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Environmental Impact Assessment (EIA)

Hybrid Grid Stations at Azizabad and Jail Road with Associated 132 KV Underground Transmission Lines

October, 2009

Karachi Electric Supply Company Limited

The Karachi Electric Supply Company Ltd.

Executive Summary

The Karachi Electric Supply Company (KESC) proposed to develop a hybrid grid station and underground transmission lines in order to reduce the energy losses during transmission of electricity. KESC incorporated in 1913 is principally engaged in generation, transmission and distribution of electric energy to industrial, commercial, agricultural and residential consumers of Karachi. The licensed area of KESC is spread over 6000 Km^2 including entire Karachi and its suburbs up to Dhabeji and Gharo in Sindh and over Hub, Uthal and Bela in Baluchistan. The Company has been privatized in November 2005 with the transfer of 73% shares to new management while 25 % of shares still lie with the government of Pakistan. Karachi is a business centre of Pakistan with a wide network of power transmission but still inadequate to meet consumer rapidly growing energy demand. This situation limits the national development and economic growth of the country. To cope with the constraints, Karachi Electric Supply Company has proposed to improve and upgrade existing power transmission infrastructure.

KESC aims to improve the electricity supply of Karachi and adjacent areas through their System Stabilization, Rehabilitation and Loss Reduction Programme. The programme is being implemented to expand generation capacity through installation of clean and more energy efficient gas-fired combined cycle units at existing thermal power stations on a fast track basis and up gradation /rehabilitation of existing transmission and distribution (T&D) assets in order to reduce the energy losses. A number of projects have been initiated to meet the targets of System Stabilization, Rehabilitation and Loss Reduction Programme. As a part of this project a new Hybrid Grid Station will be constructed with associated underground transmission lines. In first part of proposed project, Underground transmission lines will commence from the Gulshan-e-Iqbal Grid station, run along the Karachi University road and divide in two parts near Liyari Expressway on Shah Suleman Road. From Liyari Expressway one Underground transmission line will connect to Azizbad Grid station while the second one will connect to Grid station, located in Jail Road. One more transmission line will originate from the Azizabad Grid station and will terminate to the Liquatabad Grid station. In second part of proposed project, two Hybrid grid stations will be commissioned in Jail road and Azizabad. Due to underground transmission lines aesthetic value of area will likely to develop and will helpful to reduce the clusters of transmission lines that provoke aesthetics value of the Karachi city. The project once functional will support electricity transmission and distribution system and will helpful to reduce the outage of power in distribution network of Karachi city.

Pakistan Environmental Protection Act 1997 delineate that each new development project has to undertake Environmental Impact Assessment (EIA) or Initial Environmental Examination (IEE) in order to predict and mitigate the impacts of the development at an early stage. Based on nature, size, cost, legal context and associated impacts, the proposed project has been categorized for EIA study. This report documents EIA findings and recommendations.

The EIA process of the project started with the identification of potential environmental and social impacts resulting from the proposed project's activities their rating as slight and negligible with the aid of an impact assessment matrix. Project activities that were likely to result in high impacts were investigated further to validate the anticipated impact and an alternative project activity was determined that has a medium or low-level impact. For project activities with significant and minor level impacts, suitable mitigation measures are proposed to reduce the impact to a low category impact or as low as reasonably possible. Finally, for insignificant impacts, no alternatives or mitigation measures were explored, as it is expected that the environmental management systems in place will be sufficient to avoid or reduce those impacts.

Proposed project has been assessed for impact on construction and operations which will be controlled through mitigation measures. Mitigation measures are proposed through technology change, environmental management and use of cleaner practices. All vehicles, generators and other equipment used during the construction will be properly tuned and maintained in good working condition in order to minimize emission of pollutants. Vehicular movement will be restricted to a specific time for dumping of supplies and construction material. The exposure of noise generated during operations will be controlled through providing PPEs to the workers and allocation of specific daytime working hours for movement of earth moving equipment and other machinery for construction will limit the noise exposure. Effect on Flora and Fauna will be reduced through planning the excavation in such a manner that minimal clearing of the vegetation is required as to reduce the damage on large area. Construction activities generate considerable waste and provision for suitable separation, storage of waste in designated and labelled areas on the camp site and near each construction area will be made. Employment opportunity for the occupants of that area will have positive impact by getting employed, significantly impotent with other negligible impacts. In underground transmission lines the impact of electromagnetic field will reduce due to its installation a underground and through adoption of principles of careful avoidance. All the anticipated impacts of the project have been provided with proper mitigation measures to lessen the effect up to negligible.

In order to ensure that the measures are practically implemented during the construction and operation of the project Environmental Management Plan (EMP) has been proposed. Responsibilities of the project proponent and the contractor has been clearly defined and allocated to ensure effectiveness of the plan. EMP will serve as a tool for effective communication of environmental issues between the proponent and the contractor during the construction and operations phase of the project. Project proponent will undertake overall responsibility for compliance with EMP and will carry out verification checks to ensure that the contractors are effectively implementing mitigation measures.

The proposed mitigation measures will ensure that anticipated impacts of the project on the area's natural and socioeconomic environment will be well within acceptable limits. The project proponent has expressed commitment to protection of the social and natural environment from any potential adverse impact of the project. A preventive maintenance philosophy, supported by robust inspection plans and sound operational practices will be adopted to ensure sustainable and sound operation of the proposed development.

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Acronyms

AIS	Air Insulated Switchgear
CDGK	City District Government Karachi
CU	Color Units
EIA	Environemental Impact Assesment
EMP	Environmental Management Plan
EPA	Environmental Protection Agency
EPD	Environmental Protection Department
GDP	Gross Domestic Product
GIS	Gas Insulated Switch Gear
HPFF	High pressure, fluid –filled pipe
HPGF	High pressure, gas filled pipe
HSE	Health Safety and Environment
JTU	Jackson Turbidity Units
KESC	Karachi Electric Supply Company
KWSB	Karachi Water and Sewerage Board
LDL	Lowest Detection Limit
mg/l	milligrams per liter
NCS	National Conservation Strategy
NEQS	National Environmental Quality Standards
NEQS	National Environmental Quality Standards
NS	No Standards
NTU	Nephelometric Turbidity Units
OHSE	Occupational Health Safety and Environment
Pak- EPA	Pakistan Environmental Protection Agency
PCB	Polychlorinated Biphenyl
PEPC	Pakistan Environemental Protection Councel
PMD	Pakistan Meteorological Department
Pt-Co	Platinium Cobalt Standards
ROW	Right of Way
SCFF	Self contained fluid-filled
SEPA	Sindh Environemental Protection Agency
TON	Threshold Odor Number
WHO	World Health Organization
XLPE	Cross linked polyethylene

1. Introduction

KESC, an integrated power generation and supply company, wants to stabilize and rehabilitate its transmission and distribution system and Loss reduction program by adding clean and more energy efficient gas fired combined cycle units at its existing power plants on fast track basis and upgrade and rehabilitates its existing transmission and distribution (T&D) assets in order to overcome the energy losses. The T&D rehabilitation will include the replacement of towers, cables, rehabilitation of transmission lines, and installment of new grid stations and construction of new 132kV overhead and underground transmission lines. The proposed project is part of this rehabilitation and upgradation program.

In order to meet the Pakistan Environmental Protection Act, 1997 and regulations for new projects, KESC has hired SGS Pakistan to carry out the required Environmental Impact Assessment study for its new Grid stations and Underground transmission lines, situated in below depicted areas; Two Hybrid Grid stations referred to as Azizabad and Jail road grid stations would be installed in their respective areas along with three sets of Underground cables would be laid having specifications described below

- 132 kv Jail Road G/S to Gulshan Iqbal G/S--- 7.40KM
- 132 kv Azizabad G/S to Gulshan Iqbal G/S--- 5.15KM
- 132 kv Azizabad G/S to liaquatabad G/S --- 2.24KM

This document presents the findings and report of the EIA.

1.1. Project Proponent

The Karachi Electric Supply Company limited was incorporated in 1913 under the Indian Companies Act, and later it registered according to Companies Ordinance, 1984. The company is listed in Karachi, Lahore and Islamabad Stock Exchanges. The Government of Pakistan took control of the company by acquiring major shareholding in 1952. The Ministry of Water and Power looks after the affairs of the company at federal level.

KESC is principally engaged in generation, transmission and distribution of electric energy to industrial, commercial, agricultural and residential consumers under the Electricity Act, 1910 as amended to date & NEPRA Act 1997, to its licensed areas. The licensed area of KESC is spread over entire Karachi and its suburbs up to Dhabeji and Gharo in Sindh and over Hub, Uthal and Bela in Baluchistan. The total area covered is around 6000 square kilometers.

Further, an Implementation Agreement was entered into between the Government of Pakistan and the Company, setting out the key terms and conditions of the take over. The post privatization ownership structure of the Company is given in **Table 1.1**.

1.2. Project Location

In first part of proposed project, Underground transmission lines will commence from the Gulshan-e-Iqbal Grid station, run along the Karachi University road and divide in two parts near Liyari Expressway on Shah Suleman Road. From Liyari Expressway one Underground transmission line will connect to Azizbad Grid station while the second one will connect to Grid station, located in Jail Road. One more transmission line will originate from the Azizabad Grid station and will terminate to the Liquatabad Grid station. In second part of proposed project, two Hybrid grid stations will be commissioned in Jail road and Azizabad. **Figure 1.1, 1.2 & 1.3** shows the location of the proposed Project, its adjoining vicinities and Underground Transmission Lines Route Map.

1.3. Objective of EIA Study

The EIA study of proposed project is being prepared with a number of following specific objectives:

- Collection of baseline information/data for assessment of impacts;
- Collation of information collected during previous investigations into a comprehensive environmental document;
- Assessment and evaluation of the actual and potential environmental impact of the proposed development; and
- Development of Environmental Management Plan to identify the mitigation strategies targeted towards avoidance, minimization and rehabilitation of impacts.

The basic guiding principles of the Environmental Impact Assessment have been:

- To inform decision makers and result in appropriate levels of environmental protection and community well being;
- To apply the 'best practicable environmental option' and 'best available techniques not entailing excessive cost' methodologies to minimize the environmental impact of the plant;
- To provide information and outputs those assists with problem solving and are acceptable to and able to be implemented by the KESC;
- To focus on significant environmental effects and key issues;
- To ensure that the EIA Team has involved appropriate techniques and experts from the relevant disciplines and to ensure that this team has had the chance to interact on the interrelationships between the bio-physical, social and economic issues;
- To provide, as far as is possible, an objective, rigorous and balanced assessment of the issues.

1.4. Methodology of EIA Study

The Environmental Impact Assessment of proposed project has been performed in following phases:

1.4.1. Scoping

In scoping exercise of EIA, Sectoral guidelines and checklists of likely impacts and mitigation measures contained in Sectoral guidelines, proponents and reviewer of EIA project are considered against adopting a mechanistic approach.

Scoping is a vital early step, which identifies the issues that likely to be important during the environmental assessment, and eliminates those that are not. In this way, time and money are not wasted on unnecessary investigations. Scoping is a process of interaction between the interested public, government agencies and the proponent. Scoping refers to the process of identifying, as early as possible:

- The appropriate boundaries of the environmental assessment;
- The important issues and concerns;
- The information necessary for decision-making; and
- The significant impacts and factors to be considered.

In scoping phase, SGS Pakistan has compiled a generic description of the proposed activities relevant to environmental assessment with the help of the proponent. Information on relevant legislation, regulations, guidelines, and standards were reviewed and compiled. Furthermore, potential environmental issues were identified.

1.4.2. Baseline Data Collection

The change caused by a particular environmental impact can be evaluated by comparing the expected future state of environmental components with the predicted state of those components if the project does proceed. Therefore, one of the first tasks involved in the detailed analysis of an impact is the collection of information that will help to describe the baseline situation at the expected time of implementation. Specialized knowledge is usually required to specify, and set appropriate limits on, the data collection required to meet the needs of any analysis and ongoing monitoring programs that may be established.

Environmental and Socio-economic experts were used by SGS for collecting the considerable amount of baseline information on the project area. Available literature and other studies already conducted close to the project area were also used for baseline formation. In field visits, SGS Experts verified this information and collected some other information about the socio-economic status of region, flora and fauna, ground water quality, ambient air and other environmental issues.

1.4.3. Impact Identification and Evaluation

The environmental, socioeconomic, and project information collected was used to assess the potential impacts of the proposed activities. The issues studied include the potential project impacts on:

- Ambient air quality and ambient noise levels
- Soil and Ground water quality
- The ecology of the area, including the flora and fauna
- People living in immediate neighboring

Wherever possible and applicable, the discussion covers the following aspects:

- The present baseline condition;
- The potential change in environmental parameters likely to be effected by project related activities;
- The identification of potential impacts;
- The evaluation of the likelihood and significance of potential impacts;
- The defining of mitigation measures to reduce impacts to as low as practicable;
- The monitoring of environmental impacts including residual impacts.

1.4.4. Impacts Mitigation

One of the main tasks of impact assessment is to predict and prevent unacceptable adverse affects through the implementation of appropriate project modifications also known as mitigation measures. The purpose of mitigation in the environmental assessment process is to:

Look for better ways of doing things so that the negative impacts of the proposal are eliminated or minimized, and the benefits are enhanced; and make sure that the public or individuals do not bear costs which are greater than the benefits which accrue to them.

In evaluation of mitigation measures for proposed project, close consultation with KESC was carried out to ensure that any significant adverse or potentially adverse impacts identified in the project. SGS Pakistan has considered the best available techniques and practicable environmental options in the EIA Report. Moreover, all identified measures were discussed with KESC Management to ensure that their implementation is technically and economically feasible.

1.4.5. Environmental Management Plan

An environmental management plan is a document designed to ensure that the commitments in the Environmental report, subsequent review reports, and environmental approval conditions are fully implemented. It is the technically comprehensive document which is usually finalized during or

following detailed design of the proposal, after environmental approval of the development application.

For proposed project, separate Environmental management plan for smooth and effective implementation has developed and included in EIA report by SGS Pakistan. The scope of environmental management and monitoring included in plan is in accordance with national regulatory requirement and severity of impacts.

1.4.6. Documentation

This report documents the environmental impact assessment process and results are prepared according to the relevant guidelines set by the Pakistan Environmental Protection Agency and other international guidelines.

1.4.7. Limitations

The EIA document has been prepared by drawing inferences from site visits, primary data and secondary information. The study has been conducted by the consultants in a manner consistent with the level of care and skill ordinarily exercised by members or environmental engineering and consulting profession.

The conclusion in this study are based on the primary and secondary data, results derived from earlier studies, and a subjective evaluation of the possible environmental aspects that may influence the existing environmental status of the site during construction and operations of the proposed project. Opinions relating to the specific conditions are based upon information that existed at the conclusions were formulated.

The mitigation measures and other recommendations put forth in this report are of the level of conceptual design and implementation framework.

1.5. Structure of Report

This report has been structured in the following manner:

Chapter-I of this report provides the background information, location and proponent of project. Afterwards, it provides the EIA objective and methodology and consultant details.

Chapter-II describes the proposed project, project need, layout plan and associated activities, raw material details and utilities requirement.

Chapter-III gives an overview of Policy and Legislation along with International Guidelines relevant to electricity grid stations and transmission lines.

Chapter-IV provides a description of the micro-environment and macro-environment of the proposed project site. This chapter describes the Physical, Ecological and Human resources and

Economic Development, Land Use Planning etc. It also includes the quality of life including socio-economic, aesthetic and cultural values.

Chapter-V describes the potential environmental and social impacts of proposed project on the different features of the micro and macro-environment, and by using the checklist method, presents the potential environmental impacts at the designing, construction and operation stages. This chapter also presents mitigation measures for different anticipated impacts.

Chapter-VI presents the Environmental Management Plan.

Chapter-VII summarizes the Report and presents its conclusions.

The last section is followed by the references.

1.6. Point of Contact

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1.7. EIA Consultant

The EIA study was carried out by team of SGS Pakistan (Pvt.) Ltd. comprising of Environmentalist, Sociologist, Environmental Chemist and Environmental Auditors with diversified experience on local and international assignments.

Table 1.1: Post Privatization Ownership Structure of KESC

#.	Share Holders	No. of Shares	Percentage of Shareholding
1	Govt. of Pakistan	3,403,763,472	25.65
2	New Investors	9,611,964,737	73.00
3	Others	151,346,774	01.35

Figure 1.1 Project Location

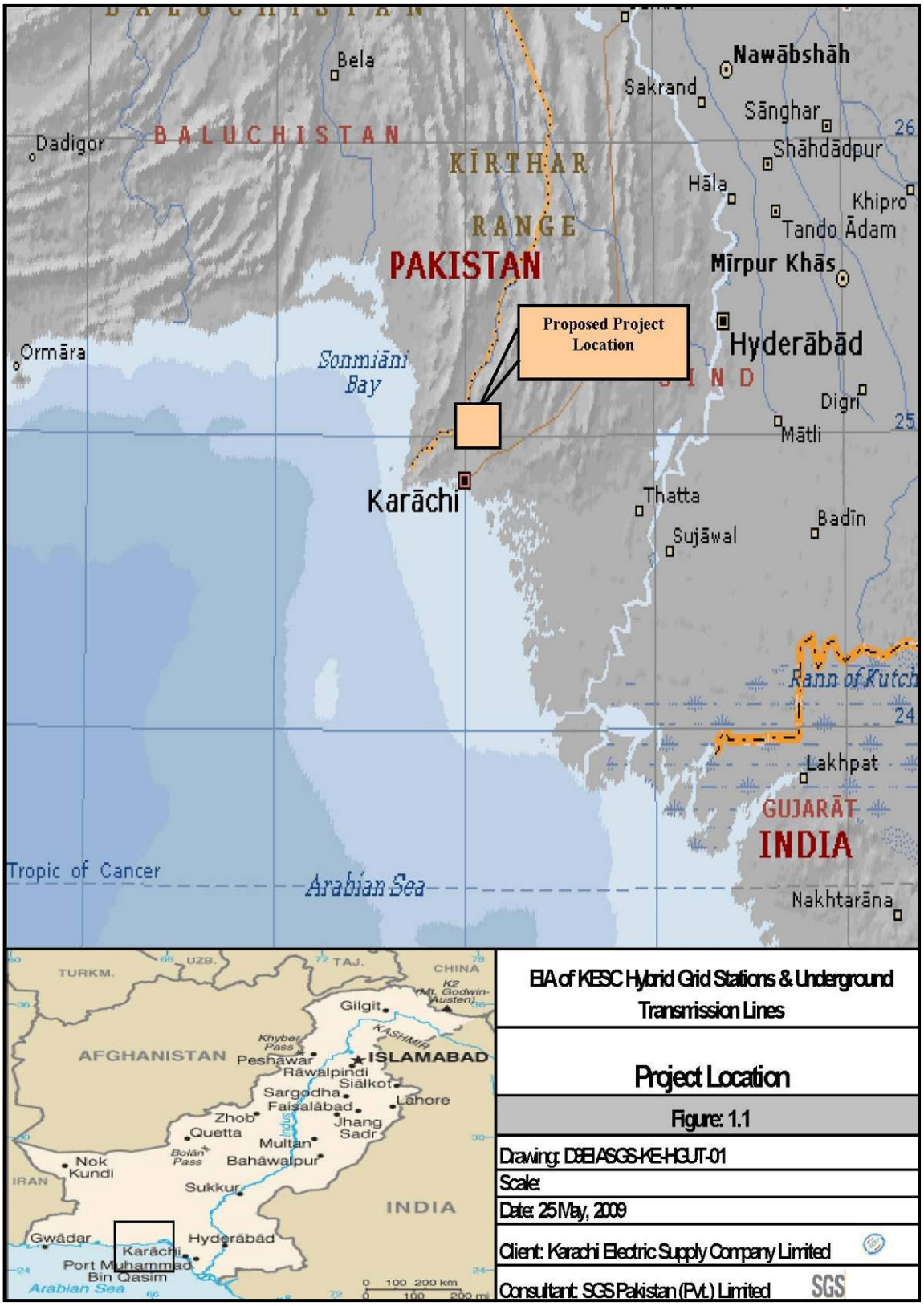


Figure 1.2 Location of the proposed Gird Station (Azizabad) and its adjoining vicinities.

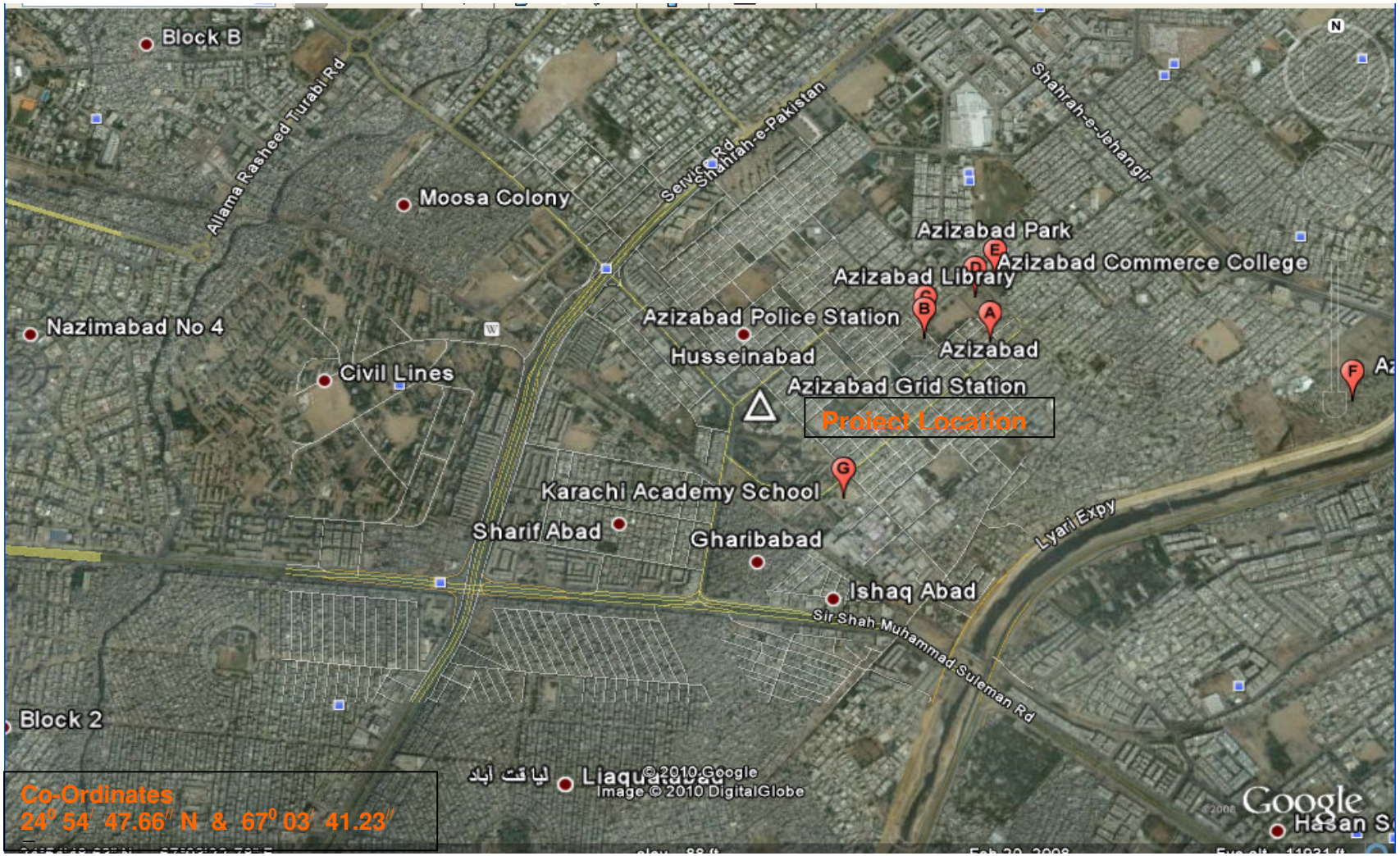


Figure 1.3 Location of the proposed Gird Station (Jail Road) and its adjoining vicinities.

2. Project Description

This Section includes the description of the proposed project with a clear explanation of project status and construction and commissioning schedule. The cost of proposed project, its need is also mentioned in this part of report.

2.1. Project Status and Construction Schedule

The proposed project has been planned to be commissioned in 06 months from the start date of project and after getting permission from the Sindh Environmental Protection Agency (SEPA). The land has been procured for the Hybrid grid stations in Azizabad and Jail Road, however finalization of routes for Underground transmission lines are in process with different organization in Karachi city, for instance City District Government Karachi (CDGK), Pakistan Railway, Pakistan Works Department etc.

At this point of EIA Study proposed project is on planning and construction stage, work schedule for project development is tentative and will be updated during detailed planning and implementation phases of project.

2.2. Capital Cost

The proposed project is being developed in different parts of Karachi city with a total capital investment of sum of Rs 425,128,987,91. This will include the installation and operation of project, associated amenities and budgetary cost for utilities, civil work and equipment/machinery purchase.

2.3. Project Need

Karachi has a wide network of power transmission but the standards and conditions of the power transmission system are inadequate to meet rapidly growing demand of electrical power. This situation limits the national development and economic growth. To cope with the constraints, the existing power transmission infrastructure has proposed to be improved and upgraded in proposed System Stabilization, Rehabilitation and Loss Reduction Programme. This program will enhance the customer service, improve power supply reliability, and strengthen health, safety and environmental management system. Installation/commissioning of proposed Grid stations and Underground transmission lines are also part of this system stabilization and rehabilitation program.

2.4. Project Description

The proposed project in this EIA report is for the support of power transmission and distribution network of KESC in Karachi city which is further divided into sub-projects i.e. Underground transmission lines and Hybrid grid stations. These are discussed in following sub-sections.

2.4.1. Underground Electric Transmission Lines

The proposed transmission lines will be buried directly into the trench. The depth of trench will be from 1.3 to 1.5 m but the distance between the conductors will be much less. Instead of wide spacing and natural air circulation like in case of over head line, other methods will be used to insulate the conductors from each other and their surroundings and to dissipate heat.

The construction, operation and maintenance cost of underground transmission system is much higher and take much longer time period to repair if damaged. Similarly construction of the cables requires special insulating materials to allow the cable to be within two inches of grounding material. Transmission line underground area must be safe from accidental contact by construction equipment and vegetation must be managed to avoid roots from interfering with the system and potentially removing soil moisture that's needed to help cool the cables.

2.4.2. Underground Transmission Lines Types

Underground transmission lines are classified by type of pipes required and their insulation. At present, following types of transmission lines are in practice:

- High pressure, fluid –filled pipe (HPFF)
- High pressure, gas filled pipe (HPGF)
- Self contained fluid-filled (SCFF)
- Cross linked polyethylene (XLPE)

In proposed project, Cross linked polyethylene will be used, which is also called "Solid Dielectric". This type of line relies on high quality manufacturing controls to eliminate any contaminants or voids in the insulation that could lead to electrical discharges and breakdown of the line from electrical stress. The solid dielectric material replaces the pressurized liquid or gas of other types of cable. They are not housed together in a pipe, but are buried side by side directly in special prepared soil. Each cable consists of a copper or aluminum conductor, a semi conducting shield, a cross linked polyethylene insulation, and an outer covering consisting of another semi-conducting shield, a metallic sheath, and a plastic jacket. The insulation is about twice as thick as the oil insulation used in other types of cable.

2.5. Underground Transmission Lines Accessories

In proposed Underground transmission lines, following types of accessories would be used:

2.5.1. Splices

It is used to join the separate pieces of conductor. These are needed because there is a limit to the amount of underground cable that can be put onto a spool for shipping and there is a limit to the amount of tension a cable can withstand as it is pulled through a pipe. In XLPE type lines, splice needs every 900 to 2000 feet and two third of XLPE splices are constructed in permanent concrete vaults and one third are in temporary vaults. Temporary vaults are not lined with concrete but filled in after construction. When XLPE is installed in trench, all splices are constructed in permanent, concrete vaults.

2.5.2. Terminations

Underground lines terminate or connect to overhead lines or substation by mean of "Risers" which are fastened to above ground structures. Three spread arms carry the underground and aboveground lines and separate the three conductors so that they meet the electric code requirements for the spacing of overhead conductors.

If spreader head are placed underground, they are called "Trifuractors" and may be placed in a concrete vault. Porcelain insulators or housings, contain the actual connections between the in-earth and in-air portions of the line. These housings are often called "Potheads".

Lightning arrestors are placed close to the terminations to protect the Underground cable from over-voltage damage that can be caused by near by lightning strikes. The insulating material is very sensitive to large voltage changes and can not be repaired.

2.6. Construction Phase of Underground Cables

During construction of underground transmission lines, following steps or process would be required:

2.6.1. Right of Way Requirements

During construction of Underground transmission lines in urban environment, heavy and slow moving equipments are required to operate, which can disrupt the traffic temporarily. A minimum 20 foot ROW is required to construct or repair an underground line in an urban area, therefore support work may require occasional use of additional lanes for traffic. The ROW should be maintained free of trees or large shrubs, which could interfere with the underground line directly (with the roots) or indirectly (by removing soil moisture that is needed to adequately cool the

conductors). Buildings are also prohibited in the ROW, since they would interfere with maintenance and repair work.

2.6.2. Cooling

Electrical conductors produce heat, especially XLPE conductors operate at about 176ºC. In order to conductors operate efficiently; heat must be carried away from the conductor which is performed by soils in and around the trench. All of the heat generated from the direct buried cables must be dissipated through the soil, if could not, the selective backfill makes a strong difference on the capacity rating. Different soils have different abilities to transfer heat; saturated soils conduct heat more easily than soils with air pockets or dry places. For this reason, the soil nearest the line must not be allowed to dry out.

In proposed underground transmission lines trench, special backfill material or soft soil will be used to ensure a good heat transfer to surrounding soil or groundwater. This backfill material is specifically designed to move heat away from the trenches.

2.6.3. Construction Method

Installation of proposed Underground transmission lines will primarily involves the following steps:

1. Trenching
2. Laying and Welding Pipes
3. Replacing the Soil and Closing the Trench
4. Splicing or joint the cables

After following the mentioned steps, testing and evaluating will be done throughout the process. If water is encountered, special pumping procedures will be used. The Underground transmission line would normally be buried 1.42 m beneath the surface. For construction, a self propelled, pneumatic tired crane will be used in most underground line construction. The welding of pipe sections will take place either in or over the trench.

2.6.4. Horizontal Boring

These techniques will be used in underground cables to avoid many surface features, such as main roads, rail road etc. Horizontal boring requires an extensive construction area on each side of the bore. The amount of space is proportional to the size of the bore, the maximum depth, and the distance of the bore.

2.6.5. Site and Route Consideration

Underground construction could be a reasonable alternative to overhead in an urban area where an overhead line cannot be installed with appropriate ROW at any cost. In an underground line might allow a shorter route to be used or, an underground line along a road corridor could reduce the land needed for easements.

2.6.6. Underground Cable Installation Obstacles

The cost of project increases with the number of obstacles that need to be crossed by excavating underneath or be avoided by routing around the obstacle. Common obstacles are streams, railroads, other utilities, sanitary and storm sewers, streets and highways in the right of way of proposed project. In proposed transmission lines, Lyari River and main roads would be the installation obstacles.

2.7. Hybrid Grid Station

A Grid station is an important element of the electricity generation, transmission and distribution system. Its function is to transform voltages from high to low or the reverse, using transformers and other heavy duty electrical switchgear. In Grid station, the electrical feed to the different destinations is fed into common distribution conductors called busbars. From these busbars, electricity is then fed into dedicated transmission lines running to specific geographic areas where the power is needed. The general location of a Grid station is initially determined by transmission requirements and lines routes.

Hybrid Grid Station is a mix of GIS and AIS technologies. It consists of bays where some are of AIS components only and some are mix of AIS and GIS technology, or where some are of GIS components only. Alternatively, and more commonly, elements of AIS and GIS technology are typically mixed in the same bay of equipment and this mixture is a hybrid of the two technologies and is applied across the complete grid station.

Under the system stabilization, rehabilitation and loss reduction Programme, KESC has proposed to install new Hybrid grid stations in Jail Road and Azizabad. Which are once completed, would be considered one of the latest and state of the art Grid stations. These pre-fabricated stations would require very small space, while commissioning and installation of compact machinery would be time efficient. The detail layout plans of these Grid stations are given in **Figure 2.1 & 2.2.**

2.8. Accessories of Grid Station

In Grid station, switches, protection and control equipment and circuit breakers are installed. Circuit breakers interrupt any short circuits or overload currents that may occur on the network. In Grid station, line termination structures, high voltage switchgear, low voltage switchgear and surge protection controls and metering are also installed. By using Grid station, it is possible to de-energize a transmission line or other electrical switchgear for maintenance or for new construction or installation. In this way it is possible to maintain the reliability of supply during maintenance work or during the development of any fault in transmission lines or in the associated switchgear. The brief detail of some main components of Grid station is as under:

2.8.1. Transformers

It uses for step down the voltage. The winding of transformer is immersed in oil. It's a highly refined mineral oil that is stable at high temperatures and has excellent electrical insulating properties. Its functions are to insulate, suppress corona and arcing, and to serve as a coolant also as it provides part of the electrical insulation between the internal live parts. It must remain stable at high temperature over an extended period.

Formerly, Polychlorinated Biphenyl (PCB) was used as it was not a fire hazard in power transformers and it was highly stable. However PCB byproducts are unstable and toxic and also accumulate in the environment. Therefore, PCB is not permitted to use these day, and will also not be used in transformer of proposed Grid stations.

2.8.2. Busbars

After passing switching components, the lines in the Grid station tie into a common bus. This consists of a number of heavy metal busbars, usually made of aluminium. In most cases there are three parallel busbars; since electrical power is distributed via three-phase sub-stations that require additional reliability often has a double bus or even a double ring of busbars, in which the bus system is actually duplicated. Each feeder as well as each outgoing line has a connection to each separate busbar. This is a safety measure that is required mainly for reliability so that in the case of a failure it would not cause a large part of the system to be brought down.

2.8.3. Buildings

Once grid station gets operational, it will not man on a 24 hours basis. Therefore, there will be no extensive buildings and services facilities are needed. The main facilities will be provided include a small office, storage space, and a control room to house the high voltage monitoring and control instrumentation and equipment.

2.9. Construction Phase of Grid Station

The first construction activity for gird station would be to clear the vegetation from the site and level off the ground surface for those areas where the heavy electrical transformers and other switchgear will stand. After this next activity would be concrete and building construction for foundations for the supporting steelworks, transformers and other switchgear, storm water drainage pipes, slabs, bund walls, the control room, building and storage areas. All open areas between the transformer plinths and other switchgear foundations will be covered with crushed stone. Before laying the crushed zone the ground surface will treated to strict specification with insecticide and herbicide to prevent insect activity and the growth of weeds and other plants in the high voltage yard. The steel work will then be erected. The transformers, circuit breakers and other high voltage equipment will be delivered to site, erected and then commissioned.

2.10. Use of Services during Construction

2.10.1. Water

Water will be required for probable used in the foundations construction for the Grid stations. The water will be sourced from the Karachi Water and Sewerage Board (KWSB), Tanker water or from the borehole on a site.

2.10.2. Sewerage

A negligible sewerage flow is expected during the entire phase of construction activities. During construction phase, water will be used in chemical toilets that will be serviced periodically. For operations, same amount of sewerage will be generated. In order to dispose of waste water from the different activities, septic tanks and soaks away will be utilized.

2.10.3. Solid Waste Disposal

Solid waste will be collected from the different parts of construction site and will be stored temporarily on-site until dispose of permanently in an appropriately permitted landfill site.

2.10.4. Electricity

Either KESC will provide the electricity during construction phase of Grid stations or diesel power generators will be utilized for the provision of electricity. For operation phase, electricity will be supplied by KESC power distribution system.

2.10.5. Work Force

There will be 100-150 people employed during different activities of construction phase of Underground transmission lines and Grid stations. Most of the workers will be recruited from the local areas, whereas, for operational phase the already KESC employed people will be utilized.

Figure 2.1: Layout Plan Azizabad Hybrid Grid Station

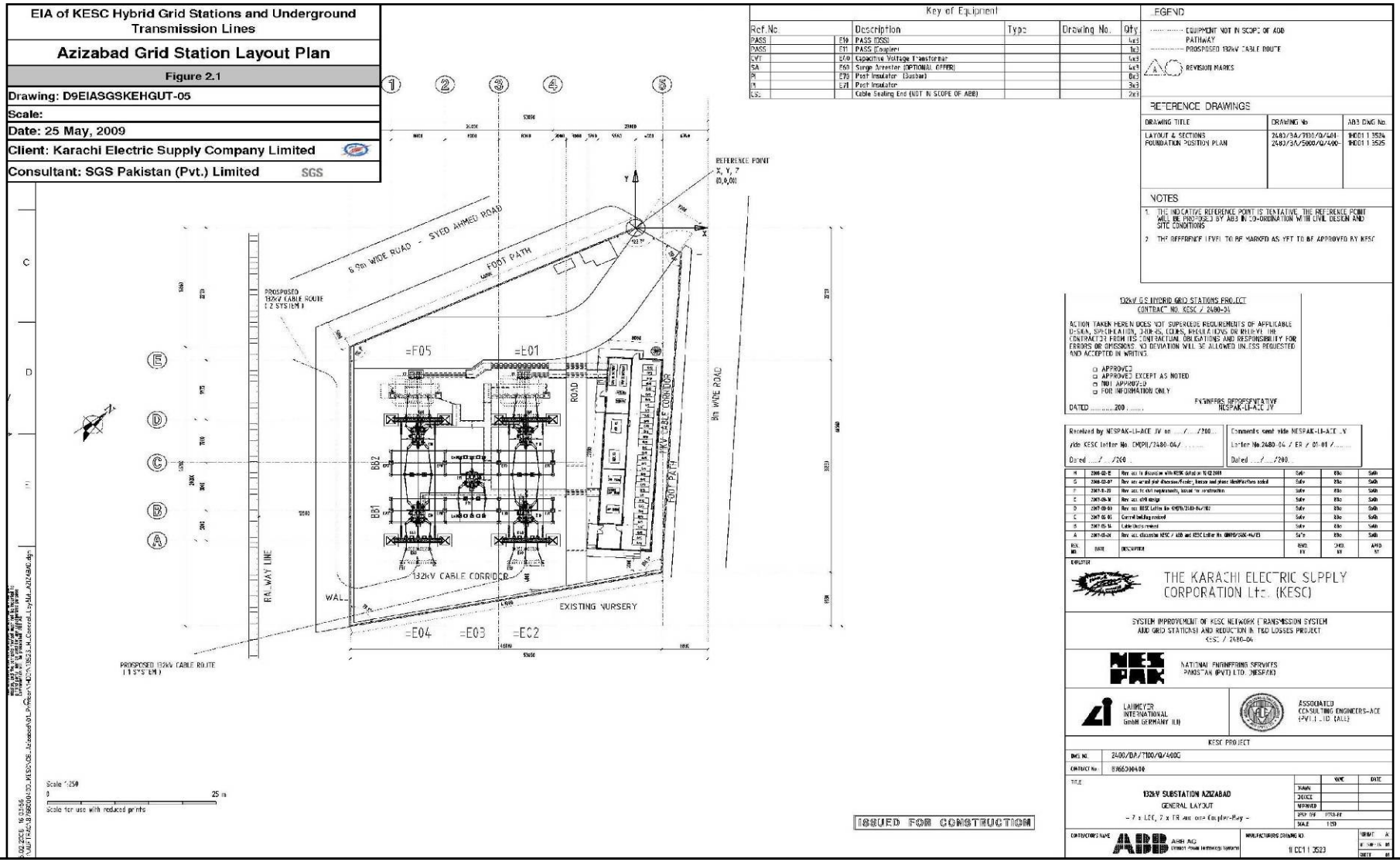
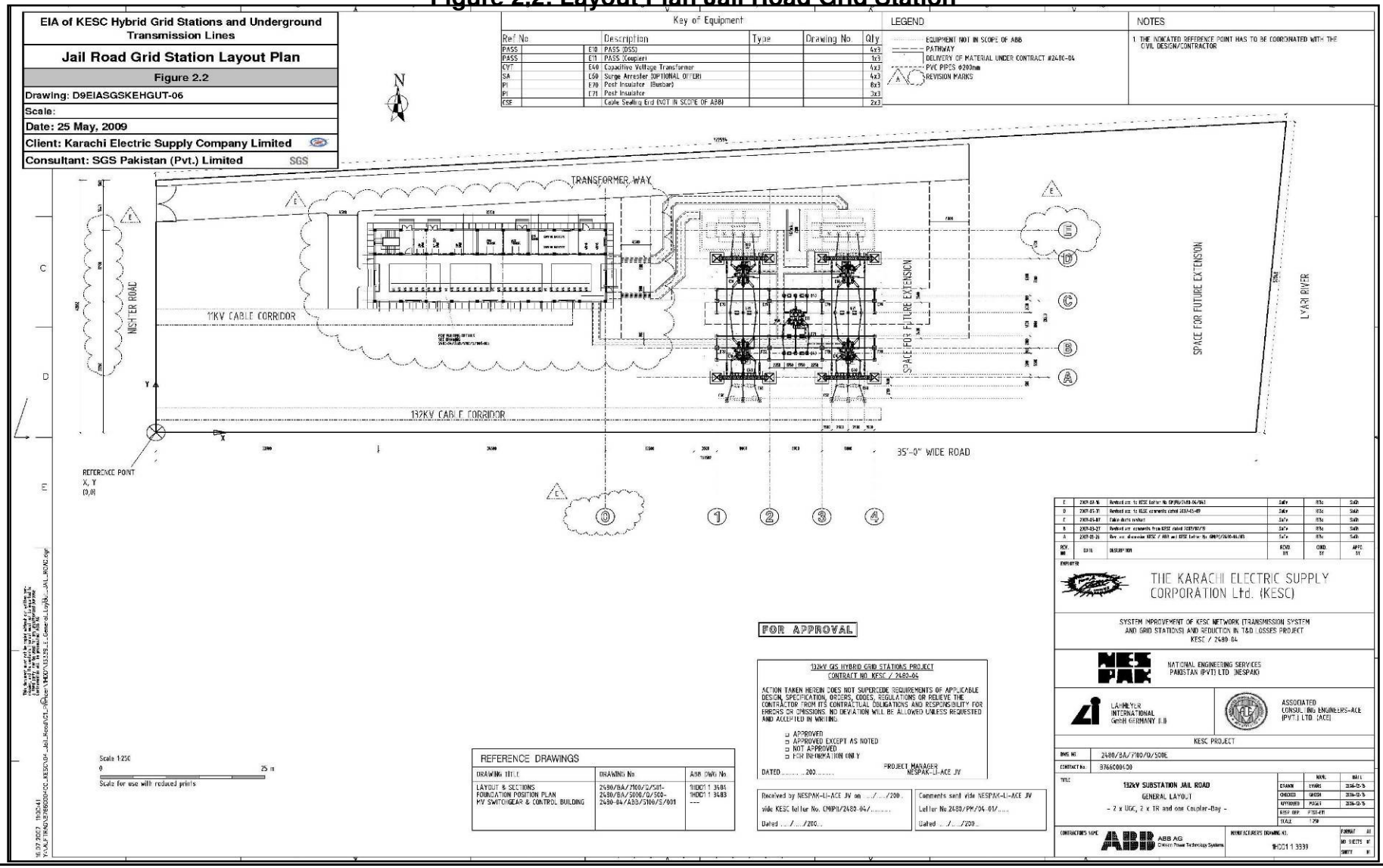


Figure 2.2: Layout Plan Jail Road Grid Station



3. Policy, Legal and Administrative Framework

The concept of sustainable development that emerged in the past few decades aims at developing a new framework for economic and social development, while maintaining the environmental and ecological integrity for the present as well as future generations. The concepts of sustainable development are included in the environmental laws for the betterment of environment. This section provides an overview of the policy framework and national legislation that applies to the proposed project. The project is likely to comply with all national legislation relating to environment in Pakistan, and to obtain all the regulatory clearances required.

3.1. National Policy and Administrative Framework

The Pakistan National Conservation Strategy (NCS) that was approved by the federal cabinet in March 1992 is the principal policy document on environmental issues in the country (EUAD/ IUCN, 1992). The NCS outlines the country's primary approach towards encouraging sustainable development, conserving natural resources, and improving efficiency in the use and management of resources. The NCS has 68 specific programs in 14 core areas in which policy intervention is considered crucial for the preservation of Pakistan's natural and physical environment. The core areas that are relevant in the context of the proposed project are pollution prevention and abatement, restoration of rangelands, increasing energy efficiency, conserving biodiversity, supporting forestry and plantations, and the preservation of cultural heritage.

Two organizations, the Pakistan Environmental Protection Council (PEPC) and the Pakistan Environmental Protection Agency (Pak-EPA), are primarily responsible for administering the provisions of the Pakistan Environmental Protection Act, promulgated by the Government of Pakistan in 1997. The PEPC oversees the functioning of the Pak-EPA. Its members include representatives of the government, industry, non-governmental organizations, and the private sector. The Pak-EPA is required to ensure compliance with the NEQS and establish monitoring and evaluation systems. As the primary implementing agency in the hierarchy, it is responsible for identifying the need for, as well as initiating legislation whenever necessary. The Pak-EPA is also authorized to delegate powers to its provincial counterparts, the provincial EPAs (environmental protection agencies). One of the functions delegated by the Pak-EPA to provincial EPAs is the review and approval of environmental assessment reports of projects undertaken in their respective jurisdictions.

3.2. Pakistan Environmental Protection ACT, 1997

The Pakistan Environmental Protection Act, 1997 empowers the Pak-EPA to:

- Delegate powers, including those of environmental assessment, to the provincial EPAs;
- Identify categories of projects to which the IEE/EIA provision will apply;
- Develop guidelines for conducting initial environmental examinations (IEE) and Environmental Impact Assessment and procedures for the submission, review and approval of the same;
- Develop environmental emission standards for parameters such as air, water and noise;
- Enforce the provisions of the Act through environmental protection orders and environmental tribunals headed by magistrates with wide-ranging powers, including the right to fine violators of the Act.

Under the provisions of the 1997 Act, the Pak-EPA has empowered four provincial EPAs to manage the environmental concerns of their respective provinces. The provincial EPAs can frame environmental regulations tailored to the requirements of their province, provided these regulations meet or exceed the minimum standards set by the Pak-EPA. They are also required to review and approve IEE/EIA of all development projects undertaken in their respective provinces, including those projects implemented by federal agencies.

3.3. Regulations for Environmental Assessment

Under Section 12 (and subsequent amendment) of the 1997 Act, a project falling under any category specified in Schedule I (SRO 339 (I0/2000), requires the proponent to file an IEE with the federal agency concerned (the Pak-EPA). Projects falling under any category specified in Schedule II require the proponent to file an EIA with the federal agency. Within ten working days of the IEE or EIA having been deposited, the federal agency will confirm that the document submitted is completed for the purpose of review. During this time, should the federal agency require the proponent to submit any additional information, it will return the IEE or EIA to the proponent for revision, clearly listing those aspects that need further discussion. Subsequently, the federal agency shall make every effort to complete an IEE review within 45 days and an EIA review within 90 days of filing. Recognizing that the Pak-EPA has delegated powers to the provincial EPAs to enforce the provisions of the 1997 Act, an IEE must be submitted to the following agencies for the sections of the highway falling in their respective domains:

- The Sindh Environmental Protection Agency
- The Punjab Environmental Protection Department (EPD)
- The Pakistan Environmental Protection Agency (for federal capital territory).

At the time of application, the project proponent is also required to pay a specified fee to the EPAs concerned.

3.4. Guidelines for Environmental Assessment

The Pak-EPA has published a set of environmental guidelines for conducting environmental assessments and the environmental management of different types of development projects. The guidelines that are relevant to the proposed project are listed below, followed by comments on their relevance to the proposed project:

The guidelines on the preparation and review of environmental reports target the project proponents, and specify:

- The nature of the information to be included in environmental reports;
- The minimum qualifications of the IEE/EIA conductors appointed;
- The need to incorporate suitable mitigation measures at every stage of project implementation;
- The need to specify monitoring procedures.

The terms of reference for the reports are to be prepared by the project proponents themselves. The report must contain baseline data on the project area, a detailed assessment thereof, and mitigation measures.

- Guidelines for Public Consultation, Pakistan Environmental Protection Agency, May 1997;
- These guidelines deal with possible approaches to public consultation and techniques for designing an effective program of consultation that reaches out to all major stakeholders and ensures that their concerns are incorporated in any impact assessment study;
- Sectoral Guidelines: Pakistan Environmental Assessment Procedures, Pakistan Environmental Protection Agency, October 1997;
- The guidelines for 'major roads' are structured to assist in identifying key environmental issues related to road development projects, as well as the various mitigation measures and alternatives that should be considered and applied accordingly. These guidelines are aimed at intermediate-level projects where the impact is likely to be more significant, as opposed to minor works such as the maintenance, repair, and improvement of existing roads.

3.5. National Environmental Quality Standards, 2000

The National Environmental Quality Standards (NEQS), 2000 specify the following standards:

- Maximum allowable concentration of pollutants (32 parameters) in municipal and liquid industrial effluents discharged into inland waters, sewage treatment facilities, and the sea (three separate sets of numbers);

- Maximum allowable concentration of pollutants (16 parameters) in gaseous emissions from industrial sources;
- Maximum allowable concentration of pollutants (two parameters) in gaseous emissions from vehicle exhaust and noise emission from vehicles;
- Maximum allowable noise levels from vehicles.

These standards also apply to the gaseous emissions and liquid effluents generated by batching plants, campsites and construction machinery. The standards for vehicles will apply during the construction as well as operation phase of the project. Standards for air quality have not been prescribed as yet.

3.6. National Resettlement Policy and Ordinance

There is no such kind of land acquisition or resettlement of Project affected persons. Therefore, no further details have been discussed.

The provisions of the Draft Resettlement Policy are consistent with the requirements of the World Bank's OP 4.12 on involuntary resettlement. After becoming law, these provisions will apply when addressing the resettlement issues that arise in the project.

3.7. Interaction with other Agencies

The client is responsible for ensuring that the project complies with the laws and regulations controlling the environmental concerns. This section describes the nature of the relationship between the client and line departments concerned.

3.7.1. Federal and Provincial EPAs

The client will be responsible for providing the complete environmental documentation required by the Pak-EPA, and Punjab EPA and remain committed to the approved project design. No deviation is permitted during project implementation without the prior and explicit permission of the EPAs concerned.

3.7.2. Provincial Revenue Departments

Under the national law, matters relating to land use and ownership are provincial subjects, and the revenue department of the province concerned is empowered to carry out the acquisition of private land or built-up property for public purposes, including on behalf of another provincial or federal agency. For this purpose, the lead department must lodge an application with the provincial government concerned to depute a land acquisition collector (LAC) and other revenue staff who will be responsible for handling matters related to acquisition and the disbursement of compensation.

The client will provide logistic support and assist in preparing the documents necessary for notification. It will also need to liaise with the provincial departments of agriculture, horticulture, and forestry in order to evaluate affected vegetation resources, such as trees and crops, etc., for compensation purposes.

3.7.3. Provincial Governments

The client must ensure that the project meets the criteria of the Punjab provincial government as related to the safe disposal of wastewater, solid waste, and toxic materials. The client will coordinate and monitor environment-related issues.

3.7.4. Local Government and Municipalities

The client will work with local government/administration and municipalities on the resettlement of squatters and removal of encroachments or sources of congestion. In specific cases, the Client will frame an agreement with the municipality, local government, or other service provider concerned on the resettlement of displaced squatters.

3.8. Other Environment Related Statutes

This section outlines statutes apart from the Pakistan Environmental Protection Act, 1997, which are relevant to the project.

3.8.1. Antiquities Act, 1975

The Antiquities Act relates to the protection, preservation and conservation of archaeological/historical sites and monuments. It prohibits construction (or any other damaging) activity within 200 m of such sites unless prior permission is obtained from the Federal Department of Archaeology and Museums. The Antiquities Act also binds the project proponent to notify the department should anything of archaeological value be excavated during project construction.

3.8.2. Provincial Local Government Ordinances, 2001

These ordinances, issued following the devolution process, establish regulations for land use, the conservation of natural vegetation, air, water, and land pollution, the disposal of solid waste and wastewater effluents, as well as matters related to public health and safety.

3.8.3. Motor Vehicles Ordinance, 1965, and Rules, 1969

The Motor Vehicles Ordinance, 1965, was extended in 1978, to the whole of Pakistan. The ordinance deals with the powers of motor vehicle licensing authorities and empowers the Road Transport Corporation to regulate traffic rules, vehicle speed and weight limits, and vehicle use; to erect traffic signs; and to identify the specific duties of drivers in the case of accidents. It also describes the powers of police officers to check and penalize traffic offenders at the provincial level. At the same time, the ordinance also empowers the Regional Transport Authority to operate as a quasi-judicial body at the district level to monitor road transport, licensing requirements, and compensations for death or injury to passengers on public carriers

3.8.4. Factories Act, 1934

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

3.8.5. Pakistan Penal Code, 1860

The Pakistan Penal Code deals with offences where public or private property and/or human lives are affected due to the intentional or accidental misconduct of an individual or body of people. In the context of environment, the Penal Code empowers the local authorities to control noise, noxious emissions and disposal of effluents. The NEQS enforced by the EPAs supersede the application of this legislation on industries and municipalities. The Penal Code, however, can provide a basis for the client to coordinate its activities with the local authorities to ensure that its construction activities do not become a cause of public nuisance or inconvenience.

3.8.6. Explosives Act, 1884

Under the Explosives Act, the project contractors are bound by regulations on handling, transportation and using explosives during quarrying, blasting, and other purposes.

4. Environmental and Social Baseline

The baseline information is being presented here pertain to the physical, biological and socio-economic environment of the areas where the proposed development would be carried out. Information available from the electronic/printed literature relevant to baseline of the area was collected at the outset and reviewed subsequently. This was followed by surveys conducted by experts to investigate and describe the existing socio-economic status, and physical scenario comprising geographical, geological, ecological and ambient environmental conditions of the area.

4.1. General Characteristic of Project Area

The proposed project site would be located in Gulshan-e-Iqbal, Azizabad, Liquatabad and Jail Road areas of Karachi city, which is the capital and financial hub of Sindh Province. These areas are surrounded by Dastagir society, Karimabad, Gharibabad, Yasinabad, PIB colony, Gulzar Hijri, Gulistan Johar etc. and geographical coordinates of this part of Karachi city and other areas are 24° 57' 19" North, 67° 3' 52" East. Mostly these areas are used for residential and commercial purposes; however in neighborhood there are some industrial areas are also located such as SITE, Korangi/Landhi and North Karachi industrial areas.

4.2. Physical Environment

4.2.1. Geology and Topography

The geological conditions of Gulshan-e-Iqbal and Liquatabad Towns are described in brief in following sub-sections, where proposed Hybrid grid stations and Underground transmission lines are proposed to locate.

4.2.2. Geological Condition of Gulshan-e-Iqbal Town

The soil of this town consists of siltstone, sandstone and clay interbed with limestone with alternate bands of clay with siltstone. Grey sandstone of Manchar formation is also exposed in the area overlying by alluvium deposits.

Lithology of the area mostly consists of yellow and grey siltstone, sandstone and clay which are interbeded with limestone of Gulistan-e-Juhar, member of Gaj formation of Miocene. In Gulshan-e-Iqbal town, some part is also overlain by the rocks of Manchar formation of Pleistocene in NE direction while some part is also covered by recent alluvium deposits. The structure of area is in anticline but in the direction of Northeast with some area covered by alluvium. The fault line finishes at the boundary of this town which arises from Jamshed Town.

4.2.3. Geological Condition of Liquatabad Town

The soil of this town mainly composed of poorly sorted, unconsolidated loose gravel, sand and silts. Lithology of the area is totally uncovered with recent alluvial deposit of quarternancy age. Structurally the town area is synclinal. The recent alluvial deposit has unconformable contact with Gulistan-e-Juhar member of Gaj formation in NE and NW direction.

4.2.4. Seismicity

Pakistan is classified into 15 seismotectonic regions. The proposed project is believed to be located in the Rann-of-Kutch-Karachi fault region, also known as Karachi-Jati Allah Bund fault, passes close to the Eastern Industrial zone of Port Qasim. It has three other segments namely the Jhimpir fault, the Pab fault and the Surjan fault. These are the infra-plate active faults that pose major earthquake hazard in the Indus delta and the estuaries of the passive continental margin.

The orientation of the Rann-of-Kutch fault is roughly east-west oriented, and is 225 km in length. This is the fault zone that is responsible for the production of earthquakes of considerably high magnitude of up to 7.6 M on Richter scale and of IX to X intensity on the Modified Mercali (MM) scale. The Pab fault on the other hand is 135 Km in length and is oriented north-south. On the basis of the established seismic potential of the active faults viz. Rann-of-Kutch and Pab faults over their entire length, together with analyses of historical and instrumental records of the Pakistan coastal zone, the risk factor for this region is estimated at 7.7 to 8.2 M for the former and 7.2 to 7.8 M for the latter.

4.2.5. Climate

The project is proposed to construct/commission in the Karachi District of Sindh Province. It has typical climate of subtropical coastal zones lying in the monsoon region. A description of physical environment in the region of proposed project location is given below.

Climatic Seasons & Rainfall

The proposed project will be located in Karachi city which has dry, hot and humid conditions and in general it is moderate, sunny and humid. There is minor seasonal intervention of a mild winter from mid-December to mid-February into a long hot and humid summer extending from April to September.

The last five years annual rain fall data shows variation between 0 – 250.4 mm, and annual maximum rain fall reported in the area is 465.6 mm during the year of 2007. The rain fall data of Karachi city is summarized in **Table 4.1.**

Temperature

At Karachi Airport, Pakistan Meteorological Department (PMD) has monitoring station, which recorded climatic data represents the all parts of Karachi city. The ambient air temperature of this city varies from summer to winter and this change in temperature has a direct influence on the environment of city. The hot weather during summer, deteriorate the air quality and increase the ambient particulate matters due to drying of road payments and open soil. The mean monthly temperature in the area varies from 17.2 to 36.8 ºC and annual average temperature is kept within 27.4 – 32.8ºC. The maximum temperature reaches to 36.8ºC during summer and minimum temperature reaches 17.2ºC during winter. The mean monthly minimum and maximum temperatures of Karachi city for last five years are given in **Table 4.2**.

Humidity

As the city lies near the Arabian Sea, therefore humidity levels usually remain high during entire year. December is the driest month and August is count as most moist month of Karachi climate. The relative humidity in project region varies from 25 to 76 %. The highest humidity in the area was recorded 76%, which was in the month of August. The humidity data from 2004 to 2008 is summarized in the **Table 4.3**.

Winds

Karachi weather is characterized by pleasant weather due to sea breeze, which blows all the year except during local disturbances experienced sometimes in winter and summer months. This wind has highest velocities during the summer months, when the direction is south-west to west. In winter, winds are of low force from North to Northeast and seldom there is stormy weather. In summer, South West monsoon prevails with wind force ranging between 0.4 m/s and 9.5 m/s on account of low atmospheric pressure due to disturbances. Heavy storms of severe intensity are rare but strong gusts of winds can take place abruptly due to changes in atmospheric pressure. The data on wind speed, experienced in Karachi region during the years 2004 - 2008 is given in **Table 4.4** while wind directions are shown in **Table 4.5.**

4.2.6. Ambient Air Quality

Mobile air quality station was installed at a location near project site for 24 hours. The ambient air quality was monitored for the priority pollutants including carbon monoxide (CO), sulphur dioxide (SO_2), nitrogen dioxide (NO_2), and particulate matter (PM10). The monitoring was carried out using state of the art equipment and USEPA approved methods. All equipments were calibrated prior using to get the accurate data. The world health organization (WHO) standards and draft

NEQS for ambient air quality are provided for reference in **Table 4.6**. The summary of air quality data results at two locations is given in **Table 4.7**. The detail of air quality monitoring indicate that the concentration of CO, NO_2, SO_2 and PM10 are well within range of the WHO and Pak-EPA Standards while the concentration of PM is higher which is expected to be due to the weather conditions at time of monitoring.

4.2.7. Water Quality

Ground Water

Three ground water samples referred to as WS-1, WS-2 and WS-4 were collected from Project site and its adjoining vicinity. One sample was collected from a shrine behind Jail road grid station referred to as WS-1 while other two samples were collected from Mosques located in Gulshan Iqbal and FC Area. WHO standards are included as **Table 4.8** and the results showing the water testing parameter is included in **Table 4.9**.

Analyses trait of three samples indicates that its PH value is laying well within limits at 7.81, 6.96 and 7.05 as defined by WHO in its drinking water guidelines. Characteristic determining parameter TDS was, however, found at 326, 1266 and 722 mg/l and lying well below the WHO permissible limit of 1000mg/litre. Major anions Chlorides figure was also found surpassing WHO limitsof 250mg/l in sample WS-2 and WS-4 respectively whereas it remains within limits in Sample WS-1.Other major anion Sulfate was, however, found within permissible range for sample WS-1 and WS-4 but it was crossing at 264mg/litre in sample WS-2. Sodium also remained at 91 and 160mg/l respectively for sample WS-1 and WS-4 which is less in concentration than permissible limit of 200mg/l as defined by WHO in its drinking water guideline. Strictly defined toxic metals remained below detection limit of the instrument and as such they do not pose any hazard to water quality of both the samples. Biological examination of three resourced samples indicates that all the samples are viably contaminated with Feacal origin.

Overall perspective of analyses trait indicates that chemically sample WS-2 is not complying the limits as defined by WHO in its drinking water Guidelines ; and whereas sample WS-1 & WS-4 are within limits as defined by WHO in its drinking water guideline. Biological examination on three samples indicates that all three samples are sufficiently contaminated with Feacal microorganisms and as such cannot be utilized for drinking applications.

Surface Water

Two surface water samples were collected from project and adjoing sites. One sample was collected from well known Lyari drain and the other one collected from KESC Training institute in Gulshan Iqbal premises. The results showing testing parameters are included in **Table 4.10**.

The sample WS-3 is an open channel stream stated to be emerging from some KWSB facility. The stream is accompanied by low degree biological loading in terms of BOD, COD and TSS at 29, 57 and 15mg/l respectively. Remaining parameters showing excellent character exhibiting meagre TDS of 316mg/l. Strictly defined toxic metals such as As,Ba,Cd,Cr,Hg,Se,Mn and Ag remained below detection limit of the instrument and as such are not causing any sort of Hazard to surface water ecology. The stream can viably be utilized for drinking applications after little pre-treatments such Flocculation and disinfection. The analyses trait of sample WS-5 indicates it is highly polluted stream emerging from sub-drains of Domestic and Industrial based outlets in the city. Analyses trait of this sample indicates its most parameters showing acute presence of pollutants in the form of BOD, COD, TSS, NH_3 and TDS. Oxygen demanding substances are exerting sufficiently large biological load in the form of BOD and COD at 181 and 367mg/l respectively.

Strictly defined toxic metals such as As,Ba,Cd,Cr,Hg,Se,Mn and Ag remained below detection limit of the instrument and as such are not causing any sort of Hazard to surface water ecology.

Other significant pollutants such as Phenolics and Phosphorous were also found in reasonable amount in the surface stream.

4.2.8. Soil

Four soil samples referred to as SS-1, SS-2, SS-3 and SS-4 were collected from Project site and its adjoining vicinity. Analyses pattern of four samples indicates that its PH value is lying well within reasonable limits, and possessing reasonable productive soil character except SS-4 which is showing little elevated figure of 9.84. The results of soil analysis are given in **Table 4.11**.

Major nutrients in the form of Nitrogen, Phosphorous and Potassium were found in reasonable ranges whereas organic matter was found at 3.08, 1.46, 2.72 and 2.38 % in sample No: SS-1, SS-2, SS-3 and SS-4 respectively, indicating the soil is reasonably fertile in character.

Strictly defined toxic metals remained at reasonably lower limits to cause any type of hazard to soil environment. Iron and Manganese were, however, found at elevated levels because of its large scale distribution on earth crust. Mercury was found at 1.073, 1.126, 1.474 and 1.739mg/l respectively in all the samples but at such level it is not hazardous to soil environment.

Overall perspective of Analysis pattern on referred soil samples indicates that the soil is reasonably productive and human friendly in all of its characteristics and is free from Organo/Inorganic based noxious pollutants.

4.2.9. Noise

The proposed project will be located at the heart of densely populated urban region of Karachi city beside well known Memon Masjid in Hussainabad area and also beside Saeed Ahmed road in front of Elementary College of education where day to day human activities are source of noise generation. The noise levels monitored at the project site are given **Table 4.12**. The WHO standards indicate that the noise levels should not exceed 65 dB during day time and 60 dB during night time in residential area. The results indicate higher noise levels due to human activities in the area.

4.3. Biological Environment in Karachi City

It is difficult to survive for natural environment under harsh climatic conditions, accentuated by drought, and multiplied by land clearance activities demanded by the forces of urbanization. Natural areas vegetation is restricted all over the urban area to depression areas where moisture would be available for greater part of the year and longer period of time.

The detail of flora and fauna are found in different part of Karachi city, is given in following sub-sections.

4.3.1. Flora

The biodiversity of vegetation on sandy plains and low hills or urban Karachi is characterized by ephemeral species plus trees and shrubs, including prosopis cineraria, Acacia nilotica, Tamarix aphylla, Lycium shawii, Salvadora oleoides, Zizyphus sp., Calligonum polygonoides and Leptadenia pyrotechnica. Species on calcareous hills in Gulistan-e-Johar, for example include Vernonia cinerascens, Commiphora wightii, Grewia tenax and Euphorbia caducifolia. The shallow slopes with varied soils on recent and sub-recent substrates at low altitudes chiefly on plains have the trees Zizyphus nummularia, Salvadora oleoides, and Capparis deciduas, and shrubs Grewia tenax, Seddera latifolia, and Rhazya stricta that are the most commonly found species, together with the grasses Ochthochloa compressa, Cymbopogon jawarancussand Aristida funiculate. With prosopis cineraria, Indigofera oblongifolia and Euphorbia caducifolia, the above combination of species makes up most of the total vegetation coverage of Karachi city district.

The two principal habitat types on the course of Lyari and Malir Rivers to central areas of Karachi city district are arid hills, and low lying sandy areas. Vegetation of the hill slopes and hillsides comprise mainly camelthorn (Prosopis spicigera) wild caper (Capparis Decidua) and large succulents such as Euphorbia caudicifolia. The sandy areas are typically vegetated with a sparse cover of small trees such as Acacia Senegal, Zizyphus nummularia and prosopis cineraria, and

shrubs and shrublets such as leptadenia pyrotechnica, Colotropis procera, Rhazya stricta, inula grantioides, Zygophyllum, simplex and Sueda fruticosa.

4.3.2. Fauna

The impoverished as well as degraded environment resulting from non-availability of surface as well as groundwater and discharge of untreated wastewater into lyari and Malir Rivers irreversibly reduced the biodiversity of the indigenous as well as introduced vegetation and hence it offers very little chance for the survival/growth of fauna in the macro environment of Karachi city district. There are even otherwise, no habitats of large and small animals, birds or reptiles within Karachi city district. Domestic livestock, particularly goats, sheep, and camels are found grazing in the suburban towns.

There are a number of characteristic bird species that have adapted to the agricultural environment in the outskirts and suburban areas of Karachi. These include Indian Roller, Common mynah, pigeon, and house sparrow.

4.3.3. Protected areas / National sanctuaries

In Pakistan there are several areas of land, devoted to the preservation of biodiversity through the dedication of national parks and wildlife sanctuaries. However, this kind of areas is not found near the project site.

4.4. Socio-economic Environment

This section of report describes the key socio-economic features of the Karachi District, including the Administrative Setup, Economy Status of Karachi city, Demographic Distribution, Languages, Education, etc.

4.4.1. Administrative Setup

According to new devolution plan in 2000, the five districts of Karachi have merged into a new city district, structured as a three-tiered federation, with the two lower tiers composed of 18 towns and 178 union councils. The towns are governed by elected municipal administrations responsible for infrastructure and spatial planning, development facilitation, and municipal services, with some functions being retained by the city district government. The third tier 178 union councils are each composed of thirteen directly elected members including a Nazim and Naib Nazim. The UC Nazim heads the union administration and is responsible for facilitating the CDGK to plan and execute municipal services, as well as for informing higher authorities about public concerns and complaints.

4.4.2. Economy Status of Karachi City

Karachi city is the financial hub of Pakistan. According to Federal Board of Revenue 2006-2007 book, tax and customs units in Karachi was responsible for 46.75% of direct taxes, 33.65 % of federal excise tax and 23.38% of domestic sales tax. It also accounts for 75.14% of customs duty and 79% of sales tax on imports.

The GDP of Karachi city is 25% of the total GDP of Pakistan and it produces about 30% of value added in large scale manufacturing sectors such as Textile, Cement, Steel, Heavy machinery, Chemicals, Food, Banking etc. in SITE, Korangi, Northern Bypass, Industrial Zone, Bin Qasim and North Karachi Industrial areas.

Most of Pakistani's public and private banks are also headquartered in Karachi, while most major foreign multinational companies operating in Pakistan have their headquarters in Karachi.

4.4.3. Demographic Distribution

The demographic distribution in Karachi has undergone numerous changes over the past few decays. Government and other sources have anticipated that Karachi's current population is about 16-18 million. The current population rate is about 5% per year, it is because of rural-urban internal migration.

Before partition (1947), Karachi had communities of Sindhis, Balochs, Pashtuns,Parsis, Hindus, Christian, Jews, Goans, Armenians, Lebanese and Gujaratis. After independence of Pakistan, a large number of Sindhi Hindus and Sindhi Sikhs left the city for India and were replaced by Muslim refugees also known as Muhajirs. The Muhajirs migrated from different parts of India and mostly speak Urdu language.

According to last census of Pakistan, which was conducted in 1998, the religious breakdown of the city is as follows.

- Muslim (96.45%)
- Christian (2.42%
- Hindu (0.86%)
- Ahmadi (0.17%)
- And Other (0.10%) Other religious groups include Parsis, Sikhs, Bahai, Jews and Buddhists).

4.4.4. Languages

The most commonly spoken language in Karachi is Urdu, the national language. However, Sindhi, Punjabi, Pashto and Balochi are also widely spoken in the city. As per the census of Pakistan 1998, linguistic distribution of the city is: Urdu (48.52%), Punjabi (13.94%), Pashto (11.42%) , Sindhi (7.22%), Balochi (4.34%), Seraiki (2.11%) and Other (12.44%). Other languages mainly include

Gujarati and Memoni with other minor languages like Dari, Brahui, Makrani, Hindko, Khowar, Burushaski, Arabic, Persian and Bengali.

4.4.5. Education

The education in Karachi is divided into five levels: primary, middle, high and university programs leading to graduate and advanced degrees. Karachi has both public and private educational institutions from primary to university level. The most famous and prestigious school in Karachi are the Karachi Grammar School, City school, Beacon House, Mama Parsi etc. Likewise these schools, there are lots of famous Universities such as Karachi University, Sir Syed University, NED, IBA, Dow Medical etc are also located in Karachi.

In 2004-05, the city's literacy rate was 65.26%, which was highest in Pakistan with a GER of 111%. Karachi is also home of Chartered Accountants Institute of Pakistan which is the most prestigious institute of country producing Chartered Accountants who are leading the corporate sector of the country. The Institute was established in 1961 and has since produced over 5,000 members.

Table 4.1: Rainfall Data at Karachi in mm

Year	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Annual
2004	13.7	0.0	0.0	0.0	0.0	Trace	3.0	5.6	Trace	39.3	0.0	4.3	65.9
2005	10.8	12.8	Trace	0.0	0.0	Trace	1.3	0.3	54.9	0.0	0.0	17.1	97.2
2006	Trace	0.0	Trace	0.0	0.0	0.0	66.2	148.6	21.9	0.0	3.1	61.3	301.1
2007	0.0	13.2	33.4	0.0	0.0	110.2	41.0	250.4	0.0	0.0	0.0	17.4	465.6
2008	8.0	Trace	1.1	0.0	0.0	0.0	54.0	37.5	Trace	0.0	0.0	21.0	121.6

Data Source: Pakistan Metrological Department

National Metrological Data Processing Centre
University Road, Karachi

Table 4.2: Mean Monthly Temperature (C°)

Year	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Annual
2004	26.6	29.9	36.2	35.4	36.8	35.6	33.5	32.6	32.8	33.7	30.7	29.4	32.8
2005	24.9	26.2	31.4	35.3	35.4	36.1	33.2	33.2	34.2	35.2	33.1	28.2	32.1
2006	18.9	24.7	25.7	29.4	31.0	32.0	31.1	28.7	30.5	30.4	26.4	20.1	27.4
2007	19.9	23.4	25.5	30.3	31.8	32.5	31.3	30.1	30.6	28.6	26.2	20.0	27.5
2008	17.2	19.0	27.0	29.2	30.6	32.1	30.7	29.4	30.7	29.6	25.0	21.0	26.8

Data Source: Pakistan Metrological Department

National Metrological Data Processing Centre
University Road, Karachi

Table 4.3: Mean Monthly Relative Humidity (Mean) at 1200 UTC (%)

Year	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Annual
2004	34	33	26	47	55	62	64	66	59	43	32	25	45.5
2005	29	41	45	37	55	59	65	65	60	37	36	30	46.6
2006	31.0	37.0	38.0	49.0	62.0	59.0	68.0	76.0	61.0	54.0	38.0	40.0	51.1
2007	31.0	44.0	43.0	47.0	57.0	64.0	66.0	72.0	59.0	35.0	41.0	31.0	49.2
2008	28.0	30.0	36.0	48.0	66.0	62.0	63.0	68.0	58.0	48.0	31.0	47.0	48.8

Data Source: Pakistan Metrological Department

National Metrological Data Processing Centre
University Road, Karachi

Table 4.4: Mean Monthly Wind Speed at 0000 UTC (Knots)

Year	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Annual
2004	2.1	2.1	2.1	3.9	6	8	8.6	9.5	5.5	2.3	0.4	2.4	4.4
2005	2.1	4	3.7	3.1	4.3	5.5	8.6	7.1	5.1	1.7	0.7	0.8	3.9
2006	1.5	1.6	1.6	4.3	7.2	6.7	6.6	5.9	4.0	3.0	0.9	1.6	3.9
2007	0.8	1.4	2.3	2.3	3.9	3.9	3.5	4.5	4.1	1.1	0.6	1.7	2.5
2008	1.5	2.3	2.3	3.4	7.7	4.9	6.6	6.3	5.2	2.2	1.3	2.1	3.8

Data Source: Pakistan Metrological Department

National Metrological Data Processing Centre
University Road, Karachi

Table 4.5: Mean Monthly Wind Direction at 1200 UTC (Knots)

Year	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Annual
2004	N27E	S46W	S53W	S49W	S52W	S54W	S54W	S62W	S56W	S47W	S45W	N86E	-----
2005	N63E	S51W	S50W	S52W	S63W	S48W	S54W	S49W	S87W	S54W	S52W	N23W	-----
2006	S48W	S62W	S50W	S57W	S64W	S60W	S67W	S78W	S51W	S53W	S49W	N79E	-----
2007	S30W	S62W	S47W	S55W	S58W	S47W	S41	S55W	S60W	S48W	S46W	N45E	-----
2008	N45E	S47W	S54W	S51W	S52W	S39W	S50W	S52W	S46W	S39W	S38W	N	-----

Data Source: Pakistan Metrological Department

National Metrological Data Processing Centre
University Road, Karachi

Table 4.6: Ambient Air Quality Standards

Pollutant	Draft Pak-EPA Standards(NEQS)		WHO Standards	
	Standard	Average Time	Standard	Average Time
CO	5 mg/m³	8 hour	35 ppm	1 hour
NO_2	80 µg/m³	24 hours	106 ppb	1 hour
SOx	120 µg/m³	24 hours	134 ppb	1 hour
PM_{10}	250 µg/m³	24 hours	70 µg/m³	24 hours

Table 4.7 : Ambient Air Quality at Project Site

Parameter	Unit	Duration	LDL	Concentration
Nitrogen Dioxide (NO2)	ppb	12 Hours	1.0	3.64
Sulfur Dioxide (SO2)	ppb	12 Hours	1.0	0.57
Carbon Monoxide (CO)	ppm	12 Hours	0.01	1.697
PM10	mg/Nm^3	12 Hours	2	174.07

Table 4.8: WHO Drinking Water Guidelines

#	Parametric Tests (mg/L) [1].	WHO
1	Aluminium	0.2
2	Ammonium	1.5
3	Antimony	0.005
4	Arsenic	0.01
5	Barium	0.7
6	Boron	0.3
7	Cadmium	0.003
8	Chloride	250
9	Chromium	0.05
10	Coliforms, total /100ml	0
11	Coliforms,E.Coli/100ml	0
12	Color	15cu
13	Copper	1 - 2
14	Cyanide	0.07
15	Fluoride	1.5
16	Hardness	NS
17	Iron	0.3
18	Lead	0.01
19	Manganese	0.1- 0.5
20	Mercury	0.001
21	Molybdenum	0.07
22	Nickel	0.02
23	Nitrate/Nitrite, total	NS
24	Nitrates(NO_3)-	50
25	Nitrites(NO_2)-	3
26	Odor	NS
27	pH	6.5 - 8.5
28	Phosphorous	NS
29	Phenols	NS
30	Potassium	NS
31	Selenium	0.01
32	Silica Dioxide(SiO_2)	NS
33	Silver	NS
34	Solids, Total dissolved	1000
35	Sodium	200
36	Sulfate	250
37	Turbidity(Non-microbial)	5 NTU
38	Zinc	3.0

Ref : Hach Product Guide, USA, Vol 2003.

[1] NS=No Standards, JTU=Jackson Turbidity Units, NTU=Nephelometric Turbidity Units, CU=Color Units, MPN Coliforms, Total or E.Coli/100ml, Pt-Co = Platinium Cobalt Standards, TON=Threshold Odor Number,*mg/l (milligrams per liter) except where notified.

Table 4.9: Ground Water Quality of the Project Area

#	Parameters	LDL	WS-1	WS-2	WS-4
			Jail Road Grid Station	Aziz Abad, F.C. Area, Umer Farooq Masjid	Gulshan-e-Iqbal, Bait-ul-Mukaram Masid
1	Temperature	-	31	23	23
2	pH at 25 °C	-	7.81	6.96	7.05
3	Conductivity, Electrical	-	562	1990	1240
4	Solids, Total Suspended (TSS)	5	5	<5.0	3
5	Solids, Total dissolved (TDS)	5	326	1266	722
6	Turbidity	0.2	2.6	0.2	1.2
7	Total Hardness	0.05	167.69	414.22	302.77
8	Alkalinity, Total as $CaCO_3$	5	107.01	360.57	262
9	Chloride	1	132.25	442.22	256.24
10	Sulfate (SO_4)	5	155.55	264.18	145.06
11	Bicarbonates (HCO_3)	5	130.54	439.89	319.64
12	Calcium (Ca)	0.02	35	92.5	82.5
13	Magnesium (Mg)	0.02	19.5	44.5	23.5
14	Potassium (K)	0.2	7.5	6	7.5
15	Sodium (Na)	1	91	286.5	160
16	Arsenic	0.005	<0.005	<0.005	<0.005
17	Barium	0.01	<0.01	<0.01	<0.01
18	Cadmium	0.002	<0.002	<0.002	<0.002
19	Chromium	0.02	<0.02	<0.02	<0.02
20	Copper	0.02	<0.02	<0.02	<0.02
21	Iron	0.02	<0.02	<0.02	<0.02
22	Lead	0.01	<0.01	<0.01	<0.01
23	Manganese	0.02	<0.02	<0.02	0.1
24	Mercury	0.001	<0.001	<0.001	<0.001
25	Nickel	0.02	<0.02	<0.02	<0.02
26	Selenium	0.01	<0.01	<0.01	<0.01
27	Silver	1	<1.0	<1.0	<1.0
28	Zinc	0.05	<0.05	0.06	<0.05
	Microbiology				
29	Heterotrophic Plate Count	-	832	624	634
30	Total Coliforms	-	39	10	10
31	Faecal Coliforms (E. Coli)	-	18	4	4
32	Faecal Streptococci / Entrococci	-	2	Absent	Absent

Table 4.10: Surface Water Quality of the Project Area

#	Parameters	LDL	WS-3	WS-5
			Gulshan-e-Iqbal, K.E.S.C Training Institue	Gulshan-e-Iqbal, Essa Nagri (Liyari Express Way)
1	Temperature	-	25	27
2	pH at 25 °C	-	7.37	7.66
3	Solids, Total Suspended (TSS)	5	15	21
4	Solids, Total dissolved (TDS)	5	316	1176
5	Turbidity	0.2	7.2	12
6	Biochemical Oxygen Demand (BOD_5)	2	29	181
7	Chemical Oxygen Demand (COD)	5	57	367
8	Oil & Grease	1	<1.0	1.25
9	Chloride	1	146.72	454.62
10	Sulfate (SO_4)	5	151.43	83.95
11	Ammonia (NH_3)	0.2	2.17	7.38
12	Phenolic Com. (as Phenol)	0.01	0.038	0.055
13	Phosphorus	0.05	0.64	1.04
14	Cyanide	0.01	<0.01	<0.01
15	Arsenic	0.005	0.01	0.01
16	Barium	0.01	<0.01	<0.01
17	Cadmium	0.002	<0.002	<0.002
18	Chromium	0.02	<0.02	<0.02
19	Copper	0.02	<0.02	<0.02
20	Iron	0.02	0.23	0.06
21	Lead	0.01	<0.01	<0.01
22	Manganese	0.02	0.06	0.1
23	Mercury	0.001	<0.001	<0.001
24	Nickel	0.02	<0.02	<0.02
25	Selenium	0.01	<0.01	<0.01
26	Sulphide	1	<1.0	<1.0
27	Silver	1	<1.0	<1.0
28	Zinc	0.05	<0.05	<0.05

Table 4.11: Soil Quality of the Project Area

#	Parameters	Ldl	SS-1	SS-2	SS-3	SS-4
			Gulshan-e-Iqbal	Azizabad	Liaqatabad	Jail Road
1	pH at 25 °C	-	8.83	8.35	8.84	9.82
2	Moisture	-	1.44	1.02	1.18	0.21
3	Electrical Conductivity	-	1266	426	4810	415
4	Organic Matter	-	3.08	1.46	2.72	2.38
5	Total Kjeldahl Nitrogen (TKN)	-	1441.16	997.73	942.3	859.15
6	Nitrogen Ammonia	0.1	1.23	0.91	0.89	0.78
7	Total Phosphorus	0.05	134.4	121.6	109.6	97.6
8	Potassium	0.2	2000	3800	2200	800
9	Chloride (Cl-)	5	1611.82	516.6	5083.34	382.29
10	Sulfate (SO4)	5	976.9	648.11	2534.84	269.94
11	Nitrate	0.003	1.97	1.41	1.3	1.31
12	Nitrite	0.005	1.1	0.94	0.87	0.75
13	Oil & Grease	1	20	20	10	15
14	Barium	0.01	<0.01	<0.01	<0.01	<0.01
15	Iron	0.02	23400	27600	18800	12600
16	Manganese	0.05	490	620	460	370
17	Molybdenum	0.5	<0.5	<0.5	<0.5	<0.5
18	Zinc	1	190	50	80	60
19	Arsenic	0.005	<0.005	0.5	<0.005	<0.005
20	Cadmium	0.003	<0.003	<0.003	<0.003	<0.003
21	Cobalt	0.03	10	20	20	20
22	Copper	0.02	40	30	70	30
23	Chromium	0.02	35	50	40	20
24	Nickel	0.02	30	50	30	30
25	Lead	0.01	45	20	40	40
26	Selenium	1	<1.0	<1.0	<1.0	<1.0
27	Silver	0.1	<0.1	<0.1	<0.1	<0.1
28	Mercury	0.001	1.073	1.126	1.474	1.739

Table 4.12: Noise levels at ProjectVicinity

Sr. #	Time	Leq(dB)	Lmax(dB)	Lmin(dB)
1	11:00	60.8	72.8	49.3
2	12:00	62.0	71.9	52.1
3	13:00	63.3	70.5	54.6
4	14:00	63.9	72.4	54.8
5	15:00	64.8	72.6	53.2
6	16:00	62.5	73.7	53.4
7	17:00	63.3	72.9	55.8
8	18:00	64.2	71.6	54.7
9	19:00	63.7	72.3	54.2
10	20:00	67.3	74.2	55.6
11	21:00	64.0	70.1	55.9

5. Stakeholder Consultation

The participation of project stakeholders in project planning, design and implementation is now recognized as an integral part of environmental impact assessment universally. The Pakistan Environmental Protection Act 1997 (Section 12(3)) highlights that "every review of an environmental impact assessment shall be carried out with public participation"
United Nations Conference on Environment and Development (UNCED) in 1992 endorsed the process of stakeholder participation and consultation as one of the key documents of the conference—Agenda 21. Agenda 21 is a comprehensive strategy for global action on sustainable development and deals with issues regarding human interaction with the environment. It emphasizes the role of public participation in environmental decision-making for the achievement of sustainable development.
This section of the report outlines the stakeholder consultation approach adopted for this EIA study, identifies the concerned groups of stakeholders, and describes the consultation process carried out as part of this study.

5.1. Objectives of Stakeholder Consultation

The overall objectives of the public consultation process were as follows:

- To provide information related to proposed project activities to stakeholders;
- To facilitate and maintain dialogue and gain the consent of all stakeholders on carrying out project activities in the area;
- To seek participation of all interested parties and identify stakeholder interests and issues;
- To create solutions for addressing these concerns and integrating them into project design, operations, and management;
- To enhance the project by learning from, and incorporating, the expertise of individuals, professionals, communities and organizations; and
- To encourage transparency and inculcate trust among various stakeholders to promote cooperation and partnership with the communities, local leadership, and NGOs.

5.2. Stakeholder Consultation Process

Stakeholder's consultation is a continuous process that does not stop with the submission or approval of the EIA but continues into the project execution stage. Involving communities and all other stakeholders' values and recognizes the stakeholders right to information about the project, as well as their right to voice their views and concerns. In keeping with this belief, consultations

were conducted in the project area not only to satisfy the legal requirements of the EIA process in Pakistan but also to improve and enhance the social and environmental design of the project. Various steps involved in the consultation include following:

5.2.1. Stakeholders Identification

The identification of stakeholders is important for the sustainability of a development project and helps to evaluate and envisage the role of stakeholders. The influence or impact of stakeholders on the project can be elaborated in the form of a matrix and the mitigation measures are proposed accordingly. People, groups or institutions directly effected by the project and can influence the project outcome are stakeholder of the project. The stakeholders that are likely to be influenced by the project activities or would like to participate in the project will include residents of the surrounding areas. The residents of the area surrounding the project site were identified as stakeholders of the project.

5.2.2. Consultation and Findings

Stakeholder consultation is a two-way flow of information and dialogue between the project proponent and stakeholders, specifically aimed at developing ideas that can help shape project design, resolve conflicts at an early stage assist in implementing solutions and monitor ongoing activities. Various techniques are used world wide to carry out the stakeholder's consultation that includes discussions, meetings and field visits. :
Concerns of the primary stakeholders of the proposed project were solicited and collected in the following manner:

1. A field visit was arranged to contact the communities within 5 Km of the project area with a team of three personnel accompanied with a local person from Azizabad -Jail Road area .
2. The team was completely aware of the processes and environmental issues related to the proposed project.
3. A brief description of the proposed project was provided verbally to the stakeholders and they were asked to express their concerns regarding the proposed project.
4. Concerns, complaints and suggestions were recorded in the written form.

The concerns of stakeholders are included as Table 5.1 of the report.

Table 5.1: Consultation Findings

EIA (Gulshan – Azizabad Project)						
S.No	Interview Date	Name	Age	Occupation	Location	Comments
1.	06-Jul-09	Allah Noor	27	Gate Keeper	Gulshan UC-5, Gulshan-e-Iqbal	Education, health and basic amenities are available in the area. The respondent doesn't know about the project but he feels it's beneficial and will not face any problem from this project.
2.	06-Jul-09	Qurban Shah	50	Security Guard	Gulshan UC-5, Gulshan-e-Iqbal	Education, health and basic amenities are available in the area. The respondent doesn't know about the project but he feels it's beneficial and will not face any problem from this project.
3.	06-Jul-09	Faizan	19	Private Employee	Gulberg UC-1, Ghareebabad	Education, health and basic amenities are available in the area. The respondent doesn't know about the project but he feels it's beneficial and will not face any problem from this project.
4.	06-Jul-09	Asif	32	Carpenter	Gulberg UC-1, Ghareebabad	Education, health and basic amenities are available in the area. The respondent doesn't know about the project but he feels it's beneficial and will not face any problem from this project.
5.	06-Jul-09	Abdul Qayyum	57	Retd. Govt Officer	Gulberg UC-2, F.C. Area	Education, health and basic amenities are available in the area. The respondent doesn't know about the project but he feels it's beneficial and will not face any problem from this project.
6.	06-Jul-09	Alferd John	32	Govt. Officer	Gulberg UC-2, F.C. Area	Education, health and basic amenities are available in the area. The respondent doesn't know about the project but he feels it's beneficial and will not face any problem from this project.
7.	06-Jul-09	Muhammad Arif	22	Student	Jamshed UC-2, Ghausia Colony	Education, health and basic amenities are available in the area. The respondent doesn't know about the project but he feels it's beneficial and will not face any problem from this project.
8.	06-Jul-09	Syed Afzal Shah	60	Retd. Govt Officer	Jamshed UC-2, Ghausia Colony	Education, health and basic amenities are available in the area. The respondent doesn't know about the project but he feels it's beneficial and will not face any problem from this project.

Figure 5.1 : EIA (AZIZABAD & JAIL ROAD PROJECT) RESPONDENTS

ALLAH NOOR 	**QURBAN SHAH** 
FAIZAN 	**ASIF** 
ABDUL QAYYUM 	**ALFERD JOHN** 
MUHAMMAD ARIF 	**SYED AFZAL SHAH** 

6. Environmental Impacts Evaluation and Mitigation Measures

This section of report identifies the significant potential environmental, socio-economic, and health and safety issues which could arise during the complete life cycle of the proposed Project. The appropriate environmental management measures to handle these issues are also discussed in this report.

There are several methods used for identifying the environmental impacts including the Checklists, Thinking through the stages of the project, Matrices, Networks, Overlays and GIS and Computer Expert Systems. These all methodologies are commonly employed to ensure that all significant impacts are identified. In this report, we will use the Checklist method for impact identification and assessment which is the most common method. This method is used to visually express the changes in environmental impacts in terms of their:

- Nature
- Magnitude
- Consequence
- Significance

6.1. Impacts during Construction Phase

The most probable impacts may be expected due to the construction of Underground transmission lines and Grid stations are given below along with their subsequent and practicable mitigation measures:

6.1.1. Dust Emission

Construction activities such as soil excavation and removal may result in deterioration of ambient air quality and be a nuisance to anyone exposed to it. After removal of top soil and vegetation cover, soil does tend to have erosion and dispersive potential which is proportional to environmental risk.

Impact Evaluation

During construction of Grid stations and Underground transmission lines, site preparation activities (excavation work, earth works, storage of exposed piles, truck dumping, hauling and vehicle movement) would be carried out which will remove the vegetation cover from the proposed development areas and expose the soil. As the said activities would be limited to construction phase and will be performed according to KESC Environmental Management Plan (EMP), therefore there

would be insignificant rise in fugitive dust emission and alteration of soil quality from removal of top soil.

The quantity of dust that may generate on a particular day of construction phase will depend on the magnitude and nature of activity and the atmospheric conditions prevailing on that day. Due to the uncertainty in values of these parameters, it is not possible to calculate the quantity from a 'bottom-up' approach, that is, from adding PM_{10} emissions from every activity on each construction site separately.

Mitigation Measures

The following mitigation measures would be implemented in construction areas to control the dust emissions:

1. Water will be sprinkled when there is an obvious dust problem on all exposed surfaces to suppress emission of dust. Frequency of sprinkling will be kept such that the dust remains under control;
2. Dust emission from soil piles and aggregate storage stockpiles will be reduced by appropriate measures. These may include keeping the material wet by sprinkling of water at appropriate frequency, and erecting the windshield walls on three sides of the piles;
3. Vehicular movement will be restricted to a specific time for dumping of supplies and construction material;
4. Workers and drivers should wear dust masks and safety goggles, especially during dry and windy weather conditions to avoid health risk.

6.1.2. Vehicle and Equipment Exhaust Emissions

Exhaust emissions due to combustion process in vehicles and other construction equipments/machines may affect the ambient air quality of the project site and surrounding areas and may be injurious to human health.

Impact Evaluation

The impact of gaseous emission on site workers and in vicinity will be small, as construction vehicles and machineries operations will be limited to construction phase and as soon as construction activities would be ended, this impact will minimize. During construction phase, following would be the sources of gaseous emission:

- Emission from the exhaust of vehicles
- Emission from the construction equipment, power generators and moving plants/equipments.

The pollutants that may generate from the combustion of hydrocarbon may include the CO, CO_2, SOx, NOx and PM_{10}. These pollutants could cause adverse effect to human health if in high concentration and may also cause vegetation damage by clogging the photosynthesis process in plants.

There is no justification to measure the above mentioned gaseous emissions in the absence of information such as engine rating, number of units and operation hours for both continuous and intermittently operating equipment.

Recently Pakistan Environmental Protection Agency has set the draft standards for industrial and vehicular gaseous emission. These standards and current practices of Occupational Health and Safety policy of KESC for gaseous emissions will be used as criteria of compliance during construction phase of project.

Mitigation Measures

The following mitigation measures will be incorporated to prevent any adverse impact on the ambient air quality:

1. All vehicles, generators and other equipment used during the construction will be properly tuned and maintained in good working condition in order to minimize emission of pollutants;
2. Emissions from the machinery and vehicles will be monitored on regular basis to ensure compliance to NEQS.
3. Occupational health, Safety and Environment policy of KESC will be followed.
4. Masks will be provided to construction workers.
5. Standby generators for power supply will be kept away from pathways and will be placed at locations where probabilities of human intervention are limited;
6. The stack height of the generators used, if any, will be at least 3 m above the ground.

6.1.3. Noise Impact

Noise is also one of the aspects which may cause hearing impacts on workers associated with construction activities and communities in immediate vicinity, especially during early morning and night time construction work activities.

Impact Evaluation

It is anticipated during impact evaluation process that activities associated to Underground transmission lines and Hybrid grid stations construction will be for short span of time, therefore noise impact would be very small. During construction phase, noise may emit from the following activities.

- Material loading/offloading vehicles and other transport used by Contractors workers;

- Construction and excavation work such as heavy earth moving equipments, pilling works, welding, cuttings, drilling, grinding etc;
- Back-up power generators for supply of electricity;
- Use of pressure horn.

According to World Bank guidelines, sound level should not exceed 70 dB (A) in the industrial/commercial areas and 55 dB (A) in the residential areas during day time. Similarly it should not exceed 70 dB (A) and 45dB (A) respectively, during night time.

Since mentioned construction activities would be limited to only day time and Environmental management plan for this impact would be followed strictly, therefore noise impact would be within the permissible limits of WHO and Pakistan National Environmental Quality Standard (NEQS).

Mitigation Measures

The following measures will be followed by project management in order to minimize the impact of noise on construction workers and people in close proximity.

1. Manage the specific daytime working hours for movement of earth moving equipment and other machinery for construction;
2. Site labor working in high noise area such as where noise level exceeds 80 dB (A), should wear earplugs.
3. The stationary sources of noise such as concrete mixers, batching plant, Power generators and pumps will be selected and segregated from work area;
4. Use of adequate muffler for all exhaust systems will be mandatory.
5. Blowing of horn by the project related vehicles will be strictly prohibited.
6. Occupational health, safety and environmental procedures and Environmental management plan for proposed project would be followed.

6.1.4. Flora and Fauna

Construction and maintenance activities of Underground transmission lines and Hybrid grid station may destroy the plants and animals or may alter their habitat so that these activities become unsuitable for them. For example, trees used by rare birds for nesting may be cut down or soil erosion may degrade rivers and wetland that required habitat.

Impact Evaluation

In order to find the impacts of proposed project on flora and fauna, field investigations have been undertaken around the proposed grid stations, located in Azizabad and near Jail road, and along the ROW of Underground transmission lines, with specific focus on endangered species of ecosystem.

The endangered ecosystem is not found along the proposed areas of construction, however, some species of flora and fauna of common nature were found.

Construction of proposed project may slightly damage the ecosystem on and around the construction areas of proposed project, however this impact would be minimum as all activities would be limited and strictly carried out on the transmission lines ROW and designated areas of grid stations. Moreover, majority of proposed construction areas are already disturbed by different Urban Planning and Development Agencies in Karachi city for their different projects.

Mitigation Measures

The following mitigation measures would be taken in order to minimize the impact on flora and fauna:

1. Clearing of the vegetation should be carried out on a phased basis to reduce the damage on large area;
2. To continue to provide the airshed functions of purification it is recommended that verges be replanted with trees and shrubs where appropriate. Tree planting also forms shelter belts, windbreaks, noise buffers, erosion control and for aesthetic appeal.
3. Selection of plants for landscaping should consider the habitat suitability, trees of national interest, flowering trees and shrubs.
4. Plant and animal communities immediately outside the project construction areas should not be at risk.
5. Birds will not be affected as they will relocate to adjacent suitable habitats.
6. By using the best practice for vegetation clearing and disposal practices will minimize the environmental risk associated with clearing and disturbance of vegetation communities.
7. Restricting vegetation clearing to only that necessary for safe construction, operation and maintenance of the proposed projects.

6.1.5. Solid Waste

Solid waste may be generated during the construction activities of project. The nature of construction waste could be metal and wooden pieces, pieces of wires, excavated soil, plastic sheets, used oil etc. This waste if not disposed of properly in environmental friendly manner, would cause some nuisance to living environment.

Impact Evaluation

Solid waste during development of proposed project may be generated from the following activities.

- Debris, vegetation, excavated soil, scraps metal from the equipment fabrication;

- Recyclable waste such as cartons, wooden pieces, copper or aluminum wires pieces, iron pieces etc.;
- Waste of domestic nature from the worker activities in construction camps.

Mitigation Measures

1. The above mentioned waste will be handled through the following mitigation measures:
2. Construction activities generate considerable waste and provision must be made for suitable separation and storage of waste in designated and labeled areas on the camp site and near each construction area;
3. Collection of waste by certified third party contractors and disposal at the Landfill sites;
4. Any hazardous waste should be separated and stored in areas clearly designated and labeled, and disposal in environmental friendly manner.
5. Workers should be trained on how to dispose of food and drink containers emphasizing the need to protect the areas in vicinity of projects.
6. Construction camps along the ROW of proposed underground cables and hybrid grid stations must be adequately equipped with portable toilets.

6.1.6. Traffic Impact

Traffic flow in the vicinity of project slightly increases during different activities of project construction.

Impact Evaluation

The transportation of trucks for raw materials and mobilization and demobilization of the earth works equipment are required during construction phase of proposed project. This activity has potential to directly impact the traffic flow along the right of way of underground transmission lines and in the vicinity of grid stations. This increase in traffic may congest the flow of traffic on Karachi University and Shah Suleman roads, and may cause some accidental injuries and deteriorate the air quality of ambient air.

Mitigation Measures

The following mitigation measures will be adopted in order to minimize the traffic impact:

1. Adequate and appropriate road signs should be erected to warn road users along the ROW of transmission lines and around the construction sites of grid stations.
2. Raw materials for construction work should be adequately covered within the trucks to prevent any escaping into the air and along the roadway;

3. The movement of equipment (trucks) during the construction of the proposed project should be limited to the working hours, 8:00 am - 4:30 pm per day;
4. Heavy equipment should be transported early morning (1 am – 5 am);
5. Traffic management plan should be developed and implemented during the construction phase;
6. Vehicles will be maintained regularly to reduce the exhaust emissions;
7. Any complain launched by community member should be responded and appropriate action will be taken to avoid it in future.

6.1.7. Water Quality

Clearing of vegetation and the subsequent exposed soil during construction activities have greatest potential risk to water quality.

Impact Evaluation

The proposed Underground transmission lines construction activities may slightly affect the water quality of Liyari River. There will be slight offsite movement of soil during excavation and vegetation removal activities of transmission lines, which will be constructed along the Liyari River. Further any crossing of drainage lines by machinery and vehicles to access construction areas may also deteriorate the quality of water.

Construction activities of Hybrid grid station will not affect the water quality in the vicinity as these activities will be limited to designated areas of grid stations and will be for small period of time.

Mitigation Measures

1. There will be minimal clearing of riparian verges for the underground transmission lines, and any crossing of drainage lines by machinery/vehicles to access construction areas will be in accordance with KESC EMP to ensure that water quality is not compromised.
2. There will be no excavation or fill placement activities will be carried in any waterway;
3. KESC will use the backfill, resurface and contouring methods for gully erosion, to provide the erosion resistance and reduce overland flow velocity;
4. Different strategies will be utilized to minimize the release of sediment to waters. These strategies shall include but not limited to the construction of diversion banks/drains, where necessary, along the elevated perimeter of the works to prevent uncontaminated storm water from contracting areas of disturbance and installation of temporary sediment fences below areas of earthworks.

6.1.8. Archaeological and Historical Sites

No archaeological and historical sites were found during survey of proposed project, located in Gulshan -e- Iqbal, Azizabad and Jail Road, and their close proximity.

Mitigation Measures:

No mitigation is required.

6.1.9. Health and Safety Impact

Construction of proposed project will involve the several construction workers which will increase the possibility of accidental injury. There may be either minor or major accidents due to different activities of construction phase.

Mitigation Measures:

The following measures will be adopted in order to minimize the above impact:

1. A lead person by the project contractor should be appointed to be responsible for emergencies occurring on the ROW and grid stations construction sites. This person should be clearly identified to the construction workers.
2. Make prior arrangements with the health care facilities such as a Health Centre in proximity, a private doctor or Hospital to accommodate any eventualities.
3. Emergency response plan should be prepared and implemented during entire phase of construction.

6.1.10. Employment

During this phase, an average of approximately 80-150 persons will be employed on contract basis which will put the positive impact on the socio-economical status of Karachi city.

6.2. Impacts during Operational and Maintenance Phase

The most focusable area in the impact assessment process of proposed project is operation and maintenance activities of Underground transmission lines and Hybrid grid station as impacts may generate during these phases may have long term and continuous affects. During scoping exercise, following probable impacts have been evaluated with their appropriate mitigation measures:

6.2.1. Electric and Magnetic Fields

Electromagnetic field (EMF) is the term used to describe electric emanations and the resultant magnetic fields caused by the movement of electrical current. The field is at its maximum closet to the conductor and the intensity drops away from the conductor. EMF is both a natural phenomena and a consequence of anthropogenic sources (e.g. electrical generation, transmission, distribution and use of electrical equipment). According to some research that EMF can have number of adverse health effects. These include but are not limited to childhood leukemia, Alzheimer's adult leukemia, breast cancer, neurodegenerative diseases, miscarriage and clinical depression.

Impact Evaluation

In Hybrid grid stations, the impact of electric field will be blocked by most of the objects around them such as walls, trees and distance from the living object. Similarly, underground transmission lines will produce the low magnetic fields as all conductors will be placed close together in trench. This short distance between the conductors causes the magnetic fields created by the each of three conductors to cancel out some of the other's fields. Hence it will result in reduce magnetic fields.

Mitigation Measures

1. Adopt the principles of careful avoidance to ensure exposure levels are well below of generally accepted standards.
2. Design the transmission line to ensure that electric and magnetic fields are minimised, given the voltage and load requirements.
3. Design line accordingly as not to increase background EMF at sensitive receptors.
4. Depth of trenches and distance of grid stations from living environment will provide a reduction in EMF exposure;
5. Increasing easement (ROW) width will provide a greater buffer distance
6. Liaise with nearby residents and undertake EMF monitoring with them. Further, maintain the complaints register and supply up to date information to the community upon request regarding EMF.

6.2.2. Gaseous Emission

The main air impacts during the operational phase of any project could be the gaseous emissions from the employee's vehicular exhaust, distant industrial facilities, project's different operations and standby power generators.

Impact Evaluation

There will be no source of atmospheric pollution from the proposed underground cables and hybrid grid stations except emissions from the KESC employee's vehicles and vehicles will b used for project maintenance. These emissions in contrast with the emissions emit by the vehicular traffic on road of Karachi city will be very low. It will also well dissipate in the open atmosphere and there will be no cumulative effect from the project.

Mitigation Measures

1. All vehicles, power generators and other equipment used during the maintenance work will be properly tuned and maintained in good working condition in order to minimize emission of pollutants;
2. Emissions from the machinery and vehicles will be monitored on regular basis to ensure compliance to NEQS.
3. Masks will be provided to maintenance workers.

6.2.3. Noise

Pumps, high speed compressor, fans, back up power generators, transport vehicles and maintenance activities could be the sources of noise emission during operational phase in any project area.

Impact Evaluation

Some maintenance activities during operational phase of project could produce noise emissions, however, this impact would be minimum and within the permissible limits of WHO and NEQS, as maintenance activities would be carried out for short period of time. During maintenance and operational phase, noise may emit from the following activities:

- Maintenance vehicles and other transport used by KESC workers;
- Excavation work such as cuttings, drilling etc; for maintenance of underground cables;
- Back-up power generators for supply of electricity;
- Use of pressure horn

Mitigation Measures

The recommended measures for reducing the impact of noise are given below:

1. All noise complains should be recorded and investigated;
2. Ensure vehicles and other maintenance equipments comply the NEQS and other international standards for noise and are maintained to meet standards;
3. If possible, all noise generating equipments are locked up by acoustic barrier to minimize the extent of impact area;
4. All operational or maintenance staff should wear mufflers/earplugs while operating or working nearby high noise emission sources;
5. Compressor should be regularly tested and monitor for any mechanical fault, as mechanically unfit or un-maintained compressors generally cause high noise;
6. Back-up power generators should be maintained regularly as they will use to facilitate the maintenance work of underground transmission lines.

6.2.4. Waste Impact

The operation and maintenance activities of proposed project may generate some hazardous and non hazardous waste and if not disposed of properly could have adverse impacts on the environment.

Impact Evaluation

The operational phase of proposed project will generate some waste which if not disposed of properly could have impacts on surrounding. These wastes will include the wires, transformer oil, wild vegetation, excavated soil and domestic waste of maintenance workers.

Mitigation Measures

The mitigation measures for above impact could be:

1. Ensure that all solid waste collected during operational or maintenance work is disposed of in an appropriate disposal site in the locality;
2. Municipal waste should also be collected by third party contractor through carts/dump trucks and then disposed of in landfill site.

6.2.5. Property Values and Aesthetics

Post construction issues such as aesthetics and property values are usually less of an issue for underground lines as they are not visible after construction and have less impact on property values and aesthetics. However, the land on which the grid station to be constructed and land surrounded by grid station is not valuable due the high area covered by the sub station and the height of the proposed

infrastructure in and around of substation. In the case of proposed project, this impact would not consider significantly as the current land uses in Karachi city generally do not rely on the visual and aesthetic environments.

Mitigation Measures

The mitigation measures could be used to reduce the potential visual impacts is following:

1. The construction area must be rehabilitated and re-vegetated immediately after the completion of construction activities. Progressive reinstatement should be applied.
2. To reduce the visual intrusion, the colour selected for roofing and walls must be of a nature, which will help to visually break up the surfaces of the buildings. Matt finishes must be used. Importantly, the roofs of buildings must not reflect or deflect sunlight or artificial light during the day or night by their colour or texture.

6.2.6. Emergency Situations

It is possible that emergencies with the electrical equipment may occur at the grid station, for example transformers can become overloaded and blow up and switchgear equipment can explode. Each of these kinds of incidents can have knock on effects and can place humans, animals and the natural environment at risk. In case of fire, air pollution and oil spillage from the transformer are the largest impact.

Mitigation Measures

The proposed mitigation measures for said impact are following:

1. A repair on live grid station is possible as the station is fitted with busbars via which current can be redirected, thereby minimizing interruptions to the transmission network.
2. In the case of an explosion, unless on site within the grid station, the risk of human or animal injury is small. Apart from the security fence, no additional mitigation measures are required.
3. Oil containing equipment in the grid station should be fitted within a bunded oil sump of sufficient size to capture all oil within a particular piece of equipment.

6.3. Summary of Impacts during Construction, Operation and Maintenance Phases of Project

According to impacts discussed in previous sections, the proposed project has both positive and negative impacts. Summary of these impacts in terms of their nature, magnitude, consequence and significance are presented in **Table 6.1** and **Table 6.2**.

Table 6.1: Summary of Environmental Impacts during Construction Phase

Impacts	Nature	Magnitude	Consequences	Significance
Dust emission	Negative	On-site and in vicinity	Air quality and health effects	Slight
Vehicle and equipment exhaust emission	Negative	On-site and in vicinity	Air quality and health effects	Slight
Noise impact	Negative	On-site and in vicinity	Health effects to workers	Slight
Flora and Fauna	Negative	Onsite and in vicinity	Effect on flora and fauna	Slight
Solid Waste	Negative	On-site	Effects on workers and micro-environment	Slight
Traffic impact	Negative	On-site and close proximity	Road accidents and wastage of fuel	Slight
Water quality	Negative	Off-site	Water bodies contamination	Slight
Archaeological and Historical sites	None	None	None	None
Health and Safety Impact	Negative	On-site and in vicinity	Effects on workers and property	Significant
Employment	Positive	Local	Socio-economic benefits	Significant

Table 6.2: Summary of Environmental Impacts during Operational and Maintenance Phase

Impacts	Nature	Magnitude	Consequences	Significance
Electrical and magnetic field	Negative	Onsite and close vicinity	Health problems to workers and people live in vicinity	Slight
Gaseous emission	Negative	On-site and in vicinity	Air quality and health effects	Slight
Noise	Negative	On-site and in vicinity	Health effects to workers	Slight
Waste impact	Negative	On-site	Nuisance to micro-environment and health problems to workers	Slight
Property values and Aesthetics	Negative	Close vicinity	Impact on property values in vicinity	Slight
Emergency situations	Negative	On-site and vicinity	Damage to health and property	Slight

7. Environmental Management Plan

This section provides an Environmental Management Plan (EMP) for managing and monitoring the environment related issues and describes the institutional framework for environmental management and resource allocations to be carried out by the Karachi Electric Supply Company Limited for mitigating the negative impacts of the proposed project.

7.1. Objectives of Environmental Management Plan

The Environmental Management Plan will address the upcoming adverse environmental impacts of the proposed project, enhance the project's overall benefits and introduce the standards of good environmental practice. The primary objectives of the EMP are to provide:

- A framework to mitigate any potential environmental impacts of the construction, maintenance or operation phase of the Project, through environmentally aware planning and design strategies;
- Define the responsibilities of the Project proponents in accordance with the three phases (construction, operation and maintenance);
- Facilitate the implementation of the mitigation measures by providing the technical details of each Project impact, and proposing an implementation schedule of the proposed mitigation measures;
- Define a monitoring mechanism and identify monitoring parameters to ensure that all proposed mitigation measures are completely and effectively implemented;
- Identify training requirements at various levels and provide a plan for the implementation of training sessions;
- Identify the resources required to implement the EMP and outline corresponding financing arrangements.

7.2. Role of Functionaries for Implementation of EMP

This sub section describes the role of functionaries for the implementation of EMP. In these functionaries, the executing agency of the Project would be KESC. In KESC, the environmental performance is supervised by Top management while the daily management is performed under the direction of GM Corporate Safety. Under Top management, environmental management during different phases of proposed project would be performed by contractors and KESC project implementation team will monitor the performance of the project contractor. The EMP will be made a part of the construction activities and the contractor will ensure that all activities during

construction stage are in compliance with the EMP and NEQS. The brief Organizational structure for Environmental management is given in **Figure 7.1**.

7.2.1. KESC Top Management

Top management of KESC would perform the following role and responsibilities:

- To react the issues and consider the solutions proposed by the Corporate Safety Department;
- To cooperate and consult with relevant environmental agency in order to perform in better way;
- To evaluate the progress of development and implementation of this management plan;
- To approve any change in decision making and authorities in consultation with GM (Corporate Safety), if appropriate.

7.2.2. GM (Corporate Safety)

In management plan, HSE team role is always considered vital. They make an EMP successful. Hereunder some roles and responsibilities of HSE team are provided:

- To improve the coordination and exchange of information between top management, employees, contractors etc.;
- To identify issues and where possible propose solutions for inclusion in the management plan review process;
- To ensure that the points of views of staff, contractors HSE officers/engineers are considered and placed in the EMP accordingly;
- To review EMP every year, tracking issues and change the EMP accordingly with the solutions and suggestions;
- To contribute towards the actions to deliver the management plan and ensure its continued development;
- To monitor the progress of development and implementation of this management plan.

7.2.3. HSE Officer/Engineer

HSE officer or engineer always works under the oversight role of corporate safety. The role of this position in any environmental management plan could be following:

- To provide professional guidance on questions relating to the environment management and issues raised by contractors/relevant personals;
- To integrate the aims and objectives of different users within an agreed plan;
- To maintain a balanced, holistic approach to the solution of concerned issues in accordance with the compliance to the legislative requirements;
- To progress the EMP process through development towards implementation.

7.2.4. Contractor

The contractor is responsible for following points:

- To conduct their activities in accordance with relevant legislative requirements of the country, project EMP and any pertinent licences or agreements;
- To exercise a duty of environmental care and notifying the GM (Corporate Safety) or Project Construction Manager of any environmental incident;
- To nominate a site HSE officer with the authority to ensure that the EMP is implemented with respect to any activity for which they are entirely responsible;
- To inform the project construction manager immediately of any complaints received in relation to the construction activities from Statutory Authorities or other stakeholders and local residents.
- To ensure that all site staff have attended an Environmental induction.

Note: The Contractor is not directly responsible for complaint resolution and should direct any complaints or inquiries from stakeholders (government or stakeholders) to the Project Manager. However, the Contractor shall comply with the reasonable directions of the Project Manager or HSE Manager to resolve any complaints.

7.3. Environmental Impacts Management

The environmental impacts management is a key component of the EMP. It ensures that the project is designed, constructed, implemented and maintained in the manner described in the EIA report. The impacts management for the proposed project activities in Azizabad & Jail road grid station is presented in **Table 7.1 and Table 7.2.** The contents of this table would be following:

Impacts: Identified impacts that may occur if not managed appropriately;

Mitigation Measures: Actions that will be implemented to achieve the objective and performance criteria;

Monitoring Frequency: Frequency for monitoring mitigation measures

Responsibility: Responsibility for undertaking control measures.

7.4. Environmental Training

Environmental impacts from the proposed Project would be managed by qualified and experienced personnel. All staff would receive the environmental induction training prior to commencement of work on Grid station. This training program will help in ensuring that the requirements of the EIA and EMP are clearly understood and followed by all project personnel throughout all phases of project. In induction training plan, Pakistan environmental regulations, EMP and other environmental duties will be focussed.

All level of staff, ranging from the top management and supervisory to the skilled/unskilled categories will be covered in this training plan. The construction/commissioning staff will be provided induction training through their managers. The tentative environmental training program, which will be finalized before the commencement of project is provided in **Table 7.3**.

7.5. Environmental Monitoring

Monitoring of all project activities will be undertaken to determine the impact on the environment as a consequence of construction, operation and maintenance of the proposed project. Therefore, self monitoring techniques will be adopted to carry out the monitoring as per EPA rules and regulations. General monitoring will be conducted weekly throughout the construction stage; inspections will be conducted annually during the operation and maintenance phase.

During monitoring activities, HSE officer or engineer from the contractor side will coordinate with the GM (Corporate Safety), who will be responsible for monitoring procedures. HSE team will identified the monitoring techniques and the frequency of selected parameters, monitoring will be conducted according to monitoring plan, given in **Table 7.4**. Corporate Safety will keep the record of all non-compliances observed during monitoring and will report these along with the actions to higher management for further action.

Any recommendations relating to construction activities during monitoring process would be considered by the contractor.

Staff will be responsible for undertaking the environmental monitoring, will maintain all monitoring and non compliance records and be responsible for scheduling follow up inspections to ensure that corrective actions are being implemented for any non-compliance detected.

7.6. Reporting

The monitoring department would present its data and findings in the form of formal report to the top management at a frequency as deemed fit by the management. The purpose of reporting would be essentially to provide necessary information enable effective decision making by the management. The monitoring report presented to the project management and may take any formal format, however, in terms of content, it must contain the following:

- Summary of the environmental impacts, mitigation measures and monitoring record;
- All incidents and their remedial measures recorded to ensure that the emergency situations are responded in accordance to the Emergency response plan.

Based on this information, the project management and local environmental agency would take decisions for performance improvement. In every subsequent monitoring report, the performance

and efficacy of measures undertaken by the management in the previous review process would also be evaluated.

Figure 7.1: The Organizational Structure of Environmental Management

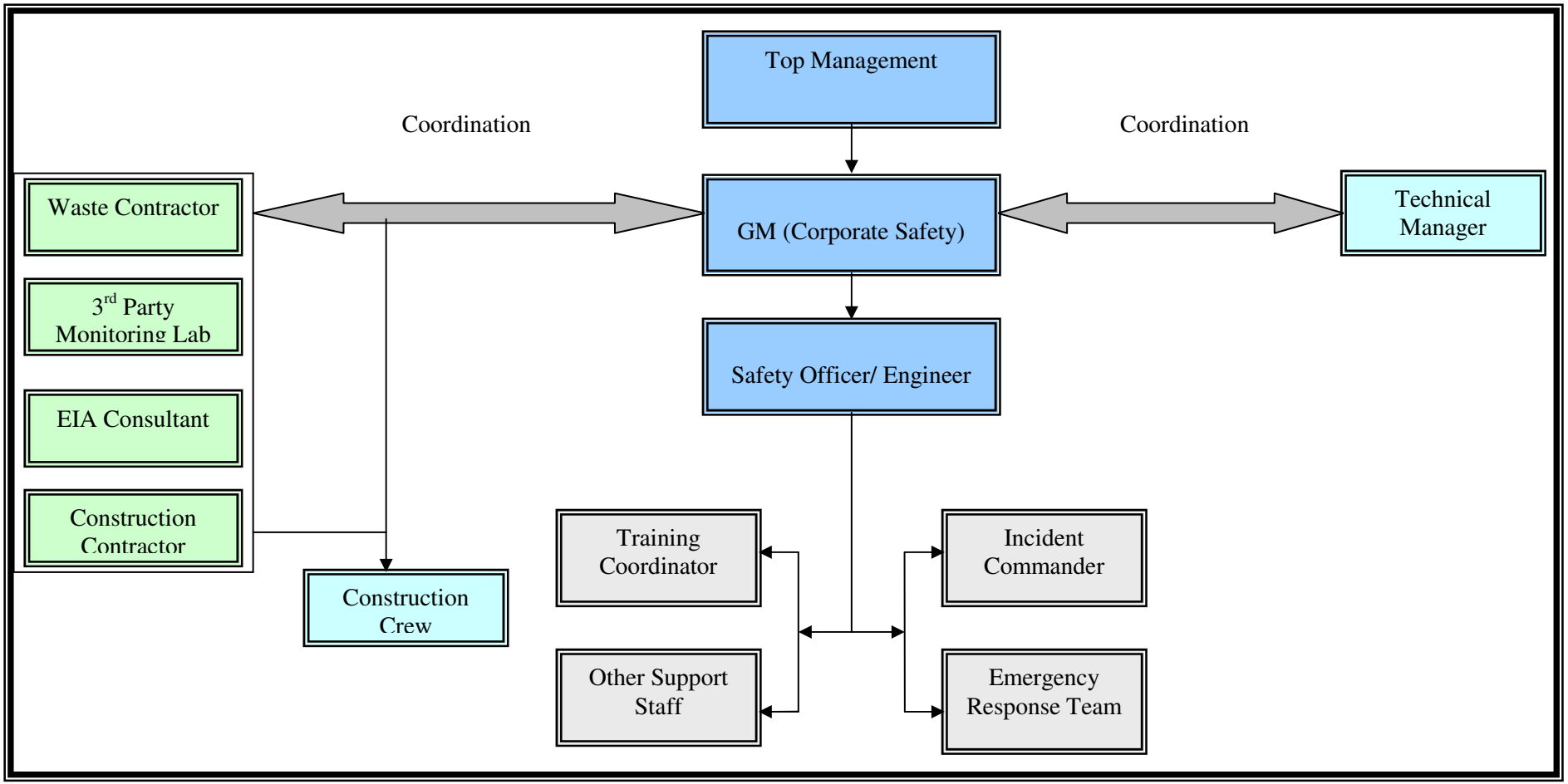


Table 7.1: Environmental Management Plan for Construction and Commissioning Phase

Area	Aspect	Mitigation Measures	Monitoring Frequency	Responsibility
Air Quality	Dust and Gaseous Emission	Water will be sprinkled daily when there is an obvious dust problem on all exposed surfaces to suppress emission of dust. Frequency of sprinkling will be kept such that the dust remains under control.	Daily and as per requirements	Contractor HSE Officer
		Vehicular movement will be restricted to a specific time for dumping of supplies and construction material.	Daily	Contractor HSE Officer
		Dust emission from soil piles and aggregate storage stockpiles will be reduced by appropriate measures. These may include keeping the material wet by sprinkling of water at appropriate frequency, and erecting the windshield walls on three sides of the piles.	Daily and during windy conditions	Contractor HSE Officer
		All vehicles, generators and other equipment used during the construction will be properly tuned and maintained in good working condition in order to minimize the emission of pollutants;	Weekly	Contractor HSE Officer
		Site workers and drivers should wear dust masks and safety goggles, especially during dry and windy weather conditions to avoid health risk.	Weekly	Contractor HSE Officer
		Emissions from the machinery and vehicles will be monitored on regular basis to ensure compliance to NEQS.	Daily	Contractor HSE Officer
		Standby generators for power supply will be kept away from pathways and will be placed at locations where probabilities of human intervention are limited;	At time of installation	Contractor HSE Officer
		The stack height of the generators used, if any, will be at least 3 m above the ground.	At time of installation	Contractor HSE Officer

Table 7.1: Environmental Management Plan for Construction and Commissioning Phase (Contd.)

Area	Aspect	Mitigation Measures	Monitoring Frequency	Responsibility
Flora and Fauna	Damage to Flora and Fauna in Project Area	Plant and trees cleaning strategies/techniques should be undertaken in consultation with some Botanist.	At the time of trees cleaning	Contractor HSE Officer
		Only selected species will be removed where possible in lieu of broad scale cleaning within the ROW of Underground transmission line.	At the time of vegetation removal	Contractor HSE Officer
		In sensitive areas of animal habitat, vegetation will be cleaned by hand.	At the time of vegetation removal	Contractor HSE Officer
		Vegetation clearing in non sensitive areas may be cleared using a bulldozer.	At the time of vegetation removal	Contractor HSE Officer
		All vegetation should be cleared on a phased basis in order to reduce the damage on large portion of vegetation	At the time of vegetation removal	Contractor HSE Officer
		Verge will be replanted with trees, shrubs etc. for continuation of airshed function of purification.	After construction	Contractor HSE Officer
		Selection of plants for landscaping should consider the habitat suitability.	After Construction	Contractor HSE Officer
		By using the best practice for vegetation clearing and disposal practices will minimize the environmental risk associated with clearing and disturbance of vegetation communities.	During construction	Contractor HSE Officer
		Birds will not be affected as they will relocate to adjacent suitable habitats.	During Construction	Contractor HSE Officer

Table 7.1: Environmental Management Plan for Construction and Commissioning Phase (Contd.)

Area	Aspect	Mitigation Measures	Monitoring Frequency	Responsibility
Noise	Disturbance to Workers and People Live in Vicinity	Use equipment that has low noise emissions or properly fitted with noise reduction devices	Weekly	Contractor HSE Officer
		Manage the specific daytime working hours for movement of earth moving equipment and other machinery for construction;	Daily	Contractor HSE Officer
		Labor working in high noise area such as where noise level exceeds 90 dB (A), should wear earplugs.	Daily	Contractor HSE Officer
		Stationary sources of noise such as concrete mixers, batching plant, and pumps will be identified and segregated from work area	At the start and during construction activities	Contractor HSE Officer
		Use of adequate muffler for all exhaust systems will be mandatory	Weekly	Contractor HSE Officer
		Blowing of horn by the project related vehicles will be strictly prohibited	Daily	Contractor HSE Officer
		Occupational health, safety and environmental policy of KESC and Environmental management plan for proposed project would be followed	Daily	Contractor HSE Officer
		WHO, World Bank and National Environmental Quality Standards pertaining to noise should be followed during construction work	During construction activities	Contractor HSE Officer

Table 7.1: Environmental Management Plan for Construction and Commissioning Phase (Contd.)

Area	Aspect	Mitigation Measures	Monitoring Frequency	Responsibility
Solid Waste	Solid Waste Generation and Disposal	All construction waste would be segregated and stored in designated and labeled areas on the construction site.	Weekly	Contractor HSE Officer
		Waste will be collected by certified third party contractors and disposed of at the landfill site.	Weekly	Contractor HSE Officer
		Any hazardous waste should be separated and stored in areas clearly designated and labeled, and disposal in environmental friendly manner.	Weekly	Contractor HSE Officer
		Workers should be trained on how to dispose of food and drink containers emphasizing the need to protect the areas in vicinity of projects.	Weekly	Contractor HSE Officer
		Construction camps along the ROW of proposed transmission lines and hybrid grid stations areas must be adequately equipped with portable toilets.	At the start of construction activities	Contractor HSE Officer
Water Quality	Impact on Water Quality	No excavation or fill placement activities would be carried in any waterway;	Daily	Contractor HSE Officer
		KESC will use the backfill, resurface and contouring methods for gully erosion, to provide the erosion resistance and reduce overland flow velocity;	Daily	Contractor HSE Officer
		Diversion banks/drains along the perimeter of the works and temporary sediment fences below areas of earthworks will utilize to minimize the release of sediment to waters.	Weekly	Contractor HSE Officer

Table 7.1: Environmental Management Plan for Construction and Commissioning Phase (Contd.)

Area	Aspect	Mitigation Measures	Monitoring Frequency	Responsibility
Traffic	Traffic Management Problems	Adequate and appropriate road signs should be erected to warn road users around construction areas. For example, reduced speed near the entrance roads.	Weekly	Contractor / Corporate Safety
		Raw materials for construction work should be adequately covered within the trucks to prevent any escaping into the air and along the roadway.	Daily	Contractor / Corporate Safety
		The movement of equipment (trucks) during the construction of the proposed projects should be limited to the working hours, 8:00 am - 4:30 pm per day.	Daily	Contractor / Corporate Safety
		Heavy equipment should be transported early morning (1 am – 5 am).	Daily	Contractor / Corporate Safety
		Traffic management plan should be developed and implemented during construction phase;	Weekly	Corporate Safety
		Vehicles will be maintained regularly to reduce exhaust emissions	Weekly	Contractor
		Any complain launched by community member should be responded and appropriate action will be taken to avoid it in future.	Daily	Corporate Safety

Table 7.1: Environmental Management Plan for Construction and Commissioning Phase (Contd.)

Area	Aspect	Mitigation Measures	Monitoring Frequency	Responsibility
Archaeological and Historical Sites	Impact on any Historical Sites	No archaeological and historical sites were found during grid stations and underground transmission line ROW survey, therefore no mitigation is required.	N/A	N/A
Employment	Socio-economic Impact	This impact is positive; therefore no mitigation is required for this impact.	N/A	N/A
Health & Safety Impact	Health and Safety Issues	A lead person should be identified and appointed to be responsible for emergencies occurring in the construction site. He/She will also be introduced to construction workers.	Weekly	Contractor HSE Officer
		Make prior arrangements with the health care facilities such as Health Centre in proximity, a private doctor or Hospital to accommodate any eventualities.	N/A	Contractor HSE Officer
		Emergency response plan should be prepared and implemented during entire phase of construction.	Monthly	Contractor HSE Officer

Table 7.2: Environmental Management Plan for Operation Phase

Area	Aspect	Mitigation Measures	Monitoring Frequency	Responsibility
Electromagnetic Field	Impact on Living Environment	Adopt the principles of careful avoidance to ensure exposure levels are well below of generally accepted standards	Quarterly	Engineering Division (KESC)
		Design the Grid stations in such a way to ensure that EMFs are minimized by adjusting the voltage and load requirements.	At the time of planning and during operations	Engineering Division (KESC)
		Design the Transmission line accordingly as not to increase background EMF at sensitive receptors	At the time of planning and during operations	Engineering Division (KESC)/ Project Manager
		Depth of trenches and distance of grid stations from living environment will provide a reduction in EMF exposure	At the time of construction	Engineering Division (KESC)
		Increasing easement (ROW) width will provide a greater buffer distance.	At the time of construction	Engineering Division (KESC)
		Liaise with nearby residents and undertake EMF monitoring with them. Further, maintain the complaints register and supply up to date information to the community upon request regarding EMF.	Quarterly	Engineering Division (KESC)

Table 7.2: Environmental Management Plan for Operation Phase (Contd.)

Area	Aspect	Mitigation Measures	Monitoring Frequency	Responsibility
Gaseous Emission	Impact on Ambient Air	All vehicles, power generators and other equipment used during the maintenance work will be properly tuned and maintained in good working condition in order to minimize emission of pollutants;	Quarterly	Fleet management / G&T (KESC)
		Masks will be provided to maintenance workers.	At the time of maintenance	Transmission Division(KESC)
Noise	Disturbance to Workers and People Live in Vicinity	All noise complains should be recorded and investigated;	Monthly	Transmission Division(KESC)
		It will make sure that all vehicles and other maintenance equipments should comply the NEQS and other international standards for noise.	Quarterly	Transmission Division(KESC)
		Restrict noise generating activities to within the hours of 7:30 pm to 06:30 am Monday to Saturday	Monthly	Transmission Division(KESC)
		If possible, all noise generating equipments are lock ed up by acoustic barrier to minimize the extent of impact area	At the time of installation	Fleet management / G&T (KESC)
		All operational or maintenance staff should wear mufflers/earplugs while operating or working nearby high noise emission sources	Monthly	Transmission Division(KESC)

Table 7.2: Environmental Management Plan for Operation Phase (Contd.)

Area	Aspect	Mitigation Measures	Monitoring Frequency	Responsibility
Waste Impact	Waste Generation and Disposal	Ensure that all solid waste collected during operational or maintenance work is disposed of in an appropriate disposal site in the locality;	Quarterly	Transmission Division (KESC)
		If sewerage waste transportation system is not exist in the locality then all municipal waste should be collected by third party contractor and then disposed of in Landfill site	Quarterly	Transmission Division (KESC)
Property Values and Aesthetics	Impact on Property Values	The construction area must be rehabilitated and re-vegetated immediately after the completion of construction activities. Progressive reinstatement should be applied.	After completion of construction activities	Transmission Division (KESC)
		To reduce the visual intrusion, the colour selected for roofing and walls must be of a nature, which will help to visually break up the surfaces of the buildings. Matt finishes must be used. Importantly, the roofs of buildings must not reflect or deflect sunlight or artificial light during the day or night by their colour or texture.	Right after construction activities	Transmission Division (KESC)

Table 7.2: Environmental Management Plan for Operation Phase (Contd.)

Area	Aspect	Mitigation Measures	Monitoring Frequency	Responsibility
Emergency Situation	Health Safety and Environmental Issues	Due to presence of busbars, grid station would be secured as busbar will help in redirecting the current at the time of live Grid station repairing and this is how interruptions to transmission network would minimum.	Quarterly	Project Engineer
		In the case of an explosion, unless on site within the grid station, the risk of human or animal injury is small. Apart from the security fence, no additional mitigation measures are required.	N/A	N/A
		Oil containing equipment in the sub-station should be fitted within a bunded oil sump of sufficient size to capture all oil within a particular piece of equipment.	Quarterly	Project Engineer

Table 7.3: Training Plan

Staff	Responsibility	Areas	Schedule
Project staff from KESC and Contractor	Contractor/Project management	▪ Findings of EIA ▪ Mitigation Measures ▪ EMP ▪ Waste disposal procedures ▪ Camp Operation ▪ Social and Cultural values of the Project areas	Prior to start of Project activities
KESC Staff	Safety Officer/Engineer	▪ Environmental sensitivity of the Project area ▪ Flora and Fauna of the area ▪ Mitigation Measures ▪ Emergency Response Plan ▪ Community Issues ▪ Social and Cultural Values	Prior to start of the Project activities
Drivers	Fleet Management (KESC)	▪ Road safety ▪ Road restrictions ▪ Defensive driving	Before and during field operations
Camp Staff	Safety Officer/Engineer	▪ Waste Disposal ▪ Housekeeping	Before and during field operations

Table 7.4: Monitoring Plan for Key Environmental Impacts

Monitoring Parameters	Monitoring Locations	Frequency	Monitoring Method/Equipment	Project Phase	Responsibilities
Dust	▪ Construction Site ▪ Contractor Camp Site	Daily	Visually/Particulate Matter Measurement	Construction	Contractor
Noise	▪ Ambient Air ▪ Construction Site ▪ At Source ▪ Vehicle/Equipment	Monthly	Noise Meter	Construction	Contractor HSE Officer
Vehicular Emissions (Smoke, CO)	Vehicles at the Construction Site	Monthly	Gas Analyzer	Construction	Contractor HSE Officer
Solid Waste (Domestic waste, sludge from treatment plant)	Collection, Handling & Disposal Areas	Monthly	Visually	Construction & Operation	Contractor /HSE Officer
Electromagnetic Field	Near Electrical equipments and at boundaries of Grid station	Quarterly	EMF Meter	Operation	Grid & Transmission Dept. (KESC)
Occupational Health & Safety	▪ Installation of different units of treatment plant ▪ Loading & offloading of goods ▪ Treatment Plant Operations	As per requirement during construction and Monthly during Operation phase	Visual observation and daily accident records checking	Construction & Operation	Transmission Division

8. Conclusion

This Environmental impact assessment study was carried out to identify the environmental and socioeconomic soundness of the installation of two 132 KV Hybrid Grid Stations, located in Azizabad and Jail road with associated underground transmission lines. This study was done in keeping the views of Pakistan international legislation and guidelines.

During study, environmental and socioeconomic baseline information was collected from variety of sources including visit of project area, previous environmental reports and studies conducted in the area, published literature and field surveys. All these information were used to compose the profile of the physical and biological environment of the area which is likely to be affected by the proposed project activities. Information for the project description was provided by the project management and their contractor.

On the basis of baseline and project description, potential environmental impacts were identified on the project's physical, biological and socioeconomic environments. The potential impacts during the construction phase of the proposed project were included the dust and gaseous emissions, noise, waste, water quality, flora and fauna, health and safety and socioeconomic benefits. Similarly, the key environmental and social issues during the operation phase were included the Electromagnetic field, gaseous emissions, waste, soil and ground water quality deterioration, aesthetic and property values and emergency situation.

After assessing above potential impacts, it has been concluded that if all project activities are carried out as described in this report and suggested mitigation measures and Environmental management plan are implemented, the project will not have the significant impact on the project area's physical, biological and socioeconomic environments. The project will also comply with all the statutory requirements pertaining to project and NEQS.

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