Initial Environmental Examination

December 2014

PAK: Pakistan Power Transmission Enhancement Program Tranche-IV (Augmentation)

Prepared by Environment and Social Impact Cell (ESIC), NTDC for the Asian Development Bank.

TABLE OF CONTENTS

LIST OF ABBREVIATIONS

ADB	Asian Development Bank
COI	Corridor of Influence
CCMR	Community Complaints Management Register
CSP	Country Strategy Program
CSC	Construction Supervision Consultants
DO	District Officer
DDO	Deputy District Office
DoF	Department of Forests
DFO	Divisional Forest Officer
DIZ	Direct Impact Zone
EA	Environmental Assessment
EARF	Environment Assessment and Review Framework
EIA	Environment Impact Assessment
EMP	Environmental Management Plan
EPA	Environmental Protection Agency
FESCO	Faisalabad Electric Supply Company
GDP	Gross Domestic Product
GOP	Government of Pakistan
IEE	Initial Environmental Examination
KPK	Khyber Pakhtunkhwa
LAO	Land Acquisition Officer
LARP	Land Acquisition and Resettlement Plan
Leq	equivalent sound pressure level
MC	Management Consultants
MMF	Multi-tranche Financing Facility
MPL	Maximum Permissible Level
NEQS	National Environmental Quality Standards

NGO	Non-Governmental Organization
NTDC	National Transmission Line and Despatch Company
PC	Public Consultation
PEPAct	Pakistan Environment Protection Act 1997
PPTA	Project Preparation and Technical Assistance
REA	Rapid Environmental Assessment
SDO	Sub Divisional Officer
SIA	Social Impact Assessment
SP	Subproject
SR	Sensitive Receiver
TOR	Terms of Reference
WAPDA	Water and Power Development Authority

EXECUTIVE SUMMARY

1. INTRODUCTION

1. National Transmission & Despatch Company (NTDC) Limited was incorporated on 6th November, 1998 and commenced commercial operation on 24th December, 1998. It was organized to take over all the properties, rights and assets obligations and liabilities of 220 kV and 500 kV Grid Stations and Transmission Lines/Network owned by Pakistan Water and Power Development Authority (WAPDA).

2. The NTDC has signed an agreement of Multi-tranche Financing Facility (MFF) with ADB extending over a period from 2006 to 2017. This document is the Initial Environmental Examination (IEE) for the extension/augmentation works in four existing grid stations i.e. (i) Extension of Two Line Bays at 500 kV Gujranwala Grid Station, (ii) Augmentation of 500/220 kV Auto Transformers at 500 kV Rawat Grid Station, (iii) Extension in 500 kV Jamshoro Grid Station, and (iv) Installation of 220 kV SVC at existing 220 kV Quetta Grid Station under Tranche 4 of the Asian Development Bank (ADB) program, Power Transmission and Enhancement Multi-tranche Financing Facility (PTEMFF).

3. This report gives an overview of project description, impact identification, their assessment and mitigation measures through environmental and social assessment study process and methodology.

2. POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORKS

4. The National Environmental Policy had been announced by Government of Pakistan in the year 2005. Pakistan Environmental Protection Council is the apex decision making body of the country. Obtaining of NOC from respective EPA is mandatory requirement for the projects falling in Schedule I or II of IEE/EIA Regulations 2000. Since these extension works do not fall in any schedule, therefore, NOC is not required. This IEE is prepared on the demand of ADB.

3. THE PROJECT

5. This sub project involves extension/augmentation works in four existing grid stations i.e. (i) Extension of Two Line Bays at 500 kV Gujranwala Grid Station, (ii) Augmentation of 500/220 kV Auto Transformers at 500 kV Rawat Grid Station, (iii) Extension in 500 kV Jamshoro Grid Station, and (iv) Installation of 220 kV SVC at existing 220 kV Quetta Grid Station under Tranche 4 of the Asian Development Bank (ADB) program, Power Transmission and Enhancement Multi-tranche Financing Facility (PTEMFF).

6. The main objectives of these augmentation/extension works are to enhance the transmission capacity of NTDC system by enhancing the capacity of existing four 500/220kV substations to meet the growing power demand of DISCOs, particularly GEPCO, IESCO, HESCO and QESCO.

- This improvement in system will help to bridge the demand supply gap to eliminate the sever load shedding of the country.

- Improvement and enhancement in overall power system efficiency, reliability and power supply position in four DISCO's area, particularly in the vicinity of Jamshoro, Gujranwala, Islamabad/Rawalpindi and Quetta.

- Improvement in voltage profile of 132 kV Grid stations in four DISCOs area.

4. ENVIRONMENTAL AND SOCIAL BASELINE CONDITIONS

7. The Gujranwala and Jamshoro are plain area, the land is fertile and fit for agriculture purposes. Rawalpindi district is mixture of hilly and plain land resources, while Quetta is hilly area.

8. The administrative units for these four projects involve the four districts from three provinces of Pakistan. 500 kV Nokhar Grid Station is located in Tehsil and District Gujranwala and 500 kV Rawat Grid Station is located in Tehsil and District Rawalpindi of the Punjab Province. While, 500 kV Jamshoro Grid Station is located in Tehsil and District Jamshoro of Sindh Province and 220 kV Quetta Grid Station is located in Tehsil and District Quetta of Baluchistan Province.

9. Gujranwala has a hot semi-arid climate (BSh), according to the Köppen-Geiger system, and changes throughout the year. 67. Rawalpindi features a humid subtropical climate (Köppen: Cwa) with long and very hot summers, a monsoon and short, mild and wet winters. 68. Jamshoro has a hot desert climate (Köppen BWh), with warm conditions year-round. The period from mid-April to late June (before the onset of the monsoon) is the hottest of the year. 69. Quetta has a semi-arid climate (Köppen BSk) with a significant variation between summer and winter temperatures. Summer starts in late May and goes on until early September with average temperatures ranging from 24–26 °C (75–79 °F).

10. Air quality in most of the project area appears good based on observation during the study period. Noise from vehicles and other powered mechanical equipment (electric generator etc.) is intermittent. There are also the occasional calls to prayer from loud speakers in the local mosques but there are no significant disturbances to the quiet rural setting.

11. No protected area, religious tree or environmentally sensitive site exists in the project corridor.

12. Majority of the population of the project area is linked with Agriculture, followed by business and then livestock. The majority of the urban population is associated with construction industries, wholesale, shops and market sales, retail trade, restaurants and hotels industries etc.

13. The electricity supply is available to almost all the villages and settlements in the vicinity of project areas. GEPCO, IESCO, HESCO and QUESCO are responsible for electricity distribution in project areas. Gas supply is available in towns, while in settlements and villages, wood is used for cooking purposes. But a very small proportion in village also uses gas cylinders for household uses.

14. According to census 1998, the Gujranwala District has a population of 3400940 persons with a growth rate of 2.85%. The population of Rawalpindi District was 3363911 persons with a growth rate of 2.75% as per census of 1998. The population of Jamshoro District was 582,094 persons with a growth rate of 2.2% as per census of 1998. According to census 1998, the Quetta District has a population of 759941 persons with a growth rate of 4.13%.

5. POTENTIAL ENVIRONMENTAL IMPACTS AND MITIGATIONS

15. As a first step, the screening of the Project was done considering the Asian Development Bank's guidelines. The project falls in Environmental Category B as per ADB requirements.

16. There are no major negative impacts of this project. Most of the negative impacts are localized and limited to project sites. Proper mitigation measures adopted as per provided EMP will surely reduce the negative impacts. Post mitigated impacts will be negligible.

17. The major positive impacts include improvement in power supply in old areas and provision of power supply to new areas, improved reliability and stability of electricity, improvement in voltage profile, control existing load shedding and creation of jobs during construction.

18. The noise can be mitigated by using silencers and earmuffs. The dust pollution can be mitigated by sprinkling water 2 to 3 times a day and controlling of speed of moving vehicles. Careful collection and disposal of oils and lubricants, proper waste disposal and safety precautions of workers etc. would be tools to make the project implementation environment friendly. A comprehensive Environmental Management Plan (EMP) has been prepared to mitigate all the environmental impacts during construction and operational phase of the project.

6. ENVIRONMENTAL MANAGEMENT AND MONITORING PLAN (EMMP)

19. A comprehensive EMMP has been prepared for the projects (Annex-I & Annex-II). It includes actions proposed for mitigation of negative impacts and effective monitoring of the implementation of proposed mitigation measures during pre-construction, construction and operation phases. This will be made part of the contract document for contractors. The contractors will be responsible for implementation of mitigation and monitoring measures through Bill of Quantities (BOQ) in the bidding documents. NTDC will also carry out its internal monitoring.

20. The total cost for the environmental management of the proposed four augmentation/extension sub-projects is about 535,600 Pak Rupees.

7. CONCLUSIONS AND RECOMMENDATIONS

21. The proposed project interventions will cause few environmental impacts mostly during construction phase and very limited during operational phase.

22. The construction stage will face negative impacts in the form of dust, smoke and noise on account of employment of vehicles, machinery and equipment. The generation of construction waste, solid waste and oil spills/seepage will have negative impacts on land and air resources. All such impacts are temporary and are of minor nature. The mitigation measures have been suggested in the EMMP.

- No land acquisition is involved, because all the extension/extension works will be carried out within the boundary walls of existing grid stations.
- The impacts identified are mainly of temporary nature and will be within the boundary walls of existing grid stations, which will automatically vanish with the completion of construction phase.

- Most of the impacts could be prevented or mitigated by adopting the mitigation measures suggested in the EMMP.
- Major Positive Impacts are:
  i. Significant improvement in reliability and stability of electric supply system.
  ii. Improvement in voltage profile.
  iii. Control of existing load shedding.

1. INTRODUCTION

1.1 Overview

1. This document is the Initial Environmental Examination (IEE) for the extension/augmentation works under Tranche-IV of the Asian Development Bank (ADB) program, Power Transmission and Enhancement Multi-tranche Financing Facility (PTEMFF). This IEE presents the results and conclusions of environmental assessment for the proposed extension/augmentation works in the existing grid stations and is submitted by the Government of the Pakistan (GoP), Ministry of Water and Power and National Transmission and Despatch Company (NTDC) to ADB. This IEE has been prepared to fulfill the ADB's Safeguards Requirement as stipulated in Safeguards Policy Statement, 2009 (SPS,2009).

2. The PTEMFF loan has been approved by ADB in year 2006 - 2007. The total cost of this subproject is estimated at US$ 13 million. ADB will finance the design, civil works and supply of equipment. A support component has also been provided to assist the NTDC with various aspects of project preparation and implementation.

3. The Project involves (i) Extension of Two Line Bays at 500 kV Gujranwala Grid Station, (ii) Augmentation of 500/220 kV Auto Transformers at 500 kV Rawat Grid Station, (iii) Extension in 500 kV Jamshoro Grid Station, and (iv) Installation of 220 kV SVC at existing 220 kV Quetta Grid Station. The space is available in the existing grid stations and tentative marking has been done on Google Earth. The detailed designs of subproject will be prepared by Project Preparatory and Technical Assistance (PPTA) Consultants. Hiring process of these consultants has already been initiated by NTDC and is on final stage.

4. The environmental assessment requirements of the GoP for power transmission projects are different to those of ADB. The environmental regulations of the GoP categorize development projects into two schedules according to their anticipated potential environmental impact. For the projects that have more adverse environmental impacts (Schedule-II of PEPA, 1997), the proponents are required to submit an Environmental Impact Assessment (EIA). While, for the projects having less environmental impacts (Schedule-I of PEPA, 1997), the proponents have to submit Initial Environmental Examination (IEE) with respective Environmental Protection Agency (EPA). For power transmission projects of higher than 11 kV, GoP demands EIA while ADB requires IEE.

5. This IEE has been prepared by Individual Consultant hired by NTDC and ADB. The objective of IEE preparation at this stage is to fulfill the requirements of Project Financing Report (PFR) of Tranche-IV to be submitted to ADB by NTDC. The detailed EIA for EPA approvals and site specific EMPs will be prepared by PPTA consultants when detailed design and physical marking on site will be available.

1.2 Background

6. The conditions of the power transmission system in Pakistan are inadequate to meet rapidly growing demand for electrical power. This situation limits national development and economic growth. To cope with the constraints, the existing power transmission infrastructure has to be improved and upgraded. The overall contribution of power infrastructure also requires institutional arrangements and capacity building that support the strategic management of the sector and planning and management of

investments. Overall, the proposed PTE-MFF facility has been designed to address the both investment and institutional aspects in the electrical power sector.

7. The Tranche IV subprojects can be broadly separated into two groups; (i) the subprojects involving improvement of facilities and equipment within existing grid station boundaries and should not require any land acquisition, (ii) construction of new transmission lines and new grid stations of 220 kV and 500 kV. Augmentation/Extension subprojects fall in the group of projects that involve improvement in the existing 500 kV and 220 kV grid stations. Environmental impacts from these improvement works are potentially insignificant, because no private land will need to be acquired permanently and there will be no loss of crops and tree removal, as all the works will be done within the boundary wall of existing grid stations.

8. The GoP has requested the Asian Development Bank (ADB) to provide finance for the Augmentation/Extension works, to help fulfill the overall objective of the MFF to encourage economic growth and improve transmission efficiency by creating a series of national improvements. The improved transmission efficiency will contribute to expansion of economic opportunities by improving capacity and efficiency in four DISOCs i.e. Gujranwala Electric Power Company (GEPCO), Islamabad Electric Supply Company (IESCO), Hyderabad Electric Supply Company (HESCO) and Quetta Electric Supply Company (QESCO).

1.3 Scope of the IEE Study and Personnel

9. This subproject will involve (i) Extension of Two Line Bays at 500 kV Gujranwala Grid Station, (ii) Augmentation of 500/220 kV Auto Transformers at 500 kV Rawat Grid Station, (iii) Extension in 500 kV Jamshoro Grid Station, and (iv) Installation of 220 kV SVC at existing 220 kV Quetta Grid Station. This IEE study has included field reconnaissance of all the sites.

10. The Study Area included the identified space for these facilities within the existing 500 kV and 220 kV grid stations of NTDC.

11. The field studies were undertaken by a team with experience of environmental assessment for power projects in Pakistan. Mr. Shabir Ahmad Khan and Malik Muzaffar conducted the preliminary scoping, survey and assessment activities and coordinated the field sampling and analysis. Mr. Shabir was also responsible to supervise collection of information and co-ordinate the various public consultation activities. The Environment and Social Impact Cell (ESIC) provided all logistic arrangements and guidance with regards to the essential detailed assessments of design, construction, operational and decommissioning impacts, noise, air quality and waste disposal. The environmental team also benefited from technical support and other important information on the impacts of the proposed power works provided by S&I department of NTDC and from PC-I prepared by Planning Department of NTDC.

12. The study process began with scoping and field reconnaissance during which a Rapid Environmental Assessment was carried out to establish the potential impacts and categorization of project activities. The environmental impacts and concerns requiring further study in the environmental assessment were then identified. The methodology of the IEE study was then elaborated in order to address all interests. Subsequently, both primary and secondary baseline environmental data was collected from the proposed works and the intensity and likely location of impacts were identified with relation to the sensitive receivers; based on the work expected to be carried out. The significance of impacts from the power transmission work was then assessed and, for those impacts

requiring mitigation, measures were proposed to reduce impacts to within acceptable limits.

13. A number of meetings were held with the officials of Project Management Unit, NTDC; and Survey & Investigation, NTDC and the requisite maps were collected. After reviewing the relevant documents/ data and maps, a field visit was made of the proposed subproject.

2. POLICY LEGAL AND ADMINISTRATIVE FRAMEWORK

14. Direct legislation on environmental protection is contained in several statutes, namely the Pakistan Environmental Protection Act (1997) the Forest Act (1927) the Punjab Wildlife Act (1974). In addition the Land Acquisition Act (1894) also provides powers in respect of land acquisition for public purposes. There are also several other items of legislation and regulations which have an indirect bearing on the subproject or general environmental measures.

2.1 Statutory Framework

15. The Constitution of Pakistan distributes legislative powers between the federal and the provincial governments through two 'lists' attached to the Constitution as Schedules. The Federal List covers the subjects over which the federal government has exclusive legislative power, while the Concurrent List contains subjects regarding which both the federal and provincial governments can enact laws. "Environmental pollution and ecology" is included in the concurrent list, hence both the federal and the provincial governments can enact laws on this subject. However, to date, after 18th Constitutional Amendment, federal ministry of Environment has been dissolved and the provincial governments are authorized to formulate environmental laws and regulations. The key environmental laws affecting this subproject are discussed below.

2.1.1 Pakistan Environmental Protection Act, 1997

16. The Pakistan Environmental Protection Act, 1997 is the basic legislative tool empowering the government to frame regulations for the protection of the environment. The act is applicable to a wide range of issues and extends to air, water, soil, marine, and noise pollution, as well as to the handling of hazardous wastes. The key features of the law that have a direct bearing on the proposed subproject relate to the requirement for an Initial Environmental Examination (IEE) and Environmental Impact Assessment (EIA) for development subprojects. Section 12(1) requires that: "No proponent of a subproject shall commence construction or operation unless he has filed with the Federal Agency an Initial Environmental Examination [IEE] or, where the subproject is likely to cause an adverse environmental effect, an Environmental Impact Assessment [EIA], and has obtained from the Federal Agency approval in respect thereof." The Pakistan Environmental Protection Agency has delegated the power of review and approval of environmental assessments to the provincial environmental protection agencies.

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

17. The Pakistan Environmental Protection Act, 1997 (PEPA, 1997) provides for two types of environmental assessments: Initial Environmental Examinations (IEE) and Environment Impact Assessments (EIA). EIAs are carried out for subprojects that have potentially 'significant' environmental impacts, whereas IEEs are conducted for relatively smaller subprojects with a relatively less significant impact. The Pakistan Environmental Protection Agency Review of IEE and EIA Regulations, 2000 (the 'Regulations'), prepared by the Pak-EPA under the powers conferred upon it by the PEPA, categorizes subprojects for IEE and EIA. Schedules I and II, attached to the Regulations, list the subprojects that require IEE and EIA, respectively.

18. The Regulations also provide the necessary details on the preparation, submission, and review of IEEs and EIAs. The following is a brief step-wise description of the approval process:

(i) A subproject is categorized as requiring an IEE or EIA using the two schedules attached to the Regulations.

(ii) An EIA or IEE is conducted as per the requirement and following the Pak-EPA guidelines.

(iii) The EIA or IEE is submitted to the concerned provincial EPA if it is located in the provinces or the Pak-EPA if it is located in Islamabad and federally administrated areas. The Fee (depending on the cost of the subproject and the type of the report) is submitted along with the document.

(iv) The IEE/EIA is also accompanied by an application in the format prescribed in Schedule IV of the Regulations.

(v) The EPA conducts a preliminary scrutiny and replies within 10 days of the submittal of a report, a) confirming completeness, or b) asking for additional information, if needed, or c) returning the report requiring additional studies, if necessary.

(vi) The EPA is required to make every effort to complete the IEE and EIA review process within 45 and 90 days, respectively, of the issue of confirmation of completeness.

(vii) Then the EPA accords their approval subject to certain conditions:

(viii) Before commencing construction of the subproject, the proponent is required to submit an undertaking accepting the conditions.

(ix) Before commencing operation of the subproject, the proponent is required to obtain from the EPA a written confirmation of compliance with the approval conditions and requirements of the IEE.

(x) An EMP is to be submitted with a request for obtaining confirmation of compliance.

(xi) The EPAs are required to issue confirmation of compliance within 15 days of the receipt of request and complete documentation.

(xii) The IEE/EIA approval is valid for three years from the date of accord.

(xiii) A monitoring report is to be submitted to the EPA after completion of construction, followed by annual monitoring reports during operation.

19. Distribution lines and grid substations of 11 kV and above are included under energy subprojects in Schedule II, under which rules EIA is required by GoP. Initial Environmental Examination (IEE) is required for distribution lines and grid stations less than 11 kV and large distribution subprojects (Schedule I). A review of the need for EIA/ IEE submission is therefore required by the relevant Environmental Protection Agency (EPA). Since these works are just improvements in the existing facilities, therefore local legislation does not warrant any approval or reporting. This IEE is prepared only on the demand of ADB.

20. There are no formal provisions for the environmental assessment of expanding existing distribution lines and grid substations.

2.1.3 National Environmental Quality Standards (NEQS)

21. The National Environmental Quality Standards (NEQS) were first promulgated in 1993 and have been amended in 1995 and 2000. The following standards that are specified in the NEQS may be relevant to the Tranche this subproject of Tranche-IV:

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

23. Maximum allowable concentration of pollutants (2 parameters) in gaseous emissions from vehicle exhaust and noise emission from vehicles.

2.1.4 Other Relevant Laws

24. There are a number of other federal and provincial laws that are important in the context of environmental management. The main laws potentially affecting subprojects in this MFF are listed below.

25. The Punjab Wildlife Protection Ordinance, 1972; empowers the government to declare certain areas reserved for the protection of wildlife and control activities within in these areas. It also provides protection to endangered species of wildlife. As no activities are planned in these areas, no provision of this law is applicable to the proposed subproject.

26. The Forestry Act, 1927; empowers the government to declare certain areas reserved forest. As no reserved forest exists in the vicinity of the proposed subproject, this law will not affect to the proposed subproject.

27. The Antiquities Act of 1975; ensures the protection of Pakistan's cultural resources. The Act defines 'antiquities' as ancient products of human activity, historical sites, or sites of anthropological or cultural interest, national monuments, etc. The Act is designed to protect these antiquities from destruction, theft, negligence, unlawful excavation, trade, and export. The law prohibits new construction in the proximity of a protected antiquity and empowers the Government of Pakistan to prohibit excavation in any area that may contain articles of archaeological significance. Under the Act, the subproject proponents are obligated to ensure that no activity is undertaken in the proximity of a protected antiquity, report to the Department of Archaeology, Government of Pakistan, any archaeological discovery made during the course of the subproject.

28. Safety Regulations; mainly three laws and regulations viz. (i) PEPA Laws, 2000, (ii) Labor Laws, and (iii) Electricity Rules, 1937 directly or indirectly govern the occupational health and safety issues during the currently studied production activities.

2.2 Structure of Report

29. This IEE reviews information on existing environmental attributes of the Study Area. Geological, hydrological and ecological features, air quality, noise, water quality, soils, social and economic aspects and cultural resources are included. The report predicts the probable impacts on the environment due to the proposed subproject. This IEE also proposes various environmental management measures. Details of all background environmental quality, environmental impact/pollutant generating activities, pollution sources, predicted environmental quality and related aspects have been provided in this report. References are presented as footnotes throughout the text. Following this introduction the report follows ADB guidelines and includes:

- Executive Summary
- Policy, Legal and Administrative Framework
- Description of the Subproject

- Description of Environmental and Social Baseline Conditions
- Assessment of Environmental Impacts and Mitigation Measures
- Analysis of Alternatives
- Meetings and Consultations
- Environmental Management and Monitoring Plan
- Conclusion and Recommendation

3. DESCRIPTION OF THE PROJECT

3.1 Type of Project

30. The subproject involves the augmentation/extension works in the existing four grid stations of NTDC. These include; (i) Extension of Two Line Bays at 500 kV Gujranwala Grid Station, (ii) Augmentation of 500/220 kV Auto Transformers at 500 kV Rawat Grid Station, (iii) Extension in 500 kV Jamshoro Grid Station, and (iv) Installation of 220 kV SVC at existing 220 kV Quetta Grid Station.

3.2 Categorization of the Project

31. Categorization is based on the environmentally most sensitive component of a subproject. The aspects of the subproject with potential for significant environmental impacts need to be assessed in detail and this environmental assessment has therefore focused on the significant impacts possible from the construction activities of the subproject.

32. The sites for these four extension works are located within the boundary walls of existing 500 kV and 220 kV grid stations and are owned by NTDC. There will be no major environmentally significant impact. No land acquisition is involved, no impact on trees and crops will occur.

33. Categorization is based on the most environmentally sensitive component and the Augmentation/Extension subproject is categorized as a Category “B” sub-project under ADB’s requirements and this IEE report is based on that assumption.

3.3 Need for the Project

34. The conditions of the power distribution system in Pakistan are inadequate to meet rapidly growing demand for electrical power. This situation limits national development and economic growth. Electricity demand is expected to grow by 7.80% per annum during next 10 years over the period 2009-19. The existing power distribution infrastructure has to be improved and upgraded to ensure a reliable power supply to increasing number of industrial, agricultural, commercial, and domestic consumers. The overall contribution of power infrastructure also requires institutional arrangements and capacity that support strategic management of the sector, and planning and management of investments. Overall the proposed MFF facility has been designed to address both investment and institutional aspects in the electrical power sector.

35. As the result of this, enhancement in capacity of NTDC transmission system is required for power evacuation. The proposed project has therefore been prepared to meet the requirement which will also result in overall power efficiency and stability to deliver adequate & quality power to the consumers.

36. The main objectives of these augmentation/extension works are to enhance the transmission capacity of NTDC system by enhancing the capacity of existing four 500/220kV substations to meet the growing power demand of DISCOs, particularly GEPCO, IESCO, HESCO and QESCO.

- This improvement in system will help to bridge the demand supply gap to eliminate the sever load shedding of the country.

- Improvement and enhancement in overall power system efficiency, reliability and power supply position in four DISCO's area, particularly in the vicinity of Jamshoro, Gujranwala, Islamabad/Rawalpindi and Quetta.

- Improvement in voltage profile of 132 kV Grid stations in four DISCOs area.

3.4 Location and Scale of Project

37. At present, sever load shedding is being faced in the country due to power shortage/demand supply gap. In this situation, the bulk Power generation is required to be added in the system to overcome the problem. In this regards, the power supply of national grid system of country will be improved by adding new transformers in the existing 500 kV and 220 kV grid stations.

38. The details of four augmentation/extension works are described in the following paragraphs.

3.4.1 Extension of Two Line Bays at 500kV Gujranwala (Nokhar) Grid Station

39. The addition of two line Bays at existing 500kV Gujranwala grid station has been proposed under tranche-IV. These Line Bays will have two (3x37) MVAR shunt Reactors (one at each line bay).

40. Sufficient space and basic infrastructural facilities are available for addition of two Line Bays at 500 kV Gujranwala grid station. But the civil works for foundations to install these facilities will be required.

41. As shown in Fig.3.1, the space (shown as Red Block) is available in existing 500 kV Gujranwala Grid Station and all the activities will be carried out inside the boundary wall.

Fig.3.1: Location of proposed Extension Works (Red Block) at Existing 500 kV Gujranwala (Nokhar) Grid Station

3.4.2 Augmentation of 500/220kV Auto transformer at 500kV Rawat Grid Station

42. The improvement in Rawat grid station has been proposed under tranche-IV. It will be done by enhancing the capacity of existing grid station by augmentation of existing 500 /220kV transformers of 450 MVA with 750MVA.

43. Sufficient space and basic infrastructural facilities are available for replacement of existing 500/200kV 450MVA transformer with 750MVA capacity at the existing Rawat grid station. As such no additional equipment/arrangement is required for replacement of existing transformer for enhancement in capacity. But, the civil works for foundations will be required and provisions have been made in the cost estimate of this scheme.

44. As shown in Fig.3.2, the proposed extension in the 500 kV Rawat Grid Station will be done in the existing space and all the activities will be carried out within the NTDC owned boundary wall area.

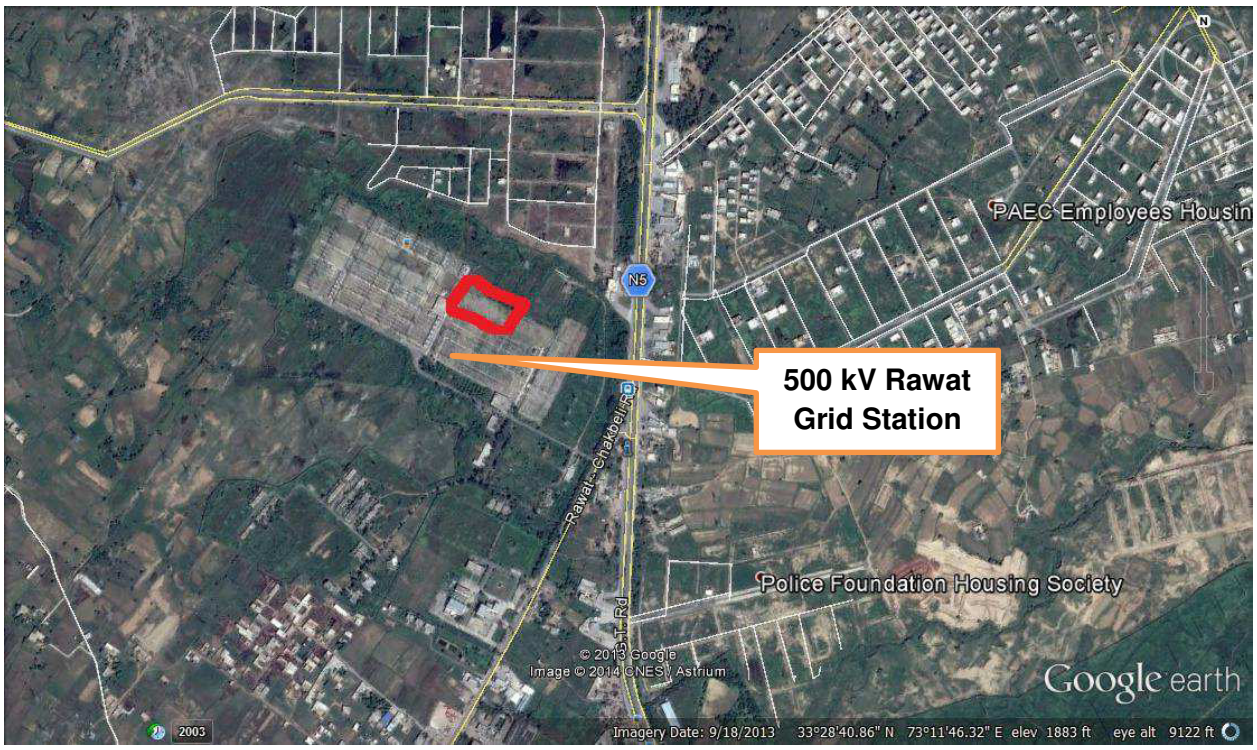

Fig.3.2: Location of proposed Extension Works (Red Block) at Existing 500 kV Rawat Grid Station

3.4.3 Extension of 500/220 kV, 450 MVA Auto transformer at 500 kV Jamshoro Grid Station

45. The extension in the existing 500/220kV Jamshoro grid station has been proposed under Tranche-IV. It will be done by enhancing the capacity of existing grid station by adding new 500 /220 kV transformers of 450 MVA capacities.

46. Sufficient space and basic infrastructural facilities are available for addition of a new 500/200kV 450MVA transformer at the existing Jamshoro grid station. While, the civil works for installation of prosed equipment at Jamshoro grid station will be required.

47. As evident from Fig.3.3, the proposed extension i.e. addition of third 500/220 kV 450 MVA transformer, at existing 500 kV Jamshoro Grid Station will done on already available space within the boundary wall of Grid Station.

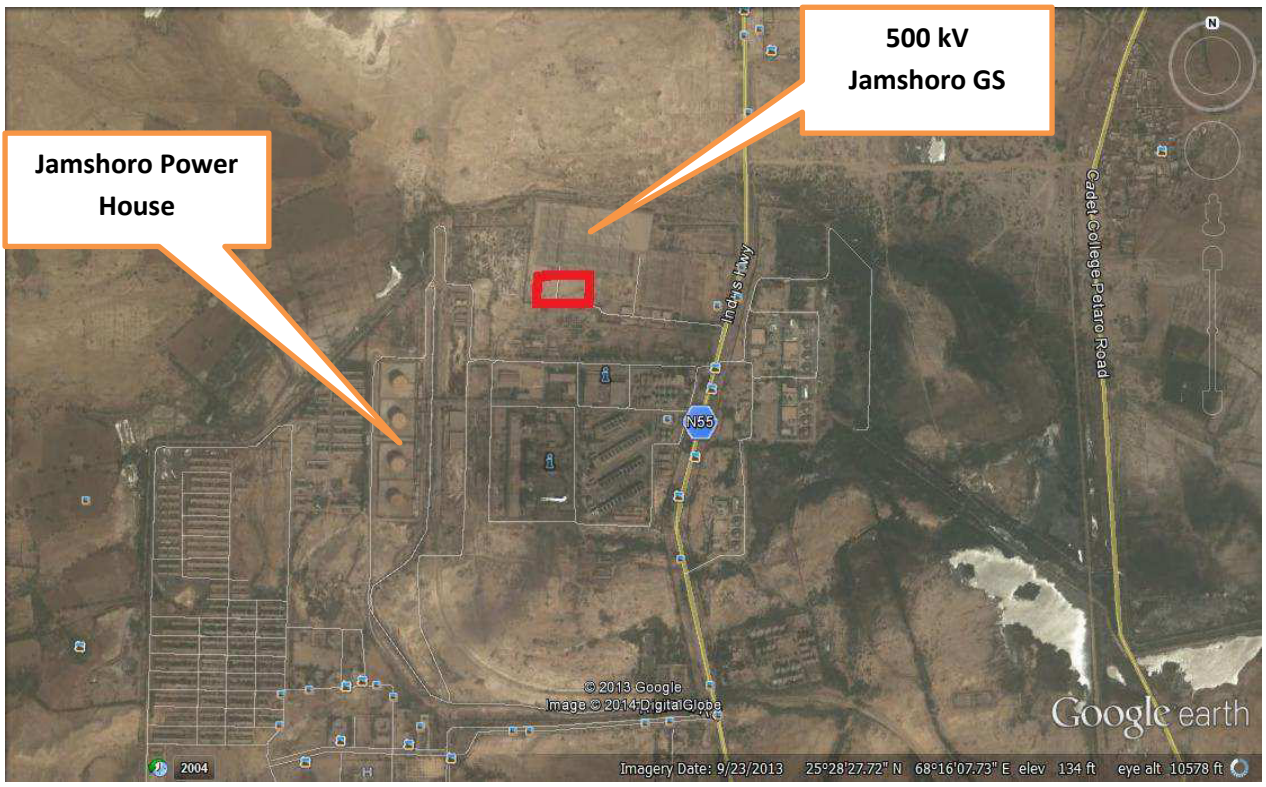

Fig.3.3: Location of proposed Extension Works (Red Block) at Existing 500 kV Jamshoro Grid Station

3.4.4 Installation of 220 kV SVC (Static VAR Compensator) at existing 220 kV Quetta Industrial Grid Station

48. Quetta Industrial 220 kV Substation is at the tail of NTDC network and it is fed from main grid through a long radial of 220 kV originating from Guddu reaching up to Quetta Industrial via Uch and Sibbi. In order to meet the growing power demand of QESCO area, the improvement in the existing system is required. This improvement will be done by providing SVC at existing 220 kV Industrial Grid Station.

49. The site of SVC at Quetta Industrial 220 kV Substation is best suited due to the reason that maximum number of 132 kV circuits in QESCO area emanates from this substation. This is also connected to 220 kV main grid system of NTDC. Therefore, the Static VAR System (SVS) at this location would support not only the 132kV network but also give boost to incoming 220kV network. The land is available at the existing site of this substation to accommodate the SVC facilities.

50. As shown in Fig.3.4, the sufficient space and other infrastructural facilities are available at existing 220 kV Quetta Industrial Grid Station, however, the civil works for foundations will be required for installation of SVC system. The provisions for civil works in the cost estimates have been made.

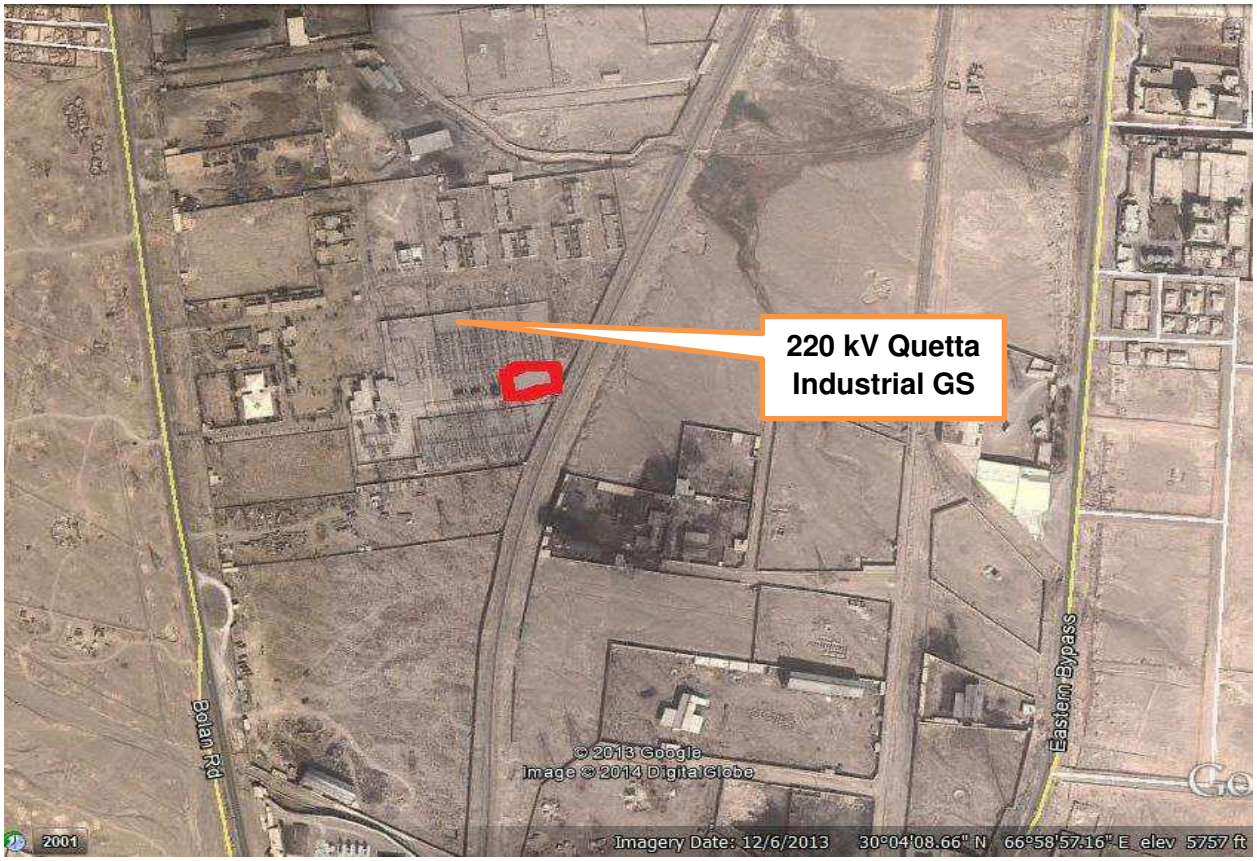

Fig.3.4: Location of proposed SVC (Red Block) at Existing 220 kV Quetta Industrial Grid Station

51. The environmental impacts are likely to be minor and localized near the foundation construction sites and are reviewed in the environmental impact section of the report. The impacts will need to be reviewed and amended if necessary if the locations change, scope of work change and when the detailed designs are available.

3.5 Analysis of Alternatives

52. The subprojects of Tranche-IV of MFF will contribute to the improvement of the overall performance of the power transmission sector, improving transmission efficiency, broadly widening access to power to drive economic opportunities. The beneficiaries of the subproject will be people, companies, and government and non-government agencies in Pakistan that use power transmission services. Power users will benefit in terms of secure power and improved power safety and potentially increased productivity.

3.5.1 Do Nothing Scenario

53. Based on the available information, the predictions have indicated that without the tranche-IV power transmission subprojects, the supply will not be reliable. This subproject is a part of an overall strategic improvement to the system.

54. In the absence of the subproject, the potential for interruptions to power supply will increase and socio-economic development of the province could be affected in the short to medium term. In an un-enhanced state, the wear and tear on existing facilities

will rise. In the short term, the power supply would improve and more reliable access to secure power would be available.

3.5.2 Alternative Construction Methods

55. The feasibility and constructability of the transmission line towers is well established locally and installation of equipment is well practiced in the international context (even if some types of equipment are new to Pakistan). The process basically includes the transportation of equipment to site and the assembly of pre-fabricated units in-situ. Thus, the impacts from construction activities are very manageable from the environmental viewpoint.

3.5.3 Alternative Geometry

56. The grid stations are already available and land is available for these facilities within the boundary walls of these grids. Some further detailed surveys may be carried out for the detailed design to determine the exact construction methods and locations but no land acquisition is envisaged to be involved in this subproject from private peoples.

57. The present assumption is that the new extensions/augmentations will be carried out on already available space in the existing four grid stations of NTDC.

3.6 Proposed Schedule for Implementation

58. The Project Proponent (NTDC) plans to have the tranche-IV completed by mid to late 2017. The details for the implementation of the 10 subprojects are in development. There will not be any land acquisition or compensation process for these augmentation works. Designs, power transmission arrangements, access, review of environmental management and construction processes will need to be completed in say about three months. When the detailed designs are completed, tendering and award of contract will take place over about three to six months. The construction period will follow and best estimates indicate about twelve to eighteen months for these works.

4. DESCRIPTION OF ENVIRONMENTAL AND SOCIAL BASELINE CONDITIONS

4.1 Project Area

4.1.1 General Characteristics of Project Area

59. The Nokhar (Gujranwala) grid station is located along the Nokhar-Gujranwala Road about 28 km South-West to Gujranwala City of the Punjab province. 500 kV Rawat Grid Station is located along GT Road about 20 km South East to Rawalpindi City of Punjab Province. 500 kV Jamshoro Grid Station is located along Indus Highway (N-55) about 15 km North West to Hyderabad City of Sindh Province. 220 kV Quetta Grid Station is located along Bolan Road about 12 km South to Quetta city of Baluchistan Province. All these grid stations are in operation and provided with all the facilities including water supply, power supply, boundary wall, security arrangements etc.

60. As the extension works are to be carried within the boundary wall of existing grid stations, so the question of impact on private land or land acquisition does not arise. Sufficient space is available in the existing grid station to accommodate the new facilities i.e. addition of new transformers.

4.1.2 Administrative Units

61. The administrative units for these four projects involve the four districts from three provinces of Pakistan. 500 kV Nokhar Grid Station is located in Tehsil and District Gujranwala and 500 kV Rawat Grid Station is located in Tehsil and District Rawalpindi of the Punjab Province. While, 500 kV Jamshoro Grid Station is located in Tehsil and District Jamshoro of Sindh Province and 220 kV Quetta Grid Station is located in Tehsil and District Quetta of Baluchistan Province.

4.2 Physical Resources

4.2.1 Topography, Geography, Geology, and Soils

62. The Gujranwala and Jamshoro are plain area, the land is fertile and fit for agriculture purposes. Rawalpindi district is mixture of hilly and plain land resources, while Quetta is hilly area.

63. Gujranwala is 226 metres (744 ft) above sea level, sharing borders with Ghakhar Mandi and several towns and villages. About 80 kilometres south is the provincial capital, Lahore. Sialkot and Gujrat lie to its north. Gujrat connects Gujranwala with Bhimber, Mirpur Azad Jammu and Kashmir, and Sialkot connects it with Jamming. About 160 kilometres southwest is Faisalabad. Rawalpindi is located only 14 kilometres south from the capital city of Islamabad, in the province of Punjab. It is in the northernmost part of the Punjab province, located 275 km to the north-west of Lahore. Jamshoro, famously known as the City of Universities is situated on the right bank of Indus River at south-west position of Province of Sindh sloping from direction North-east to south-west and is about 18 kilometers far from Hyderabad and at a distance of 150 kilometers from Karachi. Quetta has an area of 2,653 km2 and consists of series of valleys which act as a natural fort surrounded on all sides by hills; these are named Chiltan, Takatoo, Murdar and Zarghun. There are no natural boundaries between Quetta and its adjoining districts of Dera Ismail Khan to the northeast, Dera Ghazi Khan and Sibi to the east, Sukkur and Jacobabad to the southeast, Karachi and Gawadar to the south and Ziarat to the

northeast. The closest major city is Kandahar in Afghanistan which is located to the northwest of the Quetta region.

64. Geologically the project sites overlap both with the Indian and the Eurasian tectonic plates where its Sindh and Punjab provinces lie on the north-western corner of the Indian plate while Baluchistan lies within the Eurasian plate which mainly comprises the Iranian plateau.

65. The soils and subsoil conditions are already tested and are up to the mark for extension/augmentation works.

4.2.2 Climate, Temperature and Rainfall

66. Gujranwala has a hot semi-arid climate (BSh), according to the Köppen-Geiger system, and changes throughout the year. During summer (June to September), the temperature reaches 36–42 °C (97–108 °F). The coldest months are usually November to February, when the temperature can drop to an average of 7 °C (45 °F). The highest-precipitation months are usually July and August, when the monsoon reaches the Punjab. During the other months, the average rainfall is about 25 millimeters (0.98 in). The driest months are usually November to April, with little rainfall.

67. Rawalpindi features a humid subtropical climate (Köppen: Cwa) with long and very hot summers, a monsoon and short, mild and wet winters. Rawalpindi and its twin city Islamabad, during the year experience an average of 91 thunderstorms, which is the third highest in frequency after Murree and Kakul. Wind gusts have been reported by Pakistan Meteorological Department to have reached 167 km/h (105 mph) in such thunder/wind storms which results in damage of infrastructure especially electric poles, billboards and sometimes buildings too. Rawalpindi is chaotic but relatively dust-free. The weather is highly variable due to the location of the city. The average annual rainfall is 45 inches (1,100 mm), most of which falls in the summer monsoon season. However, frontal cloud bands also bring quite significant rainfall in the winter. In summer, the record maximum temperature has soared to 46.5 °C (116 °F), while it dropped to a minimum −3.9 °C (25 °F) in the winter.

68. Jamshoro has a hot desert climate (Köppen BWh), with warm conditions year-round. The period from mid-April to late June (before the onset of the monsoon) is the hottest of the year, with highs peaking in May at 41.4 °C (106.5 °F). During this time, winds that blow usually bring along clouds of dust, and people prefer staying indoors in the daytime, while the breeze that flows at night is more pleasant. Winters are warm, with highs around 25 °C (77 °F), though lows can often drop below 10 °C (50 °F) at night. The highest temperature of 48.5 °C (119 °F) was recorded on 7 June 1991, while the lowest temperature of 1 °C (34 °F) was recorded on 8 February 2012. In recent years Jamshoro has seen great downpours. In February 2003, Jamshoro received 105 millimeters (4.13 in) of rain in 12 hours, leaving many dead. The years of 2006 and 2007 saw close contenders to this record rain with death tolls estimated in the hundreds. The highest single-day rain total of 250.7 millimeters (9.87 in) was recorded on 12 September 1962, while the wettest month was September 1962, at 286 millimeters (11.26 in).

69. Quetta has a semi-arid climate (Köppen BSk) with a significant variation between summer and winter temperatures. Summer starts in late May and goes on until early September with average temperatures ranging from 24–26 °C (75–79 °F). The highest temperature in Quetta is 42 °C (108 °F) which was recorded on 10 July 1998. Autumn starts in late September and continues until mid-November with average temperatures in the 12–18 °C (54–64 °F) range. Winter starts in late November and ends in late March, with average temperatures near 4–5 °C (39–41 °F).The lowest temperature in Quetta is

−18.3 °C (−0.9 °F) which was recorded on 8 January 1970.[6] Spring starts in early April and ends in late May, with average temperatures close to 15 °C (59 °F). Unlike more easterly parts of Pakistan, Quetta does not have a monsoon season of heavy rainfall. Highest rainfall during 24 hours in Quetta is 113 millimetres (4.4 in) which was recorded on 17 December 2000. Highest monthly rainfall is 232.4 millimetres (9.15 in) which was recorded in March, 1982 and the highest annual rainfall is 949.8 millimetres (37.39 in) recorded in 1982. In the winter snow is the principal form of precipitation, and this falls mostly in the months of December, January and February. The city saw a severe drought from 1999 to 2001, during the drought the city did not receive snowfall and also received below normal rains. In 2003 the city received snowfall after a long period of five years. In 2004, and 2005 the city received normal rains after three years with snowfall while in 2006, 2007 and 2009 the city received no snow except in 2008 when Quetta received a snowfall of 10 centimeters (4 in) in four hours on 29 January 2008. On 2nd February 2008, Quetta received 25.4 centimetres (10 in) of snow in just 10 hours which was the heaviest snowfall for the city in the last ten years. During the winter of 2010 it received no snow and saw below normal rains due to the presence of El-Nino over Pakistan.

4.2.3 Water Resources

70. The strata is water bearing in Gujranwala, Rawalpindi and Jamshoro, giving good groundwater potential throughout the districts and the water table is near the surface in plains. The depth to groundwater varies from 10 m 30 m. The water table in these districts rises during rainy season (July and August) and declines during dry season (October to December) when the groundwater abstraction is higher. While in Quetta, being mountainous area, the water table is relatively below than 100 m.

4.2.4 Air Quality

71. Air quality in most of the project area appears good based on observation during the study period. Emissions should be controlled at source under the EMP. There will be a few items of powered mechanical equipment to be used in the construction of the extension/augmentation works that may give rise to creation of dust and other emissions; however, these should be minor and easily dissipated. Domestic sources of air pollution, such as emissions from wood and kerosene burning stoves as well as small diesel standby generators in some households, are minor.

72. The project area is distant from major sources of air pollution like industries or urban type traffic, domestic sources such as burning of wood and kerosene stoves, etc. or fugitive sources such as burning of solid wastes. Air quality in the project area appeared very good during the study period. The vehicular traffic is the primary source of air pollution in project corridor.

73. There should be no source of atmospheric pollution from the subproject. In the operational phase the industrial facilities with fuel powered mechanical equipment will be the main polluters. All such emissions will be very well dissipated in the open terrain and there will be no cumulative effect from the project.

74. The other major source of air pollution is dust arising from construction and other ground or soil disturbance, during dry weather, and from movement of vehicles on poorly surfaced or damaged access roads. It has been observed that dust levels from vehicles may even be high enough to obscure vision significantly temporarily.

4.2.5 Noise

75. Noise from vehicles and other powered mechanical equipment (electric generator etc.) is intermittent. There are also the occasional calls to prayer from loud speakers in the local mosques, but there are no significant disturbances to the quiet rural setting. The construction of proposed facilities will be within the grid station premises, therefore, no noise disturbance will be caused to surrounding populations. Digital Sound Level Meter Model AR-824 was used to monitor the noise levels. But the monitored values did not exceed 65 dB (A) during day time.

4.3 Biological Resources

4.3.1 Flora

76. The floral species of Gujranwala and Rawalpindi districts are; Shisham, (Dalbergia sissoo), Bakain (Melea azedarie), Simbal (Salmalia malbarieum), Mulberry (Morus alba), Peepul (Ficus religiosa), Phulai (Accacia modesta), Nim (Azadirachta inidica), and Ber (Ziziphus vulagaris). Among fruit trees, Guava, Mango, Citrus Fruits are commonly found.

77. The flora of Jamshoro includes; the Babbur (Acacia nilotica) tree is the most dominant and occurs in thick forests along the Indus banks. The Nim (Azadirachta inidica), Ber (Ziziphus vulagaris) or Jujuba, Lai (Tamarix orientalis), Kirrir (Capparis aphyla) and Kandi (Prosopis cineraria) are the more common trees. Mango, date palms, banana, guava, orange and chiku are the typical fruit bearing trees.

78. A total of 225 species of flora have been identified in the Quetta area including pistachios, juniper, wild olives, wild ash and wild almonds. Also found are shrubs including wild fig, barberry, wild cherry, makhi and herbs such as ephedra intermadia and gerardiana

4.3.2 Fauna

79. The mammals of district Rawalpindi and Gujranwala include; Greater Horseshoe Bat (Rhinolophus ferrumequinum), Asian Barbastelle Bat (Barbastella leucomelas), Cape Hare (Lepus capensis) House Rat (Ratus ratus) House Mouse (Mus musculus) and Palm Squirrel (Funnambulus pennantii). Among lizards; Indian Garden Lizard (Calotese versicolor farooqi) Caucasian Rock Agama (Laudakia caucasia) Nuristan Agama (Laudakia nuristanica), Blue Rock Agama (Laudakia tuberculata) and Bengal Monitor Lizard (Varanus bengalensis) are found.

80. Among the wild animals of Jamshoro, the Sareh (Sindh ibex), Urial or Gadh (wild sheep), Charakh (striped hyena), jackal, fox, porcupine, common gray mongoose, and hedgehog. The Sindhi phekari (red lynx or caracal cat) is encountered in some areas. There is a variety of bats, lizards, and reptiles, including the cobra, Lundi (viper), and the Peean.

81. In the surrounding of Quetta, the mammals such as Markhor (wild sheep), leopards, wolves, hyena, rabbits, wild cats and porcupines are to be found in the Quetta region. Local birds species include partridge, warblers, shikra, the blue rock pigeon, rock nuthatch, golden eagle, sparrows, hawks, falcons and bearded vultures.

4.3.3 Protected areas / National Sanctuaries

82. In Pakistan there are several areas of land devoted to the preservation of biodiversity through the dedication of national parks and wildlife sanctuaries. There is no protected area or national sanctuary near the area of works.

4.4 Economic Development

4.4.1 Agriculture, Livestock and Industries

83. Majority of the population of the project areas is linked with Agriculture, followed by business, livestock and labor works. The majority of the urban population is associated with construction industries, wholesale, shops and market sales, retail trade, restaurants and hotels industries etc.

84. Livestock breading is one of the main pursuits and means of livelihood of rural and urban population of the whole project area. The buffalo, sheep, goats and cows are common livestock animals and serve as an important source of income.

85. Roads are the means of transportation for the movement of people and goods in all the four districts and connect the areas with other parts of the country. These districts are connected with other parts of country through National Highways (N-5, N-55) and Motorways (M-2). Railways connections are also present in all the four districts.

4.4.2 Energy Sources

86. The electricity supply is available to almost all the villages and settlements in the vicinity of project areas. GEPCO, IESCO, HESCO and QUESCO are responsible for electricity distribution in project areas. Gas supply is available in towns, while in settlements and villages, wood is used for cooking purposes. But a very small proportion in village also uses gas cylinders for household uses.

87. The biomass sourcing is concentrated on home garden production of fuel wood, the extraction of wood from forests, woodland, crop plantations and agricultural residues. The other significant energy sources in the area are kerosene and LPG.

4.5 Social and Cultural Resources

4.5.1 Population Communities and Employment

88. According to census 1998, the Gujranwala District has a population of 3400940 persons with a growth rate of 2.85%. Number of males for every 100 females was 108.6 percent recorded in 1998 Census. The rural population is 49.45 % and urban population is 50.55%. The population of the district Gujranwala is predominantly Muslims. The total area of the District is 3622 sq. km with a Population Density of 939 persons per sq. km. Average household size was 7.6 persons.

89. The population of Rawalpindi District was 3363911 persons with a growth rate of 2.75% as per census of 1998. Number of males for every 100 females was 104.9 percent recorded in 1998 Census. The rural population is 46.84 % and urban population is 53.16%. The population of the district Rawalpindi is predominantly Muslims. The total area of the District is 5285 sq. km with a Population Density of 636.5 persons per sq. km. Average household size was 6.5 persons.

90. The population of Jamshoro District was 582,094 persons with a growth rate of 2.2% as per census of 1998. The population of the district Jamshoro is predominantly Muslims (96.84%) and second is Hinduism (3.14%).

91. According to census 1998, the Quetta District has a population of 759941 persons with a growth rate of 4.13%. Number of males for every 100 females was 118.5 percent recorded in 1998 Census. The rural population is 25.64 % and urban population is 74.36%. The population of the district Quetta is predominantly Muslims. The total area of the District is 2653 sq. km with a Population Density of 286.4 persons per sq. km. Average household size was 8.5 persons.

92. The major proportion of total population is self-employed, others are private employees and government employees. The difference in proportions of employed population is significant between the genders and urban and rural residences. The major occupation in project area is agricultural farming, small businesses and service in public and private sectors.

93. The main occupation of women in rural areas is house-keeping which includes attending to the cattle, extracting butter and ghee from milk, weaving and sewing of family clothes. In addition they generally help their men-folk on farms with the lighter duties like transplanting of seedlings, threshing and winnowing of grains and sometimes they also help in harvesting. In city women are house-wives or work as professionals; such as doctors, nurses, teachers, private jobs etc.

4.5.2 Education and Literacy

94. The literacy rate of Gujranwala district is 56.5 % as per 1998 census report. The literacy rate for males is higher (i.e. 63.60%) than the females (i.e. 48.80%). A lot of educational institutions are available in Gujranwala. Educational Institutions in Gujranwala include; University of the Punjab, Gujranwala, the Swedish College of Engineering and Technology, Rachna University of Engineering and Technology, Allama Iqbal Open University, Al Madina Islamic University, Virtual University of Pakistan and GIFT University. Thirty-two government and private colleges include the Gujranwala Medical College, Punjab Group of Colleges, Muhammad Ali Jinnah Law College, CMS College, Gujranwala, The Gujranwala Institute of Nuclear Medicine, University of Sargodha, Sub-Campus, University of the Central Punjab and UCL (United Center of Languages).

95. The literacy rate of Rawalpindi district is 70.4 % as per 1998 census report. The literacy rate for males is higher (i.e. 81.19%) than the females (i.e. 59.18%). The prominent educational institutions of Rawalpindi include; Army Public College of Management and Science, Fatima Jinnah Women University, Islamic International Medical College, Army Medical College, College of Electrical and Mechanical Engineering, Military College of Signals, National College of Arts, Rawalpindi campus, Numerous small affiliated colleges of University of the Punjab, Rawalpindi Medical College, University of Arid Agriculture, Barani Institute of Information Technology, Mohammad Ali Jinnah University, and Virtual University Campus, Rawalpindi.

96. The literacy rate of Jamshoro district is 43.6%. The universities in Jamshoro are: Mehran University of Engineering and Technology, Liaquat University of Medical and Health Sciences, and University of Sindh.

97. The literacy rate of Quetta district is 57.1 % as per 1998 census report. The literacy rate for males is higher (i.e. 67.27%) than the females (i.e. 44.53%). Quetta has a number of institutions of higher education. Group of Islamia Schools which was quoted

by Quid e Azam as Chota (Small), Federal Government (FG) Degree College Madrassa Road Quetta Cantt. Famous Tameer-e-Nau Public College which has always led in HSSC Board position Top spots in Baluchistan Board of Education. The military Command and Staff College was founded by the British in 1905, its centennial was celebrated in 2005. The city is home to the University of Baluchistan established in 1974, Baluchistan University of Information Technology, Engineering and Management Sciences, (BUITAMS) Sardar Bahadur Khan Women's University, Bolan Medical College, Baluchistan Agriculture College, the Geological Survey of Pakistan, the historic Sandeman Library and many other government and private colleges. Baluchistan Board Quetta is only Intermediate and Secondary education board for Baluchistan. It conducts Secondary School and Higher Secondary School examination throughout the province.

4.5.3 Cultural Heritage and Community Structure

98. There are no officially protected heritage sites or historic, religious or archaeologically important sites located in the subproject works areas. There are no major historic or archaeological features of note but there are a few places of worship within about 500 m of the works. It is expected that there will be no impact on such places.

99. Punjabis is common in district Rawalpindi and Gujranwala and Rawalpindi, while Sindhi is spoken in Jamshoro area. Balochi is the language of residents of Quetta. Urdu being National language is also spoken and understood in all the four districts.

5. POTENTIAL ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

5.1 Subproject Location

5.1.1 Impact Assessment and Mitigation

100. This Tranche-IV subproject will involve augmentation/extension works in four existing grid stations of NTDC i.e. (i) Extension of Two Line Bays at 500 kV Gujranwala Grid Station, (ii) Augmentation of 500/220 kV Auto Transformers at 500 kV Rawat Grid Station, (iii) Extension in 500 kV Jamshoro Grid Station, and (iv) Installation of 220 kV SVC at existing 220 kV Quetta Grid Station. All these works will be carried out on already available space within the boundary wall of existing grid stations.

101. The location and scale of the works are very important in predicting the environmental impacts. Therefore, it is essential that a proper analysis is carried out during the subproject planning period. This process of impact prediction is the core of the IEE process and it is critical that the recommendations and mitigation measures are carried out according to, and with reference to the conditions on the ground in the affected areas in the spirit of the environmental assessments process. In this section the potential environmental impacts are reviewed. Where impacts are significant enough to exceed accepted environmental standards, mitigation is proposed in order to reduce residual impact to acceptable levels. In this regard, the impact prediction plays a vital role as these predictions are used for developing mitigation measures and any alternative options, if appropriate. When the detailed designs are completed, the impacts and mitigation measures will need to be further reviewed to take account of how the contracts are set up and in the light of any fine tuning of the subproject proposals.

102. The environmental management plan has been prepared based on the assessment and shall be reviewed in due course at subproject inception and through construction in order to provide a feedback on any significant unpredicted impacts. It is based on the analysis of impacts, primarily to document key environmental issues likely to arise from subproject implementation, to prescribe mitigation measures to be integrated in the subproject design, to design monitoring and evaluation schedules to be implemented during subproject construction and operation, and to estimate costs required for implementing subproject mitigation measures. The EMP must be reviewed in the subproject inception by the subproject management and approved before any construction activity is initiated, to take account of any subsequent changes and fine tuning of the proposals.

5.2 General Approach to Mitigation

103. Based on professional experience on heavy transmission line and grid station projects, contractors have put emphasis on the financial compensation for nuisances. This may be acceptable for some social impacts where evacuation is necessary or where structures have been accidentally damaged, however, it is not best international practice to accept payment for environmental impacts. An approach whereby the subproject contractor pays money for nuisances rather than control impacts at source will not be acceptable. This practice should not be allowed and financial compensation shall not be allowed as mitigation for environmental impacts or environmental nuisance.

104. During the preparation for the subproject construction phase the future contractors must be notified and prepared to co-operate with the executing and implementing agencies, subproject management, construction supervising consultants

and local population in the mitigation of impacts. Furthermore, the contractor must be primed through bidding stages and the contract documentation to implement the EMP in full and be ready to engage or train staff in the management of environmental issues and to audit the effectiveness and review the mitigation measures as the subproject proceeds. The effective implementation of the EMP will be audited as part of the loan conditions and the executing agency (NTDC) must be prepared for this. In this regard, the NTDC must fulfill the requirements of the law and guidance prepared by Pak-EPA on the environmental aspects of power subprojects and the recommendations already made for subproject in this IEE and under Pakistan's PEPA 1997.

105. Noise from the construction of these facilities should not be a major consideration, as the construction activities will be limited to the boundary wall.

5.2.1 Cultural Heritage, Mosques, Religious Sites, and Social Infrastructure

106. The location of mosques and other cultural and other heritage SR sites has been reviewed. There is no mosque, graveyard, tomb or any other religious/archaeological site in and around the existing grid stations, hence, no impact on such sites is expected.

5.3 Potential Environmental Impacts in Construction Phase

5.3.1 Encroachment, Landscape and Physical Disfiguration

107. As the construction activities will be within the boundary walls, therefore, no additional landscape impacts, encroachment and physical disfiguration can be expected from construction of the subproject. However, the disposal of surplus materials (if any) must be negotiated through local authority approvals prior to the commencement of construction.

5.3.2 Cut and Fill and Waste Disposal

108. Disposal of surplus materials must also be negotiated through local authority approvals prior to the commencement of construction. The Subproject work should not involve any significant cutting and filling but the excavations (down to 4m) and piling may be required to create the foundations for these extension works (if required). It is envisaged (depending on the mode of contract) that the surface under the transformers will need to be scrabbled to remove unstable materials, or to stockpile topsoil.

109. If surplus materials arise from the removal of the existing surfaces from specific areas, these should be used elsewhere on the subproject before additional soil, rock, gravel or sand is brought in. The use of immediately available material will generally minimize the need for additional rock based materials extraction from outside. Moreover, it will also save the cost of bringing the material from some other locations.

110. The subproject detailed designers have so far estimated that no substantial additional materials will be required subject to confirmation at the detailed design stage.

111. Contractual clauses should be included to require each contractor to produce a materials management plan (one month before construction commences) to identify all sources of cement and aggregates and to balance cut and fill. The plan should clearly state the methods to be employed prior to and during the extraction of materials. Mitigation measures shall seek to control the impacts at source in the first place.

5.3.3 Trees, Ecology and Protected Areas

112. The construction activities will be carried out within the boundary wall of existing grid station, therefore, no impact on trees, ecology or protected area is envisaged. The land (space) selected for the augmentation/extension works is free from all kind of vegetation.

5.3.4 Hydrology, Sedimentation, Soil Erosion

113. No water resource is likely to be affected be implementation these extension works.

5.3.5 Air Pollution from Earthworks and Transport

114. Field observations indicate that ambient air quality is generally acceptable and that emissions from powered mechanical equipment are rapidly dispersed. Earthworks will contribute to increasing dust, and the foundation earthworks will generate dust and the following mitigation measures are needed:

- Dust suppression shall be undertaken.
- Construction materials (sand, gravel, and rocks) and spoil materials will be transported trucks covered with tarpaulins.
- All vehicles (e.g., trucks, equipment, and other vehicles that support construction works) will comply with the national vehicle regulations (NEQS).

115. The material (cement, sand and aggregate) requirements of a typical extension/augmentation works are not very large as compared to construction of a transmission line or a new grid station.

5.3.6 Noise, Vibration and Blasting

116. It is anticipated that powered mechanical equipment and some local labor with hand tool methods will be used to construct the subproject works. No blasting is anticipated, because, only foundation works will be involved within the existing grid station area.

5.3.7 Sanitation, Solid Waste Disposal, Communicable Diseases

117. The main issues of concern are uncontrolled or unmanaged disposal of solid and liquid wastes. Since, these facilities are to be added to the existing grid stations, therefore, the waste generated from construction activities will be managed through the solid waste management system already in practice at grid stations.

5.3.8 Disease Vectors

118. The improper disposal of wastewater generated from the site, it can offer a breeding site for mosquitoes and other insects. Vectors such as mosquitoes may be encountered if open water is allowed to accumulate at the construction camp site. Temporary and permanent drainage facilities should therefore be designed to facilitate the rapid removal of surface water from construction area and prevent the accumulation of surface water.

5.4 Potential Environmental Impacts in Operation Stage

5.4.1 Air Pollution and Noise from the Enhanced Operations

119. The subproject works will involve the augmentation/extension works in four existing grid stations of NTDC i.e. (i) Extension of Two Line Bays at 500 kV Gujranwala Grid Station, (ii) Augmentation of 500/220 kV Auto Transformers at 500 kV Rawat Grid Station, (iii) Extension in 500 kV Jamshoro Grid Station, and (iv) Installation of 220 kV SVC at existing 220 kV Quetta Grid Station. The operation of this subproject will not cause any air pollution or will not cause any boost in the ambient noise levels of project area. However, it is recommended that an acoustical check be made on the detailed design to determine if any noise barriers are required. There should be no source of atmospheric pollution from the subproject. In the operational phase any nearby industrial facilities with fuel powered mechanical equipment will be the main polluters. All such emissions will be very well dissipated in the open terrain and there will be no cumulative effect from the subproject.

120. There are not national noise standards in Pakistan for power distribution noise emissions that would apply in the operational stages. A criterion of 70 dB (A) Leq has been used for assessment in previous IEE studies. It is recommended that a check be made on the likely acoustical performance based on makers' specifications of the installed equipment at the detained design stage.

5.4.2 Pollution from Oily Run-Off, Fuel Spills and Dangerous Goods

121. Control measures for oily residues, lubricants and refueling are prescribed in the EMP. In the subproject maintenance yards will be created but these have no dedicated drainage which can capture run-off. Oily residues and fuel should be captured at source and refueling and maintenance should take place in dedicated areas away from surface water resources. No significant impacts should be allowed to arise, on this account, in the subproject area.

5.5 Enhancements

122. Environmental enhancements could be the major consideration in case of this subproject. It is noted that it is common practice at many such sites to create some local hard and soft landscaping and successful planting of fruit trees and shrubs has been accomplished in many sites. This practice should be encouraged as far as practicable. The tree plantation should be done within the grid stations and outside along the boundary wall as enhancements where there is space.

6. INSTITUTIONAL REQUIREMENTS AND ENVIRONMENTAL MANAGEMENT PLAN

6.1 Environmental Management and Monitoring Plan

123. In this section, the mitigation measures that are required for the proposed subproject of Tranche-IV, to reduce residual impact to acceptable levels and achieve the expected outcomes of the subproject, are discussed. The Environmental Management Plan is based on the type, extent and duration of the identified environmental impacts for the augmentation/extension works.

124. The Environmental Management Plan is based on the type, extent and duration of the identified environmental impacts. The EMP has been prepared by reference to and following the best practices and the ADB's Safeguards Policy Statement, 2009.

125. The EMP matrix is presented as **Appendix-I.** The impact prediction (Section 5) has played a vital role in reconfirming typical mitigation measures and in identifying some different approaches based on the feasibility and detailed design assumptions and any alternatives available at this stage.

126. Prior to implementation and construction of the enhancements the EMP shall be amended and reviewed by the NTDC in due course after detailed designs are completed. Such a review shall be based on reconfirmation and additional information on the assumptions made at the feasibility stage on alignment, location scale and expected operating conditions of the project. For example, in this case if there are any additional facility or alteration in the scope of work, the designs may be amended and then the performance and evaluation schedules to be implemented during project construction and operation can be updated, and costs estimates can be revised.

127. The EMP plan must be reviewed by the project management and approved by ADB, in order to take account of any sub-sequent changes and fine tuning of the proposals. It is recommended that before the works contract is worked out in detail and before pre-qualification a full extent of the environmental requirements of the project (IEE/EIA) are included in the bidding documents including the EMP. Past environmental performance of contractors and awareness of environmentally responsible procurement should also be used as indicators for prequalification of contractors.

128. In order to facilitate the implementation of the EMP, during the preparation for the construction phase, the future contractors must be prepared to co-operate with the local population in the mitigation of impacts. Furthermore, the contractor must be primed through the contract documentation and ready to implement all the mitigation measures and engage trained environmental management staff to audit the effectiveness and review mitigation measures as the project proceeds. The effective implementation of the EMP will be audited as part of the mid-term review of loan conditions and the executing agency must be prepared for this.

129. In the EMP Matrix, the impacts have been classified into those relevant to the design/preparation stage, construction stage and operation and maintenance stage. The matrix provides details of the mitigation measures recommended for each of the identified impacts, approximate location of the mitigation sites, time span of the implementation of mitigation measures, an analysis of the associated costs and the responsibility of the institution. The institutional responsibility has been specified for the purpose of the implementation and the supervision. The matrix is supplemented with a monitoring plan (**Appendix-II**) for the performance indicators. An estimation of the

associated costs for the monitoring is given with the plan including physical mitigation costs. The EMP has been prepared following the best practices and the ADB's Safeguards Policy Statement, 2009.

130. Prior to implementation of the subproject, NTDC will need to confirm that contractors and their suppliers have complied with all statutory requirements and have appropriate and valid licenses and permits for all powered mechanical equipment.

6.2 Institutional Requirements

131. The EMP was prepared taking into account the lack of capacity of the NTDC to conduct environmental assessments of the subprojects. But it is envisaged that the NTDC's Environmental and Social Impact Cell (ESIC) will conduct monitoring of subproject to check the compliance of EMP provisions. The ESIC is composed of one Manager, one Deputy Manager, two Assistant Managers and one surveyor. The staff members and the supervisory consultants are responsible for addressing environmental concerns for the ADB's MFF potentially involving hundreds kilometers of power transmission lines and dozens. Most of the environmental work is delegated to consultants. Whereas there is a limited level of awareness, NTDC staff needs more training and resources if they are to effectively provide quality control and oversight for the EMP implementation. Specific areas for immediate attention are in EMP auditing, environmentally responsible procurement, air, water and noise pollution management and ecological impact mitigation. It is recommended that an environmental specialist should be made part of team of supervisory consultants for effective monitoring of EMP provisions.

132. An Environment Specialist should also be the part of Project Management Consultants' team to assist the ESIC and PMU for monitoring and reporting to ADB for all the sub projects of Tranche-IV. This Specialist will;

- work in close coordination to ESIC and PMU, NTDC to ensure all statutory environmental submissions under PEPA, 1997 and other environmentally related legislation are thoroughly implemented;
- to ensure all environmental requirements and mitigation measures from the environmental assessment of subprojects are included in the contract prequalification and bidding documents;
- work with NTDC to execute any additional IEE and IEE requirements needed due to fine tuning of the subprojects and that environmental performance targets are included in the contracts prior to project commencement;
- work in the PMU with NTDC to ensure all environmental requirements and mitigation measures from the IEEs and environmental performance criteria are incorporated in the subproject contracts or variations and that the EMP is effectively implemented;
- work with management consultants, supervising consultants and contractors to manage and monitor the implementation of the project EMP;
- Prepare bi-annual environmental monitoring report for all the subprojects of Tranche-IV for submission to ADB;
- Participate in all safeguards review missions of ADB.

133. Overall implementation of the EMP will become NTDC's responsibility. Other parties to be involved in implementing the EMP are as follows:

134. **Contractors**: Responsible for implementing all measures required to mitigate environmental impacts during construction;

135. **NTDC Board of Directors**: Responsible to ensure that sufficient timely resources are allocated to process the environmental assessments and to monitor implementation of all construction and operational phase mitigation measures required to mitigate environmental impacts.

136. Considering that other government agencies that need to be involved in implementing the EMP, training workshops should be conducted at every six months or twice each year, for the first 2 years (and annually thereafter) to share the monitoring report on the implementation of the EMP, to share lessons learned in the implementation and to decide on remedial actions, if unexpected environmental impacts occur.

137. The environmental monitoring plan was designed based on the project cycle. During the preconstruction period, the monitoring activities will focus on (i) conducting baseline monitoring; (ii) checking the contractor's bidding documents, particularly to ensure that all necessary environmental requirements have been included; and (iii) checking that the contract documents' references to environmental mitigation measures requirements have been incorporated as part of contractor's assignment and making sure that any advance works (protection of specimens and transplantation, design of power equipment etc.) are carried out in good time. Where detailed design is required, the inclusion and checking of designs must be carried out. During the construction period, the monitoring activities will focus on ensuring that environmental mitigation measures are implemented, and some performance indicators will be monitored to record the Project's environmental performance and to guide any remedial action to address unexpected impacts. Monitoring activities during project operation will focus on recording environmental performance and proposing remedial actions to address unexpected impacts.

138. For these extension/augmentation works, the construction and operational impacts will be minor and manageable and no insurmountable impacts are predicted providing that the EMP is implemented to its full extent and required in the contract documents. However, experience suggests that some contractors may not be familiar with this approach or may be reluctant to carry out some measures. In order that the contractors are fully aware of the implications of the EMP and to ensure compliance, it is recommended that the cost of environmental measures be treated separately in the tender documentation and that payment milestones are linked to environmental performance, viz-a-viz the carrying out of the EMP.

139. The effective implementation of the EMP will be audited as a part of the loan conditions and the executing agency must be prepared for this. In this regard, the NTDC (the EA) must be prepared to guide the design engineers and contractors on the environmental aspects.

140. The NTDC procedures for handling PCB need to be strengthened. The maintenance of transformers needs to be based on the manufacturer's instructions. There need to be performance evaluation procedure prescribed and followed for each power transformer. In working areas where PCBs are handled, it is necessary to monitor the levels of chlorinated solvents. In case of emergencies, the first step is to attempt to control the spread of the liquid, this is especially relevant during transportation. In case of spills, emergency measures need to be taken by personnel specially trained and wearing protective clothes. Oil absorptive materials are a useful tool and needs to be spread over the spill. All equipment and surfaces exposed to the spill need to be washed with solvent. The best international procedures and guidelines need be followed, one such guideline is

the UNEP 'PCB Transformers and Capacitors –From Management to Reclassification and Disposal, May 2002'.

141. NTDC already prohibits use of PCB's in new power transformers, there is however, need to prepare an inventory of any PCB carrying equipment in the system and all such equipment be replaced. The maintenance instructions prepared by the Technical Services Group needs to be reviewed and revised to add PCB based equipment maintenance and a procedure for handling any PCB spills. These need to be reviewed and upgraded in light of best International practice. This would include provision of special clothing, availability of oil absorptive solvents and availability of steel containers. Training to staff on oil spills and special care during transportation of equipment using PCB's.

6.3 Grievance Redressal System

142. A Grievance Redress System (GRS) will be established by the PMU to handle the community complains received from the complaints. Under this mechanism, a Grievance Redress Cell (GRC) will be established. The project will establish a Project Information Centre at site and a Community Complaints Management Register (CCMR) will be placed there for logging complaints and grievances. All written and oral grievances will be recorded in the Register. The information recorded in the register will include the date of the complaint and particulars of the complainant; a description of the grievance; the follow-up action required; the person responsible for implementing the action; and a target date for its completion.

143. Affected communities and their representatives will be identified during the project preparation stage. The PMU will work towards resolving the grievances recorded in the CCMR in conjunction with the Supervision Consultant within seven calendar days. After this deadline, any unresolved issues will be forwarded to NTDC.

6.4 Environmental and Social Complain Register

144. The consultant's environmental team will maintain an environment & social complaint register at camp site office to document all complaints received from the local communities. The register will also record the measures taken to mitigate these concerns. The final report will be communicated to Environmental section of PMU. The Project Monitoring team shall carry out the monitoring of the implementation of social and environmental mitigation measures as per ADB Safeguard Policy Statement.

Grievance Resolution Process

Land / Crop Compensation Issues	Project / Other Items Compensation Issues
Complaint resolution will be attempted at office of SDO. If still unsettled, a grievance will be lodged to the Head PMU/NTDC. He will redress in 10 days.	Complaint resolution will be attempted at village level through GRC* in one week. If still unsettled, a grievance can be referred to court of law.

6.5 Environmental Management Cost

145. The total cost for the environmental management of the proposed four augmentation/extension sub-projects is about 535,600 Pak Rupees. The details of the cost are given in Table – 6.1.

Table 6.1: Cost Estimates for Environmental Management

Particulars	Details	Total Cost (PKR)
Implementation of Mitigation measures	Procurement of four noise level monitors	60,000 (15000*4)
	Arrangements for daily water sprinkling	100,000 (25000*4)
	Provision of PPEs (Safety Goggles, shoes, safety masks, eye shields, ear muffs, first aid kits etc.)	160,000 (40000*4)
	Plantation of trees/plants in the grid stations	80,000 (20000*4)
	Arrangements for careful collection and disposal of wastes, oils, lubricants etc.	120, 000 (30000*4)
Contingency	3% contingency	15600
Total		**535,600**

7. CONSULTATIVE MEETINGS

146. Since these augmentation/extension works are to be carried out within the boundary wall of existing grid stations and nearby communities are not likely to have any impact due to implementation of these works. Therefore, the consultation process is limited to the NTDC officials only. The purpose of these meetings and consultations was to get information about the scope of work and location of extension works within the existing grid stations.

147. Moreover, all the requisite facilities (i.e. water supply, power supply etc.) for implementation of these works are available in the existing grid stations of NTDC. Therefore, no interruption to the local resources is likely to be involved.

148. A number of meetings were held with the officials of Project Management Unit, NTDC; and Survey & Investigation, NTDC and the requisite maps/ alignments were collected. After reviewing the relevant documents/ data and maps, field visits were also made of the existing NTDC grid stations.

149. In addition, the consultative meetings were also held at site with the concerned officials and other staff of existing grid stations as below:

- Mahr Khalid Mehmood, Manager ESIC, NTDC
- Mr. Razaq Ahmad, Senior Surveyor, S&I, NTDC, Lahore.
- Mr. M. Ayub, Surveyor, S&I, NTDC, Lahore.
- Mr. Ghazanfar Ali Khan, Superintendent Engineer, NTDC, Gujranwala.
- Mr. Arqam, Sub Station Operator-II, NTDC, Gujranwala.
- Mr. Tayyab Abbas, Shift Engineer, NTDC, Gujranwala.
- Mr. Sadiqullah, Superintendent Engineer, NTDC, Rawat.
- Mr. Naveed Riaz, Assistant Engineer Operation, NTDC, Rawat.
- Mr. Raja Zahid, Sub-Station Operator- I, NTDC, Rawat.

8. CONCLUSIONS AND RECOMMENDATIONS

8.1 Findings and Recommendations

150. This study was carried out at the planning stage of the project. Primary and secondary data were used to assess the environmental impacts. The potential environmental impacts were assessed in a comprehensive manner. The report has provided a picture of all potential environmental impacts associated with the proposed extension/augmentation works in the existing 220 kV and 500 kV grid stations, and recommended suitable mitigation measures.

151. Since, these extension works are not listed in any local environmental regulations, therefore, NOC from EPAs is not required. There could be some noise impacts and waste management issues for the construction stage that must be addressed in the detailed design and through environmentally responsible procurement.

152. The extension/augmentation works are to be carried out on the space already available in the existing four grid stations of NTDC. Therefore, the question of land acquisition or disturbance to any private land, has been ruled out.

153. The contractors' evaluation should be carried out on the basis of their sensitization of environmental health and safety issues.

154. During the commissioning phase noise monitoring should ensure that statutory requirements have been achieved. Monitoring activities during project operation will focus on periodic recording environmental performance and proposing remedial actions to address any unexpected impacts (If any).

8.2 Summary and Conclusions

155. The proposed extension/augmentation works i.e. (i) Extension of Two Line Bays at 500 kV Gujranwala Grid Station, (ii) Augmentation of 500/220 kV Auto Transformers at 500 kV Rawat Grid Station, (iii) Extension in 500 kV Jamshoro Grid Station, and (iv) Installation of 220 kV SVC at existing 220 kV Quetta Grid Station are feasible and sustainable option from the power transmission, engineering, environmental, and socioeconomic points of view. Implementation of the EMP is required and the environmental impacts associated with the subproject need to be properly mitigated, and the existing institutional arrangements are available. Additional human and financial resources will be required by NTDC to complete the designs and incorporate the recommendations effectively and efficiently in the contract documents, linked to payment milestones. The proposed mitigation and management plans are practicable but require additional resources.

156. This IEE, including the EMP, should be used as a basis for an environmental compliance program and be included as an Appendix to the contract document. The EMP shall be reviewed at the detailed design stage and be converted to site specific EMP (SEMP). Continued monitoring of the implementation of mitigation measures, the implementation of the environmental conditions for work, and monitoring of the environmental impact related to the operation of the subproject should be properly carried out and reported at least twice a year as part of the project performance report i.e. Bi-Annual Environmental Monitoring Report (BAEMR) as per requirement of ADB Safeguards Policy Statement 2009.

APPENDIX-I : ENVIRONNEMENTAL MANAGEMENT PLAN (EMP) FOR EXTENSION/AUGMENTATION WORKS

Environmental Concern	Objectives	Mitigation Measures (MM) Recommended	Timing to Implement MM	Location to Implement MM	Resp imp MM	Resp mon MM
DESIGN STAGE						
1. Social Impacts	To ensure that the adverse impacts on crops and trees are mitigated according to the LARP provisions.	1. No Impact, as the constriction activities will be within the boundary wall of existing grid stations and hence no social issue will rise.	-	-	-	-
2. Hydrological Impacts	To minimize hydrological and drainage impacts during constructions.	1. The flow of waste water in the open space within the grid stations should cater far.	Before the commencement of construction activities/during designing stage.	The existing grid stations areas.	NTDC with the Design Consultant	NTDC
3. Waste Disposal	Ensure adequate disposal options for all waste including unsuitable soils, scrap metal.	1. Identify sufficient locations for disposal of transformer oils, unsuitable soils, scrap metal "cradle to grave". 2. Include in contracts for unit rates for re-measurement for disposal. 3. Designate disposal sites in the contract and cost unit disposal rates accordingly. 4. Prepare a PCB spill handling procedure and equip such teams with special clothing, steel containers and solvents.	1. During designing stage no later than pre-qualification or tender negotiations. 2. Include in the contract.	Locations approved by NTDC and waste disposal local authorities.	NTDC with the design consultant	NTDC and CSC

Environmental Concern	Objectives	Mitigation Measures (MM) Recommended	Timing to Implement MM	Location to Implement MM	Resp imp MM	Resp mon MM
CONSTRUCTION STAGE						
1. Hydrology and Drainage Aspects	To ensure the proper implementation of hydrological/drainage related mitigation measures.	1. Consideration of weather conditions when particular construction activities are undertaken. 2. Limitations on excavation depths in use of recharge areas for material exploitation or spoil disposal. 3. Use of landscaping as an integrated component of construction activity as an erosion control measure.	Prepare a thorough plan to be approved by SC one month prior to a commencement of construction.	Within the existing grid stations.	CSC or NTDC to actively supervise and enforce	NTDC
2. Orientation for Contractors, and Workers	To ensure that the CSC, contractor and workers understand and have the capacity to ensure the environmental requirements and implementation of mitigation measures.	1. NTDC to engage environmental specialist in the PMC to monitor and progress all environmental statutory and recommended obligations. 2. Conduct special briefing for managers and / or on-site training for the contractors and workers on the environmental requirement of the project. Record attendance and achievement test. 3. Agreement on critical areas to be considered and necessary mitigation measures, among all parties who are involved in project activities. 4. Continuous progress review and refresher sessions to be followed.	Induction of all relevant staff required for implementation of EMP. At early stages of construction for all construction employees as far as reasonably practicable.	All staff members in all categories. Monthly induction and six month refresher course as necessary until contractor complies.	Contractor and the CSC and record details	NTDC & CSC to observe and record success
3. Air Quality	To minimize effectively and avoid complaints due to the airborne particulate	1. Control all dusty materials at source. 2. All heavy equipment and machinery shall be fitted in full compliance with	During the construction stage.	Construction sites within the existing grid stations.	Contractor should maintain acceptable	NTDC/CSC

Environmental Concern	Objectives	Mitigation Measures (MM) Recommended	Timing to Implement MM	Location to Implement MM	Resp imp MM	Resp mon MM
	matter released to the atmosphere.	the national and local regulations. (Relevant regulations are in the Motor vehicles fitness rules and Highway Act). 3. Fuel-efficient and well-maintained haulage trucks shall be employed to minimize exhaust emissions. 4. Vehicles transporting soil, sand and other construction materials shall be covered. 5. Limitations to speeds of such vehicles necessary. Transport through densely populated area should be avoided. 6. Spraying of bare areas with water. 7. Concrete plants to be controlled in line with statutory requirements should not be close to sensitive receptors.			standard CSC to supervise activities.	
4. Noise / Ground Vibration	To minimize noise level increases and ground vibrations during construction operations.	1. All heavy equipment and machinery shall be fitted in full compliance with the national and local regulations and with effective silencing apparatus to minimize noise. 2. As a rule, the operation of heavy equipment shall be conducted in daylight hours. 3. Hammer- type percussive pile driving operations shall be not be allowed at night time. 4. Construction equipment, which	Maximum allowable noise levels should be below 80 dB (A) L_{EQ} at the boundary of the construction site.	Construction sites within the existing grid stations.	Contractor should maintain the acceptable standards CSC to supervise relevant activities.	NTDC / CSC

Environmental Concern	Objectives	Mitigation Measures (MM) Recommended	Timing to Implement MM	Location to Implement MM	Resp imp MM	Resp mon MM
		generates excessive noise, shall be enclosed or fitted with effective silencing apparatus to minimize noise. 5. Well-maintained haulage trucks will be used with speed controls. 6. Contractor shall take adequate measures to minimize noise nuisance in the vicinity of construction sites by way of adopting available acoustic methods.				
5. Exploitation Handling, Transportation and Storage of Construction Materials	To minimize contamination of the surroundings (Due to Implementation of works, concrete and crushing plants).	1. In order to minimize and or avoid adverse environmental impacts arising out of construction material exploitation, handling, transportation and storage measures to be taken 2. Conditions that apply for selecting sites for material exploitation. 3. Conditions that apply to timing and use of roads for material transport. 4. Conditions that apply for maintenance of vehicles used in material transport or construction. 5. Conditions that apply for selection of sites for material storage. 6. Conditions that apply for aggregate production. 7. Conditions that apply for handling hazardous or dangerous materials such as oil, lubricants and toxic	Update monthly	Sites within the existing grid stations.	Contractor and CSC to agree format of reporting	NTDC/CSC

Environmental Concern	Objectives	Mitigation Measures (MM) Recommended	Timing to Implement MM	Location to Implement MM	Resp imp MM	Resp mon MM
		chemicals.				
6. Construction Waste Disposal	Minimize the impacts from the disposal of construction waste.	1. Waste management plan to be submitted to the CSC and approved by MC one month prior to starting works. 2. Estimating the amounts and types of construction waste to be generated by the project. 3. Investigating whether the waste can be reused in the project or by other interested parties. 4. Identifying potential safe disposal sites close to the project or those designated sites in the contract. 5. Investigating the environmental conditions of the disposal sites and recommendation of most suitable and safest sites. 6. Used oil and lubricants shall be recovered and reused or removed from the site in full compliance with the national and local regulations. 7. Oily wastes must not be burned. Disposal location to be agreed with local authorities. 8. Machinery should be properly maintained to minimize oil spill during the construction. 9. Solid waste should be disposed at an approved solid waste facility, open burning is illegal and contrary	Update monthly	Waste disposal areas near the existing grid stations.	Contractor and CSC should supervise and take action to complete contractor's relevant activities according to EIA/IEE/ EMP requirement & environmental standards.	NTDC/ CSC

Environmental Concern	Objectives	Mitigation Measures (MM) Recommended	Timing to Implement MM	Location to Implement MM	Resp imp MM	Resp mon MM
		to good environmental practice				
7. Work Camp Operation and Location	To ensure that the operation of work camps does not adversely affect the surrounding environment.	1. Although, the labor camp will be located within the boundary wall of existing grid stations, but mitigation measures are required. 2. The labor should be allowed to use the Water and sanitary facilities available in the grid stations. 3. Solid waste and sewage shall be managed according to the national and local regulations. As a rule, solid waste must not be dumped, buried or burned at or near the project site, but shall be disposed off to the nearest sanitary landfill or site having complied with the necessary permission of local authority permission. 4. The Contractor shall organize and maintain a waste separation, collection and transport system. 5. The Contractor shall document that all liquid and solid hazardous and non-hazardous waste are separated, collected and disposed of according to the given requirements and regulations. 6. At the conclusion of the project, all debris and waste shall be removed. All temporary structures shall be removed.	Update once a month	The contractor camp will be established within the boundary wall of existing grid stations.	Contractor	NTDC/ MC

Environmental Concern	Objectives	Mitigation Measures (MM) Recommended	Timing to Implement MM	Location to Implement MM	Resp imp MM	Resp mon MM
8. Loss of Trees and Vegetation Cover of the Areas for Towers and Temporary Work-space	To avoid several negative impacts due to removing of landmark, sentinel and specimen trees as well as green vegetation and surface cover.	As the construction activities are to be carried out on open space available within the boundary wall of existing grid stations, so no tree removal will be involved. But tree plantation should be done by this project at open areas within the grid station boundary wall.	After project completion.	At open areas within the grid station boundary wall.	Design consultant, Contractor and CSC	NTDC/CSC
9. Safety Precautions for the Workers	To ensure safety of workers	1. Providing adequate warning signs. 2. Providing workers with skull guard or hard hat. 3. Contractor shall instruct his workers in health and safety matters, and require the workers to use the provided safety equipment. 4. Establish all relevant safety measures as required by law and good engineering practices.	Prior to commencement and during construction	Construction sites.	Contractor and CSC	NTDC/ CSC
10.Social Impacts	To ensure minimum impacts on the surrounding populations.	No social impact is likely to occur, as the construction activities will be carried out within the boundary wall of existing grid stations, labor camp and construction material will be within the boundary walls.	-	-	-	-
11. Institutional Strengthening and Capacity Building	To ensure that NTDC officials are trained to understand and to appreciate EMP.	Capacity building activities were taken by Environmental Officer in Tranche 1 and 2. Environmental and Social Impact Cell (ESIC) was setup with in NTDC under GM (Projects) in Tranche 1.	Initiate preconstruction and continue beyond project completion	Awareness training for all management and senior staff in NTDC at senior	NTDC	NTDC & ADB

Environmental Concern	Objectives	Mitigation Measures (MM) Recommended	Timing to Implement MM	Location to Implement MM	Resp imp MM	Resp mon MM
		Trainings and provisions of proper monitoring facilities to ECIS are recommended.		engineer and above in PMU and related units.		
OPERATIONAL STAGE						
1. Air Quality		No Impacts			NTDC	NTDC
2. Noise		No significant Impacts by Tranche-IV subprojects.		All subprojects of tranche-IV.	NTDC	NTDC
3. Compensatory Tree Planting	Not applicable	-	-	-	-	-
4. Landslides and soil erosion	Avoid landslips and loss of productive land	No significant Impacts.		All subprojects of tranche-IV.	NTDC	NTDC
5. Water Quality	Avoid disruption to water bodies.	No significant Impacts from this subproject.		All subprojects of tranche-IV.	NTDC	NTDC
6 Crops and Vegetation	Not Applicable	-	-	-	-	-
7. Social safety Impacts	Not Applicable	-	-	-	-	-

LARP = Land Acquisition and Resettlement Plan, APs = Affected Persons, TD = Temporary Drainage. EC = Erosion Control, WM = Waste Management, CSC = Construction Supervision Consultant, NEQS = National Environmental Quality Standards, MC = Management Consultants, MM = Mitigation Measure.

APPENDIX-II: ENVIRONMENTAL MONITORING PLAN FOR AUGMENTATION/EXTENSION WORKS

SR. NO.	MONITORING ACTIVITIES	RESPONSIBILITIES	TIMING FOR MONITORING
1	**DESIGN STAGE**		
1.1	Audit project bidding documents to ensure EMP is included	NTDC through project implementation unit	Prior to issue of bidding documents.
1.2	Monitor contractor's detailed project design to ensure relevant environmental mitigation measures in EMP have been included	NTDC with assistance of project implementation unit	Prior to NTDC approval of contractor's detailed alignment survey.
1.3	Monitor the thorough implementation of detailed Environmental Guidelines for Construction Works, including procurement, management, works, closing operations	NTDC with the assistance of management consultants	Prior to NTDC approval of contractor's detailed designs.
1.4	Review the management plan for waste management	NTDC with the assistance of management consultants	Prior to NTDC approval of contractor's detailed designs.
1.5	Audit detailed designs of facilities and installations to ensure standard environmental safeguards/ mitigation measures (as identified in EMP) have been included	NTDC with assistance of project implementation unit	Prior to NTDC approval of contractor's detailed designs.
1.6	Monitor the performance of environmental training and briefings and of the environmental awareness of project staff and NTDC	NTDC with the assistance of management consultants	Continuous throughout the entire project period.
2	**CONSTRUCTION PHASE**		
2.1	Regular (monthly) monitoring and reporting (bi-annually to ADB) of contractor's compliance with contractual environmental mitigation measures	NTDC with assistance of project implementation unit	Continuous throughout construction period.
2.2	Monitoring of the implementation of the Landscape Design Plan	NTDC with the assistance of management consultants	During the last phase of construction works
2.3	Commissioning phase monitoring of as built equipment versus environmental performance criteria	NTDC	At commissioning

SR. NO.	MONITORING ACTIVITIES	RESPONSIBILITIES	TIMING FOR MONITORING
3	**OPERATION AND MAINTENANCE PHASE**		
3.1	Inspections will include monitoring implementation of operational mitigation measures versus environmental criteria specified in EMP, waste management and operational noise.	NTDC	As per NTDC inspection schedules
3.2	Monitoring of the implementation of the Landscape Design Plan	NTDC with the assistance of management consultants	Twice per year for three years of operation.
3.3	Monitoring decommissioning of other plant required for installation of MFF funded components and waste disposal.	NTDC	During the life of the project