot of civic issues. Therefore they are expecting improvement in the civic facilities like availability of water, electricity etc. The consultant is of the view and recommends that the company should get developed a social development plan and set a side some amount for investment in human capital.

Detailed consultation was conducted separately with men and women folks. Their observation, expectation and available civic amenities are detailed in Appendix of this report.

10.8.1 Village Bachal Jakhro

Different consultations were made on different spots of the village including the houses and gathering places of the villages. Few consultations were also held on the way of the village females when they were fetching water from nearby storage facility of rainy waters.

Generally the villagers supported the ZORLU WF project in the area. But there was some reservation about dealing of government officials that could be due to lack of communication between the villagers and the government agencies. The community members were repeatedly referring the visit of the one of the consultants of ZORLU ENERJI during the inauguration phase of the project. They seemed to be very impressed from the attitude of the consultant who was representing the ZORLU ENERJI.

The community member welcomed the project in the area and expected that this project is going to improve the general economic conditions of the people of area by creating many more new employment opportunities during the different phases of the project construction and commissioning. Community member were also requesting the project implementer to provide to them the free electricity supply, help them in building basic infrastructure facilities like road access, sewerage and sanitation facilities in the village. Support in health sector related infrastructure development was their main demand. Their attitude towards the proposed WF was supportive.

10.8.2 Village Dad Muhammad Chang

The community of the village exclaimed that they were very lucky to have a project like this that can really change their living standards as a whole. Their area was waiting for the project like this to be initiated since long; they stated. The community members have associated extra expectations from the proposed project in the area. At the start of the discussion, they showed some apprehensions about the initial steps taken by the AEDB officials; that created some misunderstanding among the community members. When they were told that we were there to record what they had to say for the project; they opened their arms long and extended cooperation in consultation process.

Village Faqeer Muhammad Palari

The people living in this village were of the view that being away from main market they expected that this project will facilitate them with hospitals and schools for their next

generations. Our whole community was looking for the project like this one to facilitate us in clean water for drinking, school for our children, hospitals for our family members and many more facilities like these was observation of residents. Many of the community members were very anxious to know the time frame of the project to be started in the area.

Community members did not show any of their reservation on the environmental aspect during the consultation. Few were of the opinion that as this is clean system of producing the electricity so we are not expecting any of the adverse effects form this. Moreover this project is in the area which is already isolated from the normal trail that community members use to use; so they are least concerned with it.

10.8.3 Village Godar Chang

The consultations were held at the village meeting place and inside their houses (as they don't have any boundary wall; instead they use the little raised brick barrier for the purpose to serve). The community members were mostly very poor and their major source of living was the work in nearby industrial estate Noori Abad⁴⁸.

The community members were of the view if the foreign company is really serious to establish the wind power plants here then it should help us improve our living standard and reduce our suffering. One of the stake holder member and local influential was of the view that the foreign company (ZORLU ENERJI) should come here to help us and also install many more power plants in the region. It would be good for a muslim country (Turkey) to come here and earn rather any other non-muslim country to earn profit from here.

Few of the female members expressed that all this is not going to happen; they (pointing towards) project implementers will not be doing any thing here. They will simply install the power plants and vanish away. And in the end we will have nothing left for our betterment.

10.8.4 Village Ladho Ganjo

The majority of the community members were talking in favor of the proposed project. They all were unanimous regarding the betterment that proposed project can bring with the due course of time. Few of them were also talking about the workers of the other areas to come over here in the project area and create a social stress among the residents of the area. They also were afraid of being neglected in the jobs by the project implementer in the later stages of the project. They were also mentioning few other interested project implementers in the area that are also willing to go ahead with the project.

Few of the residents were also talking about the limited mobility after the construction of the WF. Community members also showed their concerns regarding the construction of boundary walls around the proposed WF. They were of the view that they would oppose this move of any of the project implementer; if the project implementer goes for that. Community members supported the project and were expecting some of the basic facilities like clean water and free electricity to be provided to them.

⁴⁸ An industrial estate on the super high way, where a number of industrial units are established

10.8.5 Village Marak Jakhro

Inhabitants of this community showed mix reaction for the project. Some of the community members were hesitant to talk with the team whereas some of the community members were apprehensive in talking.

When they were asked through intrusive and extended rapport building using participatory methodology; they started sharing their concerns and their reservations about the project. Some of the members were of the view that no one from the area was against the possible development resulting from the proposed project; but they were demanding some facilities in return of their moral support of the project in the area.

Some of the community members raised the mobility issue regarding the proposed fencing around the WTG. They were also talking about the limited access to the project area after the construction and commissioning of the project site. Community members were demanding the establishment of girl's high school for the girls, maternity home for women and transportation facilities for better access to other areas of the district.

10.8.6 Village Muhammad Arab Chang

We don't expect any thing big from the proposed project at this stage; stated a participant during the consultation in the village. Consultations were held at open fields and at village meeting places. Community members were supporting the idea of the WF in the area. They were hopeful that this project is going to help them in creating new jobs for the youth of the area. During the consultations it was noted that they has reservation on the employment opportunity which they should get on the implementation of the project.

The women participation was encouraged during the consultations so as their views can be incorporated in the development of the area.

10.9 Summary of Expectation of Stake Holders during Consultation Process

There were majority of people talking about many positive things in result of the proposed WF. They were expecting the more job opportunities (temporary and permanent) during all the phases of the project construction.

Community members expect the new wave of social and infrastructural development from the operations of the WF in the area. They expect the free electricity supply to be provided to them after the completion of the project. Community members also expect other basic infrastructural needs to be fulfilled of the area. They also expect the construction of the schools, hospitals and roads for the betterment of the people of area by the project implementer.

10.9.1 Mitigation Measures

- Local community members to be facilitated in the construction of schools and dispensaries using the CSR funds allocations. For this purpose the ZORLU ENERJI should prepare a **Comprehensive Community Development Plan (CCDP)**
- Interactions with the community members be established through some local representative; that continuously updates the ZORLU ENERJI about the social trends of the area

- Local Govt be involved in the proposed developmental works for the community members of the area
- Community participation be ensured during all phases of the project development

10.10 Summary of Concerns of Stake Holders during Consultation Process

In general the community members had supportive attitude as they thought that with the establishment of the wind farm, area in general will be developed and they will access to better civil amenities.

They had apprehension that workers of other areas would replace them in the due course of time. During the construction phase the creation of jobs for the local unemployed people is a possibility. If local job seekers could be employed (even if only for unskilled labor) the high level of unemployment could temporarily be relieved. However, maximizing employment opportunities for local people and minimizing the number of workers that will have to migrate to the area, is unlikely as construction companies usually make use of their own teams of skilled workers. Their will be increased crimes due to the new workers in the area for the project construction. The social conflicts are likely to be more frequent due to the race of exercising influence on the project implementers.

10.10.1 Mitigation Measures

- Local working force be employed in order to gain their moral support; if they are not technically qualified they better be adjusted against the non technical vacancies
- Contractors be bound to hire the local working force by incorporating an specific clause in the agreement.
- Close interaction with community members is recommended; so as to minimize the distances between the local residents and project implementers
- Permanent representative of the project implementer can help gain community confidence

10.11 Conclusion

The attitude of the stake holders is generally very positive towards the development of the WF in the area.

During all the phases of project development careful attention has been given to ecological, archaeological, and landscape impacts in influencing the project design. Technical Reports providing greater detail are available in Appendices to the Environmental Statement.

The Environmental Impact Assessment demonstrates how considerations to minimize the net impact of the WF developmental works have been incorporated throughout the lifecycle of the project, from design to decommissioning.

During the assessment process no any significance impact of "HIGH" ranking was identified. The assessment also concluded that there was sufficient capacity for the landscape to accommodate the scale of the development.

There are no culturally or archaeologically significant areas in proximity to the site. There are no standing or moving bodies of water, areas of significant habitat at the project site. The field studies did not identify any special status species of flora or fauna.

It is the opinion of the assessment team that the size and design of the project, along with proposed mitigation measures and general environmental protection procedures will ensure that the project will have minimal overall environmental impact.

Exhibit 10-1: Followed Public Consultation Framework

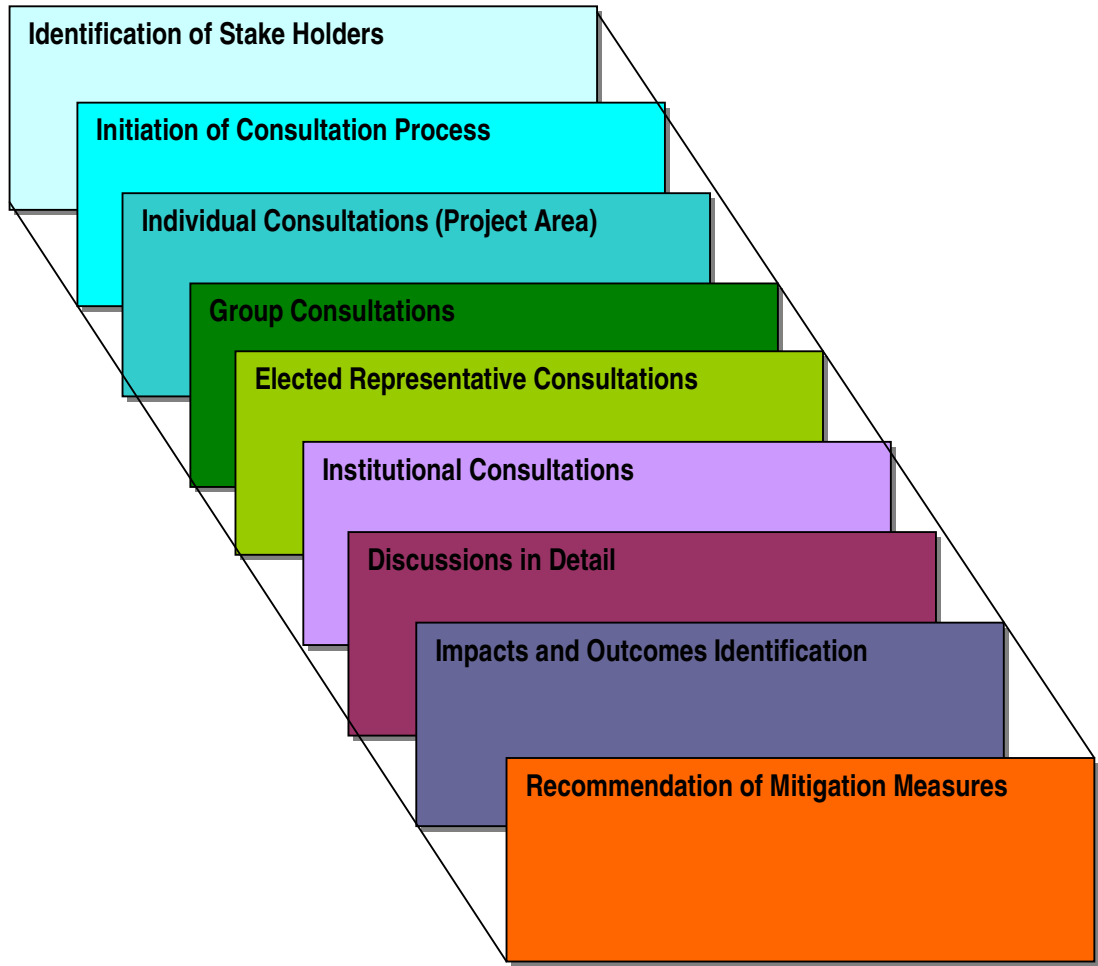


Exhibit 10-2: Checklist of Diversity Categories of Stakeholders⁴⁹

| Ascribed | Mixed | Achieved |
|--------------------|------------------------------|-----------------------|
| Age | Language | Citizen Migrant |
| Caste | Native/Immigrant | Education |
| Ethnicity or Race | Religion Spatial &Geographic | Ideology |
| Gender | | Land-Ownership |
| Sexual Orientation | | Occupation/Livelihood |
| | | Political Affiliation |
| | | Unionization |
| | | Urban/Rural |

Exhibit 10-3: Participation of the Villagers in Consultations

| Village Name | Participation in Consultation |
|---------------------------------|--------------------------------------|
| Village Marak Jakhro | 14 |
| Village Ladho Ganjo | 11 |
| Village Faqeer Muhammad Palari | 18 |
| Village Godar Chang | 09 |
| Village Marak Jakhro | 13 |
| Village Muhammad Arab Chang | 12 |
| Village Muhammad Yousuf Panhwar | 10 |
| Village Nawaz Ali Brohi | 10 |
| Village Raheem Dad Chang | 14 |
| Village Sahfoo Palari | 14 |
| Village Sulaiman Brohi | 22 |
| Village Umer Chang | 18 |
| Village Hassan Jamari | 26 |
| Village Wallo Palari | 14 |
| Village Yar Muhammad Chang | 12 |
| Village Bachal Jakhro | 16 |

⁴⁹ Source: Social Analysis Sourcebook: Incorporating Social Dimensions into Bank-Supported Projects. The World Bank. December 2003.

Appendix A: HSE Plan

HSE PLAN

ZORLU ENERJI PAKISTAN LTD

50 MW WIND FARM JHIMPIR SINDH, PAKISTAN



Table of Contents

DEFINITION OF TERMS

1. SCOPE
2. ORGANIZATION
3. SAFETY REPORTS/MEETINGS/NOTICES
4. SAFETY ORIENTATION AND EDUCATION
5. GENERAL PLANT REGULATIONS
6. PERSONAL SAFETY EQUIPMENT
7. SIGNAS, SIGNALS AND BARRICADES
8. FIRE PROTECTION
9. FIRST AID
10. TOOLS- HAND AND POWER
11. CRANES AND LIFTING EQUIPMENT
12. EXCAVATION AND TRENCHING
13. CONCRETE FORMS AND SHORING
14. FLOOR AND WALL OPENINGS, AND STAIRWAYS
15. LADDERS AND SCAFFOLDING
16. STEEL ERECTION
17. WELDING AND BURNING
18. ELECTRICAL WORK
19. VESSEL AND CONFINED SPACE ENVIRONMENT
20. ABRASIVE BLASTING
21. CHEMICAL

DEFINITION OF TERMS**Accident**

An unplanned or undesired event that can result in harm to people, property or the environment.

Exposure

The measurement of time during which the subject is at risk from a hazard.

Fatality

Death due to a work related incident or illness regardless of the time between injury or illness and death.

Harm

Includes death, injury, physical or mental ill health, damage to property, loss of production, or any combination of these.

Hazard

A source or a situation with a potential to cause harm, including human injury or ill health, damage to property, damage to the environment, or a combination of these.

Housekeeping

Maintaining the working environment in a tidy manner.

HSE

Health, Safety and Environment.

Incident

An event that:

- Results in death or injury to person where the injury requires medical attention (including first aid);
- Results in injury/damage to persons, property or process;
- Is not in compliance with statutory requirements, safe work procedures or inhouse guidelines.

Lost Time Injury (LTI)

Work related injury or illness that renders the injured person unable to perform any of their duties or return to work on a scheduled work shift, on any day immediately following the day of the accident.

Medical Treatment Case (MTC)

Work related injury or illness requiring more than first aid treatment by a physician, dentist, surgeon or registered medical personnel.

MSDS

Material Safety Data Sheet

Near Miss

A Near Miss is an event where no contact or exchange of energy occurred and thus did not result in personal injury, asset loss or damage to the environment.

Personal Protective Equipment (PPE)

All equipment and clothing intended to be utilised, which affords protection against one or more risks to health and safety. This includes protection against adverse weather conditions.

Restricted Work Case

Work related injury or illness that renders the injured person unable to perform all normally assigned work functions during a scheduled work shift or being assigned to another job on a temporary or permanent basis on the day following the injury.

Risk

A measure of the likelihood that the harm from a particular hazard will occur, taking into account the possible severity of the harm.

Risk Assessment

The process of analyzing the level of risk considering those in danger, and evaluating whether hazards are adequately controlled, taking into account any measures already in place.

Risk Management

The process of identifying hazards, assessing risk, taking action to eliminate or reduce risk, and monitoring and reviewing results.

The process of imparting specific skills and understanding to undertake defined tasks.

Unsafe act or condition

Any act or condition that deviates from a generally recognised safe way or specified method of doing a job and increases the potential for an accident.

SWL

Safe Working Load.

Work Programme

The work being undertaken by a site on behalf of the Company.

Worksite

The premises where any building operations or works of engineering construction related to the work program are being carried out.

1. SCOPE

This plan covers the requirements of the accident prevention rules and safety program to be applied to the Zorlu Enerji Pakistan Limited.

The primary purpose of this plan is to provide a guideline for preventing any accidents which may injure Employees or damage property, Zorlu Enerji Pakistan Limited shall abide by all safety rules and other regulations imposed at the site by the Laws of the country and the provisions of applicable laws, rules and regulations, including rules and procedures.

2. ORGANIZATION

2.1 General:

The safety requirements stipulated in this plan shall be strictly met and maintained by the safety organization at construction site.

2.2 Safety Committee:

2.2.1 Company shall organize a safety committee Manager, Zorlu Enerji Pakistan Limited Field Safety Manager.

2.2.2 Safety Committee shall:

- Monitor and ensure the operation of safety program in a proper manner.
- Direct, coordinate and orient the safety activities.
- Promulgate the spread of policy, objectives, rules and/ or regulations.
- Look for, detect, and identify risky conditions.
- Perform a thorough investigation of all accidents and review the recommendations to avoid any repetition of the accident.

2.3 Responsibility:

2.3.1 Zorlu Enerji Pakistan Limited Site Manager Site Manager shall

- Have the prime responsibility for ensuring the site safety.
- Establish a realistic safety policy and safety targets for the site.
- Promote the setting up of safety plan, regulations and rules and of a safety training plan, etc.
- Organize and preside over safety committee.

2.3.2 Zorlu Enerji Pakistan Limited Safety Manager shall:

- Chair a weekly safety committee meeting.
- Conduct periodic safety audits to ensure that the established safety program is implemented in a proper manner for construction work.

2.3.3 Zorlu Enerji Pakistan Limited Manager shall:

- Be responsible for all safety activities, including fire prevention during the construction period.
- Organize the safety committee.
- Establish, implement and maintain the safety program through the Safety Supervisor and Workers.
- Conduct independent audits to assure conformance with the established safety program and determine the effectiveness of individual elements of the program.

2.3.4 Zorlu Enerji Pakistan Limited Field Safety Manager shall:

- Conduct a safety program under the direction of the Construction

Manager.

- Patrol the work site periodically to verify that the work is carried out under safe conditions, with no violations of safety requirements.
- Advise promptly the Construction Supervisors and Workers of corrective action when any unsafe conditions or violations are observed.
- Check each work procedure from the safety point of view and advise the Construction Supervisors before commencement of work and, or while working
- Maintain the published safety literature, safety regulations, codes and other communications in accordance with contract. Advise management of compliance and conditions requiring attention.
- Check on the use of all types of personal protective equipment, evaluate effectiveness and suggest improvements.

2.3.5 Zorlu Enerji Pakistan Limited's Supervisor/ Foreman shall:

- Organize sites so that the work is carried out in accordance with the safety standards required for the minimum risk to employees and property.
- Know the safety requirements stipulated in the safety program.
- Give precise instructions as to the requirements for correct work method.
- Coordinate with his Subcons to avoid any confusion about areas of responsibility.
- Make sure that suitable personal protective equipment is available and in use.
- Ensure that new employees are properly instructed in precautions to be taken before they are allowed to start work.

2.3.6 Zorlu Enerji Pakistan Limited's Worker shall:

- Do nothing to endanger himself or coworkers.
- Use the correct tools and equipments for the job.
- Keep tools in good condition.
- Use proper personal safety equipment provided at all times.

3. SAFETY REPORTS/MEETINGS AND NOTICES

3.1 Accident Reports

3.1.1 All accidents are to be immediately reported orally to the supervisor in the cases described below and will be followed by a written report.

- All fatal injuries.
- All injuries requiring first aid treatment.
- All damages.
- All fires.
- All releases or spills of hazardous materials.

3.1.2 A written accident report shall describe in detail the circumstance, and include the results of the accident investigation and analysis.

This report describes the accident classification, cause, time, date, location, etc.

Written incident reports shall be submitted to Safety Manager within 12 hours.

3.1.3 A daily first aid record must be kept on all employees requiring first aid treatment.

3.2 Safety Committee Meeting

3.2.1 A safety committee meeting shall be held on a weekly basis and chaired by the Safety Manager and attended by all Safety Committee members.

3.2.2 All Safety Committee members prior to holding a meeting shall conduct a joint site safety inspection and the inspection results shall be discussed at the meeting.

4. SAFETY ORIENTATION AND EDUCATION

4.1 It is mandatory for each employee to attend the Safety Orientation program on his first day of work. No worker will be permitted to work on the site without attending the Safety Orientation Program and attached safety requirements.

4.2 The orientation will be given by the Zorlu Enerji Pakistan Limited Field Safety Manager and must include followings:

- Brief explanation of the program.
- Safety/ Security control policy.
- Outlines of applicable regulations and requirements for the project.
- Emergency procedures.
- First aid services.
- Each worker's responsibilities.

4.3 Biweekly Monday morning (2 times per month) before start of work a safety education is held by the Zorlu Enerji Pakistan Limited Field Manager for all workers and staffs

4.4 Every morning before start of work a safety talk session is held by the Supervisor with the foremen of each work place to instruct and discuss:

- Work procedures.
- Safety instructions for using equipment and tools.
- Particular hazardous conditions and precautions to be taken.
- Workmen's health conditions and other required information.

4.5 A written record will be maintained on all employees stating that they have received the safety training and fully understand the rules and regulations.

4.6 Periodic updating of the safety training procedure and requirements is provided for supervisors and foremen every two or three month.

5. GENERAL PLANT REGULATIONS

5.1 Employee Requirements:

All employees must be in good physical condition, i.e. appear healthy, have adequate hearing and sight etc.

5.2 Vehicles and Equipment:

5.2.1 Employees will comply with all safety rules and signs regarding traffic and vehicle use.

5.2.2 Speed limit within the site is controlled according to site and road condition, but must not exceed maximum 30 Km/hr.

5.2.3 Any equipment, machinery and tools, which have not been approved, must be removed from the site.

5.2.4 The engines of all vehicles and equipment should be stopped during refueling.

5.3 Alcohol and/ or Controlled Drugs:

5.3.1 Alcoholic drinks and / or Controlled Drugs are not to be used or allowed on the site at any time.

5.3.2 Anyone found under the influence of, or in possession of, alcohol or Drugs will be immediately removed from the site and refused future access.

5.4 Smoking:

5.4.1 Smoking is not permitted except in specified areas of workshops and buildings. Smoking in vehicles on the site is not permitted.

5.5 Safety Signs:

5.5.1 Zorlu Enerji Pakistan Limited shall observe the requirements of all safety signs on site.

5.5.2 Zorlu Enerji Pakistan Limited and all personnel will not remove any safety chain, Barrier, tag, marking or sign unless so directed by the proper authority.

5.6 Holographic Equipment and Radios:

5.6.1 Holographic equipment (camera, video, etc.) are not permitted on the site without prior approval in writing from Zorlu Enerji Pakistan Limited.

5.7 Time Keeping:

5.8 Environmental Control:

5.8.1 The Zorlu Enerji Pakistan Limited is responsible for the environmental

control specified for the job site including all equipment and machines used.

5.8.2 Do not dispose of any used oil or liquid waste direct to the ground, pit or storm drain. Dispose of these materials only in properly labeled containers.

6. PERSONAL SAFETY EQUIPMENT

6.1 General:

6.1.1 Each Zorlu Enerji Pakistan Limited is totally responsible for providing personal protective equipment for the protection of their employees as needs or requested.

It is also the Zorlu Enerji Pakistan Limited responsibility to ensure that his employees are well trained and use properly the personal safety equipment at all time in the Site and out of site while working.

6.1.2 All tools and equipment are required to be maintained in good working condition.

The Safety Supervisor shall inspects all tools and equipment periodically.

6.2 Head Protection:

6.2.1 Safety hats or helmets are rigid headgear made of various materials and designed to protect the heat from impact, flying particles, electric shock, or any combination of the three. Each helmet has two parts, a shell and a suspension cradle.

6.2.2 Any modification of the safety helmet, especially punching holes in shell, is prohibited.

6.3 Eye and Face Protection:

6.3.1 Protection of the eyes and face from physical or chemical agents are of prime importance in an industrial environment. And also, due to intensive sun exposure, uncontrolled dust and high humidity, locally used cotton Scarf should be issued to open area workers during construction period.

6.3.2 To select the type of protection will depend on the properties of possibly imposed hazard, but it should be borne in mind that all eye protection and most face protection devices must be considered as optical instruments. They must be selected, fitted, and used with regard to both the type of hazard and the optical condition of the user.

6.3.3 Industrial grade safety glasses (with shield) required at all times during working hours in construction site.

1) Welding and cutting

- 2) Excavation
- 3) Driving nails
- 4) Grinding
- 5) Drilling

6.4 Hand protection:

6.4.1 The kind of gloves used depends primarily upon the material or equipment being handled.

6.4.2 Gloves should not be used near rotating machinery as they can be caught and trap the hand.

6.4.3 Suitable gloves should be worn on most construction work.

6.5 Food Protection:

6.5.1 The safety shoe or boot is fitted with a metal toecap. The toecap is capable of withstanding both compression and impact loads.

6.5.2 Safety footwear for construction work must be able to withstand a compressive load.

6.5.3 Foot guards must be worn when using jack hammers, tampers and similar equipment.

6.6 Safety Belts (or Harness), Lifelines and Lanyards should be worn while working elevation is 3 m high form ground or platform level.

6.6.1 Lifelines, safety belts shall be used only for worker safeguarding.

6.6.2 Lifelines shall be secured above the point of operation to an anchorage or structural member.

6.6.3 Safety belt lanyard shall be a minimum of 14mm nylon, or equivalent, with a proper length of falling distance no greater than 1.8 m.

6.7 Respiratory Protection

6.8.1 Where industrial processes create atmospheric Contaminant, which may be hazardous to the health of employees, the first consideration always should be the application of engineering measures to control release of the contaminants.

6.8.2 In some cases, engineering control measures are not practical and the worker should therefore be supplied with personal respiratory protective equipment.

6.8.3 Ventilators, fans, air moves, dust mask or a combination of these should be used in dusty atmospheres. Users of dust masks, breathing air masks and respirators must be fit- tested and trained in their use.

7. SIGNS, SIGNALS AND BARRICADES

7.1 Accident Prevention Signs, Tags and Markings.

7.1.1 When hazardous work is to be performed the appropriate signs and symbols must be posted prior to starting work and must be removed or covered promptly when the hazards no longer exist.

7.1.2 Danger signs must be used only where an immediate hazard exists.

7.1.3 Caution signs must be used only to warn against potential hazards or to caution against unsafe practices.

7.1.4 Accident prevention signs, tags and markings are used as a temporary means of warning employees of an existing hazard, such as defective tools, equipment, etc, until the defective equipment can be repaired or removed.

7.2 warning Barricades:

7.2.1 Warning barricades will be erected before work begins or as soon as specific hazard is identified

7.2.2 Warning barricades must be erected and maintained at least two (2) meters from the edge of an excavation or opening.

8. FIRE PROTECTION

8.1 All employees must know where fire extinguishers are and how to use them.

8.2 Flammables shall be stored in properly labeled containers.

8.3 Accumulation of trash, oily rags, combustible materials and similar fire hazards of any nature will not be permitted.

8.4 All welding and cutting torches must be equipped with flame valve and standard operational gauges.

8.5 All alleyways, driveways, roads, stairway, ladder and transformers shall be kept clear of hazardous material and equipment.

8.6 Refueling of petrol and diesel equipment shall be done only in prescribed areas and with approved equipment.

Employees shall take all measures to minimize spills and to clean up immediately and spills which may accidentally occur. Refueling equipment with the engine running is prohibited.

8.7 Zorlu Enerji Pakistan Limited shall be install and maintain fire extinguisher and fire fighting equipment to be available all times at the construction site and site office.

8.7.1 There must be a fire extinguisher control equipment easily accessible for each welding, cutting, burning or other such operation.

8.7.2 Chemical power fire extinguisher must be provided at place of hot work.

All workers shall be properly trained and know how to use such extinguishers and fire hose.

9. FIRST AID

9.1 Zorlu Enerji Pakistan Limited shall provide First Aid facilities for his employees on the site.

9.2 In the event of accident, all possible efforts to keep on lookers from the scene must be made. The only employees required in such areas are those directly engaged in assisting in the emergency.

9.3 Shock:

9.3.1 Any person who has suffered a severe injury or even someone who has narrowly escaped injury is likely to be suffering from shock.

9.3.2 It is essential that persons administering first aid be aware of the symptoms of shock and take action to treat these symptoms in addition to the other injuries sustained.

9.4 Artificial Respiration

9.4.1 Electric shock, gassing or suffocation may cause breathing to stop.

9.4.2 Artificial respiration must be started immediately and continued until the patient recovers or until professional medical aid takes over. If you are alone, do not leave the patient to seek help until his normal breathing has resumed.

9.5 Chemicals:

9.5.1 Actions to be taken in the event of worker accidentally comes into physical contact with dangerous chemicals are as follows:

If splashed by chemical, goggles should be left in place until chemicals have been washed off. Unless chemicals have entered the eyes under the goggles, eye protection should be removed only after the chemicals have been washed from the surrounding area.

The eyes should be washed with clean water for at least 15 minutes. Chemicals on the skin should be washed off with water using a safety shower where available. When it is necessary to remove clothing, it should be removed while under shower or water spray medical attention is essential in these cases.

9.6 Head Injuries

9.6.1 Action in cases of head injury is to get the patient under medical care without delay.

9.6.2 No head injury should be regarded lightly. Every patient who has had even a mild injury to the head is liable to develop complications, which can be serious.

Treatment shall be as follows.

- Loosen all tight clothing around neck, chest, and waist.
- Check to see if the patient is breathing and initiate artificial respiration, if required.
- Ensure that his throat and air passages are clear of secretions, foreign bodies, and false teeth.
- Check for other injuries
- Arrange for the patient to be carefully transported to a hospital.

9.7 Bleeding:

9.7.1 Every effort should be made to stop bleeding by direct pressure such as by applying a sterilized pad or dressing.

9.7.2 The wound should be firmly bandaged. Applying mild pressure on the artery between the wound and the heart may control arterial bleeding.

9.8 Fractures:

9.8.1 Where a fracture is suspected, the limb must be immobilized. If possible, the injured part should be elevated to reduce discomfort and swelling.

9.8.2 Fracture of the spine or pelvis must be treated with great care.

9.8.3 The casualty must not be moved, but should be covered with a blanket and made comfortable. Competent ambulance employee should only remove him.

9.9 Minor wounds:

9.9.1 All minor wounds, cuts, and scratches should be treated immediately, as delay increases the risk of infection.

9.9.2 The wound should be cleaned and then covered with a sterilized dressing or adhesive plaster. If the injury becomes painful, or is inflamed, medical attention should be obtained.

10. TOOLS – HAND AND POWER

10.1.1 Any tools or equipment deemed unsafe shall be marked promptly and or repaired or replaced.

10.1.2 Each worker must satisfy himself that all tools and equipment to be used by him are in first class condition and appropriate for the job that they are to be used on.

Any defect and/or in proper functioning should be repaired to next user and or supervisors.

10.1.3 Any tools hand and power shall not be used for pry bars.

10.1.4 Tools shall be used only for the purpose for which they are designed.

10.1.5 Proper guards or shields must be installed on all power tools.

10.1.6 All portable power operated tools are of a certified or approved design and are safe to use.

10.2 Pneumatic Tools:

10.2.1 Compressed air should not be used to clean the working space.

10.2.2 Tools must not be modified or the labels and inscriptions defaced or removed.

10.2.3 Competent persons must carry out maintenance of pneumatically operated equipment at regular intervals.

10.3 Guarding:

10.3.1 When power operated tools are designed to accommodate guard, they shall be equipped with such guard when in use.

10.3.2 Belts, gears, shafts, pulleys, sprockets, spindles, drums, fly wheels, chains, or other reciprocating, rotating or moving parts of equipment must be guarded if such are exposed to contact by employees.

10.3.3 Each worker must satisfy himself that all tools and equipment to be used by him are in good condition and appropriate for the job that they are to be used on.

10.4 If by using hand and power tools, employees are exposed to the hazard of flying, falling abrasive and splashing objects, or exposed to harmful dusts, fumes, mists, vapors, or gases, they must be provided with and shall wear the appropriate personal protective equipment necessary to protect them from the hazard.

11. CRANES AND LIFTING EQUIPMENT

11.1 General

11.1.1 The manufacturer's specifications and limitations applicable to the operation of any and all cranes and derricks shall be complied with.

11.1.2 Rated load capacities, recommended operating speeds, special hazard warnings, or instruction must be visible to the operative while he is at his control station.

11.1.3 A competent person shall make a through, monthly inspection of the hoisting machinery. The operator shall maintain a record of the dates and results of inspections for each hoisting machine and piece of equipment.

11.1.4 Standard operating signals should be agreed upon and should be used to direct all operations.

11.1.5 No modifications or additions, which affects the capacity of safe operation of the equipment, shall be made without the manufacturer's written approval.

11.1.6 Accessible areas within the swing radius of the rear of the rotating superstructure of the crane, either permanently or temporarily mounted, must be barricaded to prevent any worker from being struck or crushed by the crane.

11.1.7 Overhead and gantry cranes shall be plainly marked on each side of the crane as to its rated load capacity.

11.1.8 Ensure that personnel do not ride on the hook or on a load.

11.1.9 Ensure that personnel do not stand, walk or crawl beneath a slung load.

11.1.10 Ensure that the hoist rope is vertical to prevent swinging.

11.1.11 Avoid twisting or kinking wore rope.

11.1.12 Never use nuts and bolts to join a broken chain.

11.1.13 Never drop any item of lifting gear from a height.

11.1.14 Do not put any strain on ropes which are kinked.

11.2 Operator

11.2.1 The operator must be in possession of a current Government Crane Operator's License. In addition, he must be fully familiar with and competent to operate the particular type of crane to which he is assigned.

11.2.2 An operator may be certified to operate more than one type of crane, but under no circumstances is an operator permitted to operate a crane for which he has not been certified.

11.2.3 A supervisor must ensure that his operator is physically fit and

mentally alert. If the operator shows any signs of illness, he must be removed from the crane.

12. EXCAVATION AND TRENCHING

12.1 Excavations such as ditches, trenches or holes shall be sloped sufficiently to prevent cave-in or slide. If sloping is impractical, shoring shall be used whenever the vertical dimension exceeds 1.5 meters.

12.2 Worker removing shoring after completion of work shall not be in the bottom of the excavation. Shoring shall be removed in a manner to prevent cave-in on worker.

12.3 Barricades, handrails, signals or other appropriate warning devices to protect worker from any hazardous operation or excavation shall be provided. Open trenches, excavations, etc., shall be covered when handrails or barricades do not provide adequate protection.

12.4 Grade lines, ropes, chains, and other tripping hazards shall be sufficiently marked to be clearly visible in the day or night.

12.5 Excavation by powered equipment is prohibited closer than 1.2 meters to any underground cable. Tiles covering electric cables shall not be removed without prior approval.

12.6 Located underground obstacles, cables and piping shall be marked, i.e. Physically identified, in the field and will be updated on drawings of underground.

12.7 Ground water shall be removed from and kept out of, the bottoms of all trenches and excavations.

13. CONCRETE FORMS AND SHORING

13.1 Form work and shoring shall be designed, erected, supported, braced and maintained so that it will safely support all vertical and lateral loads that may be imposed upon it during placement of concrete.

13.2 Stripped forms and shoring shall be removed and stockpiled promptly after stripping, in all areas which persons are required to work or pass. Protruding nails, wire ties, and other form accessories not necessary to subsequent work shall be pulled, cut or other means taken to eliminate the hazard.

13.3 Imposition of any construction loads in the partially completed structure shall not be permitted unless such loading has been considered in the design and approved by the engineer.

14. FLOOR AND WALL OPENING, AND STAIRWAYS

14.1 Floor and Wall Openings

14.1.1 All floor, grating or roof openings within a building, or other structure during the course of construction, alterations, or repairing, shall be covered with planks so as to carry safely any load which may be required to be supported thereon, or shall be fenced in on all sides by a standard railing and toe board.

14.1.2 Wall openings, from which there is a drop of more than 1.2 meters, and the bottom of the opening is less than 90 cm above the working surface, must be guarded by standard guardrails. If the bottom of the wall opening is less than 10 cm above the working surface toeboards must be installed.

14.2 Guarding of Open-Sided Floor and Platforms

14.2.1 Standard guardrails and toeboards must guard every open-sided floor or platform 1.8 meters or more above adjacent floor or ground level.

14.2.2 Regardless of height, open-sided floors, walkways, platforms, or runways above or adjacent to dangerous equipment, pickling or galvanizing tanks, degreasing units and similar hazards must be guarded with a standard railing and toeboard.

14.3 Guardrails, Stair, Railings and Toeboards

14.3.1 A standard railing shall consist of top rail, intermediate rail, toeboard, and posts, and shall have a vertical height of approximately 1 meter from upper surface of top rail shall be smooth-surfaced throughout the length of the railing. The intermediate rail shall be halfway between the top rail and the floor, platform, or ramp. Minimum requirements for standard railing under various types of construction are as follows:

- For pipe railings, posts and top and intermediate railings shall be at least 1/2 inches nominal diameter with posts spaced not more than 2.4 meters on centers.
- For structural steel railings, posts and top and intermediate rails shall be 50 mm by 50mm by 10mm angles or other metal shapes of equivalent bending strength, with posts spaced not more than 2.4 meters on centers.

A stair railing shall be of construction similar to a standard railings, but the vertical height shall be not more than 85cm nor less than 75cm from upper surface of top rail to surface of tread in line with face of riser at forward edge of tread.

14.3.3 Stairs and Stairways

On all structures, two or more floors (6 meters or over) in height, stairways, ladders, or ramps, shall be provided for employees during construction period. Debris, slippery and other loose materials, shall not be allowed on or under stairways.

Stairs shall be installed at angles to the horizontal of between 30 and 50.

Rise height and tread width shall be uniform throughout any flight of stairs including any foundation structure used as one or more treads of the stairs. Stairways having one or both open sides, shall have a stair railing along the open side or sides.

15. LADDERS AND SCAFFOLDING

15.1 Ladders

15.1.1 All ladders shall be made of the proper material and be in good condition.

15.1.2 The use of ladders with broken or missing rungs or steps, broken rails, or other defective construction is prohibited.

15.1.3 Metal ladders shall not be used when they can become part of an electrical circuit.

15.1.4 All straight ladders shall be tied off.

15.1.5 Ladders shall be placed so that they form an angle no greater than 30 degrees from vertical.

15.1.6 Ladders shall extend at least 1 meter above the level to be served.

15.1.7 Spikes, for use in soft ground.

15.1.8 Ensure that footwear is not greasy, muddy or slippery and has a good grip on the rung.

15.1.9 Face the ladder and hold on with both hands.

15.2 Step ladders

15.2.1 Always open fully, set level on all four feet, and lock spreaders in place. Do not use like a straight ladder.

15.2.2 Do not place tools or material on steps or platform.

15.2.3 Get specific approval before using two-man stepladders.

15.2.4 Must be tied off under certain conditions.

15.3 Scaffolding

15.3.1 Makeshift scaffold, such as boxes, crates, drums and poles are prohibited.

15.3.2 Metal tube scaffolding is preferred. Any other scaffold materials requires prior approvals.

15.3.3 Scaffolding and related material shall be carefully inspected at regular intervals and particularly just before use.

15.3.4 Sufficient sills and underpinning shall be provided for all scaffolds erected on filled or otherwise soft ground.

15.3.5 Scaffolds shall be plumb and level at all times.

15.3.6 Running scaffold shall be anchored to wall approx. every 9 meters of length and 6 meters of height.

Additional anchors may be required when using pulley arms.

15.3.7 All scaffolding must be equipped with handrails, midriiffs and toeboerds regardless of height.

15.3.8 Scaffold shall not be used as material hoist towers, for mounting derricks or to support pipe or equipment.

15.3.9 Timber boards used in the construction of work platform(s) shall be of good quality and reasonably straight grained, free from injurious ring shakes, cracks, splits, cross grains, unsound knots, knots in Contractorrease the strength of the timber. Planking shall not be painted, as this will conceal defects.

15.3.10 Planks used for platforms shall be uniform thickness and laid close together.

Planks shall be overlapped at the bearers by at least 0.6 meters, with the bearing in the center of the overlap.

When overhang a bears more than one-tenth of the length of the span, the planks shall be securely fastened to the bearer at the opposite end to prevent tipping.

15.3.11 Daily inspections shall be performed to ensure that no overstressing of structural members of scaffold will take place.

15.3.12 Safety belts or harness and lifeline shall be used if other adequate protection against falls cannot be provided during erection or dismantling.

15.3.13 Scaffolds and associated equipment shall not be modified in any manner that affects the designed performance. Only heavy tube scaffolding acceptable to heavy construction is allowed.

15.3.14 Adjusting screws together with proper blocking shall be used to compensate for unevenness of ground.

15.3.15 Braces shall not be forced to fit. the scaffold shall be adjusted until the proper fit can be made easily.

15.3.16 Only ladders shall be used when climbing scaffold; the cross braces shall not be used.

15.4 Rolling and Tower Scaffolds

15.4.1 Tower of a height greater than three times the minimum base dimension shall be used.

15.4.2 Caster brakes shall be locked when not in motion.

15.4.3 Tower shall be free of men, material and equipment before being moved.

15.4.4 Surface over which a tower scaffold is being moved shall be cleaned of rubber or any material that could cause the tower to tip over.

15.4.5 Fixed towers shall be guyed or tied-off every 6 meters of elevation.

15.5 Suspended Scaffolding

15.5.1 10mm (minimum) steel wire rope shall be used to support or suspend scaffolds.

All suspended scaffolds shall be anchored to prevent swinging.

15.5.2 The suspended support shall be electrically insulated when are welding is to be performed to guard against arcing and subsequent failure.

15.5.3 Worker on suspended scaffolds work platforms must use independent safety lines and safety harness with lifeline and lanyards.

16. STEEL ERECTION

16.1 Personal Protection

16.1.1 In all structures, all employees exposed to hazard more than 3m high shall wear safety belt or harnesses. Lifelines shall installed as needed to due to facilities tying-off. When the use of safety belt is not appropriate due to the hazard of being pinched or struck by incoming steel, connectors will be only permitted to unhook their safety harness during the actual receiving and positioning of structural members.

As soon as it is safe and appropriate to do so (generally as soon as the connection bolts have been installed), the connector will be required to rehook his safety belt.

16.1.2 Safety nets are only an acceptable substitute for safety belt when the use of safety belts is impractical. When safety nets are used, they will generally be used on the interior of the structure only. Lifeline will be installed along the perimeter and within the structure whenever employees are exposed will be tie-off whenever they are so exposed.

16.1.3 For the protection of other crafts, signs and barricades will be installed at the area where the erection of steel is in progress.

16.1.4 It should be emphasized that this mandatory and must be followed at all times. Any person who is found violating this procedure will be subject to removal from the site.

16.2 Rigging

16.2.1 A competent worker prior to initial use on the project shall inspect rigging equipment and monthly thereafter to ensure that it is safe.

16.2.2 Damaged rigging equipment shall be removed from service immediately.

16.2.3 Riggers must be qualified to rig and signal.

17. WELDING AND BURNING

17.1 Welding or cutting torches and hoses shall not be connected to cylinders when stored in any enclosure or building.

When work is shut down and hoses disconnected all valves at the gas and oxygen cylinders must be closed.

17.2 Gas and oxygen cylinders shall be handled with care, properly supported in an upright position away from any source of heat or flames and securely tied-off. All cylinders not in use shall have the protective valve cap in place, shall be vertically secured, and be stored outside the work area.

17.3 Oxygen cylinders in storage and not in use shall be separated from gas cylinders by a fire retardant partition or a minimum distance of 6 meters.

17.4 When hoisting equipment, a basket lifts gas and oxygen cylinders, cradle or similar handling device shall be closed.

17.5 When oxygen or gas cylinders are transported, protective valve caps shall be in place and valves shall be used.

17.6 Special care (use of welding blankets) shall be taken during overhead cutting and welding operations to safeguard the work and prevent falling sparks from starting a fire or causing damage. Warning signs shall be posted around and at each level below the area of overhead welding or burning operation. Fire extinguishers will be ready and available, or the plant approved fire hoses must be attached to firewater hydrants ready for use.

17.7 Gas and oxygen cylinders shall be used when secured on a cylinder carrier. Loose cylinders shall never be used.

17.8 Oxygen cylinders and equipment shall be kept free from oil or grease.

17.9 Gas and oxygen cylinders shall not be taken into confined spaces.

17.10 Welding cables and oxygen gas hoses shall be inspected regularly. The hoses shall be fitted by means of tight hose clamps.

17.11 The ground cable shall be attached as close as possible to the work piece by means of a clamp. The ground cable shall not be attached to an existing installation or apparatus. Welding of the ground cable is forbidden.

17.12 Welder and his helpers must use adequate eye and face protection while welding. Welding shields (curtains) must be used to protect the eyes of nearby workers from flashburn exposure.

17.13 Oxygen and gas cylinders must be transferred to a designated location away from operating units and tank farms after working hours.

17.14 When not in use, diesel welding machines, generators, and transformers must be turned off. When in use they must be protected by suitable covers for general protection. Refueling shall be done with machines turned off.

17.15 When employees are working with welding and cutting equipment, adequate ventilation has to be furnished.

17.16 All combustible material in the vicinity the welding or cutting operation must be removed, or if this is not possible, covered by fire resistant materials.

17.17 All welding cables and oxygen hoses shall be hung on 1m high steel column wall not to disturb on passage or access.

17.18 The work area must be kept clean and wooden, all combustible material must be removed.

17.19 Welding machines shall be turned off at the end of your shift.

17.20 Never do electric welding from a metal ladder.

17.21 Gas and oxygen cylinders shall be provided with turn-off wrench during use.

17.22 Must be check regulator well fitted to cylinder.

17.23 Do not use matches or cigarettes to light a torch.

17.24 Do not use compressed gas to clean your clothing, blow out cinch anchor holes or otherwise clean your working area.

17.25 Gas cylinders shall be handled with care and shall not be dropped.

17.26 Gas cylinder shall not be misused as rollers, support or for any other similar purpose.

18. ELECTRICAL WORK

18.1 Qualified and experienced workers shall perform all electrical works, equipment shall be locked or secured to prevent starting by unauthorized person.

18.2 Warning signs or posters, such as DANGER, NO ENTRY,

DON'T TOUCH,

Etc, shall be posted at dangerous places, such as substations, switch boxes, and overhead or underground cable.

18.3 Electrical parts to be used shall be in good condition, including cords for connection. The extension and outlets to connect tools have to be polarized.

18.4 Transformer Banks or high voltage equipment shall be barricaded with a fence. The entrance shall be locked.

18.5 Circuit Breakers shall be provided for all electrical equipment, to prevent worker from being injured by electrical shock.

18.6 Temporary switch boxes shall be installed in the space provided with a waterproof roof and door which can be locked. Switch boxes shall be grounded with vinyl-insulated copper wire.

18.7 Before welding machines are used, insulation shall be tested and certified to be in safe operating conditions. Automatic anti-electric discharge devices shall be provided for all welding machines. All exposed terminals shall be covered safely with insulation tape.

18.8 To prevent a short circuit or electric discharge, special precautions, such as grounding, shall be taken for wiring work where metal scaffolds or steel structures are erected. Grounding shall be secured by connecting the wire to on earth and buried firmly in the ground.

19. VESSEL AND CONFINED SPACE ENVIRONMENT (V/CS)

19.1 A breathable atmosphere can be maintained by either natural draft or forced ventilation. Compressed air must be blown into a V/CS. Air supplied respiratory equipment is required when entering a V/CS when there is any oxygen deficiency (less than 19.5%)

19.2 The atmosphere in the V/CS shall be tested to entry and special care must be taken to ensure that all accessible areas of the V/CS are sampled. Periodic tests should also be done during the work.

19.3 Welding and Burning

19.3.1 The possibility of flammable, explosive, or toxic materials being

absorbed in the shell material must be considered prior to burning or welding.

19.3.2 All surfaces covered with toxic preservatives shall be stripped of all toxic coating for a distance of at least 2 feet from the area of heat application or employees shall be protected by air supplied respirators and, if applicable, protective clothing.

19.3.3 Burning shall be done only with the cylinders located outside the V/CS and hose connections shall be checked for leakage prior to tank entry. Remove all hoses from the V/CS at the end of the work, during lunch periods, etc.

Welding shall be done only with welding machines left outside the V/CS.

20. CHEMICAL

20.1 Handling of Chemicals

20.1.1 Before handling any chemical it is essential to know its properties and follow the proper precaution and procedure.

20.1.2 All chemical shall be stored in appropriate containers with proper labels.

20.1.3 Hazardous chemical must be effectively isolated to avoid contamination.

Incompatible materials must not be stored in the same area.

20.1.4 All employees must be aware that many of these chemicals are potential fire, explosion hazards and/or health hazards.

20.1.5 If you need assistance in establishing the hazard potential of a chemical, always consult your supervisor.

Appendix B: Details of Public Consultation

This appendix is attached separately carrying document identification Number: FRT10V01ZEAPC.

Appendix C: Photographs







C.1 Photographs





Appendix D: Project Team

This appendix describes the names of the assessment team that carried out various environmental studies at the project area.

Gul Mastoi (Team Leader)

Gul Mastoi headed the assessment team, being a social and environmental expert. He carried out various social and environmental assessments in the field.

Ali Nawaz Channa

He was responsible for the different social and environmental assessments of the field. He carried out field investigations, impact assessment and stake holder's consultations besides formulating mitigation measures and report compilation of this EIA.

Shamshad Begum

She was the part of the assessment team as Ecologist. She carried out various botanical and avian studies of the project area.

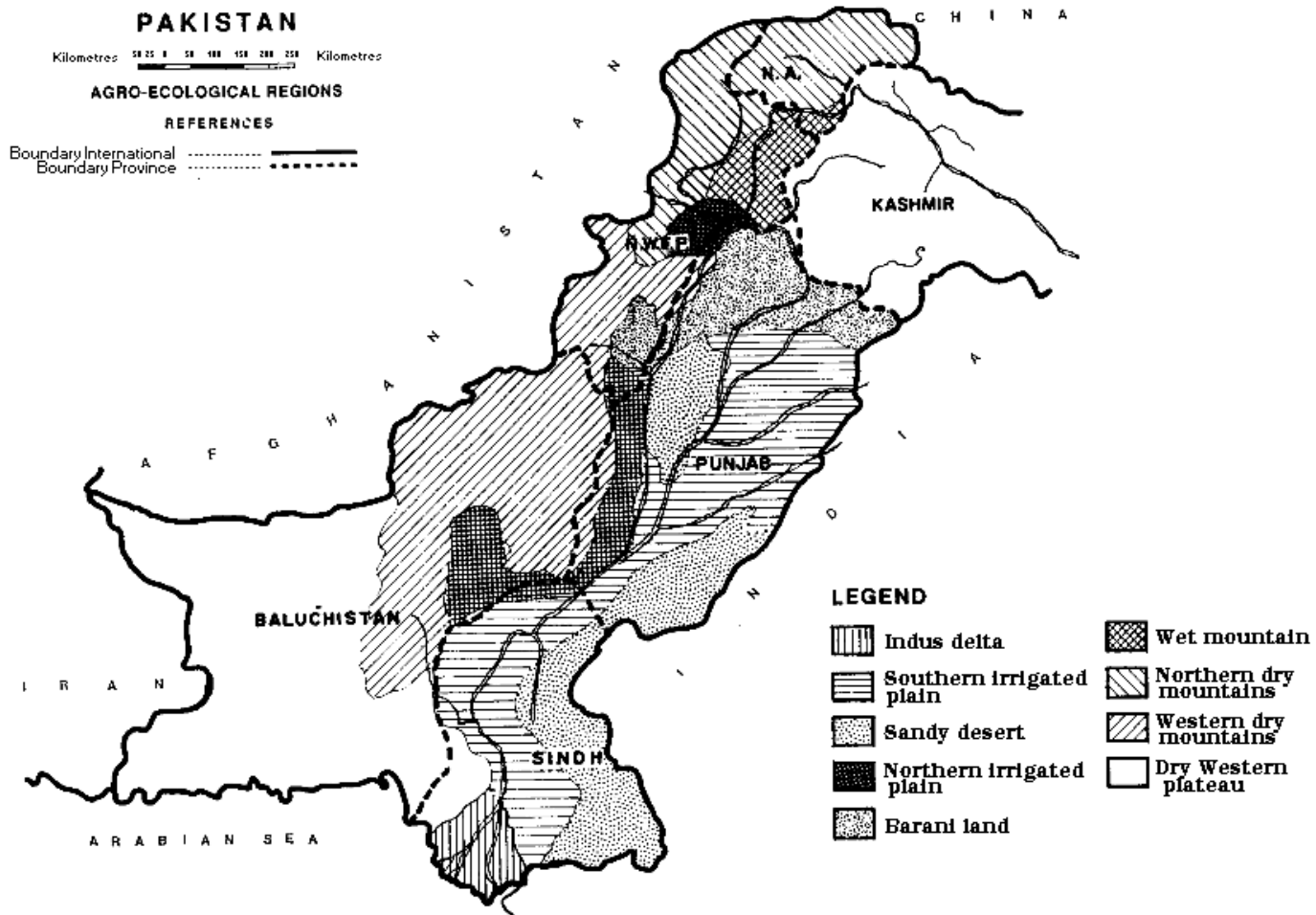
Gulnaz Sheikh

She was the part of the team responsible for the public consultation team as female member. She facilitated in female consultation.

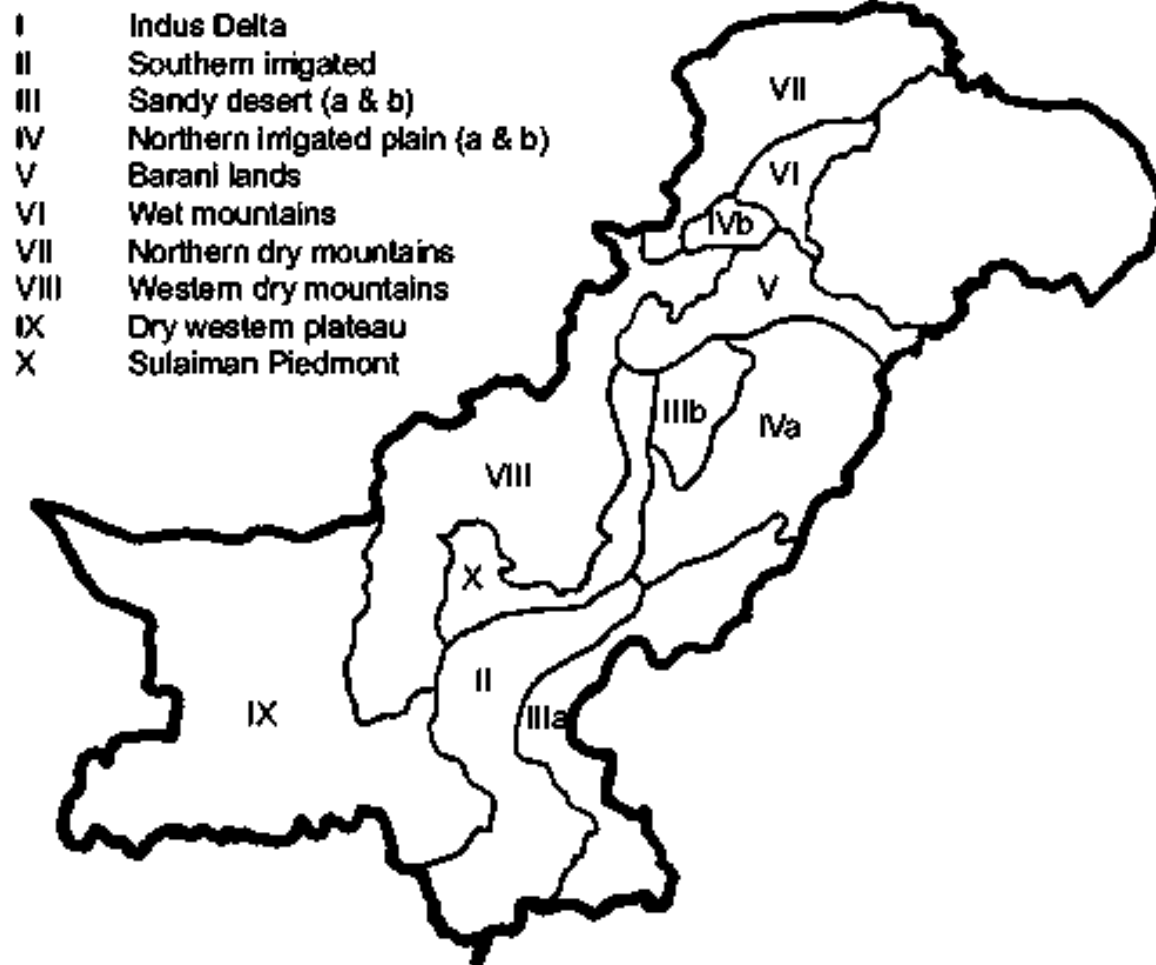
Appendix E: Maps

Maps with respect to various section/subsection of the report are provided on subsequent pages.

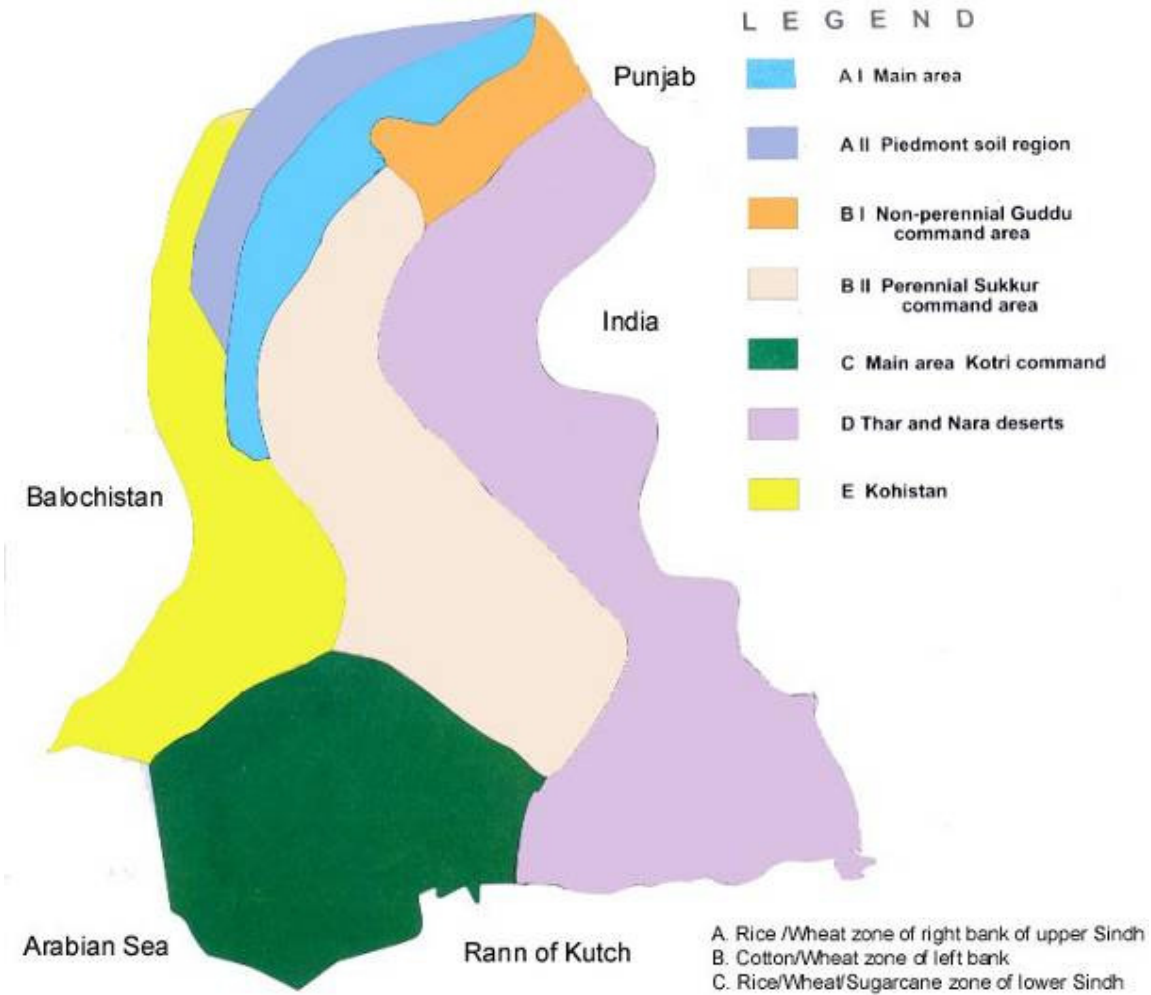
Map 1



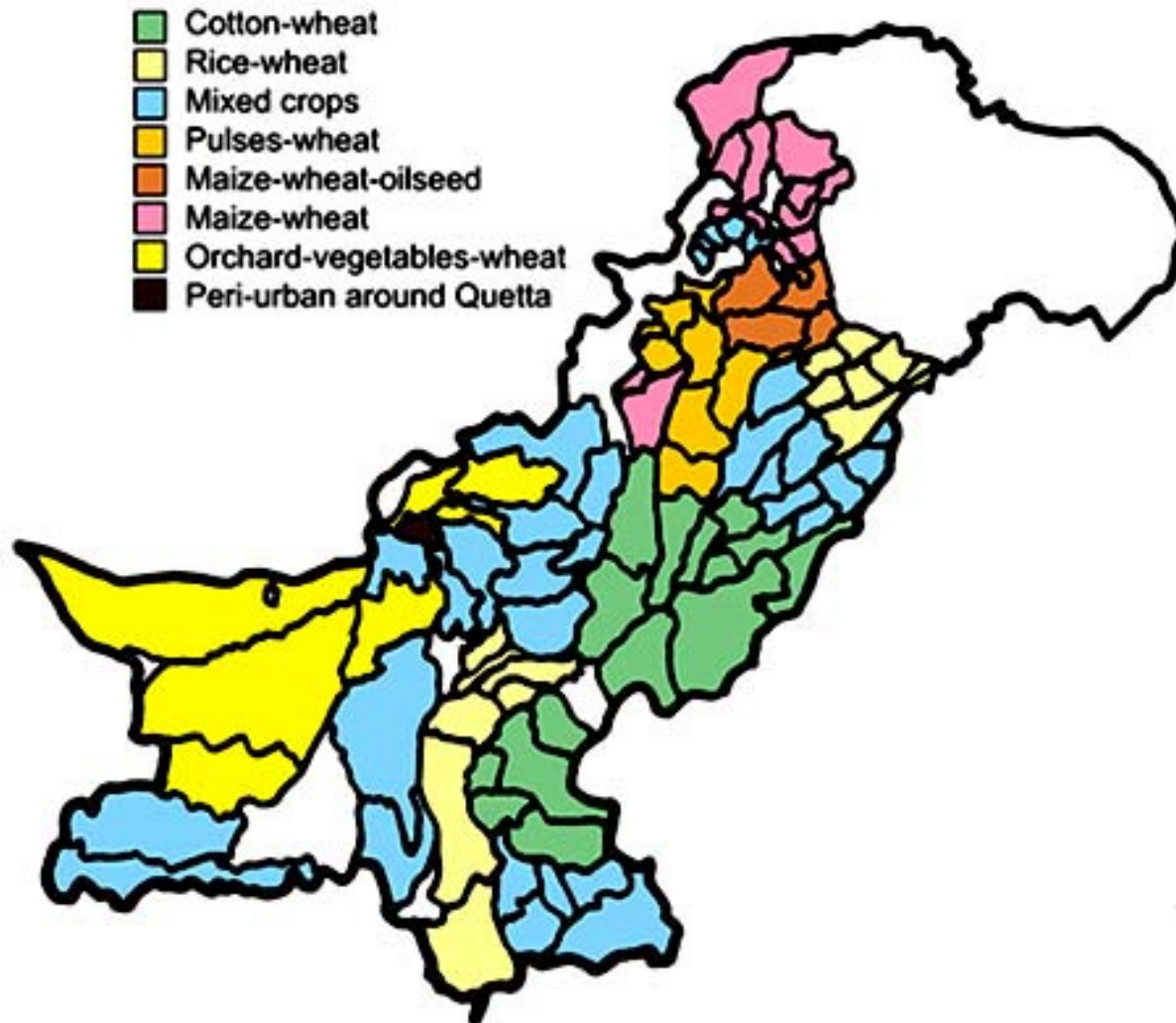
Map 2



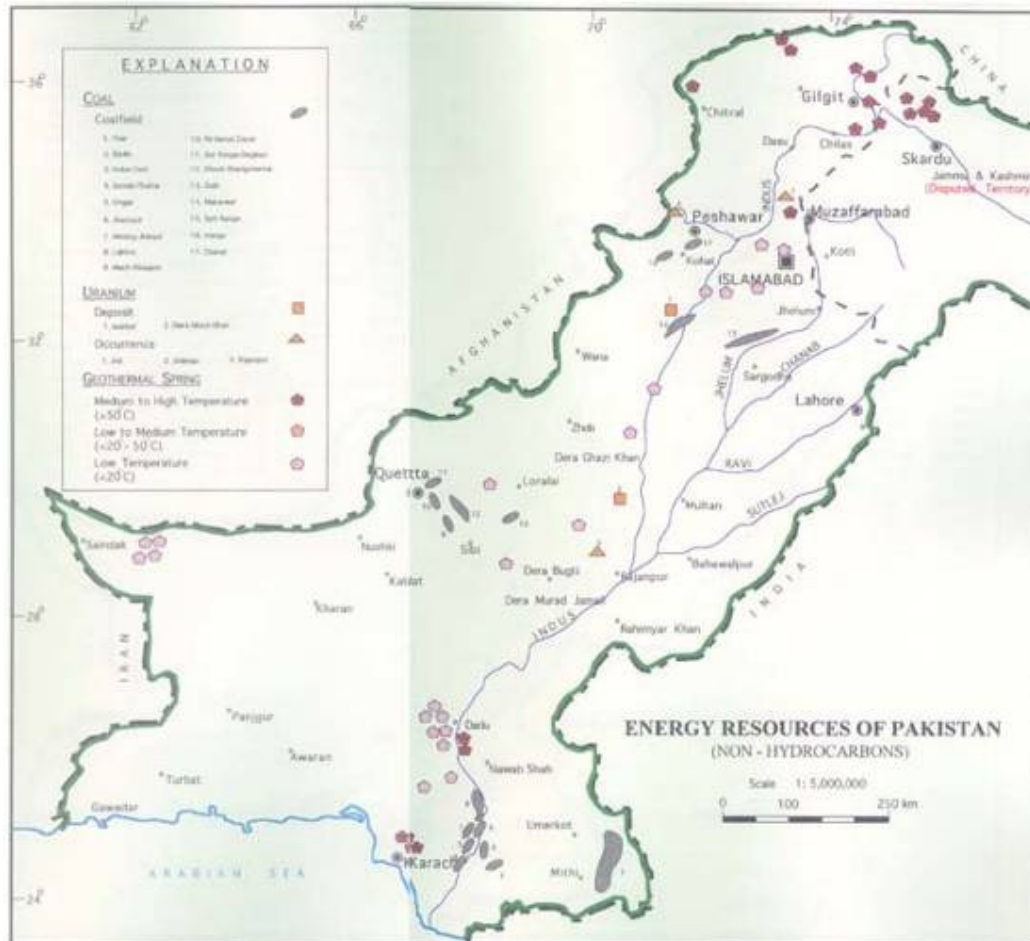
Map 3



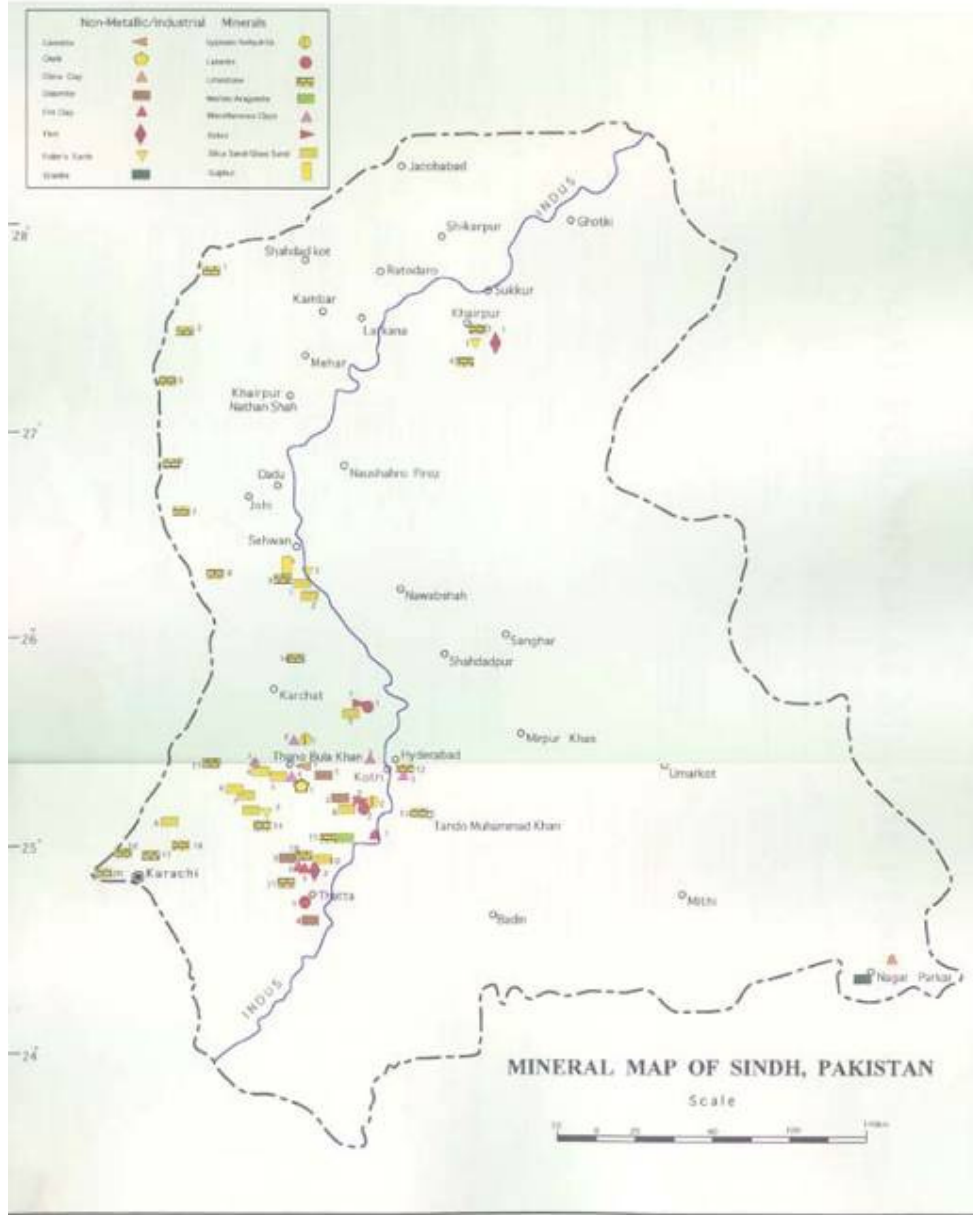
Map 4



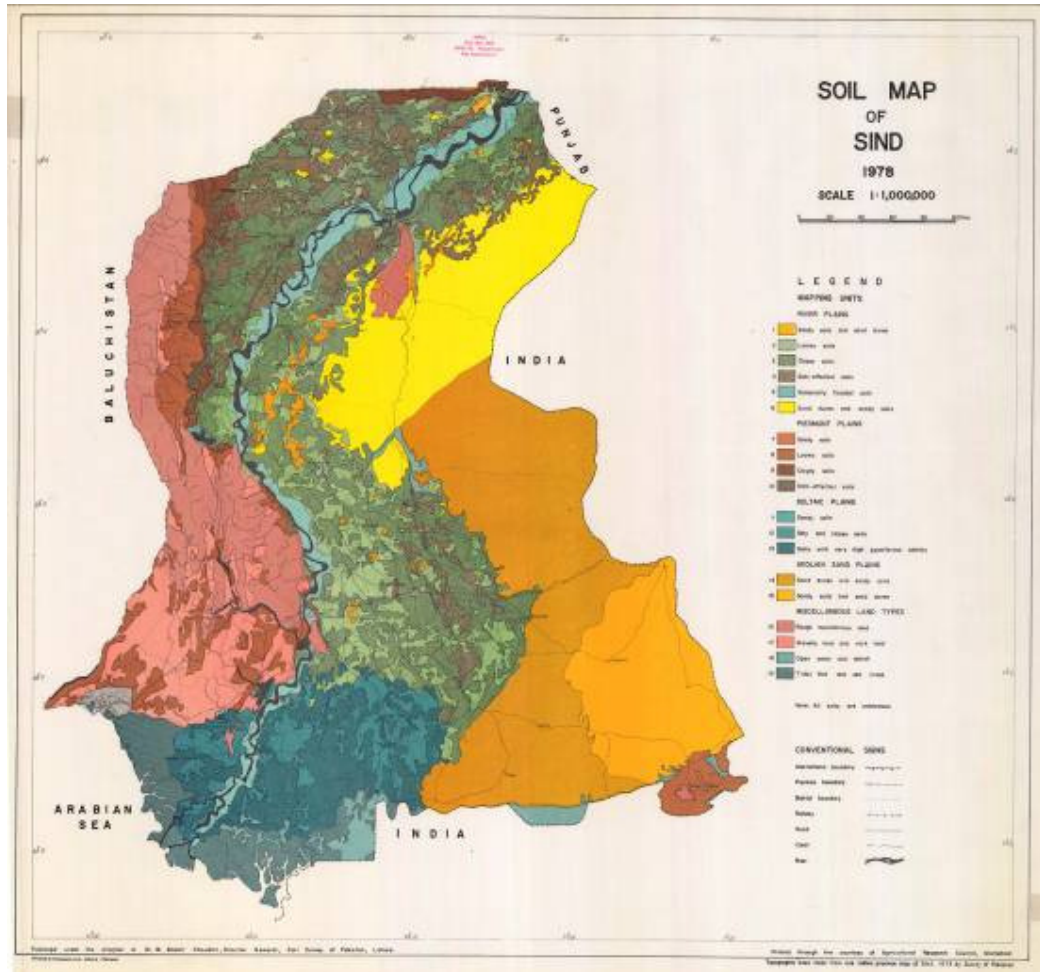
Map 5



Map 6



Map 7



Appendix F: Land Lease Agreement

Alternative Energy Development Board (AEDB)
344, B Prime Minister's Secretariat, Islamabad
Ph: 9223427 / Fax: 051-9205790



No. B/3/1/Land/07

7 December 2007

Mr. Mehmet Erdogan Gunes
General Manager
Zorlu Enerji Pakistan Ltd.
Zorlu Plaza 34310 Avclar
Istanbul Turkey

Subject: **Allocation of Land for 50 MW Wind Power Project**

Alternative Energy Development Board (AEDB) is pleased to sub-lease and give the possession of land admeasuring 1148 acres of land in Jhimpir, District Thatta to M/s Zorlu Enerji Pakistan Ltd. (ZEPL) for commissioning of its proposed 50 MW wind power project. The coordinates of land to be sub-leased to ZEPL are as follows:

| Sr. No. | Longitude | Latitude |
|---------|------------------|------------------|
| 1 | 25° 02' 14.29" N | 68° 00' 03.55" E |
| 2 | 25° 02' 49.76" N | 68° 00' 23.90" E |
| 3 | 25° 04' 12.80" N | 67° 58' 08.00" E |
| 4 | 25° 03' 48.10" N | 67° 57' 54.70" E |

2. This sublease of land is subjected to the conditions mentioned in the draft Site Sub-Lease Agreement attached herewith as Annex-I. The Agreement will be finally signed after coming to mutual agreement by both the parties. This letter gives authorization to ZEPL to initiate project activities necessary for commissioning of wind power project on this land. As the physical possession of land has already been given to ZEPL, the company is permitted to go ahead for execution of the project.

3. It is highlighted that AEDB reserves the right to add any conditions or modify the term of the draft Site Sub-Lease agreement, if found necessary, before finally signing of the agreement. AEDB will also entertain any comments and suggestion given by ZEPL on the draft Site Sub-Lease Agreement before its signing. Moreover, ZEPL may also highlight any additional concessions, if required by the company, for sub-lease of land and list down in the Schedule-I of the draft Site Sub-Lease Agreement. AEDB will endeavor to attain these concessions from respective forums.

4. Best regards.



Copy to: Camp Office, Karachi

(Brig Dr. Nasim A. Khan)
Secretary / Member Technical

STANDARDIZED SITE SUB-LEASE DEED

ALTERNATIVE ENERGY DEVELOPMENT BOARD ("AEDB")

And

ZORLU ENERJI PAKISTAN LIMITED ("ZEPL")

SITE SUB-LEASE DEED

-RELATING TO-

WIND POWER GENERATION COMPLEX

AT

JHAMPIR, DISTRICT THATTA

MADE AT

ISLAMABAD, PAKISTAN

COUNSEL FOR AEDB:
Hassan Kaunain Nafees
Legal Practitioners & Advisers

COUNSEL FOR COMPANY

1



SITE SUB-LEASE DEED

This **SITE SUB-LEASE DEED** is made at Islamabad on this 14th day of December 2007

By and Between

ALTERNATIVE ENERGY DEVELOPMENT BOARD (“AEDB”), and

And

ZORLU ENERJI PAKISTAN LIMITED, a company incorporated under the laws of Pakistan (hereinafter referred to as the “**Company**”), having its registered office at Mandviwalla Chambers, C 15 Block 2 Clifton, Karachi.

Each of AEDB and the Company is hereinafter referred to individually as a “**Party**” and, collectively, as the “**Parties**”.

RECITALS

- A. **WHEREAS**, pursuant to the GOP (as hereinafter defined) policy to involve the private sector in the development and generation of Alternate or Renewable Energy (as hereinafter defined), AEDB has been established as the principal instrumentality of the GOP to, *inter alia*, facilitate power generation through Alternative or Renewable Energy sources;
- B. **WHEREAS**, consistent with the GOP’s policy and guidelines on development and generation of Alternative or Renewable Energy, to be implemented through the AEDB, the Company has proposed to design, engineer, construct, commission, insure, finance, operate and maintain the Complex (as hereinafter defined) together with allied and incidental infrastructure and facilities at the Site (as hereinafter defined) for supply of electric power in terms of the Standardized Implementation Agreement (as hereinafter defined) and the Standardized Energy Purchase Agreement (as hereinafter defined); and
- C. **WHEREAS**, AEDB has, for the purposes mentioned in Recitals A and B, procured, among other parcels of land, the Site under the Master Lease Deed (as hereinafter defined) for sub-lease to the Company.

NOW, THEREFORE, in consideration of the mutual benefits to be derived and the representations and warranties, conditions and undertakings herein contained, and intending to be legally bound hereby, the Parties hereby agree as follows:

2




ARTICLE I

DEFINITIONS & RULES OF INTERPRETATION

Section 1.1 Definitions

Wherever used in this Site Sub-Lease Deed, the following terms shall bear the meaning ascribed below:

“Additional Concessions” – The privileges, concessions or benefits specified in Schedule I, which the AEDB shall procure from the GOS and convey to the Company for purposes of the Project, which shall constitute an integral part of this Site Sub-Lease Deed.

“AEDB” – The meaning ascribed thereto in the Recitals to this Site Sub-Lease Deed.

“Alternate or Renewable Energy” – The meaning ascribed thereto in the Alternative Energy Development Board Ordinance, 2007, and when used in relation to the Complex, means electric energy generated from wind energy by use of wind turbine generators.

“Arrears” – Any dues, fees, taxes, cesses, levies, impositions, rents or similar other charges payable to the GOS on account of the use or occupancy of the Site, except the Rent and any payment claimed by GOS on account of default by the Company of the terms of this Site Sub-Lease Deed.

“Conditions Precedent” – The conditions precedent to the effectiveness of this Site Sub-Lease Deed, as specified in Article V.

“Company” – The meaning ascribed thereto in the Recitals to this Site Sub-Lease Deed.

“Complex” – The meaning ascribed thereto in the Standardized Implementation Agreement.

“Cut Off Date” – The date specified in Article V by which the Company shall have fulfilled the Conditions Precedent.

“Encumbrances” – Any mortgage, charge or any other arrangement or agreement having the legal effect of creating security on whole or part of the Site, except as set out in this Site Sub-Lease.

“GOP” – The meaning ascribed thereto in the Standardized Implementation Agreement.

“GOS” – The Government of Sindh, Pakistan.

“Laws of Pakistan” – The meaning ascribed thereto in the Standardized Implementation Agreement.

“Master Lease Deed” – The Deed of Lease dated _____ entered in to by and between AEDB and the GOS, a copy whereof is attached herewith as Schedule II.

“Party” or “Parties” – The meaning ascribed to it in the Recitals to this Site Sub-Lease Deed.

“Project” – The meaning ascribed thereto in the Standardized Implementation Agreement, together with allied and incidental infrastructure and facilities to be developed by the Company at Site.

“Project Agreements” – The meaning ascribed thereto in the Standardized Implementation Agreement.

“Rent” – The meaning ascribed to it in Article III.

“Site” – All that piece and parcel of land, measuring 1148 acres of land situated in Jhimpir, District Thatta, and more particularly described in Schedule III, being sub-leased to the Company by AEDB under this Site Sub-Lease Deed.

“Site Sub-Lease” – This Site Sub-Lease Deed entered in to by and between the Parties, as may be amended, varied or modified by the Parties from time to time.

“Schedule” – A Schedule to this Site Sub-Lease Deed.

“Standardized Energy Purchase Agreement” – The Standardized Energy Purchase Agreement to be entered in to by and between _____ and the Company in relation to the Project.

“Standardized Implementation Agreement” – The Standardized Implementation Agreement to be entered in to by and between the GOP and the Company in relation to the Project.

“Term” – The term of this Site Sub-Lease as set out in Article IV.

1.2 Rules of Interpretation

For the purposes of this Site Sub-Lease, the rules of interpretation agreed to between the Parties in Clause 1.2 of the Standardized Implementation Agreement are incorporated by reference herein.

ARTICLE II

GRANT OF SUB-LEASE

2.1 Subject to the Company fulfilling the Conditions Precedent on or before the Cut Off Date, in consideration of the Company agreeing to enter in to, and performing under, the Project Agreements and agreeing to pay the Rent herein reserved, AEDB hereby demises unto the Company the 1,148 acres Site by way of an exclusive sub-lease, together with all rights, easements and

privileges appurtenant thereto, free from any Encumbrances or Arrears, to be held and enjoyed by the Company for the Term and other terms and conditions herein specified. The Company accepts the Site, and as a sub-lessee thereat, undertakes to develop at the Site, in accordance with the Project Agreements, an Alternative or Renewable Energy supported electric power generation facility in an efficient and timely manner, in accordance with the terms of this Site Sub-Lease Deed.

- 2.2 The Parties acknowledge and admit that the rights and interests in the Site conveyed by AEDB to the Company hereunder shall, except where any Additional Concession under Clause 2.3 is granted to the Company, remain subject to, and be performed in accordance with, the terms of the Master Lease Deed.
- 2.3 Provided that the Company does not default under any of the Project Agreements, AEDB undertakes to support and use all reasonable efforts to procure timely grant of the Additional Concessions to the Company.

ARTICLE III

RENT RESERVED

- 3.1 The Company shall pay to AEDB the rent for the Site in the manner, at the rate and on or before the times specified below (the "Rent"):
- (a) For the first ten (10) years of the Term, the Rent is fixed at the rate of Rs. 500/- (Rupees five hundred) per acre per year. AEDB acknowledges receipt of a sum of Rs. 5,740,000/- as Rent for such period and confirms that the same has been credited to the relevant Head of Account of the GOS;
- (b) For the next (10) years of the Term, the Rent is fixed at the rate of Rs. 1,000/- (Rupees one thousand) per acre per year. Such Rent shall be paid by Company in advance for each year, on or before 1st August of each year.
- (c) For the remaining Term, the Rent shall be fixed at Rs. 2,000/- per acre per year. Such Rent shall be paid by Company in advance for each year, on or before 1st April of each year.
- 3.2 The Rent fixed in terms of Clause 3.1 is all inclusive and shall not be subject to any variation, upwards or down wards, except as expressly provided herein. The Company shall not be liable to pay to the GOS or the AEDB or any local government or authority any additional rates, charges, taxes, duties, levies, cesses or other impositions of whatever nature and howsoever called in relation to the sub-lease of the Site by the Company hereunder, except any such demand on account of default by the Company of this Site Sub-Lease.




- 3.3 The Rent paid, and payable hereunder, shall be liable to withholding in accordance with law, and the Company shall furnish AEDB evidence of payment of such withholding promptly.

ARTICLE IV

TERM AND TERMINATION OF SITE SUB-LEASE

- 4.1 The Term of this Site Sub-Lease Deed shall be twenty five (25) years, commencing from the date of execution of the Master Lease Deed and shall continue until terminated earlier in accordance with this Site Sub-Lease Deed.
- 4.2 In the event the Company is unable to fulfill the Conditions Precedent on or before the Cut Off Date, this Site Sub-Lease Deed shall cease to have any effect and the Rent paid by the Company in advance under Clause 3.1 (a) for the unutilized period of the Term shall be refunded to the Company by AEDB.
- 4.3 AEDB may terminate the Site Sub-Lease Deed if the Company is unable to cure a default under this Site Sub-Lease Deed or any of the Project Agreements for a period of ninety (90) days, or a longer period if mutually agreed by the Parties, from the date of notice by AEDB.
- 4.4 The Company may terminate this Site Sub-Lease Deed at any time by written notice to AEDB without thereby incurring any liability other than that specified in the Project Agreements.

ARTICLE V

CONDITIONS PRECEDENT

- 5.1 This Site Sub-Lease shall not become effective and confer any rights in the Company under Article II unless the Company has satisfied the following conditions precedent on or before 30th June 2008 (the "Cut Off Date"):
- (a) The AEDB has issued notice in writing to the Company to take, and the Company has taken, possession of the Site;¹
 - (b) The Project Agreements shall have been duly executed by the Parties; and
 - (c) The Company shall have achieved Financial Closing (as defined in the Standardized Implementation Agreement).
- 5.2 The Parties may by mutual consent extend the Cut Off Date, provided, however, that it shall not be extended beyond ninety (90) days.

¹ In some cases this has already been done and needs to be formalized



ARTICLE VI

MISCELLANEOUS

- 6.1 Any notice, demand, or communication required or permitted under this Site Sub-Lease shall be in writing and shall be either: (i) delivered personally; (ii) mailed by certified mail, return receipt requested; (iii) sent by courier delivery service; or (iv) facsimile machine, to the respective Parties at the following addresses, unless and until a different address has been designated by written notice to the other Party:

AEDB:
Alternative Energy Development Board
PM Secretariat, Islamabad
Attention: Chairman
Fax No: +92-51-9205790

The Company:
Zorlu Enerji Pakistan Limited
Mandviwalla Chambers, C 15 Block 2 Clifton,
Karachi
Attention: Chief Executive Officer
Fax No: +92-21-5860895

- 6.2 Assignment or transfer of any of rights in the Project shall be subject to the terms of the Standardized Implementation Agreement to the extent not inconsistent with the Master Lease Deed.
- 6.3 This Lease constitutes the entire agreement between the Parties with respect to the subject matter hereof and supersedes all prior understandings and communications between the Parties in respect thereof, however, nothing herein shall derogate from or supersede any obligation of the Company under any of the Project Agreements.
- 6.4 This Site Sub-Lease shall not be amended or modified orally and no amendment or modification of this Site Sub-Lease shall be effective unless and until the same is in writing and duly executed by both Parties.
- 6.5 The failure to exercise or delay in exercising a right or remedy under this Site Sub-Lease shall not constitute a waiver of the right or remedy or a waiver of any other rights or remedies and no single or partial exercise of any right or remedy under this Site Sub-Lease shall prevent any further exercise of the right or remedy or the exercise of any other right or remedy.
- 6.6 This Lease shall be governed by and construed in accordance with the laws of the Islamic Republic of Pakistan.
- 6.7 The Parties shall enter into and execute such further agreements, deeds, instruments or documents as may be necessary or desirable to give effect to this Site Sub-Lease or any of the Project Agreements.

7



6.8 Each Party represents and warrants to the other that it has all power, authority and approval required to enter into, execute and deliver this Site Sub-Lease Deed and to perform fully its obligations hereunder, and that it has duly executed and delivered this Site Sub-Lease, which constitutes its valid and binding obligation, enforceable in accordance with the terms hereof.

IN WITNESS WHEREOF the parties hereto have hereunto set their hands and seals in the presence of subscribing witnesses:


SIGNED, SEALED AND DELIVERED.

On behalf of AEDB

On behalf of Company

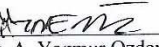
By: Brig Dr. Nasim A. Khan
Title: Secretary / Member Technical

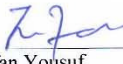
By: Bulent Cilingir
Title: Procurement and Logistics
Director

Signature: 

Signature: 

In the presence of Witnesses:

(1) 
Mr. A. Yagmur Ozdemir
Project Finance Manager
Zorlu Enerji

(2) 
Irfan Yousuf
Deputy Director
Alternative Energy Development Board





SCHEDULES

SCHEDULE-I

ADDITIONAL CONCESSIONS

[To be inserted after mutual agreement]



SCHEDULE-II
MASTER LEASE DOCUMENT

10



SCHEDULE-III

DESCRIPTION OF SITE

Details of the land 1148 acres land IN Jhimpir District Thatta whose coordinates are given as below:

| Sr. No. | Longitude | Latitude |
|---------|------------------|------------------|
| 1 | 25° 02' 14.29" N | 68° 00' 03.55" E |
| 2 | 25° 02' 49.76" N | 68° 00' 23.90" E |
| 3 | 25° 04' 12.80" N | 67° 58' 08.00" E |
| 4 | 25° 03' 48.10" N | 67° 57' 54.70" E |

Measurement and plan of land bounded by: -

ON THE NORTH Wind Power Project Sites of Fuji Fertilizer Company and Master Energy Ltd .

ON THE SOUTH Jhimpir and Jherik, District Thatta.

ON THE EAST Jhimpir Grid Station

ON THE WEST New proposed wind sites of AEDB



11