DRAFT

Initial Environmental Examination

June 2014

PAK: Trimmu and Panjnad Barrages Improvement Project
(Rehabilitation & Upgrading of Trimmu Barrage)

Prepared by NESPAK-ABB-DMC joint venture consultant for PIAIP for the Asian Development Bank.

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CURRENCY EQUIVALENTS

(as of 3rd March 2014)

Currency unit	–	Pakistan Rupee (Rs.)
$1.00	=	Rs. 97.97 (International Forex Rate)

NOTE

In this report, "$" refers to US dollars. Unless otherwise stated.

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IRRIGATION DEPARTMENT
GOVERNMENT OF THE PUNJAB

DRAFT INITIAL ENVIRONMENTAL EXAMINATION (IEE)

for

REHABILITATION AND UPGRADING OF TRIMMU BARRAGE

March, 2014

NESPAK-AAB- DMC JOINT VENTURE CONSULTANTS FOR PIAIP

National Engineering Services Pakistan (Pvt.) Limited

AAB (Pvt.) Limited

Development and Management Consultants

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LIST OF ABBREVIATIONS

ADB	Asian Development Bank
AIDS	Acquired Immunodeficiency Syndrome
AC	After Construction
AFFF	Aqueous Film Forming Foams
Amsl	Above Mean Sea Level
AR Bridge	Arterial Road Bridge
APs	Affected Persons
AOI	Area of Influence
BOD_5	Biochemical Oxygen Demand
BOQ	Bill of Quantities
BC	Before Construction
BHU	Basic Health Unit
CCA	Cultivable Command Area
CMS	Change Management Statement
COD	Chemical Oxygen Demand
CO_2	Carbon Dioxide
CO	Carbon Monoxide
CDM	Clean Development Mechanism
COSHH	Control of Substances Hazardous to Health
CSCEnv	Construction Supervision Consultants Environmentalist
CMS	Change Management Statement
CH_4	Methane
CEnv	Contractor's Environmentalist
CFCs	Chlorofluorocarbons
cft	cubic feet
CSC	Construction Supervision Consultants
CoI	Corridor of Impact
DC	During Construction
DG Khan	Dera Ghazi Khan
D/s	Downstream
DO	Dissolved Oxygen
DMC	Development and Management Consultants
DPs	Displaced Persons
DFs	Displaced Families
DD	Deputy Director
DLR	Directorate Land Reclamation

DPC	Displaced Persons Committee
EC	Electrical Conductivity
EIA	Environmental Impact Assessment
EMMP	Environmental Management & Monitoring Plan
EMP	Environmental Management Plan
EPA	Environmental Protection Agency
EPAs	Environmental Protection Agencies
ESU	Environmental and Social Unit
ERP	Emergency Response Procedure
EL	Elevation Level
E. coli	Escherichia coli
EA	Environmental Assessment
FAO	Food and Agriculture Organization
FFP	Flood Fighting Plan
FPSP	Flood Protection Sector Project
ft	Feet
GCA	Gross Cultivated Area
GDP	Gross Domestic Product
GIS	Geographical Information System
GHGs	Greenhouse Gases
GRR	Grievance Redress Register
GRC	Grievance Redress Committee
ha	Hectare
HFL	High Flood Level
HTV	Heavy Transport Vehicle
HSE	Health, Safety & Environment
HIV	Human Immunodeficiency Virus
kg	Kilogram
km	Kilometre
LMB	Left Marginal Bund
LRE	Left Retaining Embankment
LTV	Light Transport Vehicle
LAA	Land Acquisition Act
LAC	Land Acquisition Collector
LARF	Land Acquisition and Resettlement Framework
IEE	Initial Environmental Examination
IPCC	Intergovernmental Panel on Climate Change
IWT	Indus Water Treaty
ISO	International Organization for Standardization

JV	Joint Venture
mg/l	Milligrams per liter
meq/l	milliequivalents per liter
NTU	Nephelometric Turbidity Unit
N_2O	Nitrous Oxide
M&E	Monitoring and Evaluation
mm	mllimeters
NCS	National Conservation Strategy
NEQS	National Environmental Quality Standards
NESPAK	National Engineering Services Pakistan
NO_x	Oxides of Nitrogen
NTU	Nephelometric Turbidity Unit
N_2O	Nitrous Oxide
NOC	No-Objection Certificate
NDC	National Development Consultants
NGOs	Non-government Organizations
O&M	Operation and Maintenance
P&D	Planning and Development Department
PM	Particulate Matter
ppm	parts per million
ppb	parts per billion
PEPA	Pakistan Environmental Protection Act
PEPC	Pakistan Environmental Protections Council
PMO	Project Management Office
PPC	Pakistan Penal Code
PTCL	Pakistan Telecommunication Company Limited
PARCO	Pak Arab Refinery Ltd.
PIU	Project Implementation Unit
PPEs	Personal Protective Equipments
PMD	Pakistan Meteorological Department
PIAIP	Punjab Irrigated Agriculture Investment Program
PIDA	Punjab Irrigation and Drainage Authority
PID	Punjab Irrigation Department
PVC	Polyvinyl Chloride
PHS	Public Health and Safety
RP	Resettlement Plan
RSC	Residual Sodium Carbonate
R & U	Rehabilitation and Upgrading

RD	Reduced Distance
RL	Reduced Level
RRP	Report and Recommendation to the President
RE	Resident Engineer
RMB	Right Marginal Bund
RoW	Right of Way
REA	Rapid Environmental Assessment
RGB	Right Guide Bank
RRE	Right Retaining Embankment
SAR	Sodium Absorption Ratio
SA	Social Assessment
SO_x	Oxides of Sulphur
SAP	Social Action Plan
SCARP	Salinity Control and Reclamation Project
SEMU	Social & Environmental Management Unit
SFA	Social Framework Agreement
SSEMP	Site Specific Environmental Management Plan
SMO	SCARPS Monitoring Organization
SOP	Standard Operating Procedure
SVP	Sutlej Valley Project
SSOP	Soil Survey of Pakistan
S/S	Solidification/Stabilization
S.M. Link	Sidhnai Mailsi Link
TDS	Total Dissolved Solids
TSS	Total Suspended Solids
TBT	Tool Box Talk
TI	Thumb Impression
T.S. Link	Trimmu Sidhnai Link
US-EPA	United States Environmental Protection Agency
µS/cm	micro Siemens per centimeter
U/s	Upstream
$\mu g/m^3$	microgram per cubic meter
UNO	United Nation Organization
WDP	Women Displaced Persons
WWF	Worldwide Fund for Nature
WAPDA	Water and Power Development Authority
XEN	Executive Engineer

UNITS AND CONVERSION FACTORS

Length

1 inch	=	25.4 millimeters				
1 meter	=	3.281 ft				
1 mile	=	1609 meters	=	1760 yards	=	5280 ft

Area

1 sq. m	=	10.76 sq. ft	=	1.196 sq. yd
1 hectares	=	2.47 acres	=	10,000 sq. m
1 sq. km	=	100 hectares		

Volume

1 US wet gallon	=	0.833 imperial gallon	=	3.785 liters
1 US dry gallon	=	0.967 imperial gallon	=	4.404 liters
1 cu. meters	=	35.28 cu. ft		

EXECUTIVE SUMMARY

ES-1 Introduction

1. Government of Punjab is planning to undertake the rehabilitation of Punjab Barrages and improvement of the irrigation and water management system in the Punjab Province which include the rehabilitation and upgrading of the Trimmu Barrage. ADB is providing fund for Trimmu Barrage Rehabilitation & Upgrading work. The Environmental Assessment study of the proposed project has been carried out in accordance with Pakistan statutory requirement and Asian Development Bank Safeguard Policy Statement 2009.

2. Trimmu Barrage holds a strategic position in the agricultural economy of Pakistan. It was constructed in 1937-39. The barrage was designed for safe discharge capacity of 645,000 cusecs. During high floods, the excess flows are managed to pass through breaching section.

3. Trimmu Barrage is located at the confluence of Chenab and Jhelum River. Three canals namely Rangpur, Haveli Main Line and Trimmu-Sidhnai Link off-take from Trimmu Barrage. Rangpur canal emanates from the right flank, whereas Haveli Main Line canal and T.S. Link canal off-take from the left flank. Rangpur canal irrigates area of Jhang and Muzaffargarh districts. Haveli Main Line Canal irrigates areas in Jhang and Multan district. T.S. Link canal provides irrigation supplies to different areas of Multan district, Lodhran and Bahawalpur districts.

4. Ever since its construction, the structure of Trimmu Barrage has suffered heavily from floods during the monsoon seasons. The barrage is about 74 years old now and aging process together with inadequate/deferred maintenance has also contributed towards general deterioration of the different structural components of the Barrage. Punjab Irrigation Department (PID) engaged National Development Consultants (NDC) in June 1998 for the safety evaluation of Trimmu Barrage. The study recommended that rehabilitation of the barrage shall be undertaken to ensure safe operation of the barrage.

5. In 2009 with the funding from Asian Development Bank (ADB), the PID initiated “Punjab Irrigated Agriculture Investment Program (PIAIP)”. The consultancy for detailed design of the project was assigned to a joint venture of NESPAK, AAB and DMC. One of the components of PIAIP is the Feasibility Study and detailed design for the Rehabilitation and Upgrading of Trimmu Barrage.

ES-2 Legal and Administration Framework Policy

6. Under ADB Environment Safeguard Policy Statement 2009, projects are to be categorized in to three environmental categories; A, B and C according to significance of the adverse environmental impacts. This Project is categorized as category B as it has some adverse environmental impacts, but of lesser degree and significance. Trimmu Barrage is not a new mega project. It is the rehabilitation and upgrading of the existing structure and the anticipated adverse environmental impacts of the project shall be local, limited and mitigable. All such projects according to ADB Safeguard Policy Statement 2009 require having an IEE. This report comprises the IEE of the Project.

7. Pakistan Environmental Protection Act 1997 is a primary legislation applies in environmental assessment studies in Pakistan. Under section 12 (with subsequent amendment) of the 1997 Act, a project falling under any category specified in Schedule I (SRO 339(1)/2000), requires the proponent to file an IEE with concerned federal agency (Pak-EPA). Projects falling under any category specified in schedule II require the proponent to file an EIA with the federal agency. The estimated total cost of this project is well above from 50 million Pak Rupees therefore a separate EIA report is prepared for EPA Punjab.

8. All project activities should be in compliance with NEQS and should establish monitoring and evaluation systems, as required under Pak-EPA.

ES-3 Project Details and Alternatives

9. The studies of structural and mechanical components of the Barrage have envisaged some structural and hydraulic problem together with mechanical defects. These defects if not rectified the consequences could be devastation with the consequent risk of the failure of the whole system. Such a failure would also adversely affect the economy of the farming community in the command area.

10. The scope of work will include repair of the barrage structure including barrage floor as well as its extension, arrangements for safe passage of 100 years flow, replacement of road bridge deck of the barrage, repair/replacement of regulation gates, gearing and hoisting devices, modernization of barrage structure, installation of new vibrating wire piezometers and trimming of the shoals (bela) in the pond area.

11. Barrage is not safe for 100 years flow. The following options/alternatives were analyzed for the proposed project:

- Option – 1 Provision of additional bays adjacent to the right abutment of Barrage
- Option – 2 Provision of gated by-pass structure on the right side with aqueduct for Rangpur canal

12. Both the options were feasible from environmental point of view. Option 1 was selected for detail design from environmental and technical basis. Also in order to improve the barrage resistance against the uncontrolled breaches, the embankments will be strengthened with adequate free board against 100 year flood.

ES-4 Environmental Baseline Condition

13. Baseline Conditions of the project area have been established through the data collected from the field and direct interaction with the local community and officials from the various departments. Previous studies (secondary data) have also used in the development of the baseline. This report covers the prevailing physical, biological and social environment of the area. The information utilized for the preparation of IEE obtained by sampling/monitoring of physical environmental parameters, extract information using GIS technology, stakeholder consultation including Wildlife, Fishery & Forest Department, NGOs and technical site visits etc. Technical field visits were carried out by the environment team. The laboratory based testing of the physical environmental parameters (water and ambient air) was undertaken by an authorized laboratory. The results are provided in Chapter 4. The objective of the stakeholder consultation was also to explain the project intervention and

their potential impacts on the environment of the area and also share the mitigation measures with the local community to promote a general good will towards the project in the community.

14. It was found from ambient air quality monitoring that air is reasonably clean at present as all the monitored parameters are within the NEQS except PM_{10} (average concentration of PM_{10} is 190.9 µg/m³ and NEQS is 150 µg/m³). The climate of the area is arid characterized by long hot summer and short mild winter.

15. Surface water testing at the barrage indicates that the river water does meet the NEQS and FAO guidelines for agriculture purposes and fit for irrigation and recreational purpose. Groundwater samples were collected and tested from the existing hand pump at the barrage and found satisfactory for human consumption.

16. The barrage pond area provides the habitat of water fowl and many migratory birds visit the site during winter. Fish ladders are provided along both divide walls at Trimmu Barrage. Both the fish ladders are in working condition.

17. The Socio Economic Survey was conducted with the objectives to assess prevailing socio-economic conditions of the related communities and to predict the effects of the proposed different alternatives of rehabilitation and upgrading works. Simple Random Sampling Technique was used to draw representative sample. The average household size in the project area is 5.58 persons. The average literacy rate in the area is 35%. It was found that 8% of the household are engaged in fishing, 22% boatmen, 33% labor work, 31% business, 2% agriculture and 4% in service (government and private service). 100% of the respondent are Muslim and speak Punjabi language. The major cast of the area is Jhabail. Female participation for the betterment of the family is comparatively more as compared with males. In fact, rural women in the study area work 11 hours a day. Women participate in cutting water wild growth, mat (suff) making, and agriculture activities as harvesting, threshing, storage of crops and feeding of the livestock.

ES-5 Potential Impacts, Mitigation Measures and EMP

18. The environmental assessment revealed that the project activities will not cause any significant disturbance and inconvenience to local community and natural environment of the area. Construction related impacts such as air pollution, noise etc. will be mitigated by the implementation of the EMP. All the solid waste and wastewater generated from the project activities and labour camp would be disposed of according to the waste disposal plan, which is a component of the EMP. The chances of land contamination from effluents, accidental spills and leaks should be avoided and Material Safety Data Sheets (MSDS) will be placed in fuel storage area. The construction activities might require the partly or full closure of road bridge. The traffic will be managed according to Traffic Management Plan prepared by the Contractor.

19. The available Punjab Irrigation Department land in the close vicinity of the Project site would be utilized for Contractor's camp facilities. Groundwater is the major source of drinking water for the local community. It is very important to protect the water sources during the construction phase from accidental spills of diesel or any chemical, as any spill could percolate to the groundwater through the sandy stratum at site. It is concluded from the test results that if the groundwater is to be used for the water supply in the Labour Camp

then it is the responsibility of the Contractor to extract water from sufficient depth or provide filtration plant and confirm that it meets the NEQ standards of drinking water.

20. During construction, the Contactor's work force is expected to be largely available from the local population and it is the Contractor's contractual obligation to hire maximum local labour for work. Socioeconomic conditions of the project area will generally be positively impacted due to the project implementation. There are few temporary negative impacts associated with the construction phase e.g. extra burden on the local welfare facilities i.e. water supply, electricity, transportation services etc. will be insignificant and mitigable. The relocation of houses will be required. Resettlement Plan (RP) will be prepared and submitted under separate cover. Further enhance the project acceptance by the locals, some socioeconomic development schemes for the improvement of education, health, employment, infrastructure facilities etc. are recommended in RP.

21. The total estimated Environmental Management cost is Rs. 17.46 Million.

ES-6 Conclusion

22. The project will have net positive impact on the environment of the area. The barrage discharge capacity will be increased and therefore the risk of damaging crop, infrastructure, livestock etc due to uncontrolled breaching in case of flood will be minimized. Availability of jobs during construction phase shall employ and train number of unemployed local youth. Construction of spill channel and removal of bela will widen the pond area and ultimately increase the carrying capacity of fish, birds and macro invertebrates, hence improved the overall biodiversity of the area. Potential adverse environmental & social impacts of the project are associated with mainly the construction phase of the project and all of these impacts are temporary, localized and reversible in nature. These impacts can be mitigated through the proper implementation of the EMP. Therefore it is concluded that this project is environmentally friendly, financially viable, economically sustainable, generally neutral and pro-poverty alleviation.

1. INTRODUCTION

1.1 GENERAL

1. The province of Punjab is only one fourth of the total area of Pakistan yet its fertile land yields more than 50% of the total national agricultural produce. One of the reasons for such high agricultural production is the efficient use of water resources through Punjab's irrigation network. The contribution of Punjab agriculture sector is 28% to the GDP (Government of the Punjab, Punjab Economic Report, 2007). Punjab irrigation network comprises of 24 canals system fed by 14 Barrage and 9 major inter-river link canals, irrigating more than 27 million acres of land.

2. Trimmu Barrage is located at the confluence of Chenab and Jhelum River at latitude of 31°-11' North and longitude 72°-08' East. The barrage location is indicated on Figure-1.1 and 1.2. Trimmu barrage is the fourth link of the series of five barrages constructed on Chenab River, about 129 miles (206km) downstream of Qadirabad Barrage and 149 miles (238km) upstream of Panjnad Barrage. Its distance from Rasul Barrage (Jhelum River) is about 268km.

3. The barrage falls in Tehsil Jhang, District Jhang and located about 25km southwest of Jhang city on Jhang-Bhakkar road. It is connected to other parts of the country through roads and is about 250 km from the provincial capital Lahore and about 400km from Islamabad. Other main cities near the barrage include Jhang, Faisalabad and Bhakkar.

4. Three canals with the total with drawing capacity of 20,380 cusec off-take from the barrage; Rangpur canal emanates from the right flank, whereas Haveli Main Line canal and T.S. Link canal off-take from the left flank. Haveli Canal irrigates 1.017 million acres in Jhang and Multan Districts, whereas, Rangpur Canal feeds 345,000 acres in Jhang and Muzaffargarh Districts. Water conveyed to the Ravi River through T.S. Link canal is then diverted through Sidhnai Mailsi (S.M.) Link canal and serves an area of about 1.715 million acres in Bahawalpur, Vehari and Lodhran Districts. The overall CCA of the Trimmu Barrage Command Canals is 2.68 million acres that is 13.19% of the total CCA (20.31 million acres) of the Punjab and 7.05% of the entire CCA of the country (38 million acres). Asian Development Bank (ADB) is providing assistance to improve the management of Punjab Water Resources and increase the agricultural productivity of the province under the Punjab Irrigated Agriculture Investment Program (PIAIP).

1.2 BACKGROUND

5. Trimmu Barrage holds a strategic position in the agricultural economy of Pakistan. It was constructed in 1937-39. The barrage was designed for safe discharge capacity of 645,000 cusecs. During high floods, the excess flows are managed to pass through breaching section, provided on right marginal bund at RD 16-18 to safeguard the barrage. A remodeling plan of the Barrage was also under taken as a consequence of the Indus Water Treaty and a new head regulator for the Trimmu Sidhnai (T.S.) Link canal was constructed in 1961-62 with 12,500 cusec capacity for feeding lower Ravi and Sutlej River commands.

Trimmu Barrage has exhausted 74 years of its life and suffers from aging and needs to be rehabilitated. The rehabilitation and upgrading works will be carried out under the Punjab

Irrigated Agriculture Investment Program (PIAIP). Punjab Irrigation Department (PID) is the executing agency of the Punjab Irrigated Agriculture Investment Program (PIAIP). The consultancy of the project including feasibility and detailed design work was awarded to a joint venture of NESPAK, AAB and DMC.

6. Historic discharge data of Trimmu Barrage from 1959-2010 indicates that the flood discharge at Barrage exceeded the designed capacity of the barrage five times; in 1959 (943,255 cusecs), 1973 (732,910 cusecs), 1976 (704,633 cusecs), 1992 (888,117 cusecs) and 1997 (677,417 cusecs). During Super floods of 1973 and 1992 breaches occurred in left and right marginal bunds.

7. A Pre-feasibility Study for management of Severe Floods at Trimmu barrage was carried out by a Joint Venture of NESPAK, Harza Engineering Company, Delft Hydraulics and Zafar & Associates in 1997 under Flood Protection Sector Project- Phase-1 (FPSP-1). Different alternatives for management of severe floods by making suitable arrangements for passing excessive discharge over design capacity of the barrage 276,820 cusecs (921,820 – 645,000) were framed. The Punjab Irrigation Department (PID) awarded the work of carrying out Feasibility Study for Rehabilitation & Upgrading of the Trimmu Barrage to the joint venture (JV) of NESPAK in association with AAB and DMC. The Consultants submitted the Feasibility Study Report in June 2012. The study made recommendations to rehabilitate the existing barrage structure, new road bridge structure, dismantling of existing RGB, new divide wall and remove the bela masking. The study also conclude that the barrage capacity is approximately 230,000 cusecs less than the 100 years return flood and need to be raised by rehabilitation of barrage and provision of additional bays.

1.3 PROJECT OBJECTIVE

8. The necessity and objective for the rehabilitation and up-grading are to propose remedial measures for:

- Enhancing the existing flood capacity of Trimmu Barrage to safely pass 100 years flood discharge of (875,000 cusecs indicated by hydrological studies)
- Restoring the existing Trimmu Barrage to perform its designated functions and ensure improved and reliable irrigation supplies
- The decking of the road bridge has been deteriorated and become risky for present traffic requirements
- Repairing / modernization of regulation machinery for the smooth operation of the barrage
- Need for the enhancement of barrage capacity for 100 years return flood

1.4 APPROACHES ADOPTED FOR THE STUDY

9. The environmental and social data were collected and analyzed for the overall environmental study area. Primary data, including sampling and testing of the physical environmental parameters were collected during site visits. The test results and analysis of physical parameters are included in the Chapter 4. Secondary data for the overall study area was reclaimed from other institutions e.g. Forestry, Wildlife and Fisheries Department, Punjab Irrigation Department, SCARPS Monitoring Organization, SEMU, Meteorological Department and Directorate Land Reclamation (DLR) etc.

10. The base line data was developed and analyzed to identify potential environmental impacts of the Project. A risk-based methodology was adopted to identify the high-risk activities and suggest their mitigation measures. Where possible, eliminating the risk by altering the scope or method of execution of work was preferred rather than minimizing the risk with control measures. Public consultations were also undertaken inclusive of gender study, to take into account the public point of view about the project.

1.5 OBJECTIVE OF THE REPORT

11. This report comprises the Initial Environmental Examination (IEE) study of the project in order to make compliance of ADB Safeguard Policy Statement 2009. It takes into account the natural environment (physical and biological) impacts on human health and safety, surrounding communities and under water species. The study evaluates the project's potential environmental risks and impacts on its areas of influence, planning, designing and implementation to preventing, minimizing, mitigating or compensating for adverse environmental impacts and enhancing positive impacts throughout project implementation.

12. The Social Assessment (SA) has been conducted to evaluate the project's potential positive and adverse effects on the affected people and to examine project alternatives where adverse effects may be significant. The breadth, depth and type of analysis in the social assessment are proportional to the nature of the project and scale of its potential effects, positive or adverse, on the affected people. The Socio- Economic Survey was conducted by an experienced and qualified team of sociologists.

1.6 STRUCTURE OF THE REPORT

13. This report is divided into following chapters:

Chapter # 1 Introduction
Chapter # 2 Legal and Administrative Framework Policy
Chapter # 3 Description of the Project
Chapter # 4 Description of the Environment
Chapter # 5 Study of Project Alternatives
Chapter # 6 Impact Assessment, Mitigation and Enhancement Measures
Chapter # 7 Environmental Management Plan
Chapter # 8 Public Consultation

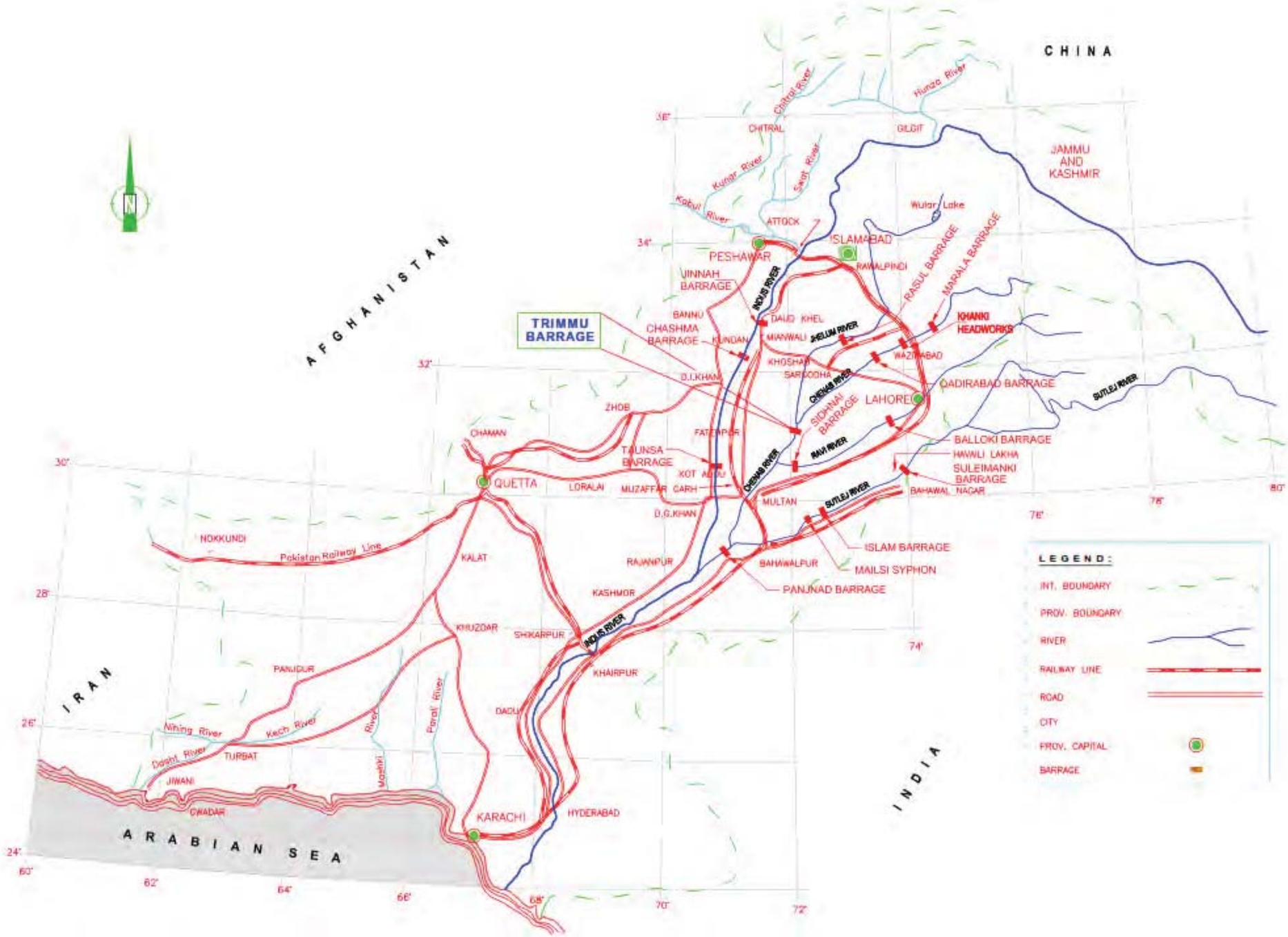


Figure 1-1 Project Location Map

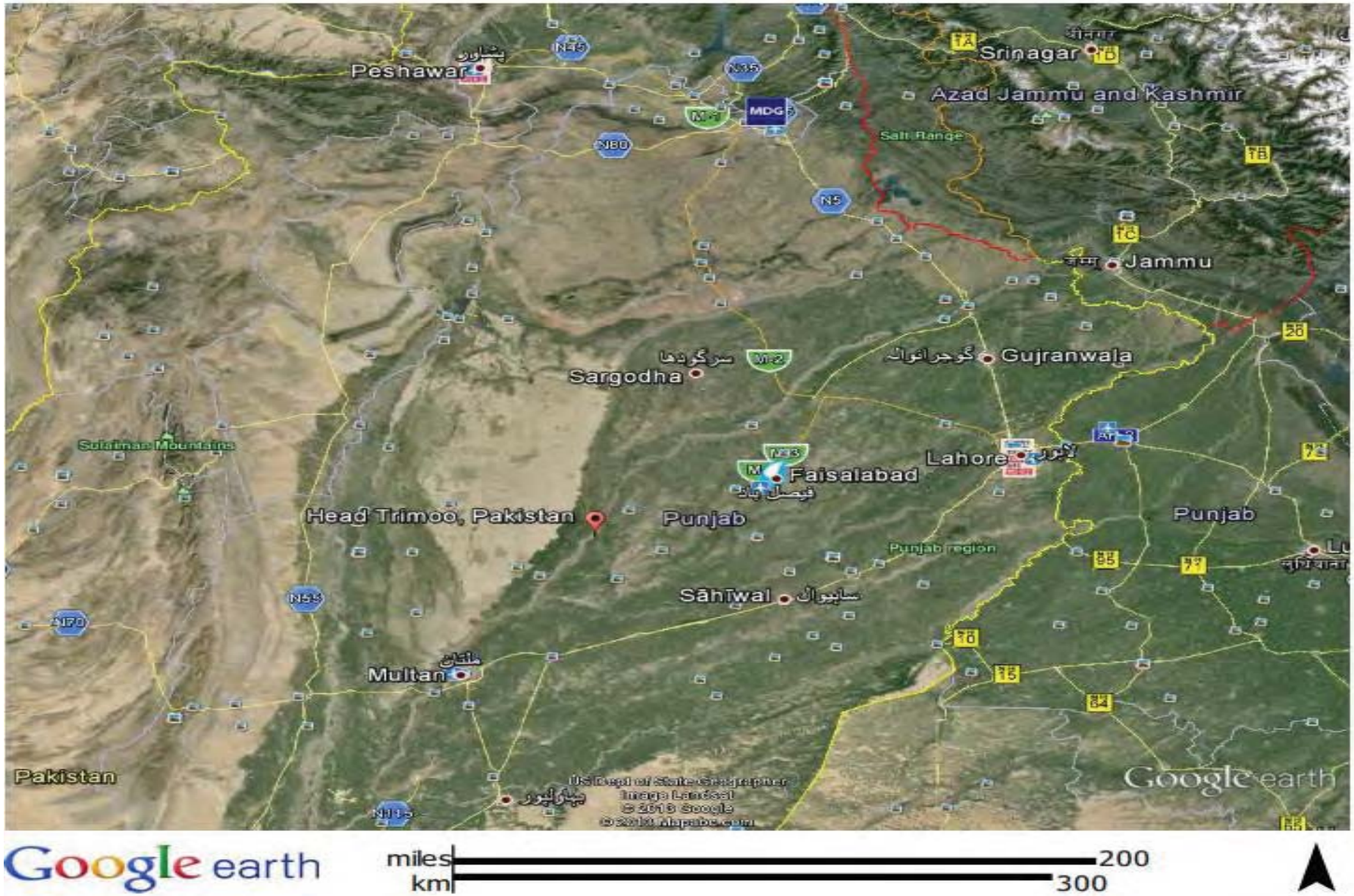


Figure 1-2 GIS Map of Barrage

2. LEGAL AND ADMINISTRATIVE FRAMEWORK POLICY

2.1 GENERAL

14. This chapter provides an overview of the policy framework and national legislation that applies to the proposed Project. The Project is expected to comply with all national legislations and Asian Development Bank Policy relating to environmental and social issues, and to obtain all regulatory clearances required.

2.2 REGULATORY REQUIREMENTS IN PAKISTAN

15. Pakistan Environmental Protection Act (PEPA) 1997 is the primary legislation applies in Environmental Assessment studies in Pakistan. Under section 12 of the Act, a project falling under any category specified in Schedule II (SRO 339(1)/2000), requires the proponent to file an EIA with concerned Environmental Agency, which in case of Trimmu Barrage is EPA Punjab. The estimated cost of Trimmu Barrage Rehabilitation and Upgrading is higher than 50 million Pak Rupees therefore it falls in Schedule II and it is mandatory to prepare an EIA for this project under PEPA 1997 for EPA Punjab.

2.3 NATIONAL CONSERVATION STRATEGY

16. The Pakistan National Conservation Strategy (NCS) was approved by federal cabinet in March 1992 and is the principle policy document on environmental issues in the country. The NCS outlines the country's primary approaches towards encouraging sustainable development, conserving natural resources and managing resources. The NCS has 68 specific programmers in 14 core areas in which policy intervention is considered crucial for the preservation of Pakistan's natural and physical environment. The core areas that are relevant in the context of the proposed Project are pollution prevention and abatement, conserving biodiversity and preservation of cultural heritage.

2.4 NATIONAL ENVIRONMENTAL POLICY

17. The National Environmental Policy provides an overarching framework for addressing the environmental issues facing-Pakistan, Particularly pollution of fresh water bodies and coastal waters, air pollution, lack of proper waste management, deforestation, loss of biodiversity, desertification, natural disasters and climate change. It also gives directions for addressing the cross sectoral issues as well as the underlying causes of environmental degradation and meeting international obligations. The policy provides broad guidelines to the Federal Government, Provincial Government, Federally Administrated Territories and Local Government for addressing environmental concerns and ensuring effective management of their environmental resources.

2.5 GUIDELINES FOR ENVIRONMENTAL ASSESSMENTS

18. The Pak-EPA has published a set of environmental guidelines for conducting environmental assessments and the environmental management of different types of development projects. The guidelines relevant to the proposed Project are listed below:

2.5.1 Guidelines for the Preparation and Review of Environmental Reports, Pakistan Environmental Protection Act, 1997

19. The guidelines, targeted at project proponents, specify:

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

20. The report must contain baseline data relating to the project area, an interpretation of the data and mitigation measures.

2.5.2 Guidelines of Public Consultation, Pakistan Environmental Protection Act, May, 1997

21. These guidelines deal with possible approaches to public consultation and techniques for designing an effective program of consultation that reaches out to all major stakeholders and ensure their concerns are incorporated in any impact assessment study.

2.6 ENVIRONMENTAL INSTITUTIONS AND THEIR RESPONSIBILITIES

2.6.1 *Provincial EPA*

22. The PID will be responsible for providing the complete environmental documentation required by the provincial EPA and remain committed to the approved project design. No deviation is permitted during project implementation without the prior and explicit permission of the EPA.

2.6.2 *Provincial Departments of Forestry and Wildlife*

23. Construction of additional bays is expected to involve uprooting of trees that exists on PID's land. Widening and strengthening of the embankments may also involve uprooting of trees. The Contractor will inform formally to the Punjab Forest Department and PID, even if these trees fall in the area of PID before undertakes any cutting/uprooting.

2.6.3 *Local Government and Municipalities*

24. The PID and its Contractors must ensure that the project meets the criteria of district governments as related to the establishment of construction camps and plants, and the safe disposal of wastewater, solid waste, and toxic materials. The PID will coordinate and monitor environment-related issues.

2.7 ENVIRONMENT RELATED STATUTES

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

2.7.1 The Forest Act, 1927 (and Provincial Acts and Rules)

26. The Act, inter alia, deals with the matters related with protection and conservation of natural vegetation/habitats. In that matter it empowers the concerned agency to declare protected and reserved forest areas and maintaining these. In spite of the fact that it recognizes the right of people for access to the natural resources for their household use, it

prohibits unlawful cutting of trees and other vegetation. In case of rehabilitation and upgrading of Trimmu Barrage cutting of trees will require for construction of additional bays, guide bank and temporary diversion at Rangpur Canal. Trees along the existing guide banks and flood retaining embankments belongs to PID, while trees along the canal channel belong to Punjab Forest Department. The permission is required prior to undertake any tree cutting from the concerned authority. Details of trees likely to be uprooted for the project execution are included in Appendix 7.3.

2.7.2 Government of Punjab, Forestry, Wildlife, Fisheries and Tourism Department (Notification No. FOFT (EXT) VIII. 17/96 Dated 1998

27. In Punjab, should the number of trees to be felled for a project exceed 100, or if the project falls within the jurisdiction of more than one district, a committee comprising the Commissioner of the division covering the districts, the Conservator of Forests, and the Superintending Engineer of the PID must accord their approval.

2.7.3 Provincial Wildlife (Protection, Preservation, Conservation and Management) Act, Ordinances and Rules

28. In addition to empowering provincial wildlife department to establish game reserves, parks, and wildlife sanctuaries, these acts regulate the hunting and disturbance of wildlife. This law will help in eliminating any trespassing into wildlife habitat areas. However, it is anticipated that the proposed project will have adverse effect on the existing wildlife habitat in the adjoining areas of Barrage and belas (small islands in the river). Site workers will be prohibited to disturb any wildlife habitat area and if they do it then it will be considered as a disciplinary offence against them. The biodiversity survey of the bela is carried out and Biodiversity Management Plan is prepared and provided in Appendix 7.4.

2.7.4 Antiquities Act, 1975

29. The Antiquities Act relates to the protection, preservation and conservation of archaeological/historical sites and monuments. There are no archeological sites or cultural heritage site inside or near the project area. Nevertheless if there is chance find during the construction phase this law would provide due guidance.

2.7.5 Provincial Local Government Ordinances, 2001

30. These ordinances, issued following the devolution process, establish regulations for land use, conservation of natural vegetation, air, water, and land pollution, the disposal of solid waste and wastewater effluents, as well as matters related to public health and safety. This law will help as and when a participatory management of irrigation system becomes the order of the day.

2.7.6 Factories Act, 1934

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

2.7.7 Land Acquisition Act 1894

32. Land Acquisition Act (LAA), 1894 is the primary law governing land acquisition in Pakistan. For the acquisition of land, the above-mentioned Act, rules and regulations are followed whether the acquisition is for Government of Punjab or any other agency. This law will help in land acquisition, if required.

2.8 FIDIC CLAUSES

33. The size and nature of the work to be undertaken for rehabilitation and upgrading of Trimmu Barrage is such that it is expected to involve international Contractor therefore following FIDIC clauses have been considered to address the environmental aspects of the project:

Clause 8.2 Site operations and methods of construction
Clause 19.1 Safety, security and protection of the environment
Clause 27.1 Fossils
Clause 42.1 Possession of site and access thereto
Clause 42.3 Right of ways and facilities in the project area

2.9 ASIAN DEVELOPMENT BANK GUIDELINES

34. The Asian Development Bank's Environmental Safeguard Policy Statement (SPS) 2009 requires that environmental considerations be incorporated in to ADB operations to ensure that the project will have minimal environmental impact and be environmentally sound.

2.9.1 Environmental Category

35. According to ADB Environment Policy, projects are to be categorized in to the following environmental categories; A, B, or C as given in the Table below. At any stage the category can be changed with the approval of the chief compliance officer if further studies and investigations reveal that the projects potential impacts are worse, minimal or negligible.

ADB Environmental Categories	Requirements
Category A: Projects with potential for significant adverse environmental impacts	-EIA (Environmental Impact Assessment) required. -Public consultation (at least twice) -EIA report to be prepared and an Environmental management plan and budget to prepare -Summary of EIA to be circulated to the Board 120 days prior the Board consideration -Summary of EIA to be disclosed to public -EIA available to public on request
Category B: Projects judged to have some adverse	-IEE (Initial Environmental Examination) is required to determine whether or not significant environmental impacts warranting an EIA are likely. If an EIA is

ADB Environmental Categories	Requirements
environmental impacts, but of lesser degree and/or significance than those for category A projects	not needed, the IEE is regarded as the final environmental assessment report. -Public consultation -IEE report to be prepared -For projects deemed to be environmentally sensitive, Summary of IEE to be circulated to the Board 120 days prior to Board consideration -Summary of IEE to be disclosed to public Environmental management plan and budget to be prepared -IEE available to public on request if it is not normally to be attached as a core appendix circulated, the Summary of IEE is normally to be attached as a core appendix to the RRP
Category C: Projects unlikely to have adverse environmental impacts	-No IEE or EIA -Environmental implications to be summarized in the RRP

36. This Project is categorized as category B as it has some adverse environmental impacts, but of lesser degree and significance. Trimmu Barrage is not a new mega scale project. It is the rehabilitation and upgrading of an already existing hydraulic structure and all impacts of the project shall be local, avoidable and mitigable. All such projects according to ADB Safeguard Policy Statement 2009 require having an IEE.

2.10 NATIONAL ENVIRONMENTAL QUALITY STANDARDS (NEQS) 2000

37. The NEQS 2000 specify the following standards:

1. Maximum allowable concentration of the pollutants (32 parameters), in emission and liquid industrial effluents discharged into inland water (NEQS 2000)
2. Maximum allowable concentration of pollutants (two parameters), in gaseous emission from vehicle exhaust and noise emission from vehicles (NEQS 2009)
3. Maximum allowable limits for drinking water quality (NEQS 2010)
4. Maximum allowable limit for ambient air quality (NEQS 2010)

38. These standards apply to the gaseous emissions and liquid effluents discharged by camp site and construction machinery. The standards for vehicles will apply during the construction as well as operational phase of the project. The standards are provided in Appendix 2.1.

2.11 INTERNATIONAL CONVENTIONS

39. Pakistan is signatory to a number of International Conventions, Protocols and Understandings relating to the environment. Those relevant to the project are described below:

2.11.1 Convention on Biological Diversity

40. The Convention of Biological Diversity was the outcome of the "Earth Summit" held in Rio-de-Janeiro in 1992. The Convention binds the signatories to respect, protect and conserve the earth environment and bio-diversity through sustainable use of natural resources.

2.11.2 Bonn Convention

41. The Convention on the conservation of migratory species of wild animals was held in Bonn in 1979. The Convention broadens the scope of RAMSAR to include migratory species other than waterfowl.

2.11.3 Kyoto Protocol

42. The Kyoto Protocol is an international agreement linked to the United Nations Framework Convention on Climate Change, which sets binding obligations on its Parties to reduce emissions of greenhouse gases. Kyoto Protocol introduced the Clean Development Mechanism (CDM) to allow developed countries to work in cooperative projects with developing countries to reduce GHGs emissions. Pakistan deposited its instruments of accession to the Kyoto Protocol in January 2005. The activities at Trimmu Barrage are of temporary nature and will not have significant contribution in greenhouse gases emissions.

2.11.4 Disclosure Policy

43. The Bank's disclosure policy requires the environmental assessment report to be disclosed to public, and a copy of the report to be sent to the Bank's InfoShop, before the Bank commences the project appraisal.

3. DESCRIPTION OF THE PROJECT

44. This chapter provides a simplified description of the proposed project. Since only the rehabilitation and upgrading of Trimmu barrage is the focus of the present assessment, as described in Chapter 1, this component is described in a greater detail in this section.

3.1 EXISTING BARRAGE STRUCTURE

45. At the time of completion of Barrage structure in 1939 the barrage comprised of:

Waterways

- Main Weir comprises 37 bays 60 ft. wide with crest level of 477.5 ft
- Undersluices exist, both on the left and the right side of the weir. The left undersluices comprise 8 bays, each 30 ft. wide, while the right undersluices contain 6 bays each 30 ft. wide

Stilling Basin

46. For the main weir, the 68 ft long stilling basin floor is placed at El. 468.00 ft. The stilling basin for the undersluices is placed at El. 464.0 ft. and is 80 ft long.

Divide Wall

47. Two divide walls are provided at Trimmu barrage separating the flow through main weir from the left and right pockets so that normal flow and the silt-distribution may be restored before the water reaches the canal regulators. The divide-walls are kept 7.0 ft. thick with a plinth formed by a 12-to-1 batter. They are reinforced vertically, and are designed to withstand a difference in level of 5.0 ft. between the two sides. They rise to a level of RL. 495.0 on upstream and RL. 492.0 on downstream sides, that is, 1.5 ft. above high flood level. The main upstream divide walls are 360 ft. long, where as central divide wall in the left pocket was made 560 ft in length that is 304 feet from the silt-excluder slab, in view of the importance of securing quiet flow upstream of the silt-excluder.

Fish Ladder

48. Two fish ladders have been provided, one along each of the weir divide walls. The total drop has been divided into falls of 1 foot each, the floor starting from a level of 481.0 on the upstream and dropping to the undersluices floor-level downstream. No substantial remodeling of these fish-ladders appears to be necessary.

Guide Bank

The guide-banks of the Trimmu Barrage are of a modified Bell type, extending upstream to a distance of 3480 ft.

Road Bridge

49. The road bridge provides 20 feet roadway with 2’-7” footpaths on each side. The bridge has been designed as per Indian Roads Association Standards considering a distributed live load of 0.58 ton per linear foot and a moving knife edge load of 7 ton per traffic line equivalent to about 13 B.S units of loading.

50. Structural analysis of this bridge, as carried out during feasibility design, has revealed that the bridge needs repairs and replacement of damaged parts.

51. A new road bridge on Rangpur Canal will be constructed due to the shifting of the canal head regulator and changing in the layout of local village road as shown in the figure 4.2: Environment Study Area Map.

Canal Head Regulator

52. There are three head regulators of off-taking canals from the barrage namely Haveli canal, Trimmu Sidhnai Link canal, Rangpur canal. There are 5 bays in Haveli canal, 10 bays Trimmu Sidhnai Link canal and 3 bays in Rangpur canal. All canals regulators have 24 feet clear bays.

Flood Retaining Bunds

i. Left Marginal Bund

53. Left marginal bund (LMB) is basically allied protection work of the Trimmu barrage and is located on upstream of the barrage. It is then followed by the Jhang protection Bund.

54. This Bund has great importance and plays a positive role in the protection of two Main Canals, Jhang city, Jhang-Shorkot highway and other national installations falling on the left side or the River Chenab. It was strengthened and raised, a 6 ft. free board over the 1973 flood levels has been provided.

ii. Right Marginal Bund

55. Right marginal bund (RMB) is also a projection work of the Trimmu Barrage on the right upstream side of the barrage. This bund protects the local settlements, Jhang Bhakkar road and Jhang Muzaffargarh road, Athara Hazari Town and other important installations on the right side of the River Jhelum. It was strengthened and raised with a 6 ft. free board over the 1973 flood levels.

Barrage Components:

Design capacity	645,000 cusec	
	Main weir	502,000 cusec
	Left undersluice	82,000 cusec
	Right undersluice	61,000 cusec
Total width between abutments	3,025 ft.	
No. of bays	Main weir	37 No. (each 60 ft. wide)
	Left undersluice	08 No. (each 30 ft. wide)
	Right undersluice	06 No. (each 30 ft. wide)
Highest Flood Level	Upstream	RL 494.30
	Downstream	RL 490.50
Pond level	Summer	RL 491.50
	Winter	RL 490.00
Crest R.L.	Main weir	RL 477.50
	Left undersluice	RL 472.00
	Right undersluice	RL 472.00
Upstream floor level	Main weir	RL 470.00
	Undersluices	RL 468.00
Downstream floor level	Main weir	RL 468.00
	Undersluices	RL 464.00
Upstream floor lengths	Main weir	0.00 ft.

	Undersluices	274.00 ft.
Downstream floor lengths	Main weir	68.00 ft.
	Undersluices	80.00 ft.

Canals:

Particulars	Haveli Main Line	Trimmu Sidhnai Link	Rangpur Canal
Designed discharge	5,170 cusec	12,500 cusec	2,710 cusec
Crest R.L.	481.0	481.0	483.50
Head Regulator	5 Nos. bays of width 24 ft. each (5 x 24 = 120 ft.)	10 Nos. bays of width 24 ft. each (10 x 24 = 240 ft.)	03 Nos. bays of width of 24 ft. each (3 x 24 = 72 ft.)

3.2 THE PROBLEM

56. Trimmu barrage is now 74 years old and in the aging process along with inadequate or deferred maintenance has resulted in general deterioration and damages of its different components e.g. the regulation gates and hoisting equipment. This obliquity of river flow has resulted many problems; any further damage to this barrage can result in colossal losses in the form of total or partial disruption of irrigation supplies, agricultural crops, loss of government revenue, and rehabilitation cost of emergency repairs. The barrage has therefore been identified as a structure requiring repairs.

57. In year 1992, the peak discharge reported at Trimmu Barrage was 888,117 cusec. Peak discharge passing the barrage was reported as 683,117 cusecs whereas additional 205,000 cusecs discharge was escaped through designated breaching section. This water, routed through breaching section, caused huge damages to the cropped areas, private & public property and infrastructure of Rangpur Canal System.

The aging process has affected every part of the Barrage. The road bridge, concrete deck and piers are deteriorated and will be appropriately repaired if required.

58. Realizing the gravity of the situation of this barrage Punjab Government has given due attention to Trimmu Barrage and has included it in the Phase-I program of rehabilitation and upgrading of barrages in Punjab.

3.3 PROJECT COMPONENTS

59. The project aims to repair and upgrading water resources and irrigation infrastructure at the Trimmu Barrage. The Project has two main components:

a) Rehabilitation of existing Barrage

b) Additional bays for flood management

60. A construction schedule is included in Appendix 3.1 and details of the works are as under:

3.3.1 Permanent Works

Civil Works

- Repairing of the barrage floor and damaged friction blocks
- Strengthening and raising of the training works
- Removing bela from U/s barrage
- Construction / Rehabilitation of infrastructure / buildings
- 11 additional bays of 60 ft width and 2 additional bays of 30 ft width, all separated by 7 ft wide concrete piers
- A divide wall is provided between additional bays and existing right undersluice
- Dismantling of existing Right Guide Bank (RGB) and construction of new RGB along right side of the new bays
- Plugging of existing regulator and construction of new head regulator for Rangpur Canal
- New AR bridge (804 ft long) across additional bays for road connection between Jhang and Bhakkar
- Amendment in the layout of existing village road and construct a new road bridge on Rangpur Canal due to relocating of the Canal head regulator.
- New Divide wall at Bay # 4 (from right) to provide a calm body of water for diversion into Rangpur canal
- Construction of silt excluder
- A 25 ft deep steel sheet pile on the front edge of upstream floor of additional bays for scour protection
- Diversion arrangement for Rangpur canal and road during construction
- Improving the existing Public Park.

Mechanical & Electrical Works

- Replacement of sill beam, complete gate / gate bottom portion, end girders, roller tracks, rocker assemblies, roller trains, wire ropes, hoisting equipment and counter weights, painting and provision of new sealing arrangement for Main Weir, Under Sluices Gates and Head Regulator Gates for Haveli and Trimmu- Sidhnai link canal
- Replacement of hoisting deck platform wooden planks with galvanized steel grating for Main Weir, Under Sluices and Canal Head Regulator Gates
- Manufacturing of stop logs with lifting beams. Provision of embedded parts for all bays for Main weir Gates

3.3.2 Temporary Works

- Dewatering system and cofferdams on upstream and downstream side of barrage for barrage works and addition of bays construction
- Temporary feeding channel for Rangpur Canal with one temporary road bridge on Athara Hazari-Jhang road
- Traffic diversion arrangements through boat bridges on Haveli Main Line and T.S. Link Canals and downstream of Trimmu Barrage

3.4 CONTRACTOR CAMP

61. It is envisaged that the Project will attract about 1500 skilled/unskilled labour. It should be ensured that maximum labor arranged locally however the majority of the skilled labor working on site likely to be migrated from other part of the country. There is Government land available near the Trimmu Barrage which could be utilized for setting up the Contractor's facilities i.e. labour camp, batching plant, work base area, waste disposal site etc. and no private land will be acquired for this purpose. The Contractor's camp and labor camp will be a permanent structure which could be used by other institutions e.g. irrigation, police, security forces etc. at the completion of the Project. The suitable locations for the Contractor's facilities are indicated on Figure 3.2.

3.5 WORK BASE AREA

62. The area marked as "S" can be used as a work base area, as indicated on Figure 3.1. The area will be more appropriate to use as work base area for the equipment and machinery involve in working at the barrage and embankments. The work base area and all the access roads to the area are located within the PID's land. No private land acquisition is anticipated for establishing the work base area at proposed location. Modification and maintenance of the surface of the bunds and access roads will be undertaken to ensure the dust free environment of the area. The local labour will access the work base area through transportation which may be provided by the Contractor.

3.6 MATERIAL REQUIREMENTS

63. The main type of materials required for the execution of the work is:

3.6.1 Civil Works

64. Concrete Work will include the handling of following material:

Cement, Crush, Sand, Plasticizer, Air Entraining Agent, Steel Reinforcement, Epoxy and Grouting Material. Earthwork will require of handling clay material (soil). The anticipated quantities of the material required are:

Material	Units	Approximate Quantity Require
Concrete	100 cft	24,292
Cement	bags	427,539
Sand	cft	106,8848
Aggregate	cft	213,7696
Stone	100 cft	12,6633
Steel	100 kg	89,438
Sheet Piles	100 kg	24,629
Clayey Soil (Fill Material)	1000 cft	67,591

3.6.2 Electrical/Mechanical Works

65. Generally following material and equipments will be used in electrical/mechanical work in this project:

Gates, Hoisting Systems, Cable, Electrical Cables, Motors, Gear Box, Welding Material and Sensors & Other Electronic Devices

3.7 INSTITUTIONAL ARRANGEMENT

3.7.1 Management Responsibilities

66. Overall responsibility for environmental management will rest on Head PMO of the Irrigation Department, Government of the Punjab as per the following framework:

i.	The Executing Agency	:	PMO of Punjab Irrigation Department (PID)
ii.	Supervising and Monitoring Agency	:	Environmental and Social Unit of PMO
iii.	General Assistance to all above agencies in their respective tasks	:	Head PMO/ Project Director, Punjab Irrigation Department will facilitate communications, logistics and data collection as and when required
iv.	Logistic Support	:	Head PMO/ Project Director, Punjab Irrigation Department shall provide the logistic support and shall be the focal point for the construction activity

(i) Project Management Office (PMO)

67. The overall responsibility for the implementation of Environmental Management/Monitoring Plan rests with the Project Management Office (PMO) with the assistance of Environmental and Social Unit (ESU) of PMO. The ESU consists of Director (Environment & Sociology), Deputy Director (Environment) and Deputy Director (Sociology). Construction Supervision Consultants will assist and advise PMO in implementation of EMP.

68. PMO will assume overall responsibility for ensuring:

- That while executing the contract and undertaking the construction all environmental norms, regulations and requirements promulgated by Pakistan Environmental Protection Council (PEPC), Pakistan Environmental Protection Act (PEPA), Environmental Protection Agency (EPA) Punjab and particularly Asian Development Bank environmental safeguard policies, with respect to the work site and adjacent areas are fully respected and implemented

- That Contractor and Construction Supervision Consultants appoint a dedicated environmental officer and allied staff. PMO will also ensure that all environmental personnel are authorized to implement the socio- environmental policies and requirements of the EMMP

- Coordination with relevant government departments and stakeholders on concerned socio-environmental issues
- Inspection and monitoring of residual impacts of the rehabilitation work and observe documentation of the impacts during the construction phase
- Inspection of the significant impacts in case of unanticipated change in the project.

(ii) Environmental and Social Unit (ESU) of PMO

- Environmental and Social Unit (ESU) within PMO will monitor Project performance
- ESU will function in coordination with the Construction Supervision Consultants and will receive reports from them on behalf of PMO
- ESU will prepare and submit periodical Progress and Monitoring Reports to all stakeholders as per their schedules. In this task they will seek assistance/ guidance from Construction Supervision Consultants as and when required

(iii) Head PMO/ Project Director

69. The Project Director shall provide or arrange the logistics including communication, transport and accommodation to all visiting persons/teams and experts from any of the above monitoring units and shall coordinate with the Contractor(s) to facilitate their visits/inspections. For all Monitoring and Evaluation activities in the field the Engineer's Representative shall act as the focal point.

(iv) Contractor

70. The Contractor will be responsible for the implementation of the project EMP. The Contractor will ensure that EMP for the project is implemented fully and must be integrated into the Project implementation, being integral part of the contract document. For any default damages so caused will be remediated by the Contractor at his own cost and expenses. In case the Contractor fails to rectify the damage the employer will take necessary actions at risk and cost of the Contractor. The amount will be determined by the Construction Supervision Consultants which will be adjusted from the amount due to the Contractor. The Contractor will also be responsible for communicating with and training of his staff in environmental aspects and implementation of the EMP.

(v) Construction Supervision Consultants

71. The Construction Supervision Consultant (CSC) will be responsible to ensure quality of work and fulfillment of contractual obligations. Environmental Specialist of the Construction Supervision Consultant (CSC) will ensure that all the environmental and social provisions are complied with and the work performed meets the applicable quality standards. He / She will confirm that the day-to-day construction activities are carried out in environment friendly manner. He / She will also organize periodic environmental training programmes and workshops for the Consultant's and Contractor's staff.

Project Organizational Structure

72. The organizational structure for the environment management / monitoring implementation is shown below. The role of the organization is described in Figure 3.1.

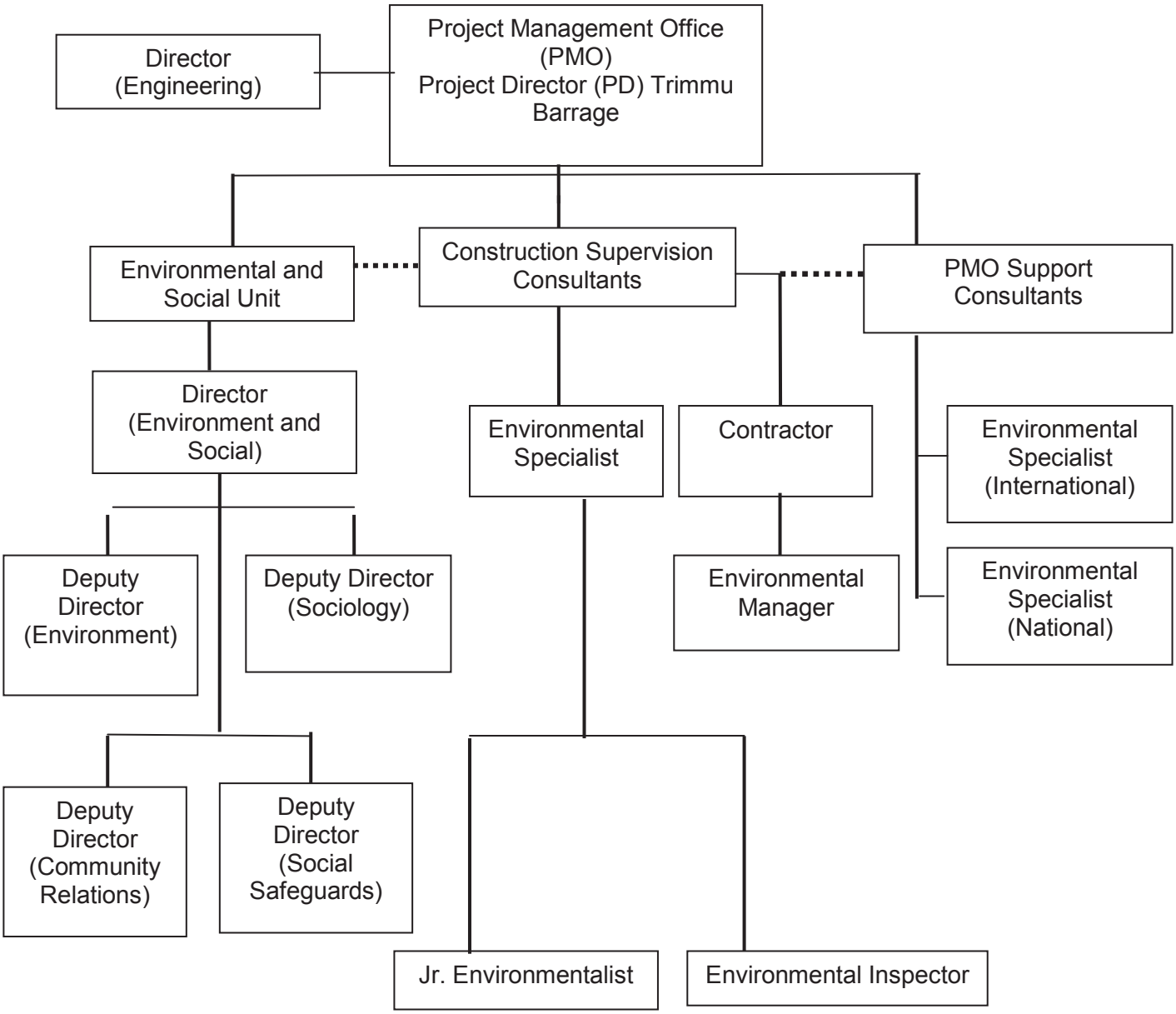


Figure 3-1 Organization Chart for Environment Management / Monitoring Implementation

Exhibit 1 - Responsibilities of PMO Environmental and Social Unit, Contractors, Monitoring and Environmental Specialist of the Construction Supervision Consultants

Organization	Designation	Responsibilities	Operating Documents
Project Management Office (PMO)	Director Socio / Environment	▪ Overall incharge of the environmental and social unit ▪ Oversee the works of environmental and social aspects related to the project(s) for Punjab Barrages rehabilitation ▪ Provide environmental and social guidance to environmental staff in project preparation and approval / sanctions, constructions, implementation, to attain optimum efficiency and success in the management and operation of the project ▪ Assist Project Director in active inter-action with donors, consultant, Contractors and other stake holders on monthly review, progress of the project or any other situation required immediate action ▪ Time management for successful completion of the project and its scheduling according to approved budget ▪ Preparation of all necessary reports required to be submitted to Govt. or donor agency ▪ Ensure compliance and implementation of rules and regulations issued by the Federal Agencies especially regarding social and environmental aspects ▪ Project planning, monitoring and evaluation specifically in environmentally & social related matters in the project	▪ Contract with Punjab Irrigation Department Relevant Asian Development Bank documents on environmental and other laws discussed in IEE of Trimmu Barrage ▪ IEE for Trimmu Barrage ▪ EMP of Trimmu Barrage ▪ Social Framework Agreement (SFA) ▪ Consultant's Environmental Reports ▪ Comply with National, International and Punjab Public Health and Safety (PHS) Acts
Project Management Office (PMO)	Deputy Director Environment	▪ Assist Director Socio, environment in office assignment and field as well ▪ Full fill the obligation as laid	▪ Contract with Punjab Irrigation Department Relevant Asian Development Bank

Organization	Designation	Responsibilities	Operating Documents
		out in his/her contract with Punjab Irrigation Department ▪ Ensures environmental protection during the project implementation according to Environmental laws, policies guidelines and technical standards ▪ Liaison with Contractor and consultants environmental team ▪ Conduct site visits to ensure compliance with IEE and EMP ▪ Coordinate with stakeholders, including general community, EPA, WWF, Asian Development Bank, Contractor, consultants and others ▪ Support DD Sociology in fulfilment of his/her responsibilities	documents on environmental and other laws discussed in IEE of Trimmu Barrage ▪ IEE for Trimmu Barrage ▪ EMP of Trimmu Barrage ▪ Social Framework Agreement (SFA) ▪ Consultants' Environmental Reports ▪ Comply with National, International and Punjab Public Health and Safety (PHS) Acts
Project Management Office	Deputy Director Sociologist	▪ Assist Director Socio, environment in office assignment and field as well ▪ Carried out the responsibilities of official spokesperson of the PMO on social aspects ▪ Deals with social mobilization and emerging socio-economic issues ▪ Coordinate with stakeholders, including general community, EPA, WWF, Asian Development Bank, Contractor, consultants and others ▪ Review all socio-environmental reports and ensure implementation of corrective measures, if any ▪ Conduct site visits to ensure compliance with IEE and EMP ▪ Support DD Environment in fulfilment of his/her responsibilities	▪ Contract with Punjab Irrigation Department Relevant Asian Development Bank documents on social aspects and other laws discussed in IEE of Trimmu Barrage ▪ Socio-economic survey as a baseline for IEE of Trimmu Barrage ▪ EMP of Trimmu Barrage ▪ PHS Acts ▪ Social Framework Agreement (SFA) ▪ Consultant's Socio-Environmental Reports ▪ Documentation received from the field ▪ Comply with HSE Acts ▪ Social Framework Agreement (SFA)

Organization	Designation	Responsibilities	Operating Documents
Construction Supervision Consultant	Environmental Specialist	▪ Ensure the implementation of the mitigation measures suggested in the EMP ▪ Monitor construction activities as per the compliance monitoring program ▪ Monitor the impacts of the project activities (effects monitoring, discussed later in this document) ▪ Liaison with environmental officers and HSE officer ▪ Manage and implement environmental mitigation measures, as well as I&P Department and Contractor's health and safety Policies ▪ Manage operation of the Contractor's environmental management staff ▪ Give training to the staff on environment awareness	▪ Contract with PMO ▪ IEE for Trimmu Barrage ▪ EMP of Trimmu Barrage ▪ Comply with HSE Plan
Contractor	Environmental officer / HSE officer	▪ Manage and implement environmental mitigation measures Contractor's health and safety policies ▪ Liaison with consultant supervision consultant's environmental specialist ▪ Manage operation of the field environmental staff ▪ Train the staff as required ▪ Implementation of EMP ▪ Cause and effects, and compliance monitoring	▪ Contract with Punjab Irrigation Department IEE for Trimmu Barrage ▪ EMP of Trimmu Barrage ▪ Comply with PHS Acts ▪ Consultant's environmental reports. ▪ Social Framework Agreement (SFA)

3.8 SOURCES OF MATERIAL

73. The common source of the material required for civil work is described in Table-3.1.

Table 3-1 Source of Raw Material

Sr. #	Construction Material	Source
1	Earth Material	Available locally, borrowed from the lands temporarily leased by the contractor for the purpose
2	Coarse Aggregate	Coarse aggregates are available at many sources, such as quarries at Sakhi Sarwar near D.G. Khan (290 km), Margalla Hills near Islamabad (400 km), and Sargodha (120 km) The choice will however depend upon the quality and suitability of the material

Sr. #	Construction Material	Source
3	Rip-rap material	Available from quarries at Sakhi Sarwar and Sikhanwali near Sargodha
4	Sand	Available locally
5	Water for preparation of concrete	Ample fresh groundwater aquifer is available along the river. The contractor will install tube wells in the area owned by PID. If private tube well is required, the SFA will be signed and the owner will be duly compensated
6	Water for compaction of embankments	Ample source water is available in the river
7	Cement	Portland cement is locally available from the factories situated in Mianwali (225 km), D.G. Khan (260km), Chakwal (305km), and Islamabad etc. However, slag cement and Granulated Slag are available from Thatta (1020km) and Zeal Pak cement factories in Sindh
8	Additives and admixtures for concrete	These materials are available in the country with leading brands like Sika and Fosroc
9	Reinforcement steel	Grade 60 reinforcement steel proposed in design is available from re-rolling mills at Lahore (260km) and Islamabad with approval of the Engineer
10	Mechanical parts of the Gates	Could be manufactured at Heavy Mechanical Complex at Taxila (400km), Factories at Lahore and Gujranwala (232km) and /or imported from abroad
11	Steel Sheet Piles	Not available locally and have to be imported
12	Interlocks Sealant for Sheet Piles	Available both locally and sheet piles manufacturer abroad
13	Piezometers	Not available locally and have to be imported
14	PVC Water Stop	Locally available

3.9 EQUIPMENT AND MACHINERY YARD

74. It is envisaged that the following equipment and machinery will be required for construction activities:

1	Dozers	17	Welding Rotary
2	Tractors with Water Tankers	18	Welding Transformers
3	Dump Trucks	19	Welding Generator
4	Wheel Loaders	20	Generators
5	Excavators	21	Centrifugal Pumps
6	Tractors with Jack Trolleys	22	Submersible Pumps
7	Grader	23	Diesel Engines for Pumps
8	Water Bouzers	24	Air Compressors
9	Tractors with Water Tank	25	Diesel Tanks
10	Vibratory Rollers (Pad Foot & Plan)	26	Cement Bulk Carriers
11	Plate Compactors	27	Mobile Crane
12	Cranes	28	Fork Lifter
13	Sheet Pile Hammer	30	Lathe Machine
14	Batching Plants	31	Concrete Mixers
15	Transit Mixers	32	Vehicles
16	Concrete Pump		

75. The equipment will be kept in a plant & equipment yard. The suitable site for the yard is indicated on Figure 3.2.

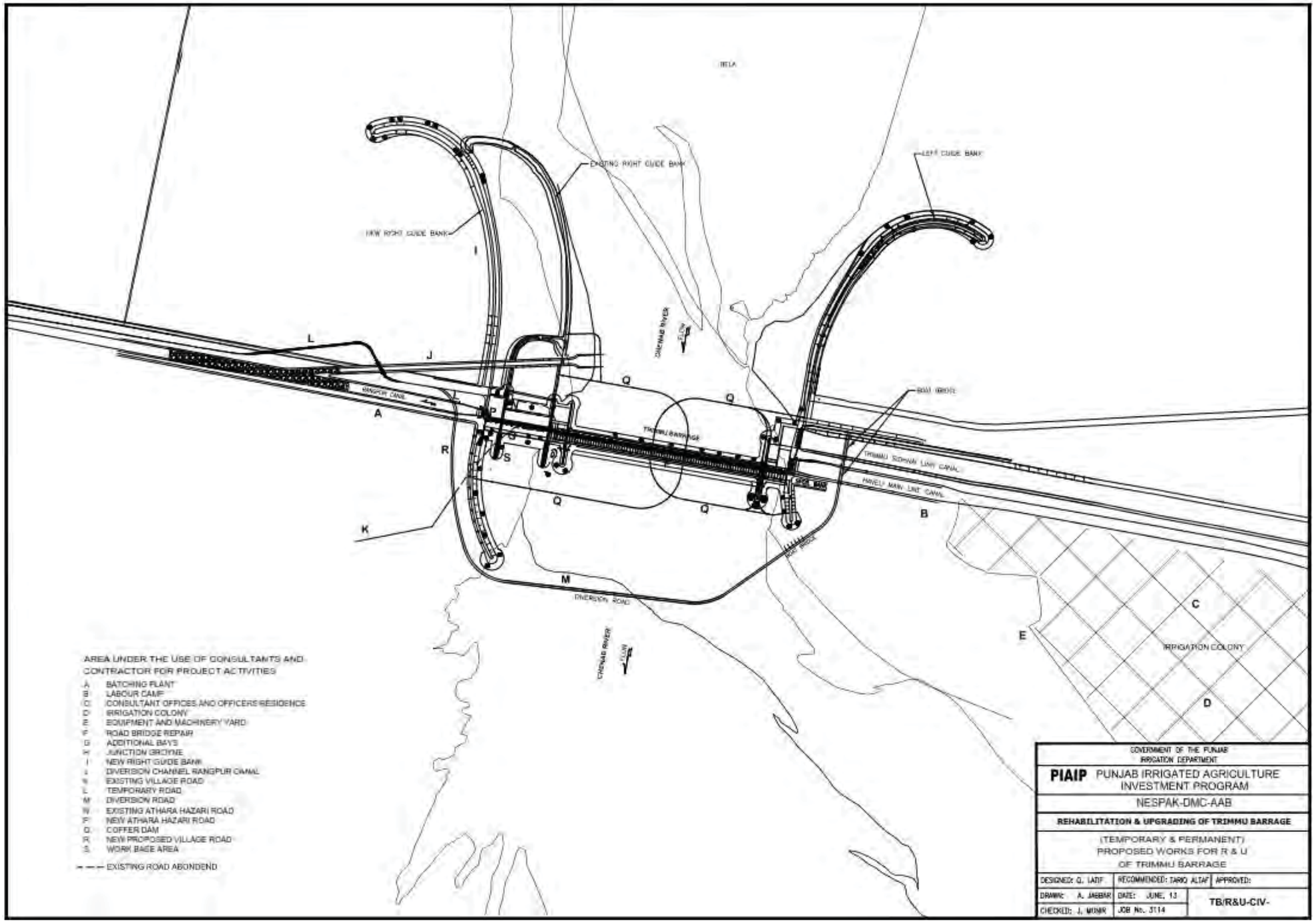


Figure 3-2 Project Layout of Selected Work Scheme

4. DESCRIPTION OF THE ENVIRONMENT

4.1 GENERAL

76. This chapter describes relevant physical, biological and socioeconomic conditions of the area, including any changes anticipated prior to the project commencement. Primary data has been collected of the area very next to the proposed construction sites by collecting samples/monitoring by an authorized laboratory, extract useful information using GIS technology and technical site surveys. Secondary data has been collected of the overall environmental study area from other institutions i.e. Land Reclamation Office, SCARPS Monitoring Organization (SMO), Forestry, Wildlife and Fisheries Department and Meteorological Department etc.

4.2 PROJECT AREA OF INFLUENCE

77. The area of project influence referred to as the “Area of Influence” (AOI) is the area likely to be affected by the project, including all its ancillary aspects such as power transmission lines, pipelines, canals and access roads, borrow and waste disposal areas, batching plant and Labor camp as well as any unplanned developments induced by the project.

78. The major features of the area and proposed locations of the Contractor’s facilities are indicated on Figure-4.1 (environmental study area map) and Figure-4.2 (layout plan of proposed site), respectively. The maps are prepared by using GIS technology and satellite image.

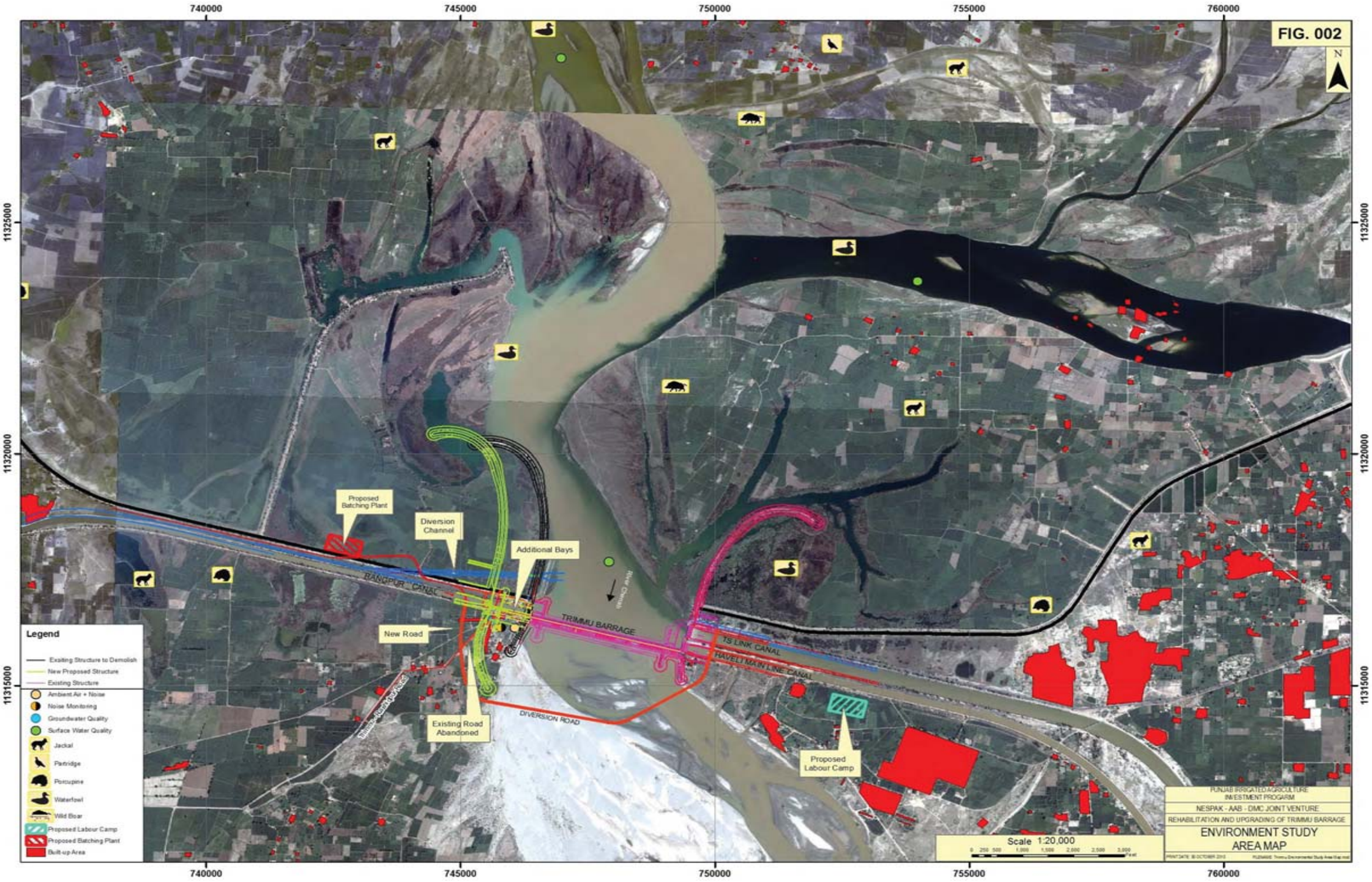


Figure 4-2 Environmental Study Area Map

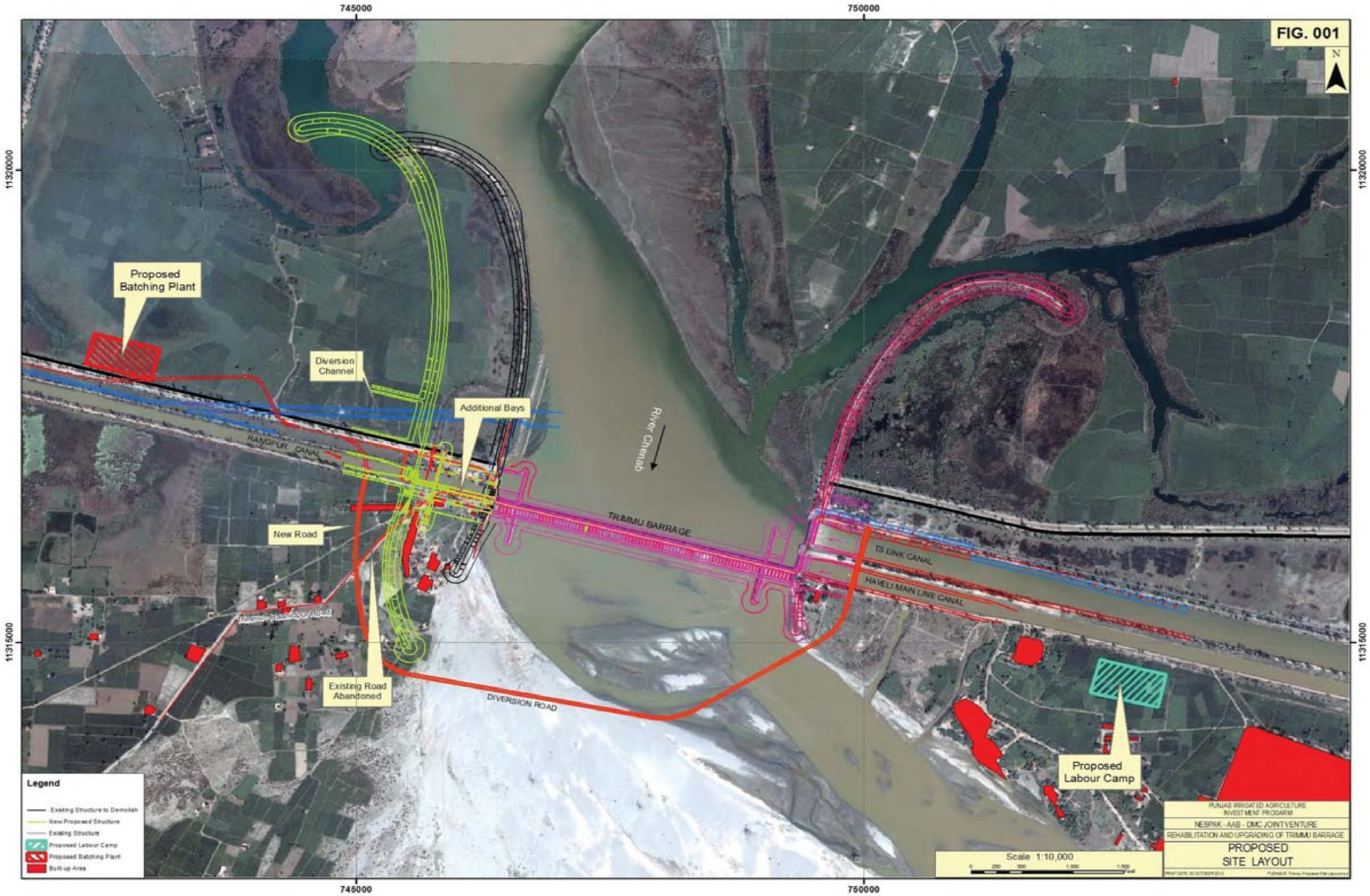


Figure 4-3 Proposed Site Layout

4.3 PHYSICAL ENVIRONMENT

79. The physical environment consists of the environmental parameters include physiography and soil, water quality (surface and groundwater), ambient air quality and climatic conditions.

4.3.1 Physiography and Soil

80. The major landform units of the area include Active/Recent flood plains and sub-recent flood plains.

81. Active flood plains are narrow strips along the river and its tributaries. The plains are inundated almost every year, covered with rich alluvium and are suitable for agriculture. Sub-recent flood plains also called alluvial terraces are depositional and are separated from the adjoining active flood plains by the river cut bluffs ranging in height from 1m to 5m. The sediments are called old alluvium and are composed of compact calcareous silty clay. The Project area forms a part of the vast Indus plain, which is a part of the Indo-Gangetic depression. This depression is of a synclinal nature. Synclinorium depression is a fore deep downward of the Himalayan foreland of variable depth, converted into flat plains by simple process of alluviation.

4.3.1.1 Soil Types

82. The alluvial deposits consist on silty sand to silty clay are underlain by rocks of Precambrian age i.e. Sandstone. There are patches of coarse soil as a top soil in sub-recent flood plain area. This group includes sand and loamy sand textures. These soils are excessively drained and have very low water and nutrient holding capacity. Therefore, management practices include light but frequent irrigations and split application of chemical fertilizers. The bore hole log is provided in Appendix 4.1.

4.3.1.2 Land Use

83. The land use of the area is described in the Table 4.1 and is shown in Figure 4.3 (overall environmental study area map).

Table 4-1 Land use Statistics

Name	Abbreviation	Area (m^2)	Area (Acres)
Nallah	N	233763.7	57.8
Built-up	V	19195812.2	4743.4
Barren Land	O	34290657.0	8473.4
Water Body	WB	2430915.7	600.7
Grave yard	GY	357516.5	88.3
Brick Kiln	BHT	189295.3	46.8
Forest	F	1649930.9	407.7
Adjacent Flood plain	FP	40500446.1	10007.8
Swamp	SWP	3053358.0	754.5
River Creek	CR	4976837.2	1229.8
Main/Link Canal	C	1437011.3	355.1
Bund	BND	242604.6	59.9
Escape/ Silt Ejector	ESC	15270.5	3.8
Cultivated	CL	71419602.7	91779.4

Name	Abbreviation	Area (m^2)	Area (Acres)
River	R	12890326.3	3185.3
Spur	SPR	28941.2	7.2
Total			**121800.8**

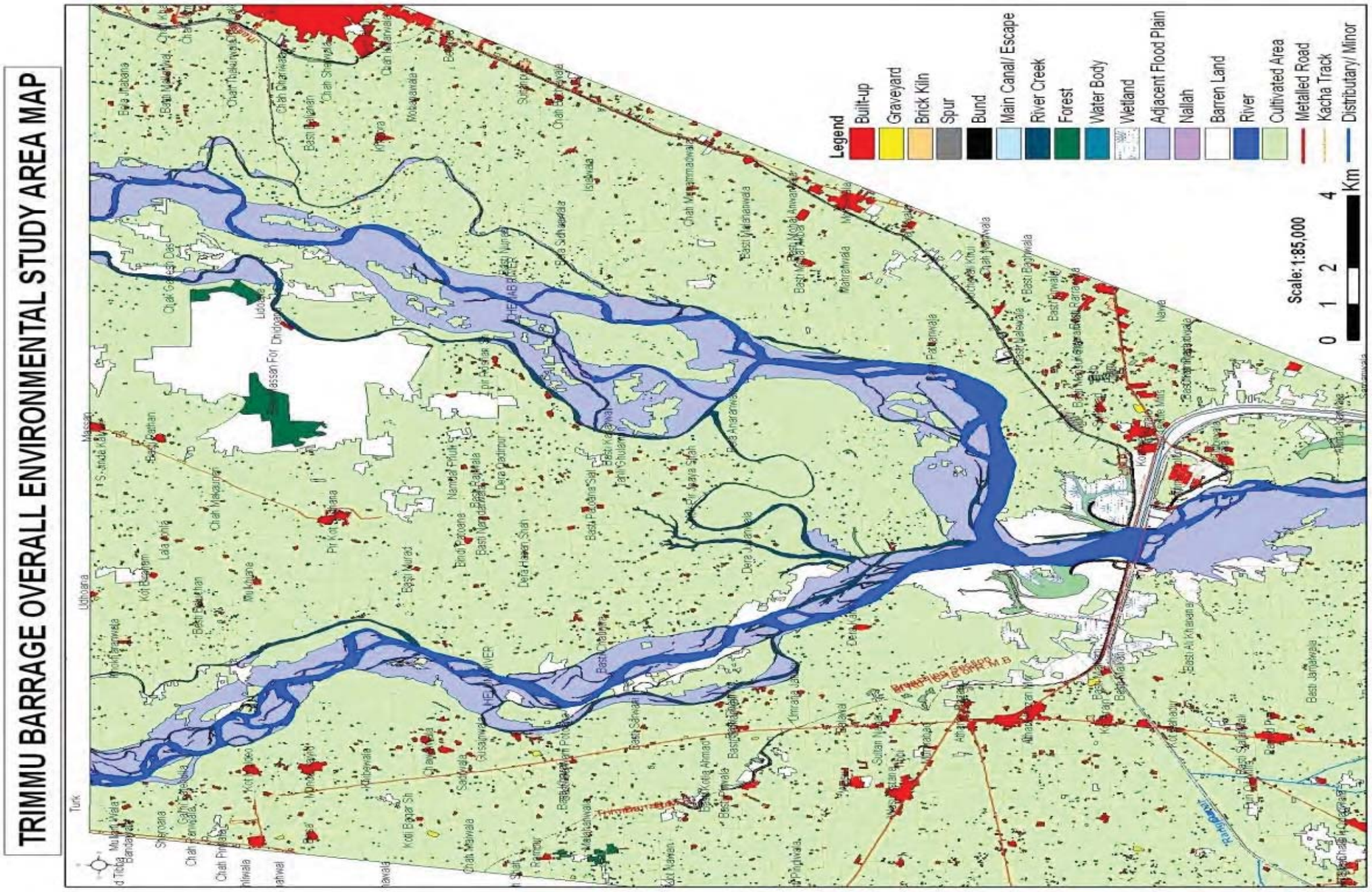


Figure 4-3 Overall Environmental Study Area Map

4.3.1.3 Surface Salinity

84. A study of surface salinity of the canal command areas of Haveli Canal and Rangpur Canal was undertaken by the SCARPS Monitoring Organization (SMO). The main parameters tested in the field were EC and pH.

85. SMO arranged auger holes at suitable sites up to 180 cm depth or to the sloughing material for the study within the canal command area. All the three canals irrigate a considerable area of Southern Punjab. The canal command areas for Haveli Canal and Rangpur Canal extend up to 201,496 acres and 416,000 acres respectively. The percentages of strongly saline (EC > 15ds/m) area found within each canal command areas are summarized in Table 4.2. Considerable area was identified as strongly saline within the Haveli and Canal command area.

Table 4-2 Surface Salinity Statistics

Canal Command	Total Acreage	Non-Saline		Strongly Saline	
		Acreage	Percentage	Acreage	Percentage
Haveli	201,496	159,081	79%	14,209	7%
Rangpur	416,000	352,378	85%	12,738	3%

Source: SMO reports publication No. 34 and 36

4.3.1.4 Seismic Data

86. Due to the continental plate drift of Indian Plate and Asian Plate, Pakistan has been suffered from the devastating earthquakes in past. NESPAK has been developed a Seismic Zoning Map for Pakistan. The whole country is divided into following 5 zones:

Seismic Zone	Peak Horizontal Ground Acceleration
1	0.05 to 0.08g
2A	0.08 to 0,16g
2B	0.16 to 0.24g
3	0.24 to 0.32g
4	>0.32g

Where “g” is the acceleration due to gravity

87. The project area falls within zone 2A as indicated in Figure 4.4. Zone 2A represents area of negligible damage from the earthquake. Design team has been considered the possible impacts of earthquake on the barrage structure.

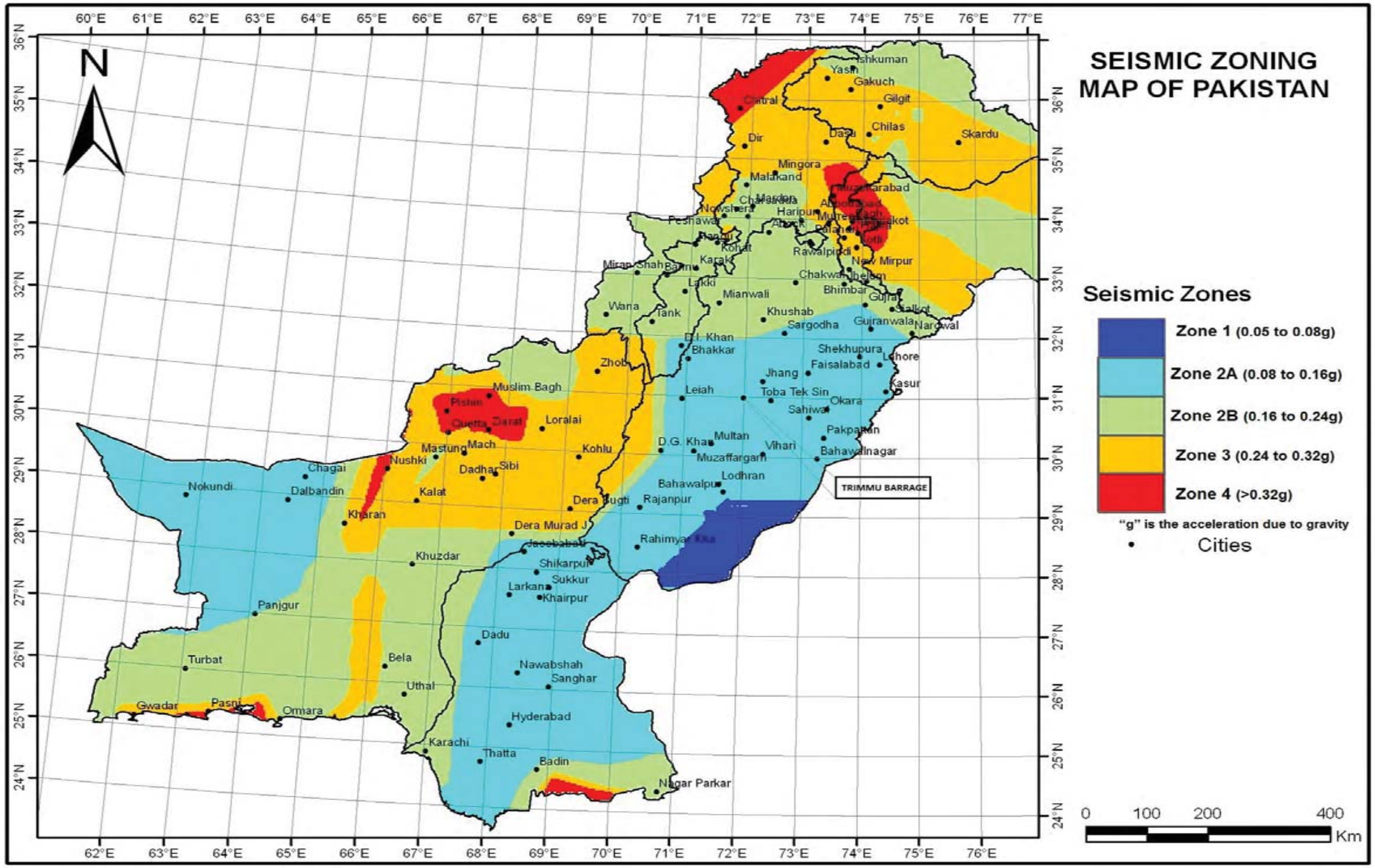


Figure 4-4 Seismic Zoning Map of Pakistan

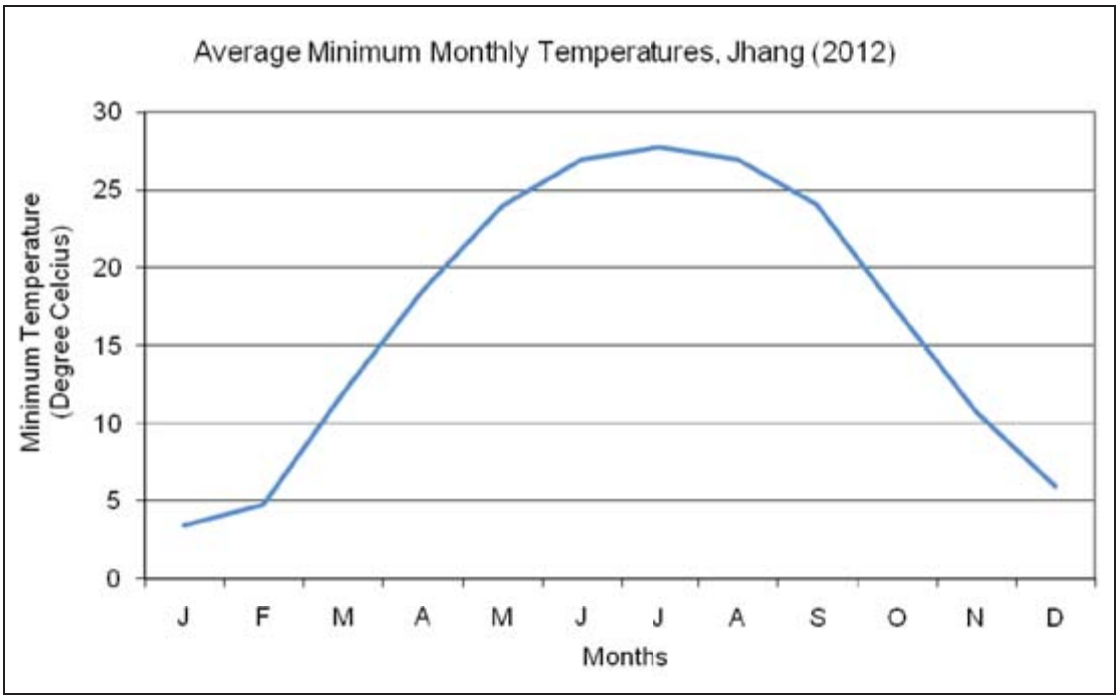
4.3.2 Climate

88. The meteorological data provided in this report collected at the nearest meteorological station to the barrage, located at Jhang city. The data and analysis provided in this chapter is based on yearly record. The climate of the area is arid characterized by long hot summer and short mild winter. The summer extends from April to October.

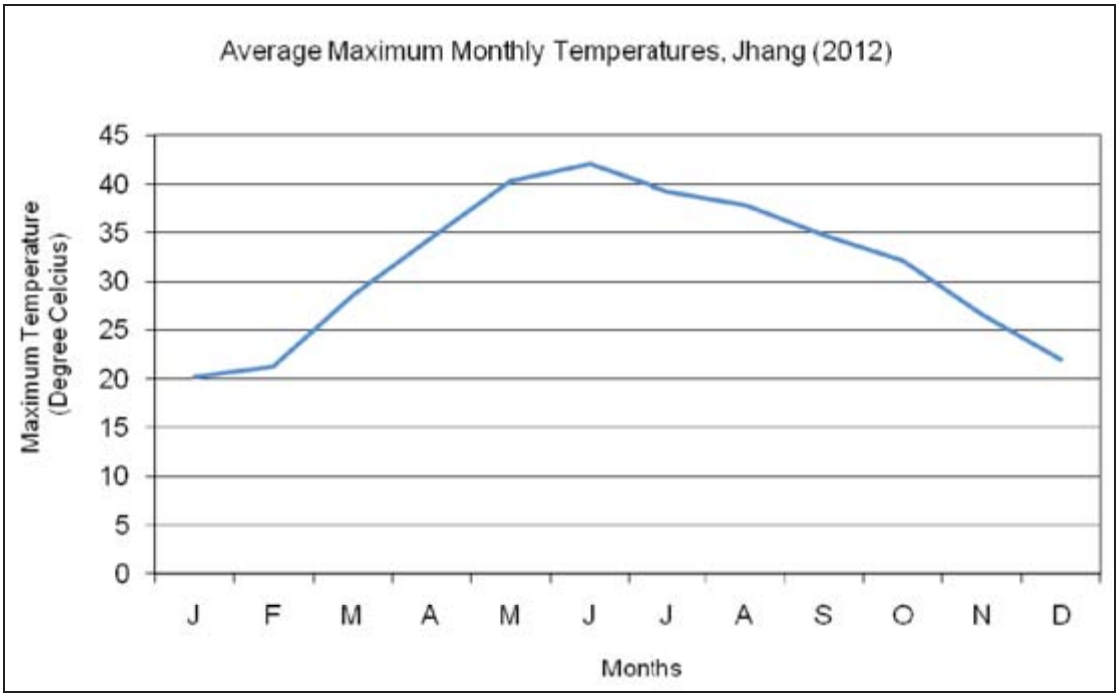
4.3.2.1 Temperature

89. The mean temperature ranged between 40°C to 42°C in summer. May, June and July are the hottest months during which maximum temperature may rise up to 42°C. The winter lasts from November to March with minimum temperature ranging from between 3°C to 11°C. January is the coldest month and chill prevails during the winter when cold wave from western & northern ranges, lashes the plain area.

Average Minimum Monthly Temperatures, Jhang (2012)



Average Maximum Monthly Temperatures, Jhang (2012)

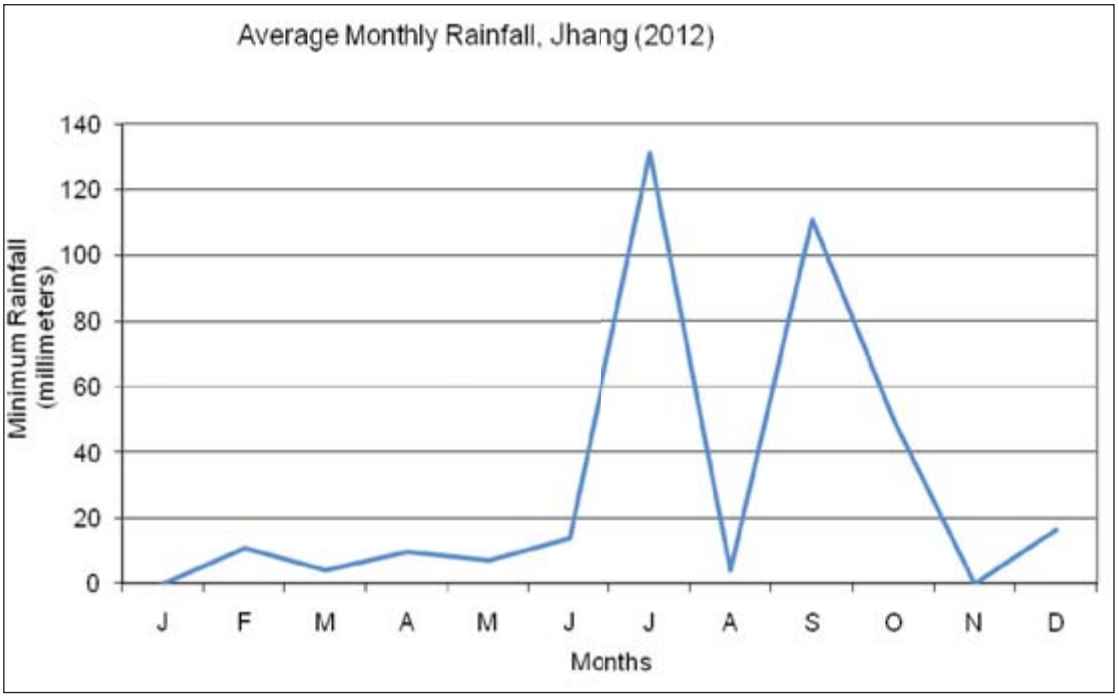


4.3.2.2 Rainfall & Humidity

90. The average annual rainfall in the area is about 131 mm. Nearly 60% of the precipitation is received during July to September whereas the rest is unevenly spread over the remaining months. On the whole the rainfall is too scant and unreliable to be of any agricultural use. The general evapo-transpiration is very high and the irrigation requirements are met through the well-organized (weir controlled) canal irrigation system.

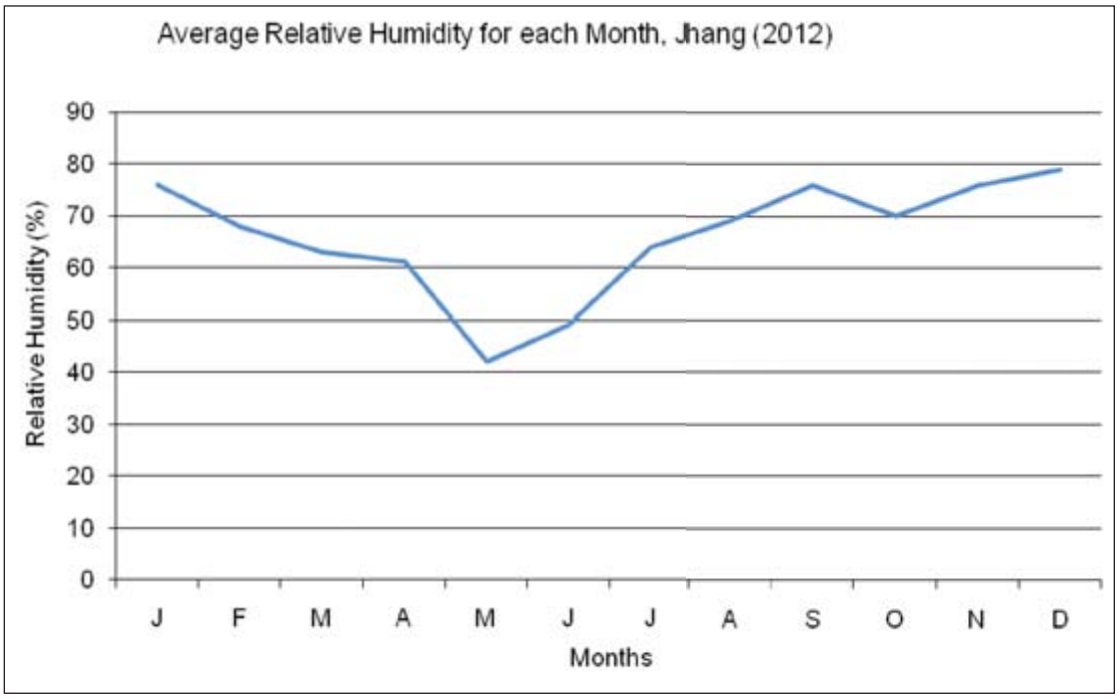
91. The monthly rainfall varies significantly. The highest rainfall was recorded during the month of July.

Average Monthly Rainfall, Jhang (2012)

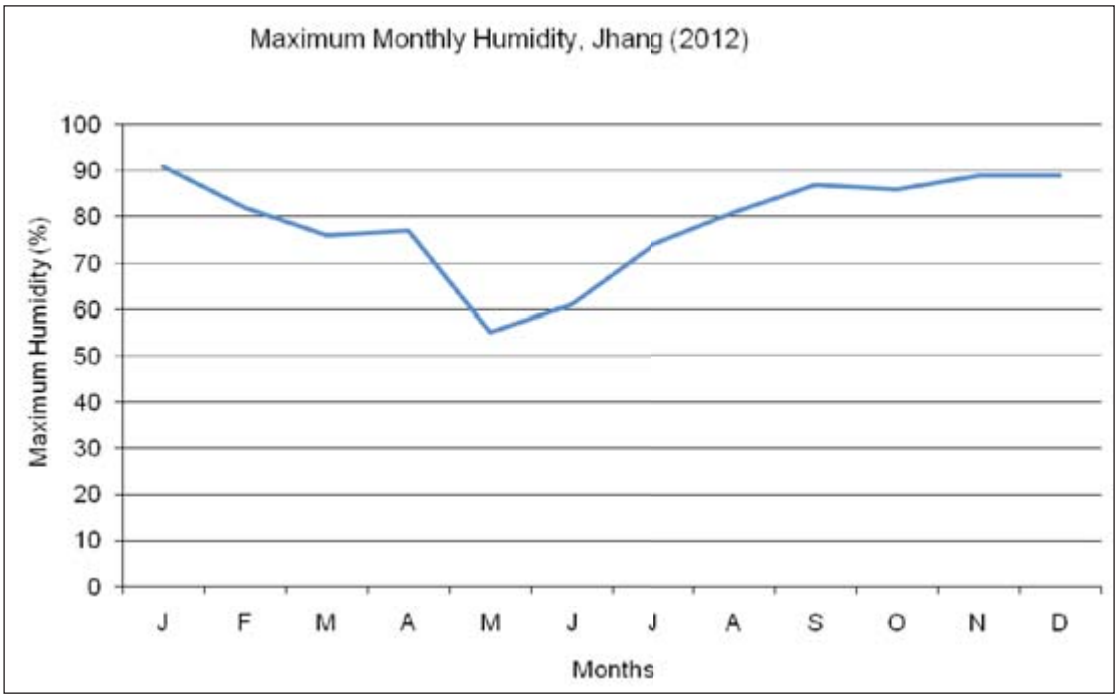


92. The average relative humidity was obtained from the Meteorological Department for Jhang during 2012. Relative Humidity varied between 42% and 79%, peaking during the month of December.

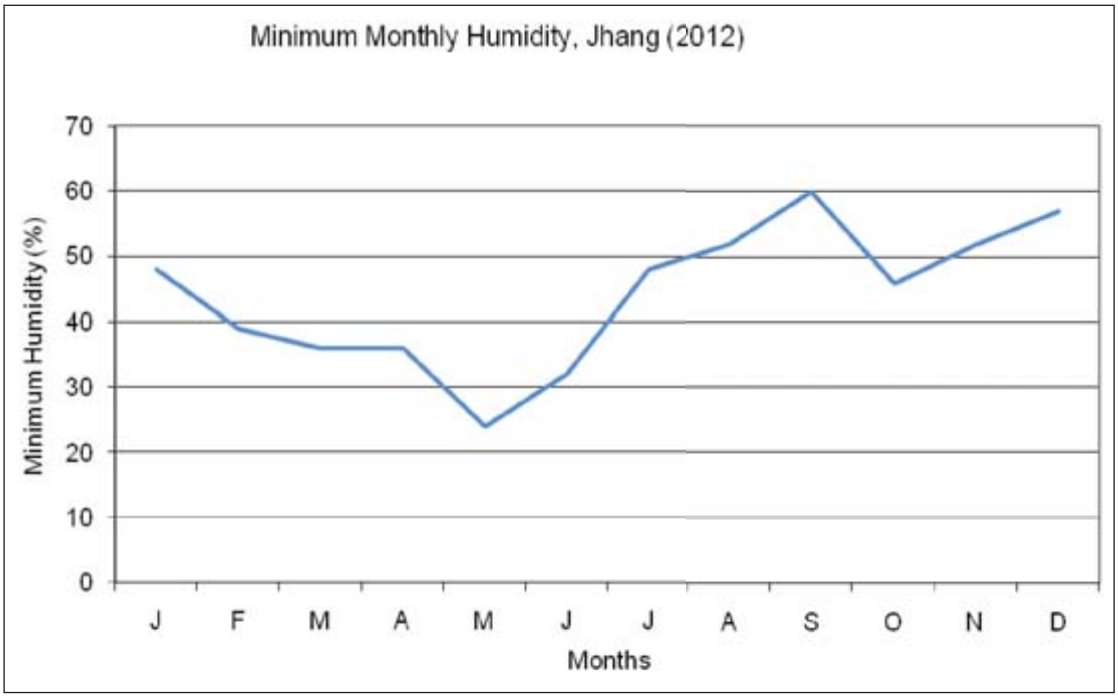
Average Relative Humidity, Jhang (2012)



Maximum Monthly Humidity, Jhang (2012)



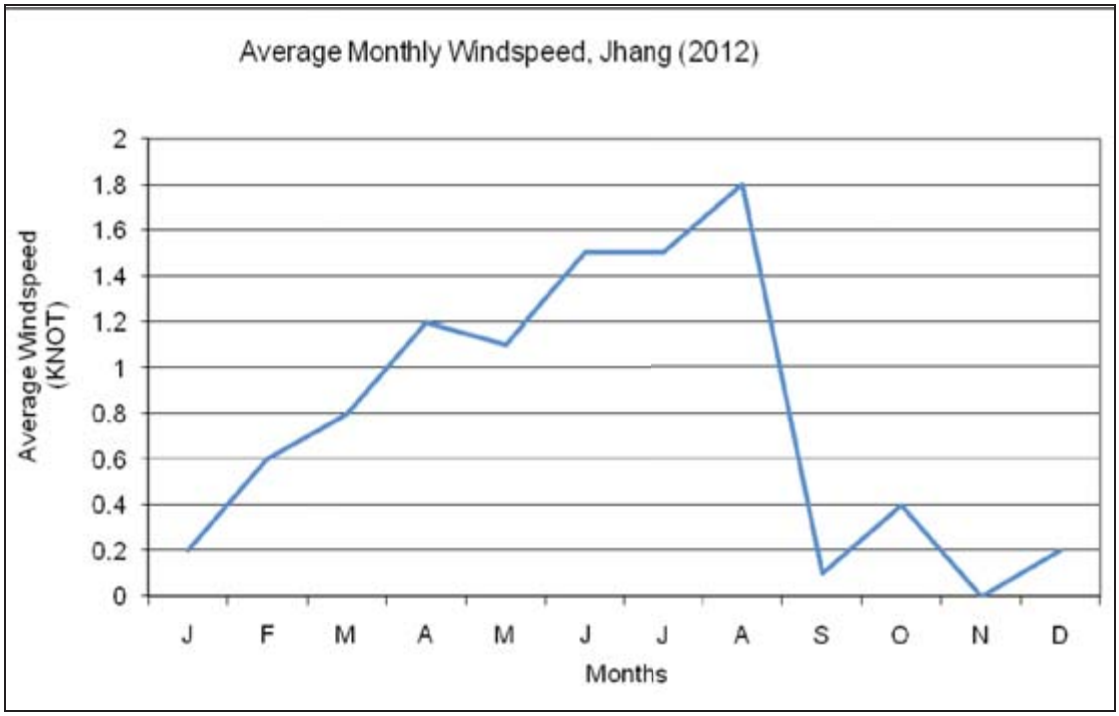
Minimum Monthly Humidity, Jhang (2012)



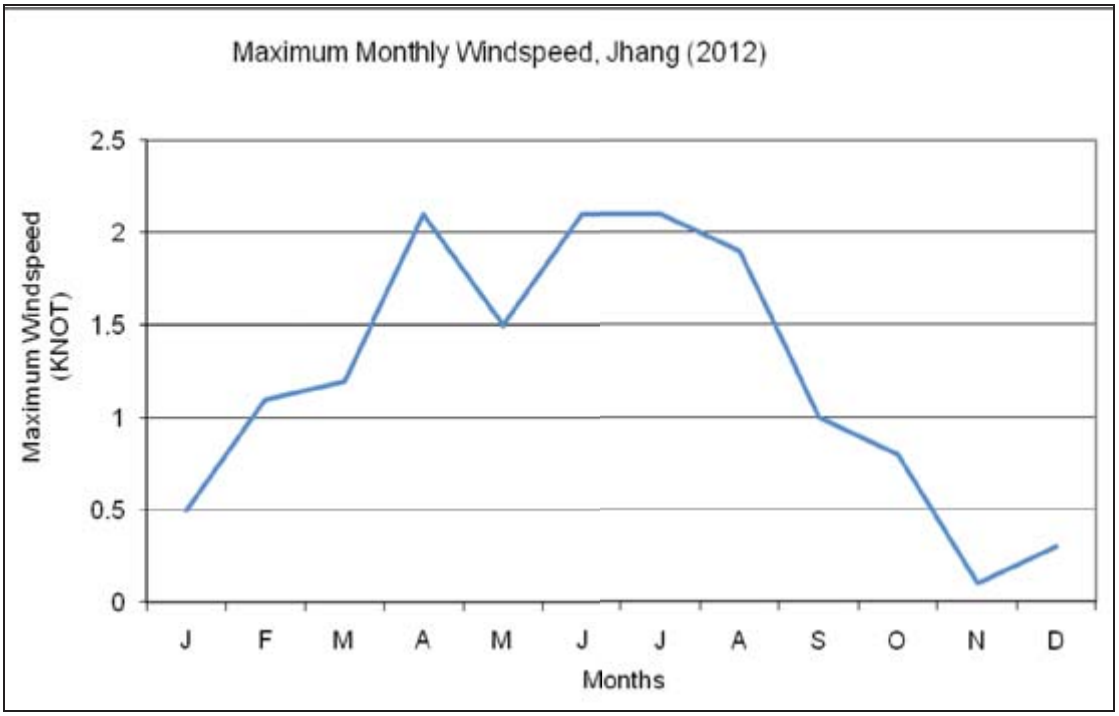
4.3.2.3 Wind

93. The wind speed significantly varied over the twelve-month period. Peak values were recorded during the month of August i.e. 1.8 KNOT while the minimum wind speed occurred in the months of December and January i.e. 0.2 KNOT during the year 2012. The typical wind direction is south to north.

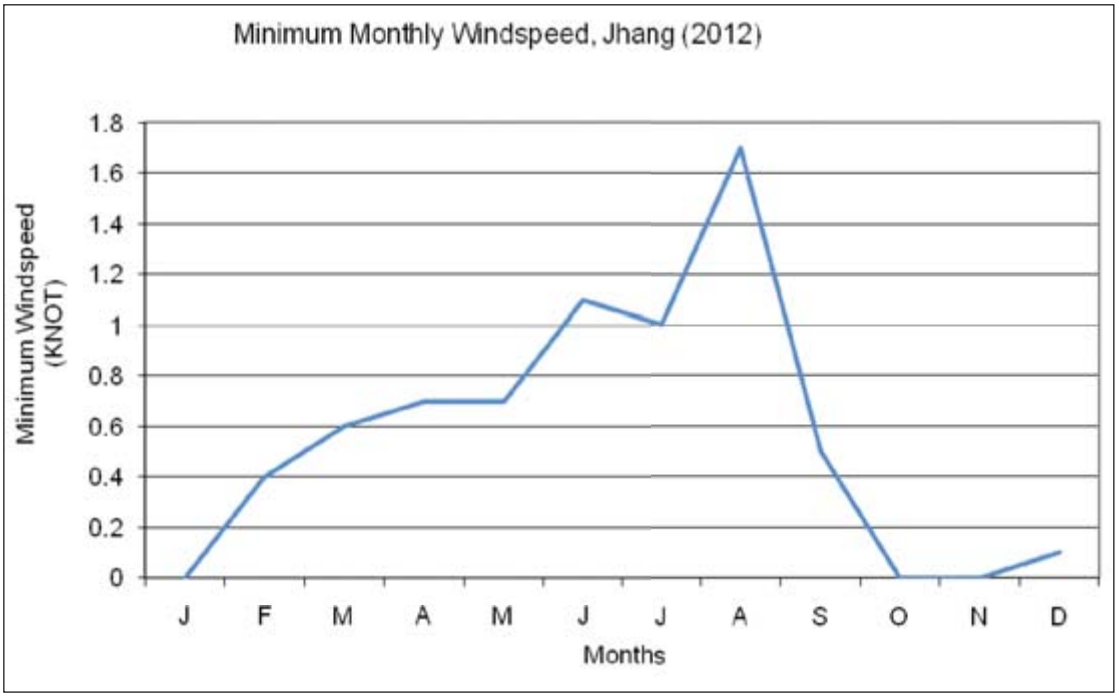
Average Monthly Wind Speed, Jhang (2012)



Maximum Monthly Wind Speed, Jhang (2012)



Minimum Monthly Wind Speed, Jhang (2012)



4.3.2.4 Climate Change

94. Climate change is considered to be the most imminent global threat. The phenomena refer to variations in planet's global climate or regional climates over time. This change can be caused by natural processes internal to the climate system (e.g. changes in ocean circulation), natural external forces (e.g. changes in the intensity of sunlight) or by human activity that alters the composition of atmosphere or brings about certain changes in land use systems. The increase in average global atmospheric temperatures also referred as "Global Warming" is caused by increases in "greenhouse" gases such as Carbon Dioxide (CO_2), Nitrous Oxide (N_2O), Methane (CH_4), Carbon Monoxide (CO) and Chlorofluorocarbons (CFCs) etc. These greenhouse gases emit from fossil fuel combustion, land use change and industrial processes. The projected levels of global warming have serious consequences for humans (and other life forms). These include a rise of sea levels, which will be caused by a continued melting of ice caps, glaciers and sea ice; major alterations in rainfall patterns; and an escalating in the number and intensity of tropical cyclones. Extreme weather events are also expected to become more frequent.

95. Global weather changes and water resources are deeply inter-related. The largest source of freshwater is rain. Global climatic changes will have major effects on precipitation and runoff. In the relatively arid and semi-arid regions, modest changes in precipitation can have proportionally large impacts on water supplies. In mountainous watersheds, higher temperatures will increase the ratio of rain to snow, accelerate the rate of spring snowmelt, and shorten the overall snowfall season, leading to more rapid, earlier, and greater spring runoff. Climate-induced changes in hydrology will affect the magnitude, frequency, and costs of extreme events, which produce the greatest economic and social costs to humans. Flooding could become more common and extreme. Recent reports of the Intergovernmental Panel on Climate Change (IPCC) suggest that the frequency and severity

of droughts could increase in some areas, as a result of a decrease in total rainfall and more frequent dry spells.

96. Any significant change in climate on a global scale may impact local agriculture and therefore affects the world's food supply. Although climate change is an inherently global issue, the impacts will not be felt equally across our planet. Regional changes are likely to differ from global averages in both magnitude and rates of change. Further, not all ecosystems and human settlements are equally sensitive to changes in climate. Nations (and regions within nations) vary in their relative vulnerability to changes in temperature, precipitation and extreme weather events and their ability to cope with such changes. The changing climate is generally deemed the greatest threat to mankind in modern times triggered by the greenhouse gases (primarily produced by the developed nations). This will have profound consequences for water and energy resources, food production and human health etc. in the developing countries like Pakistan. The harmful impacts of global warming are already manifesting themselves around the World in form of extreme weather events like storms, tornadoes, floods and droughts that are mounting in frequency and intensity.

Pakistan is low emitter of GHGs and its contribution towards the total global GHGs emissions is 0.8%. The GHGs emissions in Pakistan are shown in Table 4.3.

Table 4-3 Green House Gases Emissions in Pakistan

Green House Gases	Percentage
Carbon Dioxide	54
Methane	36
Nitrous Oxide	9
Carbon Monoxide	1
Non-methane volatile organic compounds	0.3

Source: State of Environment Punjab, 2012

97. The following Table shows the GHGs emissions from various sectors of Pakistan in 1994 and 2008 and projected up to 2050. It reflects that energy and agriculture will remain the major emitters of GHGs emissions in Pakistan and national GHGs emissions will double in 2020 compared to the year 2008 and increase 14 folds by the year 2050.

Table 4-4 Green House Gases Emissions in Various Sectors in Pakistan

Sectors	Years			
	1994	2008	2020	2050
Energy	86	157	358	2685
Agriculture	71	120	245	1395
Industrial Processes	13	8	26	67
Land use, Land use change and Forestry	7	9	14	38
Wastes	5	6	7	15
Total National Emissions	182	310	650	4200

Source: State of Environment Punjab, 2012

98. Pakistan is vulnerable to climate change impacts because it lies in the region where the temperature increases are expected to be higher than the global average. It affects the Country in a number of ways as the Indus Basin depends heavily on the glaciers of the western Himalayas, which act as a reservoir, capturing snow and rain, holding the water and releasing into the rivers. As a result of climate change, the entire ecosystem will be affected

including river flows, fish stocks, flora and fauna. Three-fourth of the water flowing through the river Indus, Jhelum and Chenab originate in the Siachen and other Himalayas glaciers. Siachen and Pindari Glaciers are retreating at an average rate of 31.5m and 23.5m per year. If these glaciers start melting at a faster pace due to global warming, they could virtually disappear in the next half century. This means increased frequency of floods in the foreseeable future but serious shortage of water in the rivers after some time threatening the livelihood of people dependant on them. The quality of water is constantly deteriorating because of excessive pumping of underground water much of which is saline. Similarly the extraction of sweet water is eroding the centuries old aquifer.

99. Pakistan unfortunately falls in the group of countries highly exposed to negative consequences of climate change. Among the damages already evident in the country is growing frequency of droughts and flooding, increasingly erratic weather behavior, reduction in freshwater supply and changes in agriculture pattern. It has become clear that climate change threatens all progress targets and plans; from health, education to livelihoods, the whole process is endangered by the probability of disasters and uncertain environmental conditions.

100. Better management of water resources is required to cope up the climate change impacts. The water storage capacity is less in Pakistan and the investment is required to increase capacity to store water, in both surface water and groundwater reservoirs. The best preparation for managing unpredictable future changes is to put in place a water resource infrastructure and management system. Pakistan is now starting to explore the combination of ‘hard’ interventions (to protect high-value infrastructure) and ‘soft’ interventions (smart adaptation to living with floods, including changing land use patterns and cropping patterns).

101. The fertile land of Punjab yields more than 50% of the total national agricultural produce due to the efficient use of water resources through Punjab’s irrigation network consisting of 14 barrages. Most of the barrages in Punjab were constructed in the first half of the 20th century. The structural stability of most of these barrages is under threat due to aging and multiple hydraulic /sedimentation /retrogression problems. The designed flood discharge capacities of these barrages have not been increased and vast damages to the public property and life experienced due to frequently occurring high floods. Therefore, the Rehabilitation and Upgrading (R&U) of barrages is required to avert any mishap.

102. Trimmu Barrage is located at the confluence of Chenab and Jhelum River. Three canals i.e. Rangpur Canal, Haveli Canal and T.S. Link Canal with the total with drawing capacity of 20,380 cusec off-take from the barrage. The overall CCA of the Trimmu Barrage Command Canals is 2.68 million acres that is 13.19% of the total CCA (20.31 million acres) of the Punjab and 7.05% of the entire CCA of the country (38 million acres). The barrage is an old structure and its designed capacity for 100 years return flood has exceeded. As the climate change is going to affect the water resources and the frequency of flood will increase. Therefore, it is required to enhance the barrage capacity by providing an additional structure (additional bays) in order to handle the floods which may increase due to climate change.

4.3.3 Ambient Air and Noise Quality Monitoring

103. Ambient air quality was monitored over 24 hours near road at Trimmu Barrage. The average concentrations of pollutants are provided in Table 4.5 and it was found that the concentration of PM_{10} was higher than NEQS. It is anticipated that vehicular emissions and location of sampling point near the road concentration of PM_{10}. Concentration of PM_{10} is found to be higher during normal atmospheric conditions in Pakistan due to emission of dust from unpaved surfaces around the roads. The detail of sampling procedure and test results are included in Appendix 4.2.

104. Noise level was monitored at the western side of the barrage and at proposed batching site. The noise level was found in range of 55.6 – 69.4 dB (L_{eq}) at western side and 57.1 dB (L_{eq}) at proposed batching plant site. The comparison with NEQS level is shown in Table 4.5.

Table 4-5 Ambient Air Quality and Noise Quality Monitoring

Sr. #	Parameter	Unit	NEQS (2010)	Results
Ambient Air Quality				
1	Nitrogen Dioxide (NO_2)	µg/m³	80	54.3
2	Sulphur Dioxide (SO_2)	µg/m³	120	7.3
3	Carbon Monoxide (CO)	ppm	80	2.6
4	Particulate Matter (PM_{10})	µg/m³	150	190.9
Noise Quality				
Sr. #	**Parameter**	**Unit**	**NEQS (2009)**	**Results**
1	Noise on western side	dB	85	69.4
2	Noise at proposed batching plant site	dB	85	68.0

4.3.4 Water Quality

4.3.4.1 Surface Water Quality

105. The natural surface water resources of the project area include Chenab and Jhelum River and the canals, which off-take from the barrage, Haveli Canal, T.S. Link Canal and Rangpur Canal.

Haveli Canal: 5,170 Cusecs
T.S. Link Canal: 12,500 Cusecs
Rangpur Canal: 2,710 Cusecs

106. Haveli canal irrigate lands of Tehsil Shorkot and Rangpur Canal irrigate Ahmad Pur Sial and part of Muzaffargarh district. Trimmu – Sidhnai Link canal plays very vital role in feeding canal system of Ravi and Sutlej Rivers, due to shortage in water discharges in these two rivers after Indus Water Treaty 1960. Trimmu Sidhnai Link canal partly feeds Adjani – Mailsi and Mailsi – Bahawal link canal system.

4.3.4.2 Hydrological Characterization

107. The average river flows upstream of the Trimmu Barrage is shown in Table 4.6. Average flows were determined for the year 2008, 2007 and 2006 during the months between May and October when river flow is significant. This indicates the peak flow usually occurs in August of due to the monsoon season in the area.

Table 4-6 Average River Flows Upstream of the Trimmu Barrage (Cusecs)

Months	Average flow in each year		
	2008	2007	2006
May	441,346	1247,896	1056,603
June	814,305	757,131	519,738
July	918,069	1035,771	1182,231
August	981,748	618,019	2636,266
September	457,390	565,376	2418,695
October	283,138	253,046	144,851

4.3.4.3 Flood Record

108. Trimmu barrage has experienced major floods during its life time. During exceptionally high floods of 1959, 1973 and 1992 breaches to LMB and RMB were experienced. The historical record of major floods pass through the barrage is summarized in Table 4.7.

Table 4-7 Peak Historical Discharge at Trimmu Barrage

Years	Discharge through weir (Cusecs)
1948	536,329
1950	555,560
1954	510,193
1957	559,575
1958	530,543
1959	943,255
1960	605,132
1973	732,910
1976	704,633
1988	584,110
1992	888,117
1995	629,561
1997	677,417

109. The discharge classification of Trimmu Barrage as given in the Flood Fighting Plan 2009 is as follows:

Normal	Below 150,000 cusecs
Low Flood	150,000 to 200,000 cusecs
Medium Flood	200,000 to 300,000 cusecs
High flood	300,000 to 450,000 cusecs
Very High flood	450,000 to 600,000 cusecs
Exceptionally high Flood	600,000 to 750,000 cusecs

110. The PID has reported that since the construction of barrage, on five occasions, floods have exceeded the design capacity of the barrage. The major floods reported by PID that have passed through the barrage and breaches in marginal bunds are given in Table 4.8.

Table 4-8 Major Floods at Trimmu Barrage Reported by PID

Sr. #	Year	Flow through weir (cusec)	Flow through breaches in embankments (cusec)	Total discharge (cusec)
1	1959	718,225	225,000	943,255
2	1973	666,910	66,000	732,910
3	1976	704,633	NIL	704,633
4	1992	683,117	205,000	888,117
5	1997	677,417	NIL	677,417

111. The most recent flood, which caused the breaching in RMB, occurred in 1992. A discharge of about 8,88,117 cusecs was received at Trimmu Barrage out of which 205,000 cusecs escaped through the breaches in the marginal bunds and 6,83,117 cusecs passed through the barrage with a raised upstream highest flood level of EL495. The area inundated due to the activation of the existing breaching section at RMB in 1992 is about 220,000 acres. The main towns / villages and other infrastructure likely to be damage at the event of breach include:

112. 18-Hazari town, Lashari, Rodu sultan, Rashidpur, Jabowana, Wasawa, Kot Bahadar, Garh Maharaja, Pir Abdul Rehman, Hassu Balil, Astana, Wasu, Multan – Muzaffargarh Road from 18-Hazari to Kot Bahadar, Jhang – Bhakkar Road from 18 Hazari to village Dousa, Rangpur Canal and 2-L and 3-L Disty system. A population of about 200,000 is likely to be affected.

4.3.4.4 Surface Water Testing

113. To assess baseline conditions of surface water in the project area, three grab samples were obtained during March 2010. The purpose of the surface water testing is to determine the suitability of the water for irrigation purposes as well as for drinking. The three locations were selected are indicated on Figure 4.1. The samples were collected from River Chenab, River Jhelum and Head Trimmu. The Contractor is obligated to ensure that in case of an extended canal closure, water of comparable quality must be supplied to the areas directly affected by the closure. Furthermore, during project implementation comparative analysis of water quality at the site of on-going activities will assist in establishing the source of any contamination if present.

114. The samples were collected and tested by an authorized laboratory from EPA. Standard sampling procedures were followed at each site to ensure the integrity of the samples collected and validity of test results. Further details test results are provided in Appendix 4.2.

Results

115. The test results are summarized in Table 4.9. The water quality parameters were compared against NEQS. The NEQ standards have been drafted for the contamination of water quality by heavy metals and other industrial toxins.

116. However, since the water that flows towards the barrage and into the canals that off-take from it is primarily used for irrigational purposes, the parameters were compared against the United Nation Organization's (UNO) Food and Agriculture Organization (FAO) guidelines for irrigation, livestock and poultry in Table 4.10. These guidelines are included in Appendix 4.3.

Table 4-9 Surface Water Quality comparison with NEQ Standards

Sr. #	Parameter	Unit	Results			NEQS (2000) (into Inland Waters)
			River Jhelum	River Chenab	Head Trimmu	
1	pH	—	7.51	7.75	7.22	6--9
2	Color	—	–	–	–	–
3	Odor	—	Odorless	Odorless	Odorless	0
4	Biological Oxygen Demand (BOD_5)	mg/l	8	5	10	80
5	Chemical Oxygen Demand (COD)	mg/l	15	11	20	150
6	Turbidity	NTU	49.9	20.3	48	–
7	Conductivity	µS/cm	659	636	649	–
8	Total Dissolved Solids (TDS)	mg/l	438	430	439	3500
9	Total Suspended Solids (TSS)	mg/l	57	18	59	200
10	Calcium Hardness	mg/l	–	–	–	–
11	Magnesium Hardness	mg/l	–	–	–	–
12	Calcium	mg/l	43.56	39.6	41.58	–
13	Magnesium	mg/l	13.28	13.58	13.28	–
14	Chloride (Cl)	mg/	95.3	93	92.3	1000
15	Sulfate (SO_4)	mg/l	63.8	64.2	65.8	600
16	Sulphide	mg/l	–	–	–	–
17	Nitrates (NO_3)	mg/l	4.1	5.3	4.5	
18	Fluoride (F)	mg/l	0.44	0.46	0.48	10
19	Sodium Absorption Ratio (SAR)	—	3.9	4.2	3.86	18
20	Residual Sodium Carbonate (RSC)	mg/l	ND	ND	ND	5
21	Ammonia (NH_3)	mg/l	<0.1	<0.1	1.1	40
22	Cyanide (CN)	mg/l	–	–	–	1
23	Grease & Oil	mg/l	<1.0	<1.0	<1.0	10
24	Arsenic (As)	mg/l	–	–	–	1
25	Cadmium (Cd)	mg/l	<0.003	<0.003	<0.003	0.1
26	Chromium (Cr)	mg/l	<0.01	<0.01	<0.01	1
27	Copper (Cu)	mg/l	<0.01	<0.01	<0.01	1

Sr. #	Parameter	Unit	Results			NEQS (2000) (into Inland Waters)
			River Jhelum	River Chenab	Head Trimmu	
28	Lead (Pb)	mg/l	0.02	0.02	0.02	
29	Mercury (Hg)	mg/l	0.001	<0.001	<0.001	0.01
30	Selenium (Se)	mg/l	<0.01	<0.01	<0.01	0.5
31	Nickel (Ni)	mg/l	<0.01	<0.01	<0.01	1
32	Silver (Ag)	mg/l	<0.1	<0.1	<0.1	1
33	Zinc (Zn)	mg/l	0.04	0.02	0.04	5
34	Iron (Fe)	mg/l	0.76	0.8	0.82	8
35	Barium (Ba)	mg/l	<0.5	<0.5	<0.5	1.5
36	Manganese (Mn)	mg/l	0.02	0.02	0.02	1
37	Chlorine	mg/l	<0.1	<0.1	<0.1	1
38	Sodium (Na)	mg/l	115	121	112	–
39	E. coli	0 /100ml	13	4	14	–

Table 4-10 Surface Water Quality Comparison with Irrigation Guidelines

Sr. #	Parameter	Unit	Results			FAO
			River Jhelum	River Chenab	Head Trimmu	
01	Electrical Conductivity	µS/cm	659	636	649	0 – 3000
02	Total Dissolved Solids (TDS)	mg/l	438	430	439	0 – 2000
03	Calcium	mg/l	43.56	39.6	41.58	0-400
04	Sulphate (SO_4)	mg/l	63.8	64.2	65.8	0 – 960
05	Nitrates (NO_3)	mg/l	4.1	5.3	4.5	0 – 10
06	Sodium Absorption Ratio (SAR)	meq/l	3.9	4.2	3.86	0 – 15
07	Magnesium (Mg)	mg/l	13.28	13.58	13.28	0 – 60
08	Chloride (Cl)	mg/l	95.3	93	92.3	0-1060

Analysis of Results

NEQ Standards:

117. The results have been compared with NEQS 2000 as shown in Table 4.9. All water quality parameters tested were within the defined ranges set by NEQS.

FAO Guidelines:

118. The water quality test results were compared with the FAO guidelines for irrigation water as shown in Table-4.10. From the salinity point of view, Sodium Absorption Ratio (SAR) in all three samples of the surface water was detected within the marginal criteria. Laboratory results for Electrical Conductivity also showed that it was within the usable range. Almost all other parameters tested within the defined limits.

4.3.4.5 Groundwater

119. Tube wells and hand pumps are the two most common sources of groundwater within the project area. The Unconfined aquifer can be found as shallow as 5 m depth from the ground level near the barrage and is mainly used for drinking and agricultural purpose. The aquifer constitutes of a stratum of loose sand of high permeability.

Groundwater Testing

120. To assess baseline conditions of ground water in the project area, one sample was obtained from an existing hand pump at the barrage in March 2010 for analysis. The hand pump was located near the right guide bank, upstream of the barrage. It has been observed that the local population uses this water source for drinking and domestic washing by a nearby restaurant. The sampling point is indicated on Figure-4.1. The approximate depth of the bore of the hand pump is 10m from ground level.

Results of Groundwater Testing

121. The water quality parameters tested for the groundwater sample are summarized in Table 4.11. The parameters were compared against FAO guidelines. Since groundwater in the area is used for drinking purposes as well, it is important to determine the quality of the water in terms of the NEQS for drinking water.

Table 4-11 Groundwater Quality comparison with NEQ Standards

Sr. #	Parameter	Unit	Result Head Trimmu	NEQS (2010) (Drinking water)
1	pH	—	7.87	6.5-8.5
2	Color	—	Colorless	–
3	Odor	—	Odorless	Non-objectionable/ Acceptable
4	Biological Oxygen Demand (BOD_5)	mg/l	–	-
5	Chemical Oxygen Demand (COD)	mg/l	–	-
6	Turbidity	NTU	2	< 5NTU
7	Conductivity	µS/cm	386	–
8	Total Dissolved Solids (TDS)	mg/l	280	<1000
9	Total Suspended Solids (TSS)	mg/l	<5.0	
10	Calcium Hardness	mg/l	90.3	<500
11	Magnesium Hardness	mg/l	37.1	–
12	Calcium	mg/l	36.1	–
13	Magnesium	mg/l	9	–
14	Chloride (Cl)	mg/l	26.8	<250
15	Sulfate (SO_4)	mg/l	40	
16	Sulphide	mg/l	<0.5	–
17	Nitrates (NO_3)	mg/l	1.7	≤ 50
18	Fluoride (F)	mg/l	0.8	≤ 1.5

Sr. #	Parameter	Unit	Result Head Trimmu	NEQS (2010) (Drinking water)
19	Sodium Absorption Ratio (SAR)	—	1.57	–
20	Residual Sodium Carbonate (RSC)	mg/l	ND	–
21	Ammonia (NH_3)	mg/l	<0.1	–
22	Cyanide (CN)	mg/l	<0.01	≤ 0.05
23	Grease & Oil	mg/l	<1.0	–
24	Arsenic (As)	mg/l	<0.005	≤ 0.05
25	Cadmium (Cd)	mg/l	<0.003	0.01
26	Chromium (Cr)	mg/l	<0.01	≤ 0.05
27	Lead (Pb)	mg/l	<0.01	≤ 0.05
28	Mercury (Hg)	mg/l	<0.001	≤ 0.001
29	Selenium (Se)	mg/l	<0.01	0.01
30	Nickel (Ni)	mg/l	<0.01	≤ 0.02
31	Silver (Ag)	mg/l	<0.1	-
32	Zinc (Zn)	mg/l	0.03	5
33	Iron (Fe)	mg/l	0.07	-
34	Barium (Ba)	mg/l	<0.5	0.7
35	Manganese (Mn)	mg/l	0.02	≤ 0.5
36	Chlorine	mg/l	<0.1	0.2 – 1.5
37	Sodium (Na)	mg/l	41	–
38	E. coli	0/100ml	Absent	Must not be detectable in any 100 ml sample

Table 4-12 Groundwater Quality Comparison with Irrigation Guidelines

Sr. #	Parameter	Unit	Groundwater Results	FAO
01	Electrical Conductivity	µS/cm	386	0-3000
02	Total Dissolved Solids (TDS)	mg/l	280	0-2000
03	Chloride (Cl)	mg/l	26.8	0 – 1060
04	Sulphate (SO_4)	mg/l	40	0 – 960
05	Nitrates (NO_3)	mg/l	1.7	0 – 10
06	Sodium Absorption Ratio (SAR)	meq/l	1.57	0 – 15
07	Magnesium	mg/l	9	0 – 60
08	Sodium (Na)	mg/l	41	0-910
09	Calcium (Ca)	mg/l	36.1	0-400

Analysis of Results

NEQ Standards:

122. The groundwater quality parameters all tested within the safer limits of NEQ standards.

FAO Guidelines:

123. The water quality test results were also compared against FAO guidelines to determine the groundwater's suitability to be used for irrigation as well. The analysis of the single groundwater sample shows that all parameters necessary for irrigation water are within the safe FAO limits.

Groundwater Quality in Canal Command Areas

124. The secondary data for groundwater quality has been collected from the Directorate of Land Reclamation and SMO offices for canals command areas. The groundwater was classified on the basis of laboratory analysis arranged by SMO for Electrical Conductivity (EC), Sodium Adsorption Ratio (SAR) and Residual Sodium Carbonate (RSC) during 2005. For ease in description, the groundwater has been expressed as usable, marginal and hazardous for irrigation as determined by the adverse value of any of the above mentioned three parameters. The classification criteria used is not intended to be strict in relation to the effects of irrigation waters on soil and crop growth and can be truly adjusted according to environmental factors such as climate, type of soil, crops grown and management practices.

125. SMO also carried out testing for pH and EC in the filed by using digital pH and EC meters and sent all the water samples to the laboratory for detailed chemical analysis. The samples were analyzed for EC, SAR and RSC. These parameters are used for the classification of water as usable, marginal and hazardous.

	Usable	**Marginal**	**Hazardous**
EC x 10^6 µS/cm	0 – 1500	1500 – 3000	> 3000
RSC (meq/l)	0 – 2.5	2.5 – 5.0	> 5.0
SAR (mg/l)	0 – 10	10 – 18	> 18

126. The groundwater quality within the canal command areas are summarized in Table 4.13.

Table 4-13 Shallow Groundwater Quality within Canal Command Areas

Command Area of Canals	**No. of Water Samples**	**Shallow Water Quality**					
		Usable		**Marginal**		**Hazardous**	
		No.	**%**	**No.**	**%**	**No.**	**%**
Haveli	159	84	53	42	26	33	21
Rangpur	213	121	57	59	28	33	15

Source: SMO reports publication No. 34 and 36

127. The overall shallow groundwater quality in Haveli Canal Command Area indicates that improvement is observed in usable and hazardous categories 53% vs 32% and 21% vs 47%, respectively. But in marginal water quality a slight increase is seen (26% vs 21%). Since the number of water samples collected and analyzed during 1977-79 and 2002-03 surveys are not compatible (47 vs 159), true comparison of the data cannot be ascertained. For Rangpur Canal Command, the comparison of groundwater quality with previous survey cannot be made because only ten (10) water samples were collected during 1977-79 against 213 water samples collected during 2002-03.

4.4 BIOLOGICAL ENVIRONMENT

128. The biological environment of the area comprises of flora and fauna. The existing habitats within the project area include the agricultural lands, Trimmu barrage pond area, canal lengths in the project area and small water impoundments of these the agricultural land occupied most of the area. This Trimmu barrage pond area is an important ecological feature of the site and is a repository to a number of bird's species. WWF-Pakistan is carrying out detailed Biodiversity Survey at Trimmu Barrage to identify, determine sensitivity and propose the management of the sensitive habitat within the project area of influence during construction and operational phases of the project. These survey results would be incorporated in the final IEE Report and Biodiversity Survey report of WWF would also be made as Appendix- 7.4 to this report.

129. According to Initial Biological Environmental Assessment report:

i. There is no threatened species of flora & fauna exists in the project area. But some research papers reported that two threatened species including Black-bellied Tern (Sterna acuticauda) and Pea-cock Soft Shell Turtle (Aspideretes hurum) were found in project area. Yet on the basis of the scope of work and previous surveys / studies in the project area, it can be stated that the project activities will not affect the threatened species. Rather the project activities will be supportive to the identified threatened species. For example, the major threat to the fresh water turtles is their illegal and uncontrolled hunting not only at the project site but in whole of the country. After the project activities are started, hunters will not find open hunting opportunities at least during the construction phase of the project due to implementation of EMP.

ii. Removal of part of the shoal (bela) will have very little and temporary negative impact upon the existing biodiversity. Pea-cock Soft Shell Turtle is found around sandy areas along freshwater bodies the bank of the barrage pond area are clayey and thickly vegetated with typha sp. and Saccharam sp. which do not offer ideal habitat to this turtle species. However, the banks of the river downstream of the barrage are sandy with very little vegetation around that provides good habitat to the turtle species and also a thermal cover to the species. Since most of the work including bela excavation will be carried out at the upstream of the barrage negligible impact on turtles are anticipated. As far as Black-ballied Tern is concerned, the specie is disturbed throughout Sindh and its distributaries. It breeds usually at sandpits and islands in rivers and in the marshes. But due to certain already existing disturbances at the project site like livestock grazing, agricultural practices by locals and sand extraction for development, is unlikely the bird carry out breeding at site.

iii. On the other hand removal of bela will widen the pond area and ultimately increase the carrying capacity for fish. Increased fish will support more fish eating birds, more

birds will support more invertebrates as the dropping of birds are food for macro invertebrates. Hence, the ultimate result of the proposed project will be increased carrying capacity of the site for overall biodiversity.

130. The bela removal plan is shown in Appendix 7.5.

4.4.1 Flora

131. The Flora can be divided into two parts:

- Riverian Tract
- Adjacent Inland Area

Riverian Tract

132. In riverian tract, especially in pond area the succession of vegetation, first colonizes are grasses and Typha followed by Tamarix as the soil become consolidated and is raised by the new silt deposition in the scrub, so that the vegetation is no longer completely submerged and erect tree growth becomes possible.

133. As the soil gets stabilized and drained the forest community normally progresses to *Acacia nilotica* and *Dalbergia sissoo*. In its present state, the flora of Riverian Alluvial deposits can be listed as follows:

Trees

- Lai (*Tamarix dioca*)
- Pilchi (*Tamarix gallica*)
- Kikar (*Acacia nilotica*)
- Sheesham (*Dalbergia sissoo*)
- Beri (*Zizyphus jujube*)
- Mesquette (*Prosopis glandulosa*)
- Bhen/Poplar (*Populus euphratica*)
- Khabbal (*Cynodon dactylon*)
- Kia (*Sacchrum Spontaneum*)
- Kunder (*Typha elephantine*)
- Sufaida (*Eucalyptus camaldulensis*)

134. Whereas the trees provide a habitat for birds the solid ground below is the houses of mammals. The margin line of Typha and grasses becomes a good habitat for reptiles while the fish occupy the adjacent waters.

Adjacent Inland Area

135. Adjacent area is either on the riverbanks or on risen parts of the consolidated alluvial deposits within the pond. The natural flora of inland area is as follows:

Trees:

- Vann *(Salvadora oleoides*)
- Farash *(Tamarix aphylla*)
- Sheesham *(Dalbergia sissoo*)
- Kikar *(Acacia nilotica*)

- Jand *(Prosopis spicigera*)
- Beri *(Zizyphus jujube*)
- Date Palm *(Phoenix rubicola*)

Kiker, Sheesham, Sufaida and Tarmail were the main type of trees found along the embankments

Shrubs*:*

- Malla *(Zizyphus nummularia*)
- Karir *(Capparis aphylla)*
- Peelu *(Salvadora persica*)
- Phog *(Calligonum polygonoides*)

Herbs:

- Hermal *(Peganum harmala*)
- Detura *(Datura alba*)

Grasses:

- Khabal *(Cynodom dacylon*)

Exotic Trees in Adjacent Area

136. Near the banks some exotic tree species have been introduced over the time. Some of these are:

- Mulberry (*Morus alba*)
- Shisham *(Dalbergia Sissoo)*
- Bakain (*Melia azadarach*)
- Shirin/siris (*Albizzia lebeck*)
- Sufaida (*Eucalyptus camaldulensis*)
- Ipal ipal (M*inosifolia*)
- Burr (*Ficus bengalensis*)
- Pipal (*Ficus religiosa*)
- Mango (*Mangifera indica*)

137. Flood retaining embankments and spurs are thickly vegetated with wooden trees. Exotic trees were found at the barrage and along the canals.

Economic Ecological Utilization of the Flora

138. The above listed flora consists of trees, shrubs, herbs and grasses. The flora on the whole has following economic and ecological values:

1. Production Values
   Timber, fuel wood and non-timber produce

2. Protection Values
   Soil conservation, wind breaks and protection and habitats for fauna

3. Environmental Values
   Production of oxygen, carbon absorption, cooling of air temperature

4. Aesthetic Values
   Trees as green dimension tool of landscape the other vegetation supplements

5. Cultural Values
   Various produce available out of the flora shape the habits and culture of the adjacent population

6. Rehabilitation Value
   Succession of vegetation on alluvial soil in the river builds up the soil at advance stage this process can add more lands to agriculture use

4.4.2 Terrestrial Fauna

139. The rich Fauna at Trimmu Barrage, upstream in the barrage head pond and downstream in the released waters, is as follows: the data collected from the Wildlife Department and from the IEE study conducted for Trimmu Barrage Rehabilitation & Upgrading.

Mammals

Sr. No.	Common Name	Zoological Name	Local Name	Family	Order
1	Long-eared Hedgehog	*Hemiechinus collaris*	Jhaa Chua	Erinaceidae	Insectivora
2	Indian Flying Fox	*Pteropus giganteus*	Chamgaadar	Pteropidae	Chiroptera
3	Kelaart's Pipistrelle	*Pipistrellus ceylonicus*	Chamgaadar	Vespertilionidae	Chiroptera
4	Least Pipistrelle	*Pipistrellus tenuis*	Chamgaadar	Vespertilionidae	Chiroptera
5	Yellow-bellied Bat	*Scotophilus heathii*	Chamgaadar	Vespertilionidae	Chiroptera
6	Desert Hare	*Lepus nigricollis*	Khargosh	Leporidae	Lagomorpha
7	Northern Palm Squirrel	*Funambulus pennantii*	Golehree	Sciuridae	Rodentia
8	Indian Crested Porcupine	*Hystrix indica*	Saih	Hystricidae	Rodentia
9	House Rat	*Ratus ratus*	Choowa	Muridae	Rodentia
10	House Mouse	*Mus musculus*	kees	Muridae	Rodentia
11	Little Indian Field Mouse	*Mus booduga*	Choowa	Muridae	Rodentia
12	Indian Gerbil	*Meriones hurrianae*	Choowa	Muridae	Rodentia
13	Indian Pangolin	*Manis Crassicaudata*	Salla	Manidae	Pholidota
14	Asiatic Jackal	*Canis aureus*	Geedarr	Canidae	Carnivora
15	Common Red Fox	*Vulpes vulpes*	Loomarr	Canidae	Carnivora
16	Small Indian civet	*Viverricula indica*	Kasturi Billa	Viverridae	Carnivora
17	Small Indian Mongoose	*Herpestes javanicus*	neola	Herpestidae	Carnivora
18	Grey Mongoose	*Herpestes edwardsii*	neola	Herpestidae	Carnivora
19	Jungle cat	*Felis chaus*	Jangli Billa	Felidae	Carnivora
20	Wild Boar	*Sus scrofa*	Suar	Bovidae	Artiodactyla

Reptiles & Amphibian

Sr. No.	Zoological Name	Common Name	Order	Family
1	*Bufo stomaticus* (Lütken, 1862)	Indus valley toad	Anura	Bufonidae
2	*Microhyla ornata* (Dumeril and Bibron, 1841)	Ant Frog	Anura	Microhylidae
3	*Euphlyctis cyanophlyctis* (Schneider, 1799)	Skittering frog	Anura	Ranidae
4	*Fejevarya limnocharis* (Boie, 1834)	Alpine cricket frog	Anura	Ranidae
5	*Hoplobatrachus tigerinus* (Daudin, 1802)	Bullfrog	Anura	Ranidae
6	*Sphaeroteca breviceps* (Schneider,	Burrowing frog	Anura	Ranidae

Sr. No.	Zoological Name	Common Name	Order	Family
	1799)			
7	*Nillsonia gangeticus* (Cuvier, 1825)	Indian soft-shell turtle	Chelonia	Trionychidae
8	*Nillsonia hurum* (Gray, 1831)	Peacock soft-shell turtle	Chelonia	Trionychidae
9	*Chitra indica* (Gray, 1831)	Narrow-head soft-shell turtle	Chelonia	Trionychidae
10	*Lissemys punctata* (Webb, 1980)	Indian flap-shell turtle	Chelonia	Trionychidae
11	*Calotes versicolor* (Daudin, 1802)	Common Tree Lizard	Squamata	Agamidae
12	*Eublepharis macularius* (Blyth, 1854)	Fat-tailed gecko	Squamata	Eublepharidae
13	*Hemidactylus flaviviridis* (Rüpell, 1835)	House gecko	Squamata	Gekkonidae
14	*Hemidactylus brookii* (Gray, 1845)	Spotted house gecko	Squamata	Gekkonidae
15	*Acanthodactylus cantoris* Gunther,	Blue-tailed sand lizard	Squamata	Lacertidae
16	*Ablepharus pannonicus* (Fitzinger,	Red-tailed snake-eyed	Squamata	Scincidae
17	*Eutropis dissimilis* (Hallowell, 1860)	Striped grass skink	Squamata	Scincidae
18	*Lygosoma punctata* (Linnaeus, 1766)	Spotted garden skink	Squamata	Scincidae
19	*Uromastyx hardwickii* (Gray, 1827)	Spiny-tailed ground	Squamata	Uromastycidae
20	*Varanus bengalensis* (Daudin, 1802)	Bengal monitor	Squamata	Varanidae
21	*Ramphotyphlopsbraminus* (Daudin, 1803)	Brahminy blind snake	Squamata	Typhlopidae
22	*Eryx johnii* (Russell, 1801)	Common sand boa	Squamata	Boidae
23	*Lycodon aulicus* (Linnaeus, 1758)	Wolf snake	Squamata	Colubridae
24	*Xenochrophis piscator* (Schneider, 1799)	Checkered keel-back	Squamata	Colubridae
25	*Bungarus caeruleus* (Schneider, 1801)	Common krait	Squamata	Elapidae
26	*Naja oxiana* (Eichwald, 1831)	Brown cobra	Squamata	Elapidae
27	*Echis carinatus* Stemmler, 1964	Saw-scale viper	Squamata	Viperidae

4.4.3 Birds

140. The barrage pond area provides the habitat of many species of migratory and game birds. Partridge is the local game bird occasionally found along the river bank. Many rare species of waterfowl also visit this site during winter.

141. The list of birds is provided below:

Sr. #	English Names	Zoological Names	Category	Status IUCN 2013	Population Trend
Order Galliformes					
Family Phasianidae					
1	Common Quail	*Coturnix coturnix*	Year-round visitor	Least Concern	Decreasing
2	Grey Francolin	*Francolinus pondicerianus*	Resident	Least Concern	Stable
3	Black Francolin	*Francolinus francolinus*	Resident	Least Concern	Stable
Order Coraciiformes					
Family Upupidae					
4	Common Hoopoe	*Upupa epops*	Winter visitor	Least Concern	Decreasing
Family Coraciidae					
5	Indian Roller	*Coracias benghalensis*	Resident	Least Concern	Increasing
Family Halcyonidae					
6	White-throated Kingfisher	*Halcyon smyrnensis*	Resident	Least Concern	Increasing
Family Cerylidae					
7	Pied Kingfisher	*Ceryle rudis*	Resident	Least	Unknown

Sr. #	English Names	Zoological Names	Category	Status IUCN 2013	Population Trend
				Concern	
Family Meropidae					
8	Green Bee-eater	*Merops orientalis*	Resident	Least Concern	Increasing
Order Cuculiformes					
Family Cuculidae					
9	Asian Koel	*Eudynamys scolopacea*	Summer Breeder	Not Evaluated	Unknown
10	Greater Coucal	*Centropus sinensis*	Resident	Least Concern	Stable
Order Psittaciformes					
Family Psittaculidae					
11	Rose-ringed Parakeet	*Psittacula krameri*	Resident	Least Concern	Increasing
Order Apodiformes					
Family Apodidae					
12	House Swift	*Apus affinis*	Resident	Least Concern	Increasing
Order Strigiformes					
Family Strigidae					
13	Spotted Owlet	*Athene brama*	Resident	Least Concern	Stable
Order Caprimulgiformes					
Family Caprimulgidae					
14	Sykes's Nightjar	*Caprimulgus mahrattensis*	Resident	Least Concern	Stable
Order Columbiformes					
Family Columbidae					
15	Rock Pigeon	*Columba livia*	Resident	Least Concern	Decreasing
16	Laughing Dove	*Streptopelia senegalensis*	Resident	Not Evaluated	Unknown
17	Collared Dove	*Streptopelia decaocto*	Resident	Least Concern	Increasing
Order Gruiformes					
Family Rallidae					
18	Common Moorhen	*Gallinula chloropus*	Resident	Least Concern	Unknown
Order Charadriiformes					
Family Scolopacidae					
19	Little Stint	*Calidris minuta*	Year-round visitor	Least Concern	Decreasing
Family Recurvirostridae					
20	Black-winged Stilt	*Himantopus himantopus*	Resident	Least Concern	Increasing
Family Charadriidae					
21	Red-wattled Lapwing	*Vanellus indicus*	Resident	Least Concern	Unknown
22	White-tailed Lapwing	*Vanellus leucurus*	Winter visitor	Least Concern	Unknown
Order Charadriiformes					
Family Sternidae					
23	River tern	*Sterna aurantia*	Winter visitor	Near Threatened	Decreasing
24	black bellied tern	*Sterna acuticauda*	Winter visitor	Endangered	Decreasing
Order Accipitriformes					

Sr. #	English Names	Zoological Names	Category	Status IUCN 2013	Population Trend
Family Accipitridae					
25	Black-shouldered Kite	*Elanus caeruleus*	Resident	Least Concern	Stable
26	Black Kite	*Milvus migrans*	Resident	Least Concern	Unknown
27	Shikra	*Accipiter badius*	Resident	Least Concern	Stable
28	White-eyed Buzzard	*Butastur teesa*	Resident	Least Concern	Stable
29	Tawny Eagle	*Aquila rapax*	Resident	Least Concern	Stable
Order Podicipediformes					
Family Podicipedidae					
30	Little Grebe	*Tachybaptus ruficollis*	Resident	Least Concern	Decreasing
Order Ciconiiformes					
Family Ardeidae					
31	Little Egret	*Egretta garzetta*	Year-round visitor	Least Concern	Increasing
32	Intermediate Egret	*Mesophoyx intermedia*	Year-round visitor	Least Concern	Decreasing
33	Cattle Egret	*Bubulcus ibis*	Resident	Least Concern	Increasing
34	Grey Heron	*Ardea cinerea*	Winter visitor	Least Concern	Unknown
35	Purple Heron	*Ardea purpurea*	Year-round visitor	Least Concern	Decreasing
36	Indian Pond Heron	*Ardeola grayii*	Resident	Least Concern	Unknown
Order Passeriformes					
Family Laniidae					
37	Bay-backed Shrike	*Lanius vittatus*	Resident	Least Concern	Stable
38	Southern Grey Shrike	*Lanius meridionalis*	Summer breeder	Not Evaluated	Unknown
Family Corvidae					
39	Rufous Tree pie	*Dendrocitta vagabunda*	Resident	Least Concern	Stable
40	House Crow	*Corvus splendens*	Resident	Least Concern	Stable
Family Dicruridae					
41	Black Drongo	*Dicrurus macrocercus*	Resident	Least Concern	Unknown
Family Muscicapidae					
42	Indian Robin	*Saxicoloides fulicata*	Resident	Not Evaluated	Unknown
43	Pied Bush chat	*Saxicola caprata*	Resident	Least Concern	Stable
Family Sturnidae					
44	Common Myna	*Acridotheres tristis*	Resident	Least Concern	Increasing
45	Bank Myna	*Acridotheres ginginianus*	Resident	Least Concern	Increasing
Family Hirundinidae					
46	Wire-tailed Swallow	*Hirundo smithii*	Resident	Least Concern	Increasing
Family Pycnonotidae					

Sr. #	English Names	Zoological Names	Category	Status IUCN 2013	Population Trend
47	Red-vented Bulbul	*Pycnonotus cafer*	Resident	Least Concern	Increasing
Family Cisticolidae					
48	Rufous-fronted Prinia	*Prinia buchanani*	Resident	Least Concern	Stable
49	Graceful Prinia	*Prinia gracilis*	Resident	Least Concern	Stable
Family Timaliidae					
50	Common Babbler	*Turdoides caudatus*	Resident	Not Evaluated	Unknown
51	Jungle Babbler	*Turdoides striatus*	Resident	Not Evaluated	Unknown
Family Alaudidae					
52	Crested Lark	*Galerida cristata*	Resident	Least Concern	Decreasing
Family Nectariniidae					
53	Purple Sunbird	*Nectarinia asiatica*	Resident	Least Concern	Stable
Family Passeridae					
54	House Sparrow	*Passer domesticus*	Resident	Least Concern	Decreasing
Family Motacillidae					
55	Yellow Wagtail	*Motacilla flava*	Year-round visitor	Least Concern	Decreasing

4.4.4 Fish and Fisheries

142. The most important types of game fish found in Indus valley are Palla (Tenua losa ilisha) and Mahasher (Torputitora spp.), which are an exceptional species. But due to construction of a series of barrages Palla cannot migrate from sea upwards and is almost extinct from river waters. Upward breeding movement of Manatee is also restricted due to barrages.

143. The data included in this section is collected during the site meeting with the fishing Contractors and visit at the local office of Fisheries Department. Mainly the fish is exported to big cities like Faisalabad, Lahore, and Karachi etc., however small the vendors along the road near the barrage sell quantity of fish. Fishing is not allowed within 1.5 km downstream of the barrage. The Contractor(s) can go up to 6 to 7 km from both side of the barrage to catch the fish. Specially designed net (Jal) by the fishermen are the common tool of catching fish. It has been found that more than 90% of the people live around the barrage are connected with the fishing industry during the fishing season. The most common type of fish found at the barrage is Mali, Gulfam, Sangari, Raho, Talapi, Mori and Soul.

144. Fisheries play a significant role in Pakistan economy and contribute towards full filling the food requirement of the country. There are also handful numbers of fish shops at the Barrage where both raw and fried fish are sold. The fishing season commences in October and finishes by mid of February. During off-season local people get involve with agricultural work or temporarily move to the cities to avail money-earning opportunities.

Fishes Commonly Found at Trimmu Barrage

Local Name	Scientific Name
Daula	*Channa marulius*
Dumbra	*Labeo rohita*
Dumbro	*Labeo rohita*
Gulfam	*Cyprinus carpio*
Khagga	*Mystus (Mystus) bleekeri (Day)*
Khagga	*Rita rita*
Mori	*Barilius Vagra*
Mullee	*Wallago attu*
Rohu	*Labeo rohita*
Saul	*Channa marulius (Ham)*
	Channa striatus (Bloch)
Singhara	*Mystus (Osteobagrus) seenghala*
Singhari	*Mystus (Osteobagrus) aor*
Singhi	*Heteropneustes fosslis*
Theil	*Catla Catla*

4.5 SOCIO-ECONOMIC STUDIES

4.5.1 General

145. Planning and implementation of resettlement requires reliable and accurate data reflecting the precise impacts on affected persons so that appropriate entitlement policies can be developed. Therefore, a socio-economic survey was carried out to capture existing prevalent socio-economic conditions of the community in the project areas and to assess the impacts of construction activities around Right Marginal Bund and removal of Bela on local settlements with a view to introduce possible mitigation measures.

146. According to ADB safeguard policy, the borrower/ client will conduct socio-economic survey(s) and a census, with appropriate socio-economic baseline data to identify all persons who will be displaced by the project and to assess the project's socio-economic impacts on them. The assessment of their income and livelihoods and gender disaggregated information pertaining to the economic and socio cultural conditions of displaced persons, for this purpose a comprehensive socioeconomic survey is conducted by focusing on gender issues and female problems.

4.5.2 Socio-Cultural Condition

147. The project area is geographically situated in Tehsil Athara Hazari district *Jhang* of the Punjab Province. The socio-cultural condition of the district is almost same. Most people living in the surrounding villages are *Punjabi* farmers. Dress patterns are the same almost everywhere, *Shalwar kameez* and *dhoti kurta* are the common dresses of males and *Shalwar kameez for* females. People belong to various castes. Most of the people are engaged in agriculture or agro-based businesses. Besides, fishing and boating is popular commercial activity in the Barrage area. Moreover, Mat-making is also a secondary vocation of women of the area.

148. As for as crop pattern are concerned, wheat, rice, sugarcane and fodder crops are planted extensively.

4.5.2.1 Demographic Profile the District

149. Population of district Jhang was estimated 3524000 in 2011 approximately. Its sex ratio is 108.4 and population density is 321 persons per sq. km. Urban population is 23% whereas rural population is 77%.

4.5.2.2 Caste System

150. Most of the people in the Project Area belong to the following castes.

Table 4-14 Major Castes

Sr. No.	Tehsil	Major Castes
1	Athara Hazari	Malkana, Bharwana, Jhabail, Arian and Kirtuana

4.5.2.3 Religion

151. Religion is instinctive to man. It is inseparable from human society. Religion helps to knit the social values of a society into cohesive whole. It is the ultimate source of social cohesion. Almost whole population of Project Area is Muslim. Cultural festivals are mostly related to traditional religious events. Pilgrimages to shrines (or Ziarats) are very is common.

Table 4-15 Major Religions

Area	Muslim	Christian	Hindu	Qadiani/ Ahmadi	Schedule Caste	Others
Study area	100	-	-	-	-	-
Jhang District	98.0	0.5	*	1.5	*	*
Punjab Province	97.2	2.3	0.1	0.3	*	0.1

*Very small number.

Source: i) 1998 District Census Report
ii) 1998 Provincial Census Report of Punjab Population Census Organization

4.5.2.4 Settlement Pattern

152. Settlement pattern is rural in the area. People live in villages and hamlets. Culture is homogeneous. All villages are connected with mettaled roads with their nearest towns. Language, traditions, rituals are common.

4.5.3 Indigenous Peoples' Safeguards

153. According to its safeguard policy the objectives for indigenous people safeguard are "To design and implement projects in such a way that fosters full respect for Indigenous Peoples' identity, dignity, human rights, livelihood systems, and cultural uniqueness as defined by the Indigenous Peoples themselves so that they (i) receive culturally appropriate social and economic benefits, (ii) do not suffer adverse impacts as a result of projects, and (iii) can participate actively in projects that affect them. This above statement was policy document in screening out indigenous people.

154. During the field survey it was especially focused to screen out such people. People living in project areas belong to various caste patterns and have homogeneous culture. People have different caste systems but their culture pattern and living habits are same as those of people of Punjab province. There is no community that meets the criteria of ADB definition of Indigenous People. As such the ADB policy on Indigenous peoples will not be triggered by the project.

4.5.4 Socio-Economic Information

155. The socio-economic information was gathered during May, 2013 by using different techniques and methodologies and is derived from primary and secondary sources. Primary data were collected through following data collection tools: (i) village profiles; (ii) household census survey; (iii) survey of all commercial structures and socio-economic survey. Village profiles Performa were got filled from the people of all villages along the Project site. Household survey forms and commercial survey forms were filled in by all affected households/ commercial units within the CoI.

156. Secondary information was gathered from all available documents i.e. District Census Reports 1998 of relevant districts, Design Utility Folders prepared by the Design Engineering Consultants, field Land Staff of Irrigation Department and Asian Development Bank Guidelines for resettlement. Meetings were held with the officials of Revenue Department, Agricultural, Irrigation and forestry department; feedback of all these meetings has also been kept in view for this study.

4.5.4.1 Methodology

157. To develop the following baseline condition of the project area, socio-economic survey was carried out in the project area. Stratified random technique was adopted for this purpose. Totally 29 survey form were filled from the project area. A team of 4 data enumerators was formed for survey from both males and females. Survey from females was conducted by female data enumerators.

158. Socio-economic survey respondents belonged to all walks of life including residents, passengers, community leaders, key influential persons, women and all possible stakeholders. The census focused on all affectees whose houses and business structures were to be affected by the project. These people were also interviewed regarding potential impacts related to the upgradation of Trimmu Barrage. Beside this, focus survey group sessions were also carried out in the villages along the Project site to gather the view point of the general public.

4.5.4.2 Questionnaire Design

159. Following Questionnaires were designed and administered for the data collection:

- Questionnaire for Village Profile
- Questionnaire for Socio-economic Survey (Household)
- Questionnaire for Census (Household)
- Questionnaire for Gender Survey

160. All the questionnaires were pre-tested in the field and some modifications were made before the initiation of actual survey.

161. A survey team consisting of three sociologists was constituted (three males & one female). Training/briefing sessions were held for the survey team members to explain the objectives of the study. Questionnaires were also discussed in detail in the training/briefing session, to ensure that each interviewer understood the meaning of each question.

Table 4-16 Censuses and Survey for DPs

Type	Data Collection Techniques	Objectives
Census	Complete enumeration of all affected households and their assets through household questionnaire	• To prepare a complete inventory of DPs and their assets as a basis for compensation • To ascertain entitlement of DPs • To ascertain income of the DPs • To ascertain income of the DPs in relation to poverty line • To assess the profession of DPs • To assess the vulnerability
Socio-economic Survey	25 percent sample of affected population using household questionnaire	• To prepare profile of DPs (economic & social and other sources of livelihood) • To prepare RP • To assess incomes, identify productive activities • To develop relocation and compensation options • To develop social preparation phase for vulnerable groups
Gender Survey	20 percent sample of affected families using household questionnaire	• To prepare socio-economic profile of female counter part of head of household (economic & social and other sources of livelihood) • To assess their role in economic and domestic activities • To assess the project impacts • To assess their priorities/needs
Follow-up survey	Sample survey and participatory rapid appraisal techniques	• To update list DPs • To prepare appropriate entitlements packages • To investigate specific issues for particular groups of DPs

162. A census was made through households' questionnaires that covered all DPs irrespective of entitlement or ownership. It provided a complete inventory of all DPs and their assets. It was used to minimize fraudulent claims made by people who move into the area affected by the project in the hope of being compensated and / or resettled. The socio-economic survey was carried out 35 percent of the affected households.

163. The socio-economic obtained data regarding likely impacts of the project on the local economy, land use and; employment and land use patterns, income and economic interdependence between households, poverty levels, local social organizations, authority structure, women's economic activities and income. Follow-up survey was done to update the DPs list. The data collection was in accordance with policy requirements, but at the same time kept simple.

164. The survey covered all DPs, including vulnerable groups and information on land, area and people. It includes DPs with concern of entitlement e.g. tenants, sharecroppers, the landless, encroachers, small business owners, wage labourers and others. Vulnerable (Indigenous people, ethnic minorities, women and households headed by women, people without legal rights to inherit or own property, the poorest, and isolated communities) among the APs have also been covered.

4.5.4.3 General Profile of the Respondents

165. Out of the respondents surveyed during socio-economic survey, 49.7% are male and 50.3% are female, 35% literate and 65% are illiterate. In village areas it is observed that most of the people are engaged in economic activities though most of them are under paid.

Table: 4-17 General Profile

Sr. No.	Aspects	Respondents	Percentage
1	Sex ratio	Male	49.69
		Female	50.31
2	Literacy Rate	Literate	35
		Illiterate	65

4.5.4.4 Respondents' Age Group

166. Table 4-18 represents the distribution of respondents according to their age group. During the survey sample size was selected from mature people. Children and minor were not interviewed. Among the respondents 77% were younger than 25 years, 6% were between 26 to 30 years, 5.5% were between 31 and 35 years, 4% between 36 and 40 years, 5.5% were older than 41and less than 50 and 2% respondents belonged to age group 51 year plus.

Table: 4-18 Age Groups

Sr. No.	Age Group	Percentage
1	15-25	77
2	26-30	6
3	31-35	5.5
4	36-40	4
5	41-50	5.5
6	51 & Above	2
Total		100%

4.5.4.5 Education Level

167. The literacy rate is the outcome of the education facilities in a society that reflect the socio-economic behavior of the communities. The literacy level is one of the factors, which determine the quality of the human resources. The low percentage of literacy indicates

cultural barriers for the spread of innovations and scientific methods. In the Study Area the literacy rate at the lowest level as only 35 percent of the population was literate.

168. Literate respondents had various education levels. Out of 35% literate respondents, 63% had primary education, 21% up to Middle, 9% up to Matriculation, 4% intermediate and 4% respondents have religious education. Educational status of the respondents is shown in the Table 4-19.

Table: 4-19 Educational Level

Sr. No.	Educational Level	Percentage
1	Primary	63
2	Middle	21
3	Matriculation	9
4	Intermediate	4
5	Religious	4
Total		100

4.5.4.6 Professional Status

169. Table 4-20 presents the respondents' professional status. Among them 2 % are farmers, 30% are businessmen, 32% are labourers, 4% are in Government and private service, 8% are involve in fishing and 22% earn their livelihood by boating. This shows most of the people in village areas kept themselves busy in different activities.

Table: 4-20 Professional Status

Sr. No.	Profession	Nos.	Percentage
1	Agriculture	1	2.04
2	Business	15	30.61
3	Labor Work	16	32.65
4	Fishing	4	8.16
5	Service	2	4.08
6	Boatman	11	22.45
Total			100

4.5.4.7 Household Income Levels

170. Table 4-21 shows the respondents' income levels. Most of them (59%) had incomes up to Rs 6,500. 14% had income between Rs. 6,600 to Rs.10,000/ month. 14 % respondents belonged to the income group ranging between Rs.11,000 to 15,000/ month, 3% between Rs.16,000 to 25,000/ month and 10% had an income more than Rs.25,000/ month. These income classes belong to various professions. Mostly labour class belongs to low income group having less than 6,500/ month.

Table: 4-21 Income Levels

Sr. No.	Income Group (Pak Rupees)	Percentage
1	Up to 6500	58.62
2	6600-10000	13.79
3	11000-15000	13.79

4	16000-25000	3.45
5	More than 25000	10.34
Total		100

4.5.4.8 Monthly Expenses

171. Table 4-22 shows that about 62% of the respondents have their monthly expenses up to Rs. 6,500. 17% respondents have monthly expenses ranging Rs. 6,600 to Rs. 10,000. 10% respondents have their monthly expenses in the range of Rs. 11,000 to 15,000. Only 10% respondents have their home expenses more than Rs. 25,000. Table 4-22 shows the monthly expenses situation. Monthly expenses are more than income which means no saving.

Table: 4-22 Monthly Expenditure

Sr. No.	Income Group (Pak Rupees)	Percentage
1	Up to 6500	62.07
2	6600-10000	17.24
3	11000-15000	10.34
4	16000-25000	-
5	More than 25000	10.34
Total		100

4.5.4.9 Project Information

172. Table 4-23 indicates knowledge of the respondents regarding the project. Roughly, half of the respondents have information that Barrage is going to be constructed in the area. People see land marker in their surroundings every day. Similarly, 51% respondents have no information about the project.

Table: 4-23 Project Information

Sr. No.	Project Knowledge	No.	Percentage
1	Yes	14	48.2
2	No	15	51.8

4.5.4.10 Availability of Infrastructure/ Social Amenities

173. The access to basic social amenities is a basic indicator for the development. The extent of basic social amenities available to the local community was assessed during survey as below:

- **Road Facilities**

174. About 100% families are residing very close to metalled road in the study area.

- **Health Facilities**

175. The survey shows that 100% respondents in the Project Area take treatment from doctors. About 93% respondents reported that they have to take treatment from private doctors due to lack of medical facilities at government hospitals. For better medical treatment, people have to go to Jhang district head quarter. People have to travel by 7 km

with an average distance from their houses to receive medical attention. Health condition of the people is generally good. Blood pressure was a common disease in the study area along with other communicable diseases such as cholera, typhoid and diarrhea.

- **Drinking Water Facilities**

176. Being near the river edge, the ground water depth is shallow. During survey, it was found that all families had installed hand pumps/electric motors inside or outside their houses. The proportion of hand pumps for drinking water in the rural areas of Jhang district is 81%. The water quality is overall good for drinking purposes.

- **Energy Sources**

177. Energy is vital for Socio-economic development. All the respondents have electricity at their houses. According to District/Province Census 1998 of all studied districts, 39%, rural areas respectively use electricity.

- **Occupation and Income Sources**

178. It is useful to have information about occupational distribution of households. Such information will facilitate better planning and execution of the project. Respondents consist of two groups, farmers and those who are landless / non- farm households. Farmers, who own or lease / encroach land to derive their living by cultivating the farmland, this community, may also supplement the farm incomes by rearing animals and off farm work. The members of non-farm community generally do business in connection with fisheries, cold drinks/ tea stall, labour work, agriculture labour, mat (suff) making and do other small business on the barrage to earn the income to fulfill their living necessities.

179. The data present in Table: 4-20 indicates the distribution of employed rural population (10 years & above) among various industries/ occupations.

4.5.5 Cultural and Historical Heritage

180. As per ADB Safeguard Policy when a project may affect cultural and historical heritage, the borrower/client will consult with affected communities who use, or have used them within living memory, for long-standing cultural purposes to identify cultural and historical resources of importance and to incorporate the views of the affected communities on such resources into the borrower's/client's decision making process. During the field survey a special focus was given to screen out such subject but no cultural object like shrine, mosque or historical place is going to be affected.

4.5.6 Need Assessment

181. During the Socioeconomic Survey and public consultation sessions, affectees were inquired about the civic facilities and social amenities required in the area. General infrastructural facilities like roads, schools, private medical clinics are insufficient in the vicinity of the area. Most of the people demanded, "a Public Park should be constructed on the bank of the Barrage" so the local tourism can be flourish and earning opportunities can be generated for the residents of the area. Some people demanded that vocational training courses should be imparted to the young APs that they can earn in a better way.

4.5.7 Non-Government Organization

182. During the Socioeconomic survey, it is revealed that not a single Non-Government Organization (NGO) was working in the field for the community development.

4.5.8 Socio-Economic Situation of Women in the Project Area

183. Women role in development is vital; it relates to a complete range of socio-economic activities. Women are users of basic services. They are working dawn to desk for their family. They also involved in economic activities and over worked. They represent a productive potential, which is not being taped.

184. Female participation for the betterment of family is more as compared to male. In economic side, women participate in cutting water wild growth, mat (suff) making, and agriculture activities as harvesting, threshing, storage of crops and feeding of the livestock. They also work as causal hired labor. On social side activities, they have to prepare food, clean the pots, houses, wash the clothes and childcare etc.

185. The data in Table 4-24 indicates that 100%, 38%, 38% and 100% of families whose women participation in household activities, agriculture, livestock and other economic activities i.e. mat making respectively in study area.

Table: 4-24 Socio-economic Conditions of Women in the Project Area

Socio-economic Conditions of Women	Percentage
Literacy Rate	24
Women participation in household activities	100
Women participation in agricultural activities	38
Women participation in livestock related activities	38
Women participation in other economic activities	100
Average working hours per day	11

4.5.9 Resettlement Issues

186. In accordance with the design for rehabilitation and upgrading of Trimmu Barrage, all the proposed civil works will be carried out within the barrage vicinity. But the construction of new additional bays and relocation and construction of Rangpur canal head regulator will cause permanent dislocation of Basti Muhammad Bakhsh located on government land owned by Punjab Irrigation Department. This component will have an impact on 65 residential structures; 21 business structures; 32 boatmen; 2 community structures (Mosque); and public structures (PARCO Oil Pipeline, guard & control room of PARCO oil pipeline, 13 electric poles and one transformer of WAPDA, PTCL fiber optic cable, Multinet and Mobilink in the barrage extension area).

187. These houses and small shops / khokhas / electric poles are located in Basti Muhammad Bakhsh on the land of Government of the Punjab under use of Irrigation Department and all the affectees of residential and business structures are squatter.

188. The displaced families are engaged in fisheries, mat (saff) making, agricultural activities and daily wage workers. They run petty business activities in their settlements and nearby barrage area. It is also found that no archaeological sites and any other structure of cultural importance are being displaced.

189. Resettlement studies are conducted to address the resettlement issues and to compensate the displaced persons in order to execute the proposed works smoothly and in a sustainable manner. The Resettlement Plan (RP) will be submitted separately to ADB.

4.6 BASELINE CONDITIONS OF PROPOSED CONTRACTOR'S FACILITY AREA

- The proposed sites for contractor's camp, batching plant, labour camp etc are in government land and land acquisition will not require
- No resettlement is required for developing the Contractor's facilities at proposed sites.
- The proposed sites are waste land and no tree cutting is required for the construction activities
- The sites have easy access from the existing main road of the area
- There are some local depressions in the area which may need to be raised with borrowing material
- The proposed sites are well away (>500m) from the build up area.
- No houses are located at the close vicinity at downstream of the wind flow of the area
- Groundwater could be utilized for the water supply to contractor's camp, labour camp and site offices

Fish Ladder along Divide Wall

Bela formation along the Right Guide Bank

Tubewell is a common source of groundwater

Women participation in economic activities

5. STUDY OF PROJECT ALTERNATIVES

190. The analysis of alternatives for the project is a vital part of the IEE process as it gives the opportunity to review and assess different ways of meeting the project objectives so that the environmental impact of the project is minimal. The following options/alternatives were analyzed for strengths and weaknesses of the proposed project:

- Option – 1 Provision of additional bays adjacent to the right abutment of Barrage without raising HFL
- Option – 2 Provision of gated by-pass structure on the right side with aqueduct for Rangpur canal

5.1 NO PROJECT OPTION (WORST CASE SCENARIO OPTION)

Analysis:

Strength and Opportunities

- There will be no adverse social impacts as no land will be required from private/illegal settlers and for immigrating new settlers
- The recurring cost of the Project will be avoided
- The irrigation systems downstream of the canals command area (CCA) of Haveli Main Line canal, Trimmu Sidhnai Link canal and Rangpur canal shall not be interrupted due to project activities
- Loss of the agriculture land which may be required for the borrowing area and Contractor's facilities (labour camp, batching plants, plant depot etc.), will be avoided
- The efforts and investments will be saved and will be allocated to another project in case this project is not taken up at all

Weakness and Threats

- The no project alternative is undesirable as it would mean continued economic, social and environmental losses
- There will be loss of property and agricultural land due to uncontrolled breaching along the weakened and damaged embankments in the event of a flood
- The local population shall be denied employment and training during project construction phase and later through escalated economic activities
- Due to leakage through the gates, less water will be available for the canals off-take from the barrage. This will adversely impact crop intensity in canal command areas
- The aging process along with inadequate/deferred maintenance has contributed to a general deterioration of different components/structures and heavy damages to the regulating gates and hoisting equipment. Any serious damage to this barrage can result in colossal losses in the form of total or partial disruption of irrigation supplies, non/less-production of agricultural crops within the canals command area, loss of government revenue, rehabilitation cost of emergency repairs, thus adversely affecting the national economy in additional to human sufferings beside multitude of social and environmental hazards. The minimum duration require for the construction of similar barrage will be easily 5 years plus

- Thousands of acres of land, property and infrastructure may be flooded in the event of high flood

5.2 ADDITION OF NEW BAYS

(SELECTED OPTION FOR DETAIL DESIGN)

Option 1:

The following components are included in this option:

- 11 additional bays of 60 ft width and 2 additional bays of 30 ft width, all separated by 7 ft wide concrete piers
- A divide wall is provided between additional bays and existing right undersluice
- Dismantling of existing Right Guide Bank (RGB) and construction of new RGB along right side of the new bays
- Plugging of existing regulator and construction of new head regulator for Rangpur Canal
- New AR bridge (804 ft long) across additional bays for road connection between Jhang and Bhakkar
- Amendment in the layout of existing village road and construct a new road bridge on Rangpur Canal due to relocating of the Canal head regulator
- New Divide wall at Bay # 4 (from right) to provide a calm body of water for diversion into Rangpur canal
- Construction of silt excluder
- A 25 ft deep steel sheet pile on the front edge of upstream floor of additional bays for scour protection
- Diversion arrangement for Rangpur canal and road during construction

<u>Strength and Opportunities</u>

- Minimize the requirement of breach at the event of high flood
- Gates repair work will rectify leakage losses through the damage gates and more water will be available for irrigation purpose in the canals
- Employment and training opportunities for the local population which will provide them life time benefits
- Plantation of hundreds of new trees, which will improve the aesthetic value and enhance the biodiversity of the area
- Lower project cost compared to option 2

<u>Weaknesses and Threats</u>

- Adverse social impacts as the existing shops and houses will be required to relocate for the construction of new bays
- Temporary adverse environmental impacts on wildlife habitat during construction phase
- 65 No. of houses and other infrastructure including business structures, mosques etc. falling within the work area need to be re-located

- 1217 No. of trees found within the proposed escape channel location will be uprooted to clear the area for the construction of new bays and relocating the existing structure e.g. canal head regulator, right guide wall etc.
- Temporary adverse environmental impacts during construction phase of the project i.e. dust pollution, noise pollution etc. are envisaged

5.3 PROVISION OF FUSEPLUG WEIR AND FLOOD BYPASS CHANNEL

Option 2:

The main components in this option include

- Gated structure 1430 feet wide with all appurtenant structures and 239,280 cusecs capacity
- Road Bridge over bypass channel
- Dismantling of existing RGB
- New RGB upstream and downstream
- Submerged aqueduct for Rangpur canal
- Increase the barrage capacity by developing cunnet within the bela and remove the bela during high flow
- Gate Repair Work

Strength and Opportunities

- Strengthening of embankments will minimize uncontrolled breaching, occur in the event of high flood
- Main town and villages and thousands of agricultural land will be saved from flood damages at the event of high flood by diverting the flood water with flood bypass channel
- Employment and training opportunities for the local population which will provide them life time benefits
- Gates repair works will rectify leakage losses through the damage gates and more water will be available for irrigation purpose in the canals
- Plantation of new trees will enhance the biodiversity of the area

Weaknesses and Threats

- 28 No. of houses and other infrastructure including school, mosque etc. falling within the work area need to be re-located
- Temporary adverse environmental impacts on wildlife habitat during construction phase
- 1465 No. of trees found within the area will need to be uprooted
- Higher project cost than option 1
- Adverse environmental impacts from construction activities i.e. air pollution, dust pollution, noise pollution etc.
- 55 acres of agricultural land will be acquired on permanent basis for project implementation

5.4 CONCLUSION

191. No project option is rejected because the feasibility study concludes that the structural failure of the barrage could cause the colossal losses in the form of human life, wildlife, land, property and irrigation set up.

192. Option 1 considered to be the best option in respect of environmental & social point of view. The work scheme also provides the most cost effective solutions, of the issues identified in feasibility and design calculation, as compare to the other options.

193. Option 2 is technically ruled out as it has more cost than the option 1 and also has more adverse environmental impacts compare to option 1.

6. IMPACT ASSESSMENT, MITIGATION AND ENHANCEMENT MEASURES

194. This chapter discusses the potential impacts of barrage rehabilitation and upgrading works which have been identified through the use of standard checklists, expert knowledge and experience. The impacts identified for the selected option of work scheme were assessed for their significance keeping in mind their consequences, reversibility, occurrence, duration, location, timing etc. The evaluation of the environmental & social impacts has been summarized in Table-6.1.

6.1 POTENTIAL IMPACT SOURCES

195. Environmental impacts and social impacts attributed to the Project can be broadly classified into three main groups

- Impacts assessment during design phase
- Impacts mitigation during construction phase
- Remedial measures during operational/post construction phase

196. Some of the impacts can be anticipated and avoided at design stage with appropriate adjustment in the Project Design some can be mitigated by good implementation technique and others by following the operational manual. It might be substituted or replaced chemical impacts.

6.2 IMPACTS AND MITIGATIION MEASURES ASSOCIATED WITH THE IMPLEMENTATION OF THE PROJECT

197. The following impacts are anticipated in case of the implementation of the Project

- The project will have some adverse impact on the existing residential area and as a result of increase in noise and dust levels and movement of the additional machinery and traffic.
- There will be no major loss or damage to livelihood. The temporary employment to the local communities will be given. This will be a significant positive impact.
- There is no historical monument or archeologically sensitive site hence no apparent impact on such sensitive sites is expected.
- As far as tree cutting is concerned, survey of existing trees on the site shows that 1217 no. trees will be uprooted on site during construction activities. Every tree cut on site for the execution of work should be replaced with the plantation of minimum of 5 new trees.
- There will be no permanent and significant adverse impacts on the aquatic ecology of the river and wildlife habitat of the area as seasonal flow regime of the river will remain unchanged. To facilitate the works on the barrage the cofferdams will be built. The environmental impact of cofferdams will be localized and short term (during construction phase of project), which can be mitigated with good engineering practice.

198. Potential adverse environmental impacts of selected work schemes on the physical, biological and socio-economic environment during design, construction and operational

phases have been identified. Measures to mitigate these impacts and their residual impact are discussed below:

(i) Physical Environment

- Land Resources
- Hydrology and Water Resources
- Air Quality
- Noise level

(ii) Biological Environment

- Flora
- Fauna
- Fish
- Endangered species

(iii) Culture and Heritage

(iv) Socio-economic

199. The relevant checklist of ADB's Rapid Environmental Assessment (REA) is included in Appendix 6.1. In Table 6.1 physical, biological, cultural and social impacts have been discussed under pre-construction (design phase), construction and operational phase. Each sub component has been assessed as slight, moderate or significant. The impacts have then been marked as avoidable, mitigable and irreversible. The components so assessed have been discussed and explained after the assessment of Table 6.1.

Table 6-1 Project Evaluation of Environmental Impacts

(Sheet 1 of 3)

Category	Impact Assessment		Impact								
			Slight			Moderate			Significant		
			1*	2**	3***	1*	2**	3***	1*	2**	3***
1. Design Phase											
	1.1	Damage from Retrogression				✓					
	1.2	Damage to flood retain embankments					✓				
	1.3	Obstruction to fish migration in the river					✓				
	1.4	Obstruction to gate operations and leakage from the damaged gates				✓					
2. Construction Phase											
Physical Environment Land Resources	2.1	Impacts of establishing Labour Camp, Batching Plant and equipment & material yard					✓				
	2.2	Impacts of Waste Disposal site					✓				
	2.3	Impacts of Borrowing Site					✓				
	2.4	Damage to Paths, Access Roads and Cross Drains					✓				
	2.5	Impacts of Crushed Stone Transportation					✓				
	2.6	Impacts of oil, chemical Spill or Dumping out near Building or House					✓				
	2.7	Damage the agricultural land or crop destruction					✓				
Hydrology and Water Resources	2.8	Impacts of New Road and Bridge Construction						✓			
	2.9	Impacts of using groundwater as drinking Water & Wastewater disposal Impacts					✓				

* Avoidable through design

** Mitigation through Contractor's obligation or by communities through social framework agreement (SFA)

*** Non-reversible, Permanent change (to be adopted)

(Sheet 2 of 3)

Category	Impact Assessment		Impact								
			Slight			Moderate			Significant		
			1*	2**	3***	1*	2**	3***	1*	2**	3***
2. Construction Phase											
Physical Environment	2.10	Contamination of Surface water due to construction and dismantling of Cofferdam					✓				
Hydrology and Water Resources	2.11	Contamination of surface water due to Electrical Mechanical Work		✓							
	2.12	Impact of Extended Canal Closure				✓					
	2.13	Impact of Road Bridge Construction					✓				
	2.14	Impact of Additional bays Construction						✓			
Air Quality	2.15	Impact of Source of Construction Water		✓							
	2.16	Dust, Smoke and other Pollutants from Plants & Equipments		✓							
	2.17	Smoke from Burning of Waste material or Burning Firewood		✓							
	2.18	Impact on Air Quality from Earth Work Activities		✓							
Noise	2.19	Noise Pollution from Construction Activities					✓				
Biological Environment	2.20	Damage to Biological Resources					✓				
	2.21	Disturbance to Wildlife					✓				

* Avoidable through design

** Mitigation through Contractor's obligation or by communities through social framework agreement (SFA)

*** Non-reversible, Permanent change (to be adopted)

(Sheet 3 of 3)

Category	Impact Assessment		Impact								
			Slight			Moderate			Significant		
			1*	2**	3***	1*	2**	3***	1*	2**	3***
2. Construction Phase											
Socio Economic	2.22	Impacts due to Land Acquisition		✓							
	2.23	HIV/AIDS and other communicable diseases					✓				
	2.24	Impacts on Existing Services; education, health, electricity and water supply etc.					✓				
	2.25	Impacts of finding Archaeological site, Graveyard etc.		✓							
	2.26	Impact on Public Health & Safety due to Construction activities					✓				
	2.27	Impact on Employment		✓							
	2.28	Tribal Tension and local rivalries on canal and aquatic life		✓							
3. Post Construction											
Monitoring and Evaluation as per Operational Manual and Monitoring Plan	3.1	Impacts due to non -application of the prescribed O&M plan					✓				
	3.2	Continuous evaluation of design efficiency				✓					

* Avoidable through design

** Mitigation through Contractor's obligation or by communities through social framework agreement (SFA)

*** Non-reversible, Permanent change (to be adopted)

6.3 IMPACTS AND MITIGATION MEASURES DURING DESIGN PHASE

6.3.1 Damage from Retrogression

Adverse Environmental Impact

200. Accompanied by pulsating hydraulic jump, damage to friction blocks and upstream floor of the barrage

Mitigation Measures

201. Repair and grouting the damaged floor and blocks

6.3.2 Damage to Flood Retain Embankments

Adverse Environmental Impacts

202. The aging process along with inadequate / deferred maintenance has been contributed to general deterioration of the structural integrity of the embankments. This could trigger uncontrolled breaches at the event of flood and cause significant damages of the surrounding area

Mitigation Measures

- Increase the embankments height and width to increase their resistance against floods

6.3.3 Fish Migration Obstruction

The functioning of the fish ladder is reported to be satisfactory. Hence no substantial remodeling appears to be necessary and there is no obstruction in fish migration.

6.4 IMPACT AND MITIGATION MEASURES DURING CONSTRUCTION PHASE

6.4.1 Physical Environment

(a) Land Resources

6.4.1.1 Impacts of Labor Camp, Batching Plant and Material & Equipment Yard

Adverse Environmental Impact:

203. Because of the availability of the ample PID land near the barrage, this will not cause any serious problem. PID will arrange the land suggested on Figure 4.2 for labour camp and batching plant.

Mitigations Measures:

- The Contractor will, in consultation with residence engineer, resolve the exact location of all these facilities
- PID will arrange the land for the Contractor camp and batching plant as indicated on Figures 4.2 and 3.2. If the Contractor prefers any other location then the Contractor will be responsible for the additional payment to the land owner(s), responsible for the developing the social & environmental baseline condition and agreed the new proposed location with consultant's environmentalist and PMO

6.4.1.2 Impacts of Waste Disposal Site

Adverse Environmental Impacts:

204. There is sufficient government land available on site for the disposal of construction waste including excavated soil, crushed concrete etc. Selected site for the Batching plant is a low lying area, construction waste can be utilized for the preparation of the area for batching plant or other Contractor's facilities.

205. Inadequate disposal of waste could contaminate the land. If the waste is not handled properly it could be a nuisance and cause diseases in the local community. Domestic waste contains a high percentage of readily degradable hydrocarbons which releases a bad odor when it undergoes decomposition, especially in hot and humid conditions. Construction waste classified as inert waste which could be a problem to dispose off.

Mitigation Measures

- Domestic waste generated at the labor camp and site offices should be collected and temporarily stored at the designated bunded area within the camp area before being disposed off the site by the specialize Contractor
- A temporary domestic waste storage area should be prepared, maintained and visually inspected on a regular basis by the Contractor to prevent the land adjacent to the waste disposal site from contaminating
- The location of construction waste disposal site should be such that no tree cutting, crop destruction or private land acquisition occurs and it should be away from major settlements. The waste should be properly disposed off in a manner that does not disturb the natural drainage, soil cover, water quality, air quality and aesthetics of the area.
- Construction waste should not be mixed with domestic waste as the construction waste could be reused as a fill material or disposed off separately
- The temporary waste storage area for domestic waste site will be rehabilitated at the completion of the project and photographic record will be kept as an evidence
- 3 Rs (reduce, reuse and recycle) technique would be implemented for managing solid waste disposal

Residual Adverse Impact:

206. The waste storage area will attract animals and spread a foul odor in the surrounding area

6.4.1.3 Impacts of Borrowing Site

Adverse Environmental Impact:

207. Soil required for the strengthening the embankments, diversion for Rangpur canal etc will be acquired from the other activities of the project i.e. construction of additional bays involving excavating work. Additional borrow material will be obtained from the selected borrowing sites. The Contractor will get approval of borrow area from the Engineer's Environmentalist and ESU of PMO before commencing excavation on site. During the use of borrow area any damage to private land, public or private property will be repaired by the Contractor. The Contractor will also produce an agreement with landowner for the excavation of the borrow area. The excavating activities could have adverse environmental

impacts including soil erosion, drainage problem, threaten existing structure stability, and impact the health and safety of the workers and local population.

Mitigation Measures:

- The additional earth required for revamping of retired embankment and other works would be used out of the available government land where possible. If there is lot of transportation involve in using PID land and earth is required to be lifted from private own land, then the owner(s) of the land will be duly compensated by the Contractor
- The Contractor will not leave the borrow pits in an unusable condition such that it could be filled with rain water and cause the problems for the community e.g. breeding place for mosquitoes etc.
- The Contractor will ensure that the selected borrow areas are clearly demarcated, and indicate the maximum allowable depth of the pit before the soil is excavated
- No soil will be excavated outside the demarcated area. If unexpected soil or strata is found during excavation at the site then the excavation must be stopped immediately, and the environmentalist and site manager must be informed as soon as possible
- The edges of the pits should be given flat slopes and area should be leveled as far as possible when the excavation is complete
- Barren or unfertile land will be preferred for use as a borrowing area than agricultural land
- If the agricultural land along the embankments needs to be used as a borrowing area then the following additional measurements will be undertaken by the Contractor:
  - Excavate at least 50m away from the toe of the embankments
  - Remove 6 inches of the topsoil and store on a separate site for its re-spread back on the leveled borrow area
  - Excavate up to maximum of 3 feet
  - Level slops as far as possible
  - Place the topsoil back on reasonably leveled area

Residual Adverse Impact:

208. Uneven topography will be generated due to excavating land

6.4.1.4 Impacts of New Road and Road Bridge Construction

Adverse Environmental Impact:

209. The layout of existing village road will be revised and an new road bridge on Rangpur Canal Head Regulator will be constructed due to relocating of Rangpur Canal head regulator. Private land acquisition or resettlement is not anticipated for these activities. The construction activities will require the loss of vegetation, modification in natural drainage pattern and resettlement of people and infrastructure. The air, noise and dust pollution will be generated from construction activities.

Mitigation Measures:

- During construction phase, an effective signage for alternative routes shall be placed
- Regular spraying of water shall be carried out to minimize dust pollution
- Noise monitoring shall be carried out on regular basis during noise producing activities and ensure the noise level is within the NEQS limit.

- All vehicles, machinery, equipment and generators used during construction activities will be kept in good working conditions.

6.4.1.5 Damage to Paths, Access Roads and Cross Drains

Adverse Environmental Impact:

210. Infrastructure (road, drains etc.) could be damaged through carelessness of the drivers/operators of heavy machinery. Such carelessness can cause considerable damage to paths, road and drains if the drivers/operators are not made aware, trained and bound to protect the infrastructure.

Mitigation Measures:

- An effective signage and safety caution board can reinforce the instructions to the drivers for example maximum load limit, type of vehicle allowed, speed limit etc.
- It is a Contractor's contractual obligations to impose strict control over operators and drivers of all types of vehicles
- The valid license driver will be appointed
- Should any damage take place due to the site traffic movement, the Contractor must be bound to carry out the repair immediately
- Enforce the maximum speed limit for site traffic to 30 km/hour

6.4.1.6 Impacts of Oil/Chemical Spill or Dumping out any Building or House near the Project Area

211. Inadequate storage and mobilizing of material on site could cause accidental spills or leakages. Dumping of waste material or spillage at the private land or outside the designated area will contaminate the land and water resources as the unconfined aquifer consist on sandy stratum on site.

Mitigation Measures:

- It is a Contractor's Contractual obligation to design, construct and maintain material storage areas
- All the material mobilization should be controlled and carried out by the competent staff
- All loading and unloading of the materials should be carried out with an appropriate plant & equipment
- The material storage area should be bunded
- Spill kits, including absorbing pad, sand bags etc., should be available at material storage area to handle any accidental spill
- In case of damage to private land, the land owner(s) should be compensated
- Secondary containments with 120% volume may be used
- Shovel and sand may be dumped near the fuel place and AFFF portable fire extinguisher may be placed

6.4.1.7 Impacts of Crushed Stone and Fine Aggregate Transport

Adverse Environmental Impact:

212. Stones shall be brought from Sargodha District or Margalla hills, so no quarrying has to be done locally. But the vehicles carrying the stones shall exert additional traffic load on

the roads leading to the project area. By keeping the road dust free and repaired even the slightest impact shall stand mitigated.

Mitigation Measures:

- It is a Contractor's contractual obligation to use the roads and paths carefully and in case of any damage, repair the damaged roads and paths immediately
- Undertake regular spraying of water on traffic routes and places prone to cause dust pollution
- Lorries should cover with the cloth or fine net to minimize the dust pollution and accidental drop of stones
- The stone will be transported in safest manner i.e. side wall protection and back side protection to avoid falling of stones on road

6.4.1.8 Impacts of Finding Graveyard and Burials

213. No graveyard is identified within the direct area of influence of the project activities. However if unrecorded graveyards and/or burials are found during the courses of construction activities, the supervising agency will contact and work with local religious authorities within the immediate project area to allow for possible identification of the remains and where appropriate, properly undertake relocation and burial.

6.4.1.9 Contamination from Oil & Diesel and Other Spill from Construction Machinery

214. The dumping site for waste material or empty containers can damage the land with associated physical, biological and social losses. The impacts can be mitigated through effective application of the maximum spill regulations, general criteria for oil and breakage at construction sites, as per standards set forth by Oil Spill Contingency Plan of PKP Exploration Ltd, Guidelines for Oil Spill Waste Minimization and Management issued by International Petroleum Industry, Environmental Conservation Association and with mitigation measures described below:

(i) <u>Minor Spills</u>

215. Soil contaminated by minor spills/leakages (defined as leaks from vehicles, machinery, equipment or storage containers such that the area and depth of soil contaminated is less than one (1) sq. ft and three (3) inches respectively) is to be scraped and sent to a burn pit (incinerator).

(ii) <u>Moderate Spills</u>

216. Moderate spills are defined as spills of volume less than or equal to 200 liters. These are to be contained and controlled using shovels, sands, absorbing mat and native soil. These equipments and materials are to be made available at camp sites during the operation (Spill Kit). The contaminated soil will be excavated and sent to the treatment site such as bioremediation or solidification/stabilization (S/S). The excavated area will be lined with an impermeable base before being filled with clean soil.

(iii) <u>Major Spills</u>

217. Major spills are defined as spills of volume much greater than 200 liters. This would require indication of Emergency Response Procedure (ERP) and Oil Spill Contingency Plan

to be prepared by the Contractor in consultation with the Engineer. These spills are to be handled and controlled by a specialize Contractor to clean the site.

Mitigation Measures:

- All the oil based material should be stored in the designated bunded area
- The Spill Kit should be available on site to handle small spills on site
- Good housekeeping will minimize accidental spills
- All loading and unloading of material should be supervised and carried out with Contingency Plan
- Empty drums of the fuel should be handled with care as some material may be left over in the drums or container
- All the liquid material or fuel should be stored well away from any control water body i.e. river, canal, wetland etc.

(b) Hydrology and Water Resources

6.4.1.10 Water Supply System & Wastewater Disposal Impacts

Adverse Environmental Impact:

218. Pumping groundwater from the major aquifer for water supply for the labor camp shall neither cause any significant change in the groundwater reservoir, nor in the river or canals, which in fact recharge the reservoir. There will be no any residual adverse impact on groundwater. The impact can be considered as slight and mitigable. The Contractor should tap the underground reservoir and install hand pumps or tube wells with an overhead water tank to supply drinking water to the labours and workers at appropriate pressure. Groundwater test results indicate the shallow groundwater quality is fit for human consumption.

219. It is envisaged that a considerable volume of wastewater will be generated from labour camp. There are plenty of examples of successful systems of using wastewater for agriculture. Domestic wastewater is expected to be contaminated with pathogens. Many factors affect the degree to which the potential risk due to the presence of pathogen in wastewater can become actual risk of disease transmission and pose a health risk to consumers and workers (farmers). The following situation can have an adverse impact on human health:

1. Either an infective dose of an active pathogen reaches the field or pond or the pathogen multiplies in the field or pond to form an infective dose.
2. The infective dose reaches a human host.
3. The host become an infected
4. The infection causes disease or further transmission.

Mitigation Measures:

- It is the responsibility of Contractor to test and confirm the suitability of the groundwater before its supply for domestic use

- The depth of the extraction well should be increased until the quality of groundwater meets the NEQ standards or the Filtering Unit can be installed by the Contractor to achieve NEQ standards
- Four main measures are recommended to be considered to protect health; wastewater reuse, wastewater treatment, crop restriction, control of wastewater application and exposure, and promotion of hygiene of those wastewater treatment.
- It is the responsibility of the Contractor to set up a suitable and appropriate wastewater collection and disposal system. The Contractor will submit the sewerage system design to the engineer. No wastewater will be disposed off into river or private land. The sewerage system will be comprises of septic tank and soaking pits with designed filter bed.
- Method and level of treatment of wastewater depends upon the anticipated use of the effluent. In view of the expected use of treated water for agriculture purposes, treatment at primary level will be cost effective. It is therefore proposed that underground septic tank with bypass arrangement for rainwater be provided in the labour camp with about three days storage capacity of waste water.
- To keep the cost to a minimum it is recommended to install a partial wastewater treatment system, using septic tanks with soaking pit.
- If the wastewater is discharged into the control water body i.e. river or canal then it is a Contractor's contractual obligation to confirm that the effluent meets the NEQS levels. Provision of underground septic tank is a preliminary treatment and reduces the total suspended solids (TSS) concentration to the acceptable level however it may not reduce the BOD level up to the required level. Therefore it is suggested that, if required, an aeration treatment system should be emplaced to meet the BOD level before discharge of the effluent into the river. Aeration of wastewater can be achieved from number of treatment methods including mechanical aeration, providing steps in the open channel, aerobic stabilizing pond (maximum depth up to 4 feet) etc. The selection of treatment method depends on the availability of space and initial concentration of the BOD
- The treated domestic sewage should be tested on regular basis before it is pumped into the river or used for agricultural purposes
- In case of the provision of soaking pit, the groundwater at downstream of the pit shall be monitor by collecting sample from the nearest existing source i.e. tube well or hand pump

Residual Adverse Impact:

- Treatment of wastewater with the underground septic tank will not cause any odor except during the occasional cleaning of the chambers

6.4.1.11 Contamination of Surface Water Due to Construction/Dismantling of Cofferdam

Adverse Environmental Impact:

220. During the construction and subsequent removal of coffer dams, the soil material can contaminate river water and affect aquatic life, particularly downstream fisheries.

Mitigation Measures:

- The material used for the construction of cofferdam should not contaminate river water in terms of suspended solids, pH, oil etc. The Contractor will use good engineering practices to minimize contamination of river water

6.4.1.12 Contamination of Surface Water Due to Electrical/Mechanical Works

Adverse Environmental Impacts

221. As most of the electrical / mechanical work is to be performed at the barrage structure, any accidental spill of material could be devastating for the river environment. The work may also involve the building of temporary structures like the cofferdam, scaffolding etc. Failure of the temporary structure could cause serious injuries to the workers and pollute the river.

Mitigation Measures

- Risk assessment of the area may be carried out and accordingly mitigation measures should be provided. Daily TBT (Tool Box Talk) should be conducted to create awareness among workers and provide proper supervision
- All temporary structure should be designed and build by a specialized Contractor.
- The temporary structure should be approved by a competent person before its use.
- Daily Inspection should be carried out at the work area before the start of every working shift
- Good housekeeping should be maintained to avoid any accidental spill or falling of objects in to the river
- Oil based material should be kept in bunded bowser or container
- Electrical equipment should be handled with extra care
- Provide proper PPEs (personal protected equipments) for all the workers as a precaution against any mishap, and interlink various parts of the construction complex
- Ensure proper usage of PPEs by site workers and inform client under the HSE Plan of Contractor

6.4.1.13 Impacts of Extended Canal Closure

Adverse Environmental Impacts

222. Gate repair work and the installation of the hoisting system and electric motors will require the closure of canals. Non availability of the canal water could adversely affect crops and people living along the canal. The canal water is primarily used for agricultural purposes and at a few places within the canal command area for domestic use e.g. cloth washing, kitchen washing and for even cooking purpose. The Diversion Restoration Plan is given in Appendix 6.2.

Mitigation Measures:

- All the activities that require canal closure will only be undertaken during the annual routine closure of the canals
- If the extended canal closure is required then alternate water supply should be arranged in affected canal command area

- For the construction activities, Rangpur canal shall need dry area and a temporary diversion channel shall be provided during construction phase to fulfill the water requirement of Rangpur Canal Command area

6.4.1.14 Impact on Source of Construction Water

223. The Contractor could use river water as a source of water for sprinkling on kacha (unpaved) path for dust control and for vehicle washing purposes.

224. Groundwater could be used as a source of water supply for the Contractor's camp and the batching Plant. . The water should meet the NEQ drinking water standards of Pak – EPA. The Contractor should tap the underground reservoir and install hand pumps or tubewells with overhead tanks to supply drinking water to the labour camp, and to the batching plant for concrete preparation. Withdrawing water from the aquifer shall not cause any significant change in the storage of the aquifer nor the river and canals, which eventually recharge it. The impact can be considered as slight and mitigable.

Mitigation Measures:

- The Contractor is obligated under the contract to pay for water obtained from private sources
- The Contractor is obligated under the contract to supply running tap water, flush latrines and underground septic tanks with soaking pits for the disposal of wastewater through the sewerage system
- All the wastewater generated from vehicle washing and site set ups e.g. batching plant, plant & equipment yard etc. should be tested to meet the NEQ standards for effluents before being disposed off

(c) Air Quality

6.4.1.15 Dust, Smoke and other Pollutants from Plant & Equipment

Adverse Environmental Impact:

225. From previous work experience (rehabilitation of Taunsa Barrage etc.) it has been observed that the emission or dust from the batching plant can be very harmful for the site workers and the local population. The dust emission could cause skin and respiratory disease e.g. skin rashes, lungs problem etc. Two batching plants with capacity of 30 cu.m/hr (1050 cft/hr) are to be used. The possible suitable location has been proposed for the Batching Plant. Contractor should select the suitable location provided the following control measures are in place:

Mitigation Measures:

- Air quality should be monitored on regular basis near the plant
- The plant should be located at least 500m away from any living area. The plant should not be operated outside working hours
- Regular spraying of water should be carried out to minimize dust pollution
- All vehicles, machinery, equipment and generators used during construction activities will be kept in good working conditions to minimize exhaust emissions. The fitness certificate will be produced by the Contractor to avoid the unacceptable emissions. CO and smoke emission test will be carried out on quarterly basis and noise monitoring tests will be carried out three times a day

- Proper PPE should be issued to the site workers and measures should be adopted to ensure that the workers will wear the PPE properly when working on site
- If Contractor select any other site than the site suggested on Figure 4.1 than the site has to be agreed with the consultant's environmentalist and PMO. The following additional control measures need to be implemented in case the selected site is closer to the residential area
  - The plant has to be a **Zero Emission Plant** by installing new plant/ computerized and automatic plant. This will include using washed aggregated and enclosed cylose with automatic injection system of the material in to the mixing chamber. Recently a zero emission plant has been established and is working successfully at Jinnah Barrage, and could be visited for getting details before installation
  - The plant area should be constructed and maintained on an impermeable layer to prevent contamination of river water from surface run off
  - The access roads for the delivery Lorries pass through the living area. These roads/paths should be sprayed with water on regular basis to minimize dust pollution

Residual Impacts:

- Deterioration of air quality
- Although the recommended plant consists of an enclosed cylose, the plant activities will generate some dust especially in consistently dry weather

6.4.1.16 Smoke from Burning of Waste Material or Burning Firewood

Adverse Environmental Impacts

226. A large number of big and small fires in the labor camp can produce smoke which can cut off visibility, reduce traffic ability and cause suffocation along with causing diseases of the respiratory tract.

Mitigation Measures:

- It is the Contractor's contractual obligation to use and provide clean and smoke free fuel in the labor camp
- Cutting and burning trees or shrubs for fuel shall be prohibited
- Gas Cylinders should be used in the labor camp for cooking purposes

6.4.1.17 Impact on Air Quality of Earth Work Activities

Adverse Environmental Impacts

227. Excavating activities will generate dust and pollute the surrounding area. Emissions from the plants used in earth work activities will also degrade the air quality of the site.

Mitigation Measures

- Regular spraying of water should be undertaken to minimize the dust pollution
- All vehicles, machinery, equipment and generators used during construction activities will be kept in good working condition to minimize the exhaust emissions

(d) Noise

6.4.1.18 Noise Pollution from Construction Activities

Adverse Environmental Impact:

228. It has been proposed to raise the embankment height and width to maintain the stability of the slopes. Part of the embankments farm the boundary of the wetland and trees along the embankments provide habitat of many species of birds. Construction activities along the embankments could generate noise and air pollution and disturb the natural habitat.

Mitigation Measures:

- Suitable equipment and plant should be used in execution of the work to minimize noise pollution
- The noise level should be monitored on a regular basis and levels should be maintained within the NEQS. At the start of the work activities noise levels should be monitored on hourly basis for at-least the first 2 days of work, after which the monitoring interval could increase to daily basis
- If required, the work area should be cordoned off with noise absorbing panels to segregate the work area from the barrage pond area
- The Contractor will regularly spray water on the site traffic routes to minimize the dust pollution
- All vehicles, machinery, equipment and generators used during construction activities will be kept in good working conditions and will be properly tuned and maintained in order to minimize noise pollution, exhaust emission and minimum land disturbance
- It is the Contractor's obligation to stop unnecessary traffic and workers from entering into the barrage pond area
- All working activities should be restricted within the allowed working hours
- The maximum speed limit of 30km/h should be enforced for vehicles using the embankments and access road
- The Traffic Management Plan will be included in EMP and should be implemented during construction phase

Residual Adverse Impact:

- Movement of the site traffic and tree cutting will generate some noise

6.4.2 Biological Environment

229. The anticipated biological impacts can be on the following:

- Damage to Flora
- Damage to Fauna
- Damage to Endangered Species
- Damage to Fish

6.4.2.1 Damage to Biological Resources and Disturbance of Wildlife

Adverse Environmental Impacts

230. About 10 acres of land will be required for Labor Camp & Batching Plant. The labor camp and batching plant location should be carefully selected with approval of the Engineer

to minimize tree cutting. There is a risk of the destruction of habitat of the area due to the noise and dust generated from the movement of site traffic and work activities along the embankments. Bela trimming activities could also adversely impact the wildlife of the area.

Mitigation Measures

- Carefully select area for labor camp and batching plant so that minimum or no tree cutting is required for these activities. The proposed sites for labour camp and batching plant will not require any tree cutting
- The outside boundary of the camp should be fenced or walled to keep camp activities inside the camp area
- It is the Contractor's obligation to ensure that unnecessary and out of bound activities/movements are not done outside the area allotted to him for setting-up the labor camp, material depots and machinery yard
- No fire arms should be carried by any of the site workers
- All forest, wildlife and fisheries laws should be fully respected and abided by the Contractor and his work force
- Limits and norms of wildlife, forestry and fishery should be fully respected and implemented
- Necessary sign boards should be displayed to remind the obligation of labour, visitors and members of public towards Biota
- Inspections by wildlife, forest and fisheries officers are facilitated in camps to facilitate the proper implementation of relevant laws
- 24 hours security should be provided by the Contractor at the Labor Camp and Batching Plant
- Every tree cut on site for the execution of work should be replaced with the plantation of minimum of 5 new trees
- All vehicles, machinery, equipment and generators used during construction activities will be kept in good working condition and be properly tuned to minimize the adverse impact on waterfowl habitat by reducing noise, exhaust and land disturbance
- Communities are given awareness and are involved in the proper protection of the Biota inside and around the project area
- No unauthorized tree or bush cutting will be allowed. Should it be necessary, it must not be done without the permission of the "The Engineer" and must follow the change management process
- If possible, the nests of birds on trees that need to be uprooted should be shifted to other nearby trees
- Walk over survey should be conducted before excavating the bela and any ground nest or particular habitat (rabbit whole etc.) should be relocated
- Excavating work within the bela should not be arranged during the fish breeding season (April to June) to avoid the adverse impact due to a possible increase in the turbidity of the river

Residual Impacts

- Nests of some of the birds shall be destroyed if the trees and bushes are cleared
- Disturbance of wildlife by the site traffic and noise from tree cutting/uprooting if required

6.4.3 Socio-Economic Impacts

231. The overall impacts of the Project on the social and economic activities in the project area will be positive. A Resettlement Plan (RP) has been also prepared to acquire land and compensate the people living along the embankments as squatters on government land which need to relocate. RP will be submitted under different cover.

232. Table: 6.1 shows that during the construction phase, the project will impact badly on various activities like agriculture, transportation, fishing, boating, environment etc.

233. Meanwhile, after the completion of rehabilitation and upgradation works, the situation would be reverse. According to Table 6.2, there will be the improvement in water availability, water efficiency, flood control and fisheries.

Table: 6-2 Impacts during Construction

Sr. No.	Segment	Impact %	
		Positive	Negative
1	Agriculture	17.2	82.8
2	House	6.9	93.1
3	Land Acquisition	20.7	79.3
4	Transport	10.3	89.7
5	Fishing	13.8	86.2
6	Seasonal Employment	65.6	34.4
7	Business	6.9	93.1
8	Social Mobility	3.4	96.6
9	Environment	34.4	65.6

Table: 6-3 Impacts after Construction

Sr. No.	Segment	Impact %	
		Positive	Negative
1	Water Increase	82.8	17.2
2	Water Efficiency	79.3	20.7
3	Flood Control	89.7	10.3
4	Fisheries	86.2	13.8
5	Business	72.4	27.6
6	Social Mobility	82.8	17.2
7	Environment	72.4	27.6
8	Game Reserve/ Picnic Resort	93.1	6.9

234. The adverse social impacts and their mitigation measures are discussed as follow:

6.4.3.1 Gender Impacts

235. In general, about one-half of the total population of Pakistan is women who have the rights to have an equal participation in the economic development of the country. In this

context, in the development project, a particular attention was given to the women relating to the compensation pertaining to their activities.

236. A RP will include measures ensuring that the socio-economic needs and priorities of women are identified, addressed and mitigated accordingly. The following gender provisions will be incorporated to safeguard the specific needs and problems of women displaced persons (WDPs) during subproject implementation. The socio-economic data gathered will be gender-disaggregated. Gender roles analyzed and if women and the needs, aspirations and priorities of women will be taken into consideration during consultation and preparing mitigation measures and reported in the RP. In this context, female enumerators were involved to collect data and assist women in resettlement activities. Women household heads were registered as the recipients of compensation and rehabilitation measures due to the project impact. Land titles and use rights to replacement of land were registered in the name of women if the land lost to a subproject was legally owned by women.

6.4.3.2 Impacts of Land Acquisition

Adverse Environmental Impacts

237. Generally land acquisition is required for work activities such as widening or constructing new embankments, wetting channel, access road, Labor Camp, Batching Plant, work base area, structural waste disposal site and Contractors Camp. To facilitate these activities Irrigation Department is already in possession of enough land where these works can be executed. Proposed locations for labor camp and batching plant site would also be accommodated in the Irrigation Department land.

Mitigation Measures

- All the activities requiring land acquisition are to be planned by PID. No private land acquisition is anticipated for the project execution and establishing contractor's facilities. If the contractor prefer private land for establishing contrator's facilities e.g. batching plant, labour camp etc than follow 1894 Land Acquisition Act and the cost of the land is to be paid to the owners by the contractor. An appropriate framework agreement should be completed and signed by all the concerned parties and submitted to the Engineer
- Resettlement Plan (RP) has been prepared to compensate and restore the livelihood of the affectees (encroachers).

6.4.3.3 Social Impacts on Local Population due to Migrating Labor from other Parts of the Country

Adverse Environmental Impacts

238. There is a risk of adversely affecting the social life of the local population due to the arrival of a large number of laborers from outside the area. Extra burden on the local infrastructure and services e.g. medical facility, shops, restaurants, mosque, public transport etc. is also anticipated.

Mitigation Measure

- The outside boundary of the camp should be fenced or walled and competent security guards will be deputed on shift duty for security reasons
- Locating a labour camp at least 500 m or ideally 1km away from the villages (local settlement)
- Leisure facilities including playgrounds, restaurant etc. should be provided inside the labour camp
- All the unskilled labour and where possible skilled labour should be arranged locally
- Pick and drop facilities should be arranged for local labour

6.4.3.4 HIV/AIDS and other Communicable Diseases

239. The labor camp, their interaction with truck drivers and like personnel are potential places for the spread of HIV/AIDS if the incidence exists. Majority of the people living in the surrounding of the Project, and potential Labor are not aware of the source, mode of communication or consequences of HIV/AIDS. Although their religious and cultural value system, to a large extent excludes the outbreak or rapid communication of HIV/AIDS, yet its occurrence in such a situation cannot be precluded. It is necessary that along with other communicable diseases such as cholera, typhoid, diarrhea and tuberculosis, awareness and preventive campaigns are run from time to time in the Labor campus and the field offices of the Project on Communicable diseases.

Mitigating Measures:

The Contractor shall:

- Arrange to run a proper campaign, in the labour camp, to make people aware of the cause, mode of transmission and consequences of HIV/AIDS. Awareness of consequences and transformation of HIV/AIDS will be provided by an approved trainer
- Strengthen the existing local health & medical services for the benefit of the labourers as well as the surrounding villages
- Ensure proper cleanliness and hygienic conditions at labour camp by ensuring a clean mess, proper drainage and suitable disposal of solid waste. Inoculation against Cholera will be arranged at intervals recommended by Health Department
- Keep all the camps, offices, material depots, machinery yards and work site open for the inspection of health and safety measures, and related documents
- The Contractor will conduct the medical test of all labour before induction
- The heating and cooling facilities will be provided by the Contractor. The free medical facilities will be paid by the Contractor in case of injury
- Pick and drop facilities from labor camp to workplace will be provided by the Contractor
- Provide a group insurance cover to the workers and labour on site or in the camp, against accidents, mishaps or loss of life on duty

6.4.3.5 Existing Services & Employment (Positive Social Impacts)

240. The economic analysis shows high economic benefits compared to costs. Salient economic benefits of the project are:

- Improvement of available services in the area and opportunities for employment, education, healthcare, transportation, especially for women and children
- Easy marketing of agricultural products
- Availability of jobs during construction phase shall employ and train a large number of unemployed youth. They will receive a life time of benefits through skill training, capacity building and poverty alleviation. A large number of semi-skilled and unskilled workers in the project area will be hired
- Greater awareness about healthcare including HIV/AIDS and Hepatitis amongst the labourers and the local community shall be created
- At micro level, economic activities may bring the cost of living down by making essential commodities available in greater bulk and at cheaper rates. This combined with better employment opportunities will bring poverty line rate lower
- Rehabilitation of the barrage structure will have a positive impact on the local tourism industry
- Boost to agriculture through ensured and enhanced irrigation water
- Increased economic activity with improved irrigation

6.5 OPERATIONAL AND MANAGEMENT (O&M) PHASE

241. No alteration in the Barrage operation will be resulting due to the project implementation. Additional bays will be operational with the existing barrage without raising HFL and therefore no adverse impact is anticipated during operational phase of the project

242. At operational phase of the proposed Project a comprehensive Operation and Management Manual (O&M) shall be prepared by the Project Manager at the completion of the work as per ISO (International Organization for Standardization) Standards. An effective monitoring and evaluation has to be done as per O&M and monitoring plan. Mistakes at operational level or handling the operations by untrained staff can prove very risky and costly. Important points to be attended at the operational stage are as follows:

(i) Develop comprehensive O&M Rules
(ii) Strict implementation of prescribed Environmental Management Plan (EMP)
(iii) Continuous evaluation of design efficiencies
(iv) Understanding and training of staff on Operation and Maintenance Manual
(v) Regular maintenance of engineering works
(vi) Continued public consultation and feedback on it
(vii) Continued attention towards gender issues and women consultation
(viii) Irrigation system to run up to its design capacity and not beyond
(ix) Refresher Training Courses for operational staff

243. On the basis of the impact assessment, the project will improve environmental and social condition of the area. No permanent adverse environmental impacts have been identified due to the project implementation. All the adverse impacts resulting from the construction activities are mitigable.

7. ENVIRONMENTAL MANAGEMENT PLAN

244. This chapter gives a framework of the Environmental Management Plan (EMP) for the project. Contractor shall make Site Specific Environmental Management Plan (SSEMP) and get approved from supervision consultants before commencing of work at site.

245. The EMP proposes an effective plan of action that will indicate responsibilities and required measures to minimize the negative environmental & social impacts at various stages of the project. The Environmental Management Plan for the Project has been discussed under three main components:

- Mitigation Plan
- Monitoring Programme
- Institutional Arrangements

246. Most of the mitigation activities planned in the EMP will be executed & cover under provisions in the construction contract and with necessary agreement with the communities.

7.1 MITIGATION PLAN

247. The mitigation plan is a key component of EMP. The mitigation plan includes measures to mitigate potential negative impacts and enhance its positive impacts during initial physical works and normal operation of Irrigation System. This section outlines the potential impact of rehabilitation works on the physical, biological and socioeconomic environment and their associated mitigation measures as already identified in IEE report of the Trimmu Barrage Project. It also assigns the responsibilities for implementing these measures.

- Lists of mitigation measures which will be directly covered by the consultant's environmentalist and Contractors and not those mitigation measures which are covered under civil or mechanical work
- The person(s) responsible for ensuring the implementation of the measures
- The person(s) responsible for the monitoring
- Parameters to be monitored for the effective implementation of measures
- A time scale for the implementation of measures to ensure that the objectives of mitigation plan are fully met

248. The Mitigation and Monitoring Plan for the activities likely to have a direct impact on the environment is presented in EMP Table.

7.1.1 Mitigation of Adverse Impacts at Design Phase

249. Majority of negative impacts can be avoided (eliminated) through the use of adequate and environmentally sound technical design. The Project has however been designed on the basis of the lessons learnt from similar projects and major design initiatives undertaken to avoid any major negative impacts are as follows:

1. Necessary measures should be taken to exclude any big deposits of soil or debris anywhere

2. To ensure the availability of water at the tail ends of canals off-take from Trimmu Barrage
3. As far as possible appropriate indigenous technology and knowledge should be utilized while planning and designing the project
4. Improve flood fighting plan by strengthening embankments

7.1.2 Mitigation of Adverse Impacts at Construction Phase

250. To reduce the potential impacts of the construction activities there will be a monitoring programme to assess Contractor's compliance/performance with the project EMP during construction phase.

251. The contract document will contain requirements for:

(i) Proper management of construction waste
(ii) Control measures for waste fuel disposal
(iii) Reduction of oil/lubricants, spill or leakage, noise and dust level
(iv) Rehabilitation of areas used for construction detours and sites used for temporarily storage of construction materials
(v) Proper use and maintenance of equipment with appropriate noise and smoke abatement
(vi) Restoration of borrow areas (whether on state land or private land)
(vii) Other requirements as obligation of the Contractor emanating from the EMP
(vii) Specific provisions will also be included to make it mandatory to use formal health and safety measures including protection against Communicable diseases and Hepatitis. Group insurance measures to minimize accidents and avoiding fatalities during the construction process
(viii) Advisory element to address a number of other issues will also be included in the contract. These will include:

– Road Closure

252. For transporting construction material or conveying heavy machinery to the site, the rural roads passing near or through village(s) may have to be closed temporarily and access of public for certain period may have to be blocked. The dates, timings and duration of such period will need to be agreed with authorities and communities.

– Cultural and Historical Resources

253. Communities shall be requested to identify in the field, all known sites of cultural and historical value that may be affected by the Project, for protective actions by the Contractor.

– Archaeological Field Support

254. The Government of the Punjab will make available (on demand) a qualified archaeologist to conduct field investigations when important search work and new material sites area opened. No such site is yet in view but just in case it does, the services of archaeologist will be obtained.

– Graveyard and Burials

255. If unrecorded graveyards and/or burials are found during the courses of construction activities, the supervising agency will contact and work with local religious authorities within

the immediate Project area to allow for possible identification of the remains and where appropriate, properly undertake relocation and burial.

- Local Employment

256. The Contractor will be advised to arrange locals as unskilled labour and skilled workers are easily available from local communities as and when required. It is desirable that maximum employment benefits are made available to local communities.

- Land Acquisition and other Compensations

257. During the community consultation, in the Project area, it was made clear by the communities that they would expect due compensation, if their buildings, trees or land were affected or destroyed during construction activities or any of its allied structures. Social Action Plan and Resettlement Plan have been prepared to address the social impacts of the Project.

- Resource use Agreement – Construction Materials

258. Earth is commonly available in abundance around the Barrage area. Stones are available from District Sargodha and Margalla hills. Yet there may be a need for additional agreement with public to obtain certain materials. In that case the farmland should be given the last priority in procuring the fill material when inevitable, however, due compensation should be paid. Whenever the borrow pits are dug, considerable care should be taken in their location. The site may invariably be rehabilitated after use. Ideal situation would be that the site is made good to a condition similar to that prior to the project. It will be helpful if Photo graphs of pre-project condition are used for the purpose of comparison.

- Resource Use Agreements – Water

259. Although ample quantity of groundwater is available in the Project area, yet the Contractor will be required to confirm the quality and demand detail and indicate source of water prior to the start of construction. Disposal plan for wastewater without polluting the fertile soil, river water or ambient air, shall be produced by the Contractor for approval of The Engineer/Project Director.

7.2 MONITORING PLAN

260. Monitoring Plan is an essential component of the Environment Management Plan (EMP). Implementation of the EMP shall be the contractual obligation of the Contractor. For that the Contractor shall engage full time technical staff capable of carrying out the suggested measures in the EMP as contractual obligations under the contract agreement. The design and construction supervision consultant shall also have a full time Environmental specialist and Environmental Inspector to provide an overall professional cover to the environmental monitoring process and the procedures and initiate required reports and point out any gaps in the implementation of the mitigation measures or enforcement of the measures of the EMP. Environmental and Social Unit (ESU) under PMO will be responsible of the overall implementation of EMP and provide technical guidance to the design and Construction Supervision Consultants and Contractors.

7.2.1 Monitoring of Environmental Non-Compliance

261. Any environmental “non-compliance” that remains within the “nothing doing” category during the reporting month, would be considered as a “minor deviation”. In case the non-

compliance attains the status of “non-mitigation” during the second month, it would be considered a “moderate” environmental non-compliance. In the case the non-compliance continues into the third month it will fall in the category of “undone”, and as such would be considered as a “major non-compliance” and eventually leading to serious punitive action including suspension of the Contractor’s payment or any other penalty as may be considered appropriate under the law, subject to the recommendation of the Engineer.

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Environmental Mitigation & Monitoring Plan

Sr. #	Project Component	Description	Measures / Actions	Responsibility		Parameters for Monitoring	Frequency	Cost
				Executor	Monitor			
A- LAND RESOURCES								
1	**Borrow Materials from Earth Borrow Site**	**Borrow Material:** Soil excavation from the designated area of the site will be required for strengthening of the embankments and construction of coffer dams. Construction of additional bays will generate soil material which could be used as fill material provided it meets the engineering parameters. Contractor has to get approval of the borrow area from Consultant's Environmental Specialist and ESU of PMO before commencing excavation on site. Excavation and earth movement activities may generate dust and affect the air quality of the surrounding area. Material to be used for the construction of the coffer dams will include silt for core filling and	1.1 Ensure that selected borrow areas are approved by the Engineer and clearly demarcated by barricading/fencing before starting any soil removal. No such excavation activity should be done outside the demarcated area	CEnv	CSCEnv PMO-ESU	Records of clear boundary marker demarked in place	BC Once before start of excavation	BOQ
			1.2 Ensure to have a photographic record of the site before and after the restoration of the borrow site	CEnv	CSCEnv PMO-ESU	Photographs records	BC, DC, AC	BOQ
			1.3 Ensure that the excavation for fill material is restricted to specified depth	CEnv	CSCEnv PMO-ESU	Compliances with Specification	DC Check once a week on typical working day	SFA
			1.4 Ensure that the surface drainage is provided to control the surface run off	CEnv	CSCEnv PMO-ESU	Control in place. Their effectiveness in case of rain	BC, DC Once before construction Once a week on a typical working day	BOQ
			1.5 Ensure that the movement of earth moving machinery is limited to the work area	CEnv	CSCEnv PMO-ESU	Compliance Site inspections	DC: Daily Once a month	BOQ
			1.6 Ensure that erosion protection	CEnv	CSCEnv PMO-ESU	Visible signs of any soil	DC Monthly basis	BOQ

Sr. #	Project Component	Description	Measures / Actions	Responsibility		Parameters for Monitoring	Frequency	Cost
				Executor	Monitor			
		soil material for random filling.	measures are taken, such as retaining wall (if required), avoidance of steep cut			erosion	Once after rain	
			1.7 Barren and infertile land should be preferred for use as borrow area. If agricultural land is to be used as borrow area then following measures should be taken by the Contractor: • Remove first 15cm top soil and keep it on site to re-spread after completion of the excavation • Excavation of the earth fill be limited to an approximate depth of 90cm • Stabilize the slopes during excavation	CEnv	CSCEnv PMO-ESU	A detailed protocol in checklist	DC, AC Daily At completion of excavation When required	BOQ
			1.8 Ensure that the borrow area to be leveled and the edges of the pits be given flat slopes as far as possible and as per the satisfaction of the	CEnv	CSCEnv PMO-ESU	Photographs record	DC, AC When required	BOQ

Sr. #	Project Component	Description	Measures / Actions	Responsibility		Parameters for Monitoring	Frequency	Cost
				Executor	Monitor			
			land owner and top soil restored after the completion of the excavation activity					
			1.9 Ensure that complete documentation for the borrow areas is maintained i.e. volume excavated, date of excavation, levelling date after completion of excavation	CEnv	CSCEnv PMO-ESU	Records	BC, DC At the start of the excavation.	BOQ
			1.10 Ensure that regular water sprinkling is carried out during executing of excavation to mitigate the dust pollution	CEnv	CSCEnv PMO-ESU	Compliance	DC Daily When required	BOQ
2	**Construction of new Access Road, Widening of Existing Roads, Construction of new Village Road and new road bridge on Rangpur Canal**	New roads will not be required for providing access to the Contractor's facilities i.e. batching plant site, material yard, labour camp etc. Access road may be required for the approach to the boat bridge. There is ample PID land available on site and private land acquisition will not be required for the access	2.1 Contractor will furnish the traffic management plan, according to the recommendations made in IEE and it must be implemented in order to control the traffic	CEnv	CSCEnv PMO-ESU	Compliance with specification	BC, DC When required	Direct Cost
			2.2 Ensure that the temporary route(s) are adequate for the existing traffic plus the site traffic	CEnv	CSCEnv PMO-ESU	Compliance	BC, DC Daily When required	BOQ

Sr. #	Project Component	Description	Measures / Actions	Responsibility		Parameters for Monitoring	Frequency	Cost
				Executor	Monitor			
		roads. The existing village road will be realigned and new road bridge will be constructed. The general mobility of local community, their livestock as well as their business activities and clientele in and around the construction area may be hindered.	2.3 Ensure that regular water sprinkling is carried out to mitigate the dust pollution	CEnv	CSCEnv PMO-ESU	System in place	DC When required	BOQ
			2.4 Ensure that the traffic sign board regarding revised road layout and change in speed limit or new speed breakers are placed at least one km from the alteration	CEnv	CSCEnv PMO-ESU	Compliance Photographs	DC Daily When required	Direct Cost
			2.5 It is the Contractor's contractual obligation to provide training to drivers and operators. The driving license will also be submitted to the Engineer for approval	CEnv	CSCEnv PMO-ESU	Compliance with specification	BC, DC When required	Direct Cost
			2.6 Ensure that the alternative route is designed on the basis of the traffic survey conducted by the Contractor (if required)	CEnv	CSCEnv PMO-ESU	Compliance	BC Once at start of the allied work	SFA
			2.7 Ensure that mobility of the men and animals is not hindered due to the construction activity	CEnv	CSCEnv PMO-ESU	Compliance Social Survey	DC Daily When required	BOQ

Sr. #	Project Component	Description	Measures / Actions	Responsibility		Parameters for Monitoring	Frequency	Cost
				Executor	Monitor			
			2.8 The people will be duly compensated for relocation and acquisition of land	CEnv	CSCEnv PMO-ESU	Compliance of SFA & Land Act	BC Once at the start of the work	SFA
			2.9 Any damage to the land, property or existing roads from the Contractor's activities will be remediated by the Contractor at the earliest possibility	CEnv	CSCEnv PMO-ESU	Record Photographs	DC Once at the start of the work When required	SFA
3	**Site for Disposal of Construction Waste Material**	It has generally been observed that at completion of construction the waste material is dumped at the site without proper planning. The material from the coffer dams will be in significant quantity and will require proper disposal site.	3.1 Ensure that the selected construction waste disposal site is marked and fenced before starting the work and it should be away from major settlements. All waste from the construction activities should be disposed off according to waste management plan	CEnv	CSCEnv PMO-ESU	Record	BC	BOQ
			3.2 Ensure that Photographic record of the waste disposal site is kept before starting waste disposal activity and after site restoration	CEnv	CSCEnv PMO-ESU	Photographs record	BC, DC Once before start When required	BOQ
			3.3 Ensure that all trucks used for the transportation of	CEnv	CSCEnv	System in Place	BC, DC Once at the start of work	BOQ

Sr. #	Project Component	Description	Measures / Actions	Responsibility		Parameters for Monitoring	Frequency	Cost
				Executor	Monitor			
			waste construction material are covered and watertight		PMO-ESU		When required	
			3.4 Ensure that the Contractor's obligations regarding disposal of construction waste material defined in contract document are followed	CEnv	CSCEnv PMO-ESU	Compliance	DC Daily	BOQ
			3.5 Ensure that the movement of lifting machinery and vehicles is limited to the disposal site	CEnv	CSCEnv PMO-ESU	System in Place	DC Daily When required	BOQ
			3.6 Ensure that waste material is properly disposed off, compacted and cover in a manner that does not affect the natural drainage	CEnv	CSCEnv PMO-ESU	Compliance	DC Daily After every rain fall When required	BOQ
			3.7 Ensure dumping and levelling on site only as agreed per contract agreement and SFA (in case private land is used)	CEnv	CSCEnv PMO-ESU	Follow Contract Documents and complete SFA	DC Daily When required	BOQ
4	**Installation of Batching Plant**	**Land requirement:** Ample land is available near barrage to establish batching plant. **Land contamination:**	4.1 Ensure that no private land is used to establish the batching plant. Contractor needs to get approval from CSCEnv and	CEnv	CSCEnv PMO-ESU	Compliance	BC Once at the time of installation of Batching Plant	SFA

Sr. #	Project Component	Description	Measures / Actions	Responsibility		Parameters for Monitoring	Frequency	Cost
				Executor	Monitor			
		Dumping of waste fresh concrete may contaminate the land. **Raw material:** Raw material for the construction work mainly include cement, sand, aggregate, steel, water lubricants, fuel and additives. The material will be stock piled at the area provided by PID near the batching plant. **Wind direction:** While installing the batching plant the direction of the wind should be considered	PMO-ESU if he/she uses any private land for this purpose. Contractor will pay for the use of private land					
			4.2 Ensure that the location of the batching plant is at least 500 m from the villages (main settlement) and out of phase with the prevailing wind direction. If the selected location is less than 500m from the residential area then it has to be zero emission plant	CEnv	CSCEnv PMO-ESU	Compliance with specification	BC Once before installation of Batching Plant	SFA
			4.3 Ensure that land contamination from the batching plant, during transportation and dumping of the waste fresh concrete is controlled through careful working of the Contractor's crews to avoid spillage of concrete and dumping of waste concrete on private land. Carry fresh concrete in mobile concrete drums	CEnv	CSCEnv PMO-ESU	System in place	DC Daily When required	SFA

Sr. #	Project Component	Description	Measures / Actions	Responsibility		Parameters for Monitoring	Frequency	Cost
				Executor	Monitor			
			4.4 If the selected location is next to the control water body i.e. Chenab and Jhelum River or active canal then the area for batching plant should be bunded with an impermeable layer to prevent contamination of the river or canal water from surface run off in case of rain or by any other means of water flow. The area should be maintained on regular basis	CEnv	CSCEnv PMO-ESU	Design and prepare the Batching Plant area by a competent person. Photographs record	BC At the stage of establishing batching plant DC Weekly inspection When required	BOQ
			4.5 Ensure that leak / spill record is maintained for each incident of spill or damaged vehicles. Damaged/ defective vehicles will not be operated unless repaired	CEnv	CSCEnv PMO-ESU	Compliance	DC Daily When required	BOQ
			4.6 Ensure that the material is stocked piled at the designated area provided by PID near the construction site	CEnv	CSCEnv PMO-ESU	Compliance with specification	BC/DC At the time of establishment of Batching Plant	BOQ
			4.7 Ensure that surface drainage is	CEnv	CSCEnv PMO-ESU	System in place	DC Daily	BOQ

Sr. #	Project Component	Description	Measures / Actions	Responsibility		Parameters for Monitoring	Frequency	Cost
				Executor	Monitor			
			not blocked due to the pilling of the raw material				Once a month after each rain.	
			4.8 Contractor will store material on site with care and suggestions provided in IEE in order to minimize the risk of spill or leakage into the river or control water body	CEnv	CSCEnv PMO-ESU	Compliance	BC Once at the time of installation of Batching Plant.	BOQ
5	**Contractor's Camp Location and Workshop**	**Land requirement:** There is ample PID land available around the project area for the Contractor's camp, officer hostel, workshop etc. So no private land will be acquired for the construction of these facilities. PID will arrange land for the labour camp construction and batching plant. **Disposal of wastewater:** The unmanaged disposal of wastewater, generated from labour camp & vehicle washing area, will contaminate land. The Contractor can use the existing disposal	5.1 Ensure that no private land is used to construct the Contractor camp and workshop(s)	CEnv	CSCEnv PMO-ESU	Compliance	BC Once at the Time of camp establishment	BOQ
			5.2 Ensure that the location of the labour camp will be at a distance of 500m from the major local settlement	CEnv	CSCEnv PMO-ESU	Measured distance	BC Once before the establishment of the camp.	BOQ
			5.3 PID will provide space near the barrage to establish Contractor's camp and workshop	CEnv	CSCEnv PMO-ESU	Compliance	BC Once before the establishment of the camp	BOQ
			5.4 Ensure that Photographs of area adjacent to the camp site and other features are taken prior to commencement of any work activity	CEnv	CSCEnv PMO-ESU	Photograph records	BC: Once before construction activity	BOQ

Sr. #	Project Component	Description	Measures / Actions	Responsibility		Parameters for Monitoring	Frequency	Cost
				Executor	Monitor			
		system (for offices and official residence) after making necessary renovation / expansion of the system only to a limited extent. However the existing disposal system cannot cope with the wastewater generated from labour camp. **Utilities:** Contractor will share the facilities of water supply, telephone lines and electricity on payment basis with PID. **Disposal of solid waste:** Unmanaged disposal of solid waste will contaminate land, spread bad odour and cause unhygienic conditions at the work place. Existing disposal arrangement can be used after making necessary renovation / expansion of the system by the Contractor.	which should be used as a reference during site restoration					
			5.5 Ensure that room size(s) are as per standard specifications	CEnv	CSCEnv PMO-ESU	Compliance per specification	BC: During camp design phase	BOQ
			5.6 Ensure that domestic washing areas are demarcated and water from washing areas and kitchen is released in filter bed soaking pits	CEnv	CSCEnv PMO-ESU	System in places	DC Daily When required	BOQ
			5.7 Ensure that septic tank of appropriate design is used for sewage treatment and outlets released into soaking pits with filter bed	CEnv	CSCEnv PMO-ESU	System in places	BC, DC Once before start of work When required	BOQ
			5.8 Ensure that latrines, tanks and soaking pits are built at a safe distance from water hole (tube wells or hand pumps), stream, or dry streambed and the bottom of the sump or soaking pits is above the ground water level	CEnv	CSCEnv PMO-ESU	Compliance	BC During design phase of camp set up and waste treatment system	BOQ
			5.9 Ensure that soaking pits are located:	CEnv	CSCEnv PMO-ESU	Compliance per specification	BC Once at the Time of camp establishment	BOQ

Sr. #	Project Component	Description	Measures / Actions	Responsibility		Parameters for Monitoring	Frequency	Cost
				Executor	Monitor			
			• In absorbent soil • Down-slope and away from the camp • Downstream from the camp water source and above the high watermark of any nearby water body (if any)					
			5.10 Ensure that effective drainage system is in place at site in order to avoid rain or wastewater ponding in the area	CEnv	CSCEnv PMO-ESU	System in place	BC Once at the start of work	BOQ
			5.11 Ensure that existing wastewater disposal system is not overstressed, if used	CEnv	CSCEnv PMO-ESU	System analysis On-going consultation with local authorities	DC Monthly basis	BOQ
			5.12 Ensure that Contractor makes assessment and carries out renovation / expansion works of existing facilities in consultation with PID	CEnv	CSCEnv PMO-ESU	System in place	DC When required	Direct Cost
			5.13 Ensure the application of Solid	CEnv	CSCEnv	Implementation of Waste	BC, DC Once before	BOQ

Sr. #	Project Component	Description	Measures / Actions	Responsibility		Parameters for Monitoring	Frequency	Cost
				Executor	Monitor			
			Waste Management Plan, as described in IEE: - Recyclable material should be segregated at source and should be collected separately in bins which can then be sold - Combustible waste should be burnt at burn pit only - Non-combustible, non-recyclable garbage sent to the designated waste disposal site in the area - Medical waste transported to the local clinical waste disposal site, utilized by the nearest hospital - Solid residue from the septic tank will be transported to municipal sewage facilities at Jhang city - Contaminated soil sent to burn pit or landfill		CSCEnv PMO-ESU	Disposal Plan	establishing Contractor's Camp Daily during Construction Phase When required	Direct Cost

Sr. #	Project Component	Description	Measures / Actions	Responsibility		Parameters for Monitoring	Frequency	Cost
				Executor	Monitor			
6	**Relocation of Camps, Material Storage Area, Batching Plant and Special Approaches Routes and Roads**	**Land requirement:** The recommended locations for batching plant, labour camp site and Contractor's camp are approachable through existing roads. Therefore no private land will be required for access roads..	6.1 If relocations happened, Contractor obligations defined as per Contract documents and SFA agreement shall apply	CEnv	CSCEnv PMO-ESU	Compliance with SFA	BC When required	SFA
			6.2 If the Contractor selects different location for the batching plant, labour camp etc. from the recommended locations then the Contractor will develop base line data for the new location at his own cost, resources and get approval from the CSCEnv and PMO	CEnv	CSCEnv PMO-ESU	Compliance	BC At the set up of the Batching Plant, Labour Camp etc.	BOQ
7	**Access Tracks**	**Damage to paths, roads and linear fixtures crossed/damaged by moving machinery moving to and from the construction site:** Heavy traffic may damage the existing roads or private property. Contractor will carry out necessary repair work.	7.1 Ensure that Contractor remains vigilant that the moving machinery should remain within the boundary of PID land	CEnv	CSCEnv PMO-ESU	Compliance with map Site inspections	DC Daily Once a month	
			7.2 After completion of construction work all the damaged roads will be restored by the Contractor, as per Contractor's contractual obligations	CEnv	CSCEnv PMO-ESU	Compliance	AC When required	BOQ
			7.3 Ensure that gravel	CEnv	CSCEnv	Compliance to	DC	BOQ

Sr. #	Project Component	Description	Measures / Actions	Responsibility		Parameters for Monitoring	Frequency	Cost
				Executor	Monitor			
			is dumped only on locations designated by the Consultants and dumping of gravel does not result in blocking of traffic, damage to vegetation or cause any drainage problem		PMO-ESU	civil drawing Site Inspections	Once at the start of work On monthly basis	
			7.4 Ensure that construction corridors along the access road are marked	CEnv	CSCEnv PMO-ESU	Compliance	DC Daily Monthly basis	BOQ
			7.5 Ensure that the access roads do not block the natural drainage and culverts	CEnv	CSCEnv PMO-ESU	Control in place	DC Once at the start of work	BOQ
			7.6 Ensure that surface run-off controls are installed and maintained so as to minimize soil erosion and ponding of area with rain water	CEnv	CSCEnv PMO-ESU	Control in place	DC Once after every rain storm	BOQ
			7.7 Ensure adherence to the speed limit of 40 km/hr at the access roads	CEnv	CSCEnv PMO-ESU	Compliance	DC When required	BOQ
			7.8 Ensure that construction corridor is monitored and repairs are undertaken when required	CEnv	CSCEnv PMO-ESU	System in Place	DC Daily When required	BOQ
			7.9 Ensure that	CEnv	CSCEnv	Compliance	DC	BOQ

Sr. #	Project Component	Description	Measures / Actions	Responsibility		Parameters for Monitoring	Frequency	Cost
				Executor	Monitor			
			vegetation clearing will be minimized and no tree will be uprooted without prior consent of the Supervision the Consultant		PMO-ESU	with IEE/EMP	When required Once a month	
			7.10 Ensure that the disposal of cleared vegetation is not in a manner that may affect the blockage of natural drainage	CEnv	CSCEnv PMO-ESU	Site Inspections Implementation of Waste Disposal Plan	DC Daily Once a month	BOQ
8	**Waste Disposal Management**	This component describes the waste disposal plan that will be employed during the construction and restoration period. The main types of waste to be disposed off will be: Fuel, oils, and chemicals (empty drums, contaminated soil etc.); Sewage; Camp site waste; Medical waste; Demolition waste; Excavated soil; Packing waste; Excess construction material	8.1 Ensure that the demolition waste and excavated material's disposal site is agreed with environmentalist of supervision consultant and marked on site before starting the work	CEnv	CSCEnv PMO-ESU	Compliance	BC/DC When required	BOQ
			8.2 Ensure that Photographs of the area of the nominated waste disposal site are collected to restore the site at the completion of the construction phase	CEnv	CSCEnv PMO-ESU	Photographs record	BC/DC Once at the start of work When required Once a month	BOQ
			8.3 Ensure that all the waste generated from different locations must be disposed off according to the	CEnv	CSCEnv PMO-ESU	System in Place	DC As and When required	BOQ Direct Cost

Sr. #	Project Component	Description	Measures / Actions	Responsibility		Parameters for Monitoring	Frequency	Cost
				Executor	Monitor			
			Waste Disposal Plan					
			8.4 Ensure that all trucks used for the transportation of waste construction material must be covered and watertight	CEnv	CSCEnv PMO-ESU	System in Place	DC When required	BOQ
			8.5 It is the Contractor's contractual obligation to complete and follow the SFA in case is any private land damaged/ contaminated due to disposal of waste generated from the construction activities	CEnv	CSCEnv PMO-ESU	SFA Environmental Audit	DC Once a week When required	SFA
			8.6 Ensure that the movement of lifting machinery and vehicles is limited to the work area	CEnv	CSCEnv PMO-ESU	Compliance	DC Daily When required	BOQ
			8.7 Ensure that soils are properly disposed off in a manner that does not affect the natural drainage	CEnv	CSCEnv PMO-ESU	Site Inspections	DC As and When required	BOQ
9	**Land Contamination due to Spill of Lubricants, Fuel, Chemicals and Other Waste Material**	The construction machinery (to be used during the construction period) includes cranes, trucks, loaders/ dumpers and batching plants. There are	9.1 Ensure that the maintenance of vehicle (LTV and HTV) and other plant takes place only in designated areas underlined with	CEnv	CSCEnv PMO-ESU	Compliance System in place	DC Daily As and When required	BOQ

Sr. #	Project Component	Description	Measures / Actions	Responsibility		Parameters for Monitoring	Frequency	Cost
				Executor	Monitor			
		chances of contamination of the land due to release of contaminated effluents, accidental spill, leaks, run off from the material storage yard etc.	concrete slabs and a system to catch surface runoff. The Contractor will construct lined wash area for vehicle washing					
			9.2 Ensure effluents from rig washing and other potentially contaminated effluents are released in to soaking pit	CEnv	CSCEnv PMO-ESU	System in place	DC When required	BOQ
			9.3 Ensure that fuels, oils, and other hazardous substances are handled and stored according to standard safety practices such as secondary containment bunded area. Fuel tanks should be labelled accordingly	CEnv	CSCEnv PMO-ESU	System in Place	DC Once in week When required	BOQ
			9.4 Ensure that fuels, oils, and chemical are stored in areas lined by an impermeable base and containing dykes. The Material Safety Data Sheets (MSDS) will be available at fuel storage area	CEnv	CSCEnv PMO-ESU	System in place	DC Once every 15-days Once a month	BOQ

Sr. #	Project Component	Description	Measures / Actions	Responsibility		Parameters for Monitoring	Frequency	Cost
				Executor	Monitor			
			9.5 Ensure spills are avoided during fuel and oil transfer operations. Appropriate arrangements to minimize carrying around at site should be made. If required, carry in proper container(s) or vehicles	CEnv	CSCEnv PMO-ESU	System in place Arrangements in place	DC Daily When required	BOQ
			9.6 Keep spill kit including shovels, plastic bags, absorbent materials and sand bags on site near fuel and oil storage areas	CEnv	CSCEnv PMO-ESU	System in place	DC Daily Once a month	BOQ
			9.7 Ensure that refuelling of vehicles is planned on daily basis to minimize travel and chances of spill	CEnv	CSCEnv PMO-ESU	Work Planning	DC Daily	BOQ
			9.8 Ensure that operating vehicles are checked for any fuel, oil, or battery fluid leakage regularly	CEnv	CSCEnv PMO-ESU	Compliance	DC Daily When required	BOQ
			9.9 Ensure that record of leak / spill incidents are maintained for each vehicle and repairs affected	CEnv	CSCEnv PMO-ESU	System in place Maintain	DC Daily When required	BOQ

Sr. #	Project Component	Description	Measures / Actions	Responsibility		Parameters for Monitoring	Frequency	Cost
				Executor	Monitor			
			vehicles at the earliest opportunity. Leaking vehicles will not be operated unless repaired			Record		
			9.10 Soil contaminated by minor spill (covering an area up to 0.1 m^2 and 75 mm deep) will be collected and disposed off at burn pit	CEnv	CSCEnv PMO-ESU	Compliance	DC When required	BOQ
			9.11 Ensure that soil contaminated by moderate spills or leaks (up to 200 liters) is contained using shovels, sand and soil. The contaminated soil will be removed from the site and sent to landfill site or burn pit as required. Major spills of volume exceeding 200 liters will be handled and controlled by a specialized Contractor as suggested in Waste Disposal Plan	CEnv	CSCEnv PMO-ESU	Compliance	DC When required Once a month	BOQ
10	**Agricultural Land and Crop Destruction**	It is envisaged that no agricultural land is involved for	10.1 Ensure that destruction of agricultural land is	CEnv	CSCEnv PMO-ESU	Implementation of Contractor's	DC Daily When required	SFA

Sr. #	Project Component	Description	Measures / Actions	Responsibility		Parameters for Monitoring	Frequency	Cost
				Executor	Monitor			
		establishing the Contractor's facilities i.e. batching plant, labour camp, Contractor's camp, material yard, workshop etc. Accidental damage to the crop or agricultural land may happen due to mistake of Contractor's vehicle driver or labour.	avoided by controlling the work activities and vehicles movement by the trained banksman			contractual obligation		
			10.2 If it is absolutely unavoidable and private land or crop damage from the Contractor's activities does take place then the affectees should be compensated and SFA completed by the Contractor	CEnv	CSCEnv PMO-ESU	Compliance SFA	DC When required	SFA
11	**Any Discharge or Diversion of Water to a Graveyard or Archaeological Site**	No graveyard / archaeological site are found in the project area so no such situation may occur in the area.	11.1 If during construction such sites are found and discharge or diversion of water is likely to damage the site then it is the Contractor's obligation not to let it happen	CEnv	CSCEnv PMO-ESU	Site Inspections	DC Daily When required	Direct Cost
			11.2 Solve the problem by collaboration with the communities as per SFA	CEnv	CSCEnv PMO-ESU	Compliance SFA	DC When required	SFA
12	**Electrical & Mechanical Works**	Renovation of electrical and mechanical installations of the existing barrage will be carried out in situ so there will be no impact on the land resources	No action is required					

Sr. #	Project Component	Description	Measures / Actions	Responsibility		Parameters for Monitoring	Frequency	Cost
				Executor	Monitor			
		due to this activity.						
13	**Extended Canal Closure**	The construction activities requiring canal closure will be scheduled in such a way that these must be finished within normal canal closure period and extended canal closures should be avoided. If required cofferdam or temporary structure should be constructed to maintain routine discharge into all three canals	13.1. Ensure that the extended canal closure is avoided by planning the work activities.	CEnv	CSCEnv PMO-ESU	Compliance of Work Plan	DC When required Once a month	BOQ
			13.2 In case of emergency avoid full closure of canal by setting up cofferdam	CEnv	CSCEnv PMO-ESU	Compliance	DC When required	Direct Cost
			13.3 Cofferdams or temporary diverted routes of canals will be constructed by a competent staff or sub-Contractor to keep running the canals during work activities, as routine	CEnv	CSCEnv PMO-ESU	Site Inspections Appointment process	DC When required	BOQ
B- WATER RESOURCES								
14	**Construction of Coffer Dams**	**Contamination:** Contamination of the river water from soil material during construction and removal of the coffer dams may consequently affect the aquatic life, particularly downstream fisheries.	14.1 Ensure that soil material used for the construction/ dismantling of the coffer dam should not contaminate the river water in terms of suspended solids, pH, oil based material to impact adversely on the aquatic life, particularly downstream fisheries by adopting good	CEnv	CSCEnv PMO-ESU	Compliance with method statement Site Inspections	DC, AC During construction/dismantling of the coffer dam Once a month	BOQ

Sr. #	Project Component	Description	Measures / Actions	Responsibility		Parameters for Monitoring	Frequency	Cost
				Executor	Monitor			
			engineering practice					
			14.2 Carry out water testing to ensure the setting up /dismantling and operation of the cofferdam do not have any adverse impacts on the quality of control water bodies (river, canals) DO, TDS, EC and pH tests will be conducted at coffer dam U/s and D/s area on monthly basis	CEnv	CSCEnv PMO-ESU	Laboratory based and on site Water testing of control water	DC Monthly basis of on site testing Quarterly basis of laboratory base testing	Direct Cost
			14.3 The Contractor will consult with the environmentalist of Supervision Consultant to get the approval of construction/ dismantling process and location of the cofferdam	CEnv	CSCEnv PMO-ESU	Compliance	BC/DC At the set up and dismantling Cofferdam	BOQ
15	**Batching Plant**	**Use of water:** Preparation of concrete at the batching plant would need water free from sediments and high salt concentrations, particularly sulphates. Groundwater in vicinity of the river will meet	15.1 Ensure that pumping of the groundwater will not affect the private or public tube well in the vicinity	CEnv	CSCEnv PMO-ESU	Compliance	BC Before establishing new tube well	BOQ
			15.2 Ensure that Contractor uses the water free from sediments and high	CEnv	CSCEnv PMO-ESU	Compliance	DC When required Daily	BOQ

Sr. #	Project Component	Description	Measures / Actions	Responsibility		Parameters for Monitoring	Frequency	Cost
				Executor	Monitor			
		this requirement. Therefore, the Contractor will install tube well at the site to meet this requirement. Water may also be needed for curing the concrete. For this the Contractor will use river water. **Disposal of wastewater:** Wastewater generated from the batching plant will be loaded with cement and fine aggregate. Disposal of this water into the river will affect the water quality and consequently the aquatic life. The suitable site for the batching plant is indicated on Figure 4.1.	salt concentration for the preparation of concrete at the batching plant					
			15.3 Ensure that wastewater or surface runoff generated during rain or from the batching plant should not enter in to the river without treatment	CEnv	CSCEnv PMO-ESU	Site Inspections	DC Daily When required	BOQ
			15.4 Ensure the effluent meet the NEQS through impounding or other type of treatment before this is disposed off in to the river	CEnv	CSCEnv PMO-ESU	Compliance with contractual obligation. Effluent testing (if generated)	DC When required Monthly basis	BOQ
			15.5 Ensure that Engineer to oversee that the contract clauses relating to batching plant are complied by the Contractor	CEnv	CSCEnv PMO-ESU	Compliance	DC Daily	BOQ
16	**Drinking Water Supply & Wastewater Generated from Contractor's Camp & Workshop**	**Water consumption:** The Contractor will require arranging water supply at the camp for human consumption as well as for the use at workshop for washing and otherwise. This may be required from the existing water	16.1 Ensure water source for domestic use i.e. camp site tap(s) or extraction well is monitored	CEnv	CSCEnv PMO-ESU	System in place Water testing	DC Quarterly basis	Direct Cost
			16.2 Ensure that drinking water quality standards are maintained while supplying water to the	CEnv	CSCEnv PMO-ESU	Compliance with drinking water NEQ standards	DC Quarterly testing	BOQ Direct Cost

Sr. #	Project Component	Description	Measures / Actions	Responsibility		Parameters for Monitoring	Frequency	Cost
				Executor	Monitor			
		resource available with PID for the use at the colony or install a new tube well. The arrangement will be made in consultation with Consultant and PMO. **Disposal of wastewater and other waste effluents:** The Contractor's camp will generate wastewater from two sources, viz., residential area and workshop. Both wastewaters will have different types of contaminants, i.e. domestic wastewater contains human excreta while the workshop wastewater will have oil and grease. Disposal of untreated wastewater into the river may pollute river water and affect the aquatic life.	labour camp and also regular water testing and monitoring is done					
			16.3 Ensure that local water supplier is compensated for the water if extracted from the existing water supply system for the community	CEnv	CSCEnv PMO-ESU	Compliance	DC When required	BOQ
			16.4 The Contractor will provide wastewater treatment facilities separately for both types of wastewater (domestic wastewater & construction wastewater)	CEnv	CSCEnv PMO-ESU	Compliance with contractual obligation	DC Daily When required	BOQ
			16.5 Ensure that sewage and other waste effluents are handled properly to avoid contamination of the control water bodies	CEnv	CSCEnv PMO-ESU	Compliance of contractual obligation Effluents testing	BC, DC At the design stage of waste treatment system Quarterly Basis	BOQ
17	**Electrical & Mechanical Work**	Renovation of electrical and mechanical installations of the existing barrage will be carried out in situ. Accidental spill or leakage of chemicals or	17.1 Ensure good housekeeping to avoid any accidental spill or leakage into the river	CEnv	CSCEnv PMO-ESU	Site inspection by the technical staff	DC When required Daily	BOQ
			17.2 The Contractor will provide suitable	CEnv	CSCEnv PMO-ESU	Compliance Site inspection	DC When required Daily	BOQ

Sr. #	Project Component	Description	Measures / Actions	Responsibility		Parameters for Monitoring	Frequency	Cost
				Executor	Monitor			
		oil based material could contaminates the river water and adversely affect the aquatic life.	working platform e.g. scaffolding or mobile working tower, if required to avoid accidental spills					
C- AIR QUALITY AND NOISE POLLUTION								
18	**Dust, Smoke and Other Potential Pollutants from Plants & Equipments**	A vast variety of construction plant and machinery including but not limited to bulldozers, dumpers generators, batching plant and vehicles will be used during the construction phase. These construction activities will generate dust, smoke and other potential pollutants in the air.	18.1 Ensure that all equipment including generators and vehicles used during the project are properly tuned and maintained in good working condition, in order to minimize the exhaust emissions	CEnv	CSCEnv PMO-ESU	Monitoring gaseous emission rates from generator and other key equipment	DC Quarterly basis Noise level When required	BOQ
			18.2 If the selected site for batching plant is closer than 500m from the build-up area then ensure that **zero emission** plant is installed	CEnv	CSCEnv PMO-ESU	System in place	BC Once at start of the work	BOQ
			18.3 Ensure that dust emissions due to vehicular traffic are minimized by reducing speed, vehicular traffic minimized through good journey management and water sprinkling on non-metalled road	CEnv	CSCEnv PMO-ESU	Visible dust: Visible observation of size of dust clouds	DC Daily During peak Construction Period. Surprise visit Once a week	BOQ

Sr. #	Project Component	Description	Measures / Actions	Responsibility		Parameters for Monitoring	Frequency	Cost
				Executor	Monitor			
			when required					
			18.4 Ensure that periodic ambient air quality monitoring is carried out to assess the concentration of Carbon Monoxide (CO), Carbon Dioxide (CO_2), Nitrogen Dioxide (NO_2), Sulphur Dioxide (SO_2) and Particulate Matter / (PM_{10}) and ($PM_{2.5}$) in the atmosphere	CEnv	CSCEnv PMO-ESU	Compliance	DC Quarterly basis	Direct Cost
19	**Smoke from Burning of Waste Material or Burning of Firewood in the Labour Camp**	It is the Contractor's responsibility to provide clean source of fuel i.e. sui gas such that the site workers do not burn wood as fuel. Burning special waste (clinical waste, packing waste etc.) may emit poisonous or hazardous emission.	19.1 It is Contractor's contractual obligation to provide gas as clean source of energy at Contractor's camp and do not allow the labor to use wood as fuel	CEnv	CSCEnv PMO-ESU	Compliance contractual obligations	BC Once at the start of work DC Once a week	BOQ
			19.2 Ensure that all the combustible non-hazardous waste material should be burnt in the burn pit only	CEnv	CSCEnv PMO-ESU	System in place	DC Daily When required	BOQ
			19.3 Ensure that the quantity of waste burnt at one time is managed so as to minimize smoke emission	CEnv	CSCEnv PMO-ESU	Maintain record	DC When required	BOQ
			19.4 Control fuel	CEnv	CSCEnv	Maintain	DC	BOQ

Sr. #	Project Component	Description	Measures / Actions	Responsibility		Parameters for Monitoring	Frequency	Cost
				Executor	Monitor			
			consumption and minimize its waste or leakage by regular monitoring		PMO-ESU	record	When required	
20	**Noise Pollution from Construction Activities**	The use of old/outdated machinery may raise the noise level during the construction phase. The Contractor will use the appropriate machinery to carry out the work.	20.1 It is the Contractor's obligation to use appropriate machinery fit for purpose	CEnv	CSCEnv PMO-ESU	Compliance with the contract	DC Daily When required	BOQ
			20.2 Ensure the minimum use of vehicle horns particularly during embankments strengthening work along the pond area	CEnv	CSCEnv PMO-ESU	Compliance	DC Daily When required	BOQ
			20.3 Ensure the implementation of the 30km/h speed limit on site	CEnv	CSCEnv PMO-ESU	Compliance	DC Daily When required	BOQ
			20.4 Ensure that periodic noise monitoring is undertaken to check the noise pollution during working hours	CEnv	CSCEnv PMO-ESU	Noise Monitoring	DC Monthly basis When required	Direct Cost
D- BIOLOGICAL RESOURCES								
21	**Damage to Biological Resources During Construction**	The pond area at the upstream of the barrage consists of wetland and provides the habitat of many species of migratory waterfowl and game birds. Almost all the	21.1 When aligning the access road ensure that the chosen route requires minimum vegetation loss and no tree cutting	CEnv	CSCEnv PMO-ESU	Compliance	BC Once at the time of aligning of access road	BOQ
			21.2 Ensure wood	CEnv	CSCEnv	Compliance	DC	BOQ

Sr. #	Project Component	Description	Measures / Actions	Responsibility		Parameters for Monitoring	Frequency	Cost
				Executor	Monitor			
		work activities are outside the Barrage pond area. For other project activities Contractor may require to clear vegetation from the areas to be used for: - Borrow soil material - Establishing Contractor Camp - Erecting Batching Plant - Haulage Tracks including Guide banks Bela removal may adversely impact the wildlife of the area due to noise and heavy machinery movements.	and shrubs are not used as fuel during construction phase		PMO-ESU	with IEE/EMP	Daily Once a month	
			21.3 Ensure that there is no open defecating in the vicinity of camps or construction site	CEnv	CSCEnv PMO-ESU	Compliance with Waste Disposal Plan	DC Daily When required	BOQ
			21.4 Ensure that no fire arms are carried out by any of the employees or labour, except designated security staff if required	CEnv	CSCEnv PMO-ESU	Compliance Site inspection	DC Daily When required	BOQ
			21.5 Ensure that safe driving practices are observed so that the accidental killing of reptiles or small animals crossing the road could be avoided	CEnv	CSCEnv PMO-ESU	Compliance with IEE/EMP Endorse speed limit	DC Daily When required	BOQ
			21.6 Ensure that damage to the natural topography and landscape is kept minimum as possible	CEnv	CSCEnv PMO-ESU	Compliance with Environmental protection Act	BC/DC Daily When required	BOQ
			21.7 Ensure that no-hunting, trapping and/ or harassing wildlife takes place at site. The wildlife protection laws should be strictly implemented	CEnv	CSCEnv PMO-ESU	Compliance with wildlife protection rules & regulation	BC/DC Daily When required	BOQ
			21.8 Ensure that the	CEnv	CSCEnv	Compliance	DC	BOQ

Sr. #	Project Component	Description	Measures / Actions	Responsibility		Parameters for Monitoring	Frequency	Cost
				Executor	Monitor			
			illegal fishing in the river by the project staff is prohibited		PMO-ESU	with Fishery roles & regulation	Daily When required	
			21.9 Ensure that the general awareness of the crew is enhanced regarding the wildlife, through environmental training and notice boards	CEnv	CSCEnv PMO-ESU	Compliance with Environmental and Wildlife Protection laws	DC Daily When required	Direct Cost
			21.10 Ensure that no project vehicle or staff is allowed to access the restricted areas to interfere with security and wildlife habitat	CEnv	CSCEnv PMO-ESU	Site inspections Fenced the Contractor's facilities	DC Daily When required	BOQ
			21.11 Ensure that shooting permit should not be given by the Wildlife Department for the shooting in Barrage pond area during the construction phase	CEnv	CSCEnv PMO-ESU	Consultation with Wildlife Department	DC When required	BOQ
			21.12 Ensure that site workers are protected from harmful species of animals	CEnv	CSCEnv PMO-ESU	Compliance with mitigation measures as explain in IEE	DC Daily When required	BOQ
			21.13 Ensure that river ecology is monitored prior to the start of the project, during construction and post construction	CEnv	CSCEnv PMO-ESU	Include a specialize ecologist in the environmental team	BC At the preparation of IEE DC Quarterly basis	BOQ

Sr. #	Project Component	Description	Measures / Actions	Responsibility		Parameters for Monitoring	Frequency	Cost
				Executor	Monitor			
			21.14 Ensure that excavating activities for the bela trimming purpose are carried out preferably during non- breeding season of fish (April to June). Monitor turbidity on regular basis during excavating activities	CEnv	CSCEnv PMO-ESU	Site inspection and work planning	DC When required	BOQ
E- SOCIO-ECONOMIC AND CULTURAL ISSUES								
22	**Health & Safety Impacts on Site Work Force and Local Population**	**Population at risk:** Since the main settlement is located far from the project site, therefore it is unlikely to emplace any health & safety hazards for the local population due to the project activities. However there will be safety and health hazards for the work force, particularly for the people working on the repair/ renovation of gates and hoists and installing electric equipments under the	22.1 The Contractor should provide training to the workers on safety matters	CEnv	CSCEnv PMO-ESU	As per contract	BC/DC When required	Direct Cost
			22.2 Ensure that Compliant Management Register and Accident Record Register is maintained at Camp site office	CEnv	CSCEnv PMO-ESU	Maintain Record Compliance	DC Daily When required	BOQ
			22.3 Ensure that no machinery is left unattended at work site	CEnv	CSCEnv PMO-ESU PMO-ESU	Maintain plants log sheet Site inspections	DC Daily When required Once a month	BOQ
			22.4 Ensure PMO representative visits each month to gather	PMO-ESU	CSCEnv PMO	Maintain Complain Management	DC Daily Monthly basis	BOQ

Sr. #	Project Component	Description	Measures / Actions	Responsibility		Parameters for Monitoring	Frequency	Cost
				Executor	Monitor			
		condition of full impoundment of the barrage pond.	complaints from Social/Environment Complaints Management Register and provide feedback to the community on the status of the previous complaints to the community elders			Register		
			22.5 Ensure the use of horns is prohibited, except when necessary	CEnv	CSCEnv PMO-ESU	Display sign boards Compliance	DC Daily When required	BOQ
			22.6 Ensure all entry points into the construction area are staffed 24 hours a day	CEnv	CSCEnv PMO-ESU	Compliance Provision of 24h security	DC Daily When required	BOQ
			22.7 Ensure that safe driving practices are adopted, particularly while passing close to settlements. This includes a speed limit of 40km/h within built up area (residential area) and 30km/h on site	CEnv	CSCEnv PMO-ESU	Implementation of traffic management plan	DC Daily When required	BOQ
23	**Existing Service Facilities like Education, Health, Electricity, Drinking water Supply and Public Gathering,**	Social consultation will be done and all impacts influencing the communities will be defined and all these factors will be added and incorporated in the contract document of	23.1 Service facilities may be legalized through SFA	CEnv	CSCEnv PMO-ESU	Contractor's obligation defined in contract data Compliance of SFA	DC Daily When required	SFA
			23.2 Ensure that women of the area	CEnv	CSCEnv	Gender Analysis	BC, At the preparation of	BOQ

Sr. #	Project Component	Description	Measures / Actions	Responsibility		Parameters for Monitoring	Frequency	Cost
				Executor	Monitor			
	Religious Congregations etc.	the Contractor as a Social Frame Agreement (SFA).	are consulted and their point of view incorporated regarding the project activities and community development projects		PMO-ESU		IEE DC Quarterly basis	
			23.3 Ensure that religious congregations must be observed carefully in order to avoid conflicts with tribal leaders and local communities	CEnv	CSCEnv PMO-ESU	Public Consultation	BC At the preparation of IEE DC When required	BOQ
			23.4 Contractor's camp should include but not limited to the following facilities: mosque, restaurant, leisure centre, health & safety centre and welfare facilities	CEnv	CSCEnv PMO-ESU	Contractor's Contractual Obligation.	BC At preparation of contract document	BOQ
24	**Tribal Tension Local Rivalries on Running Canals and Use of Aquatic Life**	Just one month before the start of the construction work social framework agreement will be made between the community members and the resident engineer. In order to avoid conflicts with tribal leaders and local communities; mutual consents will be	24.1 Ensure that polices having direct bearing on project activities are culturally acceptable , in order to avoid conflicts with tribal leaders and local communities and to offset any impact on the local social structure	CEnv	CSCEnv PMO-ESU	Public consultation Compliance of SFA	BC Once at the start of work DC When required	BOQ
			24.2 Ensure women	CEnv	CSCEnv	Compliance	BC,	BOQ

Sr. #	Project Component	Description	Measures / Actions	Responsibility		Parameters for Monitoring	Frequency	Cost
				Executor	Monitor			
		discussed in SFA.	are informed through traditional means of communication of the presence of foreign men (migrated labour etc.) in their area		PMO-ESU	Gender Analysis	At the preparation of IEE DC When required	
			24.3 Ensure that individuals holding titles to private property used in the project (if any) are compensated in accordance with the market rates and all payment are recorded	CEnv	CSCEnv PMO-ESU	Compliance of SFA & Land Act	BC Once at the start of the work DC When required	SFA
			24.4 Focus on water related issues related to project implementation in regular group meeting with local community	CEnv	CSCEnv PMO-ESU	Group meetings, Public consultation	BC/DC When required	BOQ
25	**Adverse Effects on Archaeological Sites, Any Grave yards and Burial Sites**	No important cultural and archaeological site has been found or reported in the area.	25.1 If any archaeological, historical, cultural, religious or grave yard found during the project implementation then the Contractor will ensure that no damage to any such sites is caused due to the project activities	CEnv	CSCEnv PMO-ESU	Compliance with law indicated in chapter 2 of IEE	BC At the completion of IEE DC Daily When required	Direct Cost
			25.2 Ensure that if any such sites are	CEnv	CSCEnv	Compliance	DC Daily	BOQ

Sr. #	Project Component	Description	Measures / Actions	Responsibility		Parameters for Monitoring	Frequency	Cost
				Executor	Monitor			
			found during the construction stage the Supervision Consultant should be informed immediately					
26	**Public Health & Safety Services at Construction Site**	Due precautions shall be taken by the Contractor, at his own cost, to ensure the safety of his staff and labour and, in collaboration with and to the satisfaction of the local health authority, to ensure that medical staff headed by qualified medical doctor, first aid equipment and stores, sick bay and suitable ambulance service are available at the camp site, housing, and on the site at all times throughout the period of the contract and that suitable arrangements are made for the prevention of epidemics and for all necessary welfare and hygiene requirements.	26.1 Ensure that an Ambulance is available on site on a 24-hour basis during construction phase The Contractor will ensure the availability of MBBS doctor and paramedic staff at Contractor's camp on full time basis. The Contractor will also get a hospital on panel for dealing with emergency conditions	CEnv	CSCEnv PMO-ESU	Compliance	DC Daily When required	BOQ
			26.2 Ensure that all materials, gears and equipment (including personal protective equipment) required to carry out the work safely are provided to the staff	CEnv	CSCEnv PMO-ESU	Compliance	BC/DC Once at the start of work DC Daily	BOQ
			26.3 Ensure that employees must have access to running potable water at their place of work and also shaded area is	CEnv	CSCEnv PMO-ESU	System in place	DC Daily When required	BOQ

Sr. #	Project Component	Description	Measures / Actions	Responsibility		Parameters for Monitoring	Frequency	Cost
				Executor	Monitor			
			provided for rest during working shift					
			26.4 Ensure use of horns is prohibited, except when necessary	CEnv	CSCEnv PMO-ESU.	Compliance	DC Daily When required	BOQ
			26.5 Ensure that safe driving practices are adopted, particularly while passing close to settlements. This includes a speed limit of 40km/h within built up area and 30km/h max. speed limit on site	CEnv	CSCEnv PMO-ESU	Compliance Traffic Management Plan	DC Daily When required	BOQ
27	**Employment Opportunities**	The project will open new jobs opportunities which the local population could avail. PID may request the Contractor to hire labour from the local community It is believed that substantial amount of unskilled work force for construction could be recruited from the local population near the project site. Therefore Barrage construction will have a positive	27.1 Ensure maximum (up to 100%) unskilled and possible semi skilled and skilled jobs are to be provided to people from local communities, provided the suitable competent persons with required qualifications/ experience are available	CEnv	CSCEnv PMO-ESU	Compliance with labour laws in contract documents	BC At the stage of employment DC When required	BOQ
			27.2 Ensure project staff interaction with local community is	CEnv	CSCEnv PMO-ESU	Land selection for labour camp should	BC During preparation of IEE	BOQ

Sr. #	Project Component	Description	Measures / Actions	Responsibility		Parameters for Monitoring	Frequency	Cost
				Executor	Monitor			
		impact on the socio-economic fabric of the local society. The Contractor will evaluate the available manpower taking into consideration the level (skilled or unskilled) and numbers of the workers who could be inducted in the labour/ work force of the Project. The Contractor will give preference to employing suitable personnel living close to the Project area on the conditions which will be in accordance with the National Law ensuring that the working conditions for the labour / work force at the site take due care of the health, safety and ambient conditions conducive to appropriate working/living standards applicable to a work site.	minimal			be at least 500m away, physical barrier between work area and public places	DC When required	
			27.3 Ensure that inter tribal balance is maintained when giving employment to the local population. Preference to be given to the people directly affected by the project	CEnv	CSCEnv PMO-ESU	Public Consultation	BC At the stage of employment DC When required	BOQ
			27.4 Ensure that guidelines are prepared and implemented to sensitize non-local labour to local norms and customs in order to minimize cultural conflicts or disputes	CEnv	CSCEnv PMO-ESU	Public Consultation	BC at the stage of employment DC Quarterly	BOQ
			27.5 Ensure that field crew is medically screened before employment	CEnv	CSCEnv PMO-ESU	Compliance with PHS Act	BC At the stage of employment	BOQ
28	**Communicable Diseases**	The labour(s) at camp, their interaction with truck drivers and alike personnel are potential	28.1 Ensure that periodic awareness campaign for Hepatitis, HIV/AIDS	CEnv	CSCEnv PMO-ESU	Compliance with PHS Acts, health & safety awareness	DC Quarterly When required	Direct Cost

Sr. #	Project Component	Description	Measures / Actions	Responsibility		Parameters for Monitoring	Frequency	Cost
				Executor	Monitor			
		places for spread of communicable diseases if the incidence exists. Almost 100% of the people of project area and the potential labour are not aware of the source, mode of communication or consequences of Hepatitis, HIV/AIDS. Although their religious and cultural value system, to a large extent excludes the outbreak or rapid communication of HIV/AIDS, yet its occurrence in such a situation cannot be precluded. It is necessary that along with other communicable diseases like Cholera, Typhoid and Tuberculosis, awareness and preventive campaigns are run from time to time in the labour camps and the field offices of the project on HIV/AIDS.	and other communicable diseases like cholera, typhoid and tuberculosis is undertaken for the project staff			courses		
			28.2 Ensure that a risk assessment for the spread of HIV/AIDS is undertaken in the project area on the basis of data from the Punjab HIV/AIDS program	CEnv	CSCEnv PMO-ESU	Medical testing of site worker	BC At the employment DC Quarterly basis	BOQ
			28.3 The medical staff ensure periodical checks of the cooking staff and cooking practice particularly for symptoms of hepatitis A	CEnv	CSCEnv PMO-ESU.	Medical Testing	DC When required	BOQ

Sr. #	Project Component	Description	Measures / Actions	Responsibility		Parameters for Monitoring	Frequency	Cost
				Executor	Monitor			
29	**Restoration/ Rehabilitation**	It will be the requirement of the contract that restoration of borrow areas will be done at completion of the work. All borrow areas will be leveled as far as possible, graded and brought in a level form resembling to natural condition prior to extraction / borrowing. Camp site and temporary facilities will be restored in accordance with contractual obligations and requirements. All the community roads and bridge roads which were under Contractor use will be restored to their original shape or better.	29.1 Ensure that all borrow sites are remediated as per contract requirements	CEnv	CSCEnv PMO-ESU	Compliance Photograph record	After completion of excavating work	BOQ
			29.2 Camp site is restored and changed to tourist resort if possible and agreed by the PID	CEnv	CSCEnv PMO-ESU	Compliance	After completion of work	BOQ
			29.3 All extra products / materials, solid and liquid will be disposed off in accordance with the requirement of the IEE and contract document	CEnv	CSCEnv PMO-ESU	Compliance with Waste Disposal-Plan	After completion of work	BOQ
			29.4 All fencing and access gates relevant to construction activities will be removed	CEnv	CSCEnv PMO-ESU	Compliance with restoration guidelines	After completion of work	
			29.5 All pits (including burn pits, sumps and depression) will be backfilled unless agreed with the CSCEnv at the completion of the project	CEnv	CSCEnv PMO-ESU	Compliance	At completion of work	BOQ
			29.6 The portion of the access track likely to be of no use for other activities will be restored by removing culverts and gravel	CEnv	CSCEnv PMO-ESU	Compliance	After completion of work	BOQ

Sr. #	Project Component	Description	Measures / Actions	Responsibility		Parameters for Monitoring	Frequency	Cost
				Executor	Monitor			
			topping					
			29.7 While abandoning sumps the extra cap of soil will be placed over them to allow for compaction	CEnv	CSCEnv PMO-ESU	Compliance with restoration guidelines	After completion of work	BOQ
			29.8 Ensure that no potential conflicts arise with landowners during the restoration of the borrow areas	CEnv	CSCEnv PMO-ESU	Compliance with SFA	After completion of work	SFA

BC - Before Construction; DC - During Construction; AC - After Construction; CEnv - Contractor's Environmentalist
PMO-ESU - Project Management Office- Environmental and Social Unit; CSCEnv - Construction Supervision Consultants Environmentalist

7.3 CHANGE MANAGEMENT

262. An environmental assessment of the proposed project has been made during the preparation of IEE. However it is possible that change in project design may be required when the project is implemented. This section describes the mechanism to handle changes that might affect the project environmental impact. The changes in the project design may be grouped into three orders:

263. **First Order Change** is one that leads to a significant departure from the project described in the IEE such as change in project location and design. The change management statement (CMS) will be submitted to EPA for approval with a copy to the Asian Development Bank.

264. **Second Order** Change is one that is not significantly different from those described in the IEE such as;

- Increase in project personnel by 25%
- Changes in the documentation and communication, stakeholders consultation program

265. The change management statement (CMS) will be submitted to EPA for information with a copy to the Asian Development Bank.

266. **Third Order** Change is one that is of little consequence to the IEE findings, such as;

- Re-aligning a particular section of road to avoid cutting tree

267. The assessment report will be compiled and recorded.

7.4 COMMUNICATION AND DOCUMENTATION

268. Communication and documentation is an essential feature of EMP. The key features of such mechanism are:

7.4.1 Data Recording and Maintenance

269. All forms to be used for recording information during the environmental monitoring. A standard format will be followed to correspond all the gathered dataCheck boxes will be used as much as possible to facilitate data entry. Tracking system will be developed for each form. The checklists are provided in Appendix 7.1.

7.4.2 Storage of Information

270. The database to be maintained may include the following information:

- Training programs
- Staff deployment
- Non-compliances
- Corrective action
- Environmental data listed below:
  - Soil and land pollution
  - Disposal of excavated silt and earth
  - Disposal of waste

- Water resource
  - Quality
  - Quantity
- Fuel oil and chemical spills
- Vegetation record
- Record of wildlife
- Noise pollution
- Air and dust pollution
- Socio-economic data
- Site accidents
- Animals mortality

7.4.3 Meetings

271. The following environmental meetings during the project will take place:

- Primary meeting for setting out the regular meetings framework
- Scheduled meetings between Contractor and Supervising Consultant
- Progress review meeting among ESU of PMO, Environmental Specialist and Environment Officer

272. The purpose of the meeting will be to discuss the conduct of the operation, non – compliances noted by the consultant's environmental team and measures for their remedy. The meeting will be recorded in the form of a daily/monthly environmental report.

7.4.4 Reports

273. The Environmental Specialist of the Supervision Consultant shall produce periodical reports as well as inspection notes based upon the visits to the Project site. This information shall make a basis for ESU for their further reporting or visiting the site. All reports shall be location and activity specific. The reports shall especially identify areas of Contractor's non-compliances with the EMP and provide guiding remarks on actions to be taken. The significance of the non-compliances shall also be noted. Copies of these reports shall be sent to the Resident Engineer (RE) who shall forward them to the Team Leader, Head PMO, Punjab Irrigation Department and the Contractor for their action(s).

274. The RE will include in his routine reports a summary status of activities relating to the EMP. Supplemental reports on issues should also be prepared as and when required.

275. The consultant' s environmental team will produce daily, monthly, and annually reports, as well as a final report of the project based on the information collected. The list of distribution reports is given in Exhibit-2.

Exhibit 2 - Periodic Reports

Report	*To be Prepared by*	*To be Reviewed by*	*Distribution*
Daily	-Contractor's HSE officers	-Contractor environmental officer -Consultant's Environmental Specialists	-Resident Engineer
Monthly	-Environmental officer of the Contractor	-Consultant's Environmental Specialists	- Resident Engineer -PMO
Quarterly	-Environmental team of the Construction Supervision Consultants	-ESU of PMO	-Resident Engineer -PMO -PID - EPA Punjab -ADB
Biannually	-Environmental team of the Construction Supervision Consultants	-ESU of PMO	- Resident Engineer -PMO -PID -EPA Punjab -ADB
Annually	-Environmental team of the Construction Supervision Consultants	-ESU of PMO	- Resident Engineer -PMO -PID -EPA Punjab -ADB
Effects Monitoring	-Environmental team of the Construction Supervision Consultants	-ESU of PMO -EPA Punjab	-Resident Engineer -PMO -PID -EPA Punjab -ADB
Change Management	-Environmental team of the Construction Supervision Consultants	-ESU of PMO -EPA Punjab	-Resident Engineer -PMO -PID -EPA Punjab -ADB
Final	-Environmental team of the Construction Supervision Consultants	-ESU of PMO	-Resident Engineer -PMO -PID -EPA Punjab - ADB

7.4.5 Photographic Record of the Project Area

276. Key locations shall be identified for taking Photographs of the project area by using digital camera before the construction starts and the following information shall be recorded for each shot on a prescribed form

- Shot number
- Name of photograph
- Date
- Time
- Featured photograph
- Other observations

277. Photographs shall be retaken for the key location after completion of all activities.

7.4.6 Social Complaints Register

278. The consultant's environmental team will maintain a 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 PMO. The details of Grievance Redress Mechanism are provided in the RP. The Project Monitoring team shall carry out the monitoring of the implementation of social and environmental mitigation measures as per ADB Safeguard Policy Statement.

7.4.7 Record Register

279. The environmental specialist of the Construction Supervision Consultants will be responsible to maintain and update all environment related data, record and documents. The results from environment monitoring and sampling program should be fully documented and recorded. The results will be available for inspection by the regulatory authorities and Asian Development Bank on site. The record should provide the following quality assured monitoring and sampling information:

- Parameters monitored and sampled
- Specified details of measurements/samples to support analytical and quality assurance (QA) requirements e.g. dates, times, location, other relevant parameters
- Results of measurements/sample analysis
- Interpretation and review of results against specified trigger level

280. This will be maintained at a site to document any change in the project design as well. These changes will be handled through the change management mechanism if any. The final report will be communicated to ESU. Environmental issues Tracking Report form will be completed and maintained by the Contractor which is provided in Appendix 7.2.

7.5 WASTE DISPOSAL PLAN

281. This component describes the waste disposal plan that will be employed during the construction and restoration period. The main types of waste to be disposed off include:

- Waste generated during construction;

- Fuel, oils, and chemicals;
- Sewage;
- Camp site waste;
- Medical waste;
- Demolition waste;
- Packing waste; and
- Excess construction material

282. Domestic waste and construction waste will be the main type of waste generated from labour camp and construction activities. Domestic waste contains high percentage of readily degradable hydrocarbon which gives bad smell on decomposition, especially in hot and humid environment. Construction waste classified as inert waste which could be problematic to dispose off. It is recommended to collect the domestic waste and construction waste separately. The Contractor will adopt 3 Rs (reduce, reuse and recycle) technique for proper disposal of solid waste.

7.5.1 Domestic Waste

- All the waste generated at labour camp should be collected and temporarily stored at the designated bunded area within the labour camp
- The area should be prepared, maintained and visually inspected and recorded on regular basis by the Environment Officer of the Contractor
- The waste storage area should be fenced to stop animal's direct contact with the waste. The site must be decontaminated to keep the building free from foul smells, spreading of diseases and healthy working environment on regular basis
- It is the responsibility of Contractor to arrange the waste collection from the labour camp with local authority or waste disposal corporation on regular basis
- Waste Chute should be provided within the labour camp. Chute will enable the collection of thrown solid in the covered storage site
- Biodegradable Bags should be provided to the occupants and residents of the labour camp for collecting their waste
- Implement resource conservation and recover recyclable waste e.g. paper, steel cans, glass bottles etc. from the collected waste and divert the filtered waste to the waste disposal pit

7.5.2 Construction Waste

- Construction waste could be reused as a fill material or construction material. However the detail testing should be undertaken to confirm the suitability of the waste, if is used as a construction material.
- If the construction waste disposed off on site in the form of construction waste disposal site then once the hole filled with the construction waste the top of the fill should be capped with clayed material and compacted to minimize water infiltration.

The waste disposal system is summarized in Exhibit-3 below:

Exhibit 3 - Waste Disposal Plan

Types of waste	Description	Phases	Disposal methods
Construction waste	Crushed concrete & excavated soil	Road Bridge and Barrage structure repair work	Dumping and leveling of waste only on site agreed with the Environmental Specialist and ESU. Waste will be properly disposed off in a manner that does not disturb the natural drainage, soil cover, water quality, air quality and aesthetics of the area. The dumped material will be strengthened by stone pitching.
Fuel, oils, and chemicals spills contaminated soil or wastewater	Contaminated soil or water	All phases	Soil contaminated by minor spills / leakages (defined as leaks from the vehicles, machinery, equipment, or storage containers such that the areas and depth of soil contaminated is less than 1sqft and 3 inches respectively) will be scraped and sent to the burn pit where it will be burned along with other combustible wastes. Moderate spills defined as spills of volume less than or equal to 200 litres will be contained and controlled using shovels, sand, and native soil. These materials and equipment will be made available at camp site and construction site during operation. The contaminated soil will be excavated and stored in a bunded area lined with impermeable base. Depending on the volume of the contaminated soil, the disposal may involve sending it to burn pit or for specialized treatment such as bioremediation or solidification/stabilization (s/s). Major spills of volume exceeding 200 litres will require the initiation of PMO emergency response procedures. These spills will be handled and controlled according to the specialized measures and special treatment as suggested by the spills removal experts. The contaminated water should be collected in separate container and sent to the suitable treatment site after the mutual agreement with environment consultant and PMO.
Sewage and grey wastewater	Wastewater from kitchen and washing areas, sewage	Construction / Operation Phase	Sewage to be disposed off using septic tanks and soaking pits with designed filter bed. Sewage and solid residue to be disposed off in sewage treatment facilities of Jhang city. The septic tank and soaking pits with filter bed may be designed on per capita basis.

Types of waste	Description	Phases	Disposal methods
			Wastewater from kitchen and washing areas to be disposed off in filter bed soaking pits. No any kind of wastewater will disposed off into river or anywhere without prior approval of the Engineer
Camp site waste	Fruit or vegetable residue, domestic garbage	Construction / Operation Phase	Colour coded waste collection drums will be placed at the appropriate locations to segregate different types of waste. Recyclable waste to be given away for recycling; and non combustible waste to be buried in waste disposal pit by the local authority of district Jhang with other city waste as agreed with ESU and Environmental Specialist. Green waste will be disposed off at the composting unit.
Medical waste	Syringes, glass bottles, soiled bandages, expired drugs, dressing	Construction / Operation Phase	To be incinerated at nearby hospital incinerator, if any, or an equivalent facility used by nearest major hospital and specified by the Contractor in SSEMP.
Workshop waste, and fluid waste	Used oil, ferrous /non- ferrous materials, batteries, oil etc.	Construction / Operation Phase	The collection and disposal of oil based waste material should be arranged with specialized certified waste disposal Contractor.
Demolition Waste	Concrete, bricks, other building materials	Construction / Operation Phase	Reusable materials to be given away for re-use. Remaining waste to be buried at designated construction waste disposal site which will be specified by the Contractor in SSEMP as per site conditions.
Packing waste	Paper, plastic, textiles, cardboard, rubber, wood, glass, tin, cans, aluminium canes	Construction / Operation Phase	Recyclable waste to be handed over to recycling contractors. Non-recyclable waste to be collected and disposed off with other domestic waste generated at Contractor camp and labor camp.
Excess construction	Sand, aggregate, cement, bricks,	Construction / Operation Phase	To be sold back or given to the supplier or other users at earliest possibility so that it should not affect any activity at site and

Types of waste	Description	Phases	Disposal methods
material	reinforcement steel bars, paints and other construction materials		aesthetics and environment of the area.

7.6 ILLUSTRATED TRAFFIC MANAGEMENT PLAN

283. Execution of mechanical and civil works at the barrage will require partial or full closure of the road bridge during construction. Therefore, traffic management would be required during such time periods spanning long hours in a day. It is the Contractor's contractual obligation to prepare and submit a Traffic Management Plan, and get its approval from the Engineer, traffic police, XEN Irrigation and HSE Officer and implement on site. The plan should be available for public in local library and disclosed in newspaper. The suggestions made in this section should be incorporated by the Contractor in preparation of the Traffic Management Plan.

284. The purpose of traffic management plan is to cope with traffic distribution that call for coordinated actions from several services responsible for road/traffic management on a given road or network.

7.6.1 Barrage Structure Repair Work

285. There is a single carriage way bridge on top of the main weir at Trimmu Barrage for public transport. If part of the road needs to be used to undertake the barrage structural repair work then the working area should be clearly marked with separating fence. No unauthorized person should be allowed to enter the working area. Following measures should be taken during the construction of the bridge:

- Temporary route should be provided during the bridge construction to maintain traffic flow. The alternate river crossing facility available at:
  - i) Bridge on River Chenab on Jhang Sargodha Road at upstream of Trimmu Barrage
  - ii) Road Crossing at Khushab on River Jhelum at upstream of river
  - iii) Garh Maharaja Bridge on River Chenab

- The temporary route should be adequate for the existing traffic plus the site traffic and designed and built by a specialized Contractor.
- The rural roads leading to or passing near the construction site could be used to convey men and materials to the construction sites provided no damage is done to road or private property or crops.
- It is the Contractor's contractual obligation to use the roads and paths carefully and in case of any damage, repair the damaged roads or paths.

286. **Closing one Lane:** When closing down one lane of the road then the traffic light system should be set up to allow only one side traffic at a time. Sign posts about the new traffic light and/or proposed new road layout should be placed at least one km from the road closing lane. Sign boards about the expected delay in traffic and queue build up should be placed in Jhang, Faisalabad and Bhakkar.

287. **Complete Closure of the Road:** There is an active river creek at downstream of the barrage and boat bridges shall be assembled at downstream of barrage and on Haveli and T.S. Link Canals as temporary alternate route.

288. The alternate river crossings for heavy traffic are available at:

Chiniot on Chanab River (upstream of Chenab River)

Multan on Chenab River (downstream of Trimmu Barrage)

Khushab on Jehlum River (upstream of Trimmu Barrage)

289. The Contractor will mention the closure of bridge in print media, electronic media and local newspaper properly. If the road needs to be closed completely for short period then it is suggested that the closure should not be more than continuous 4 hours. Local traffic police should be informed at least a week before the closure required. Traffic sign board regarding the closure time and suggestion for alternate routes should be placed at the exit of main city i.e. Jhang, Bhakkar and 18-Hazari towards the Trimmu Barrage. Where possible the closure should be arranged outside the off peak times (consider peak time from 6am to 10am and 3pm to 7pm). The traffic should be stopped before it enters the built up area near the barrage i.e. settlements near the barrage to avoid the distraction of the local community and damage to infrastructure from the accumulated traffic.

7.6.2 Maintenance and Repair of Embankments

290. The existing embankments can be used for transporting soil, material and plant and equipment. However, the width of the bunds is 25 ft which can cope with the traffic on both directions. It is recommended to provide crossing/waiting bays along the embankments to avoid any accidental slip of vehicles. The soft barricading/ fence should be provided at the edges of the path/roads etc.

7.6.3 Transportation of Labour and Machinery

291. The labour camp has been proposed to establish near barrage where the activities have to be carried out. There will be no hindrance for movement of labor in between the working place and the camp. The machinery yard will be located in the irrigation workshop located on the road approaching to the barrage so there will be no hindrance for deployment of machinery to the working areas.

7.6.4 Proposed Traffic Routes for Transportation of Materials

i. Proposed routes for cement carrying loaders

292. Cement could be purchased directly from the cement factories in Pakistan including Dera Ghazi Khan (D.G.), Mianwali, Chakwal, Islamabad, subject to the approval of the Engineer. The recommended routes for transportation of cement to the construction site are as follow:

i. Dera Ghazi Khan- Kabirwala-Shorkot-Jhang

ii. Chakwal-Phularwan-Naya Lahore-Jhang

iii. Mianwali- Khushab-Jhang

iv. Islamabad- Phularwan-Naya Lahore-Jhang

ii. Proposed routes for coarse aggregate/crush carrying loaders

293. Most of the quarries for course aggregate and crushed stone are located in Sargodha, Sakhi Sarwar and Margalla (Taxila). The following routes may be used for transportation of the aggregate:

i. Sakhi Sarwar- D.G. Khan- Kabirwala-Shorkot-Jhang

ii. Taxila- Islamabad- Phularwan-Naya Lahore-Jhang

iii. Sargodha-Chund Bharwana-Jhang

iii. Proposed routes for sand loaders

294. The sand could be extracted from the bed of River Chenab and River Jhelum (if so considered appropriate by the Engineer). There are various local routes to approach the river and could be used for transportation of sand to the work areas.

iv. Proposed routes for steel carrying loaders

295. Structural steel may be purchased from the local supplier mainly based in big cities e.g. Lahore, Faisalabad etc. The following routes may be used for transportation of steel:

Lahore-Sheikhupura-Faisalabad-Jhang

7.6.5 Contractor's Obligations

296. The following steps are suggested for proper management of traffic on routes to be used for material transport:

i. The Contractor will display sign boards and banners about traffic diversion at places on detour routes
ii. He will display at appropriate places particularly near settlements a traffic man to control traffic
iii. Provision of speed breakers at appropriate places in consultation with/approval of the Engineer which should be removed after completion of the project
iv. Obey speed limits as prescribed in Environmental Management Plan
v. The Contractor will provide copies of his day to day traffic management program to the Engineer
vi. The Contractor will arrange a rescue team and first-aid facility in case of any accident
vii. The Contractor will keep the smoke emission of the vehicles within NEQS
viii. Water will be sprinkled on earthen routes for dust abatements
ix. No private property without permission of the owner will be used for trespassing
x. Restriction on playing radio/tapes at high volumes
xi. Restriction on use of noise producing machinery during night near settlements.

7.7 OUTLINE OF EMERGENCY RESPONSE AND CONTINGENCY PLAN

297. If any of the results of the environmental monitoring/sampling exceed specified trigger levels of the monitored parameters, the appropriate actions will be undertaken to prevent hazard to human life, property and the environment outside the operating site bounding control and minimize any immediate risks of pollution of the environments, ensure the immediate initiation of necessary investigation and management actions to identify, mitigate and remediate the cause of the accident. Initiate training and periodic testing/checking when necessary.

298. The probabilities of accident such as oil spills, accidental habitat destruction, water or air pollution, breach in cofferdam and encountering of high flow are very low. However, such accidents may occur and overall environmental emergency response method may be used:

- Obtain an early warning of the emergency conditions so as to avoid adverse impacts on the environment

- Safeguard personnel to prevent injuries or loss of life
- Minimize the impact of such event on the environment by mitigating the potential for escalation and containing of the hazards
- Site In charge should have permanent mode of contact (e.g. mobile phone or walkie talkie) with the HSE officer.
- Contact name and number of HSE officer should be available in site office and displayed on site office notice board.

299. It is the responsibility of the Contractor to provide at least one First Aider during working hours on site to handle emergency conditions and accidents. The Contractor will ensure the availability of MBBS doctor, paramedic staff and an Ambulance on full time basis at the Contractor's camp. The Contractor will also get a hospital on panel for critically injured persons. The First Aid provider at working area will perform the following duties.

- Keeping all necessary first aid medicines and bandages in the first aid box at every time
- Replace the medicines before their expiry dates to avoid any health hazard to the people
- Provide first aid to the injured in the event of accident
- Report any accident / incident to the environmental manager immediately for necessary action
- Call ambulance in case of any serious emergency

300. Emergency siren should be installed at the barrage to inform the site worker about any emergency situation. The operation of the siren will be controlled by the HSE officer or his nominated person. The designate assembly area also should be marked and informed to site worker.

301. An outline of a contingency plan for the accidental spill is shown in Exhibit –4.

Exhibit-4 - Accidental Spill Contingency plan

Step	Diesel spill	Chemical and Oil Spill
Alert / Mobilize (by work supervisor)	-Alert emergency coordinator and team	-Alert emergency coordinator and team
Initial action (by HSE Officer)	-Start log of event -Determine appropriate strategy -Notify PMO in Lahore -Notify relevant authority	-Start log of event -Determine appropriate strategy -Notify PMO in Lahore -Notify relevant authority
On-going actions (Site Incharge)	-If there is a containment breach, use earth moving equipment to construct ditch or berm to contain spill. Use pump / absorbent to recover the product. Handle the recovered product according to the COSHH sheets	-If there is a containment breach, use earth moving equipment to construct ditch or berm to contain spill. If it contaminates the river use pump / absorbent pad to recover the product. Handle the recovered product according to the COSHH sheets
Stand Down (Site Incharge / The Engineer)	-Once the incident has ended the emergency team and authorities will commence a full investigation	-Once the incident has ended the emergency team and authorities will commence a full investigation
Waste disposal (Contractor)	-Collect all contaminated soil or absorbing pads and incinerate or treat with bioremediation at a controlled access area. In case of contaminated water the water should be treated and reused or pump it back in to the river	-Incinerate or treat with bioremediation the collected product at a controlled – access area at the burn pit. Collect all contaminated soil and incinerate it at the burn pit

7.8 HEALTH, SAFETY & ENVIRONMENT (HSE) PLAN

302. It is the Contractor's obligations to provide and implement the Health, Safety & Environment (HSE) Plan. The purpose of this HSE Plan is to identify the potential impacts and to develop a mechanism for a better management of health, safety and environment (HSE) issues relating to the project. A detailed HSE Plan will be submitted by the Contractor to The Engineer/Client for approval.

303. **Objectives:** The HSE objectives include but are not limited to the following:

- To avoid all possible injuries during the execution of the project.
- To ensure all personnel employed on the Project are competent to carry out their designated safety tasks
- To develop positive health, safety and environmental protection attitude and perceptions at all levels of the project organization and create safety and environmental awareness in general
- Implement training programmes that support the achievement of the Contractor's staff and personnel's competency in relation to health, safety and environment
- Complete the project without incurring any significant property damage to the adjacent permanent structures or temporary facilities
- Complete the project without causing unnecessary risks and damage to the surrounding environment
- Implement a hierarchy of communication forums that ensure that HSE concerns are raised and addressed at all levels of the organization
- Introduce methodology of motivating "good" safety and environmental performance
- Continuous monitoring and improve HSE performance

304. **Site HSE Rules:** The following HSE rules must be strictly followed:

- HSE orientation sessions before starting work
- Wearing of personal protective equipment
- Follow the message and instructions displayed on HSE notice boards at site
- Be aware of emergency assembly points and escape routes
- Promptly report all accidents to the concerned authority
- Maintain appropriate barricades as required
- Never temper with electrical cables and appliances
- The construction site should be designated as "NO SMOKING" area
- Vehicles must be driven at designated routes and drivers must have driving license for the class of vehicle they are operating
- Vehicles shall only be parked in designated parking areas

305. **Emergency Response Plan:** The purpose of this plan is to describe responsibilities in preparation for response to and recovery from and reasonably foreseeable incident.

306. In the event of any emergency the In-charge Site HSE/Environment Manager or a member of the HSE team shall take the following actions:

- Shall attend site of incident; assess the situation and issue directions to the concerned parties and to the Fire Fighting Team in case of fire
- Ensure that message about the incident have been communicated to Site Manager / Environment Manager of the Contractor
- Evaluate the scale of the incident and decide whether additional resources are required to deal with it adequately
- Liaise with site supervision staff for withdrawing any working permits
- Liaise with site supervision staff for the mobilization of any plants and equipment necessary for dealing with the emergency
- Limit access to the area with barriers, or other means to prevent unauthorized access
- Co-ordinate the re-instatement measures following stabilization of incident
- Maintain the records of the incident/ accident and prepare a full report of the event
- Take prompt and appropriate actions for defined events such as serious illness/injury, fatality, and snake bite etc.

307. Health**, Safety and Hygiene:** The measures should include:

- Initial medical examination of all employees of the Contractor to verify their fitness for work
- Provide a group insurance cover to the workers and labour on site or in the camp, against accidents, mishaps or loss of life on duty
- Monthly talks on occupational health
- Provision of qualified medical personnel and adequate medical facilities to the staff
- First Aid trainings
- Provision of hygienic food to the employees
- Provision of drainage, sewerage and septic tanks in office buildings and camp areas
- Good housekeeping practices should be ensured at camp sites, construction sites and batching plant site

308. Security**:** Security measures should include:

- Provision of Identity Card to the employees
- Regular attendance and a controlled time keeping of all employees
- Proper checking of visitors
- Restriction of un-authorized persons to the residential and work areas
- Restriction of carrying weapons and control hunting by employees
- Provision of boundary walls / fences with proper exits to office and residential areas

7.9 TREE PLANTATION PLAN

309. The cutting/uprooting of trees will be required for the construction of additional bays, guide bank and other temporary works e.g. diversion channel on Rangpur canal. The trees that may require uprooting were identified by the environmental team. It is estimated that total 782 numbers of mature trees and 435 numbers of young trees will require to be uprooted, the details are provided in Appendix 7.3. To mitigate this environment loss the only way out is the re-plantation in the vicinity of the project area. It is proposed to plant five new

trees for each tree uprooted on site i.e. 6,085 numbers of new trees. Majority of the trees that need to be uprooted are Kikar and no protected tree is needed to be uprooted. The possible sites for new plantation include new guide bank, proposed labour camp site, and in irrigation colony and offices. All the trees need to be uprooted belongs to Irrigation Department. The Contractor will be responsible for protection and watering the new plantation during construction phase of the project and Irrigation Department during operational phase of the project. The existing public park located along left guide bank also needs to be rehabilitated. The rehabilitation may include construction of boundary wall, sitting area and children play area.

7.10 BORROW AREAS RESTORATION

310. As far as possible, excavated material generated from construction of additional bays should be utilized as fill material. If during construction further material is required or Contractor need to borrow material from any other site then the Contractor can acquire private land by entering into in accordance with a lease agreement with the land owner. Contractor will also get its approval from the Consultant. Photographs record will be kept before and after the land use as borrow area. The Contractor will not leave borrow pit in such a condition that they are unusable and could be filled with rain water and provide breeding place for mosquitoes or cause any health and safety issues.

311. Agriculture land should be restored such that it can be reused for the agricultural purpose. The restoration of agricultural land includes but not limited to the following steps:

- Remove 6 inches of the topsoil and keep it separate on site for its re-spread back on the leveled borrow area
- Excavate up to maximum 3 feet
- Level slopes as far as possible
- Place the topsoil back to restore the site as per satisfaction of the land owner

7.11 LAND ACQUISITION PROCEDURE

- Land Acquisition Act (LAA) 1894 is the primary law governing land acquisition in Pakistan. The rules and regulation of above law will be followed for the acquisition of private land
- Temporary acquisition of private land may be required for borrow material. If the Contractor proposes different locations of labour camp, batching plant etc. and requires any private land then he/she needs to follow the LAA 1894 to compensate the land owner
- Land valuation will be carried out with the help of district officer and agreed with the private land owner
- Cut of date will be announced at the day of compensation; value agreed and signed with land owner and authorities
- The compensation will be paid to the affectee(s) prior to possession of the land being taken over by the Government of Punjab

7.12 RISK MANAGEMENT PLAN

312. The outline of the Risk Management Plan is provided in this section. The detailed and more precise plan should be prepared and implemented by the Contractor’s Project

Manager. The following Plan identifies the possible hazards associated with the project activities, consequences of the occurrence, probability of the occurrence and action to reduce the risk to acceptable level i.e. low to medium.

Exhibit-5 - Risk Management Plan

Hazards	Consequences of Occurrence (Severity-L,M,H)	Probability of Occurrence (L, M, H)	Risk (L, M, H)	Action to Manage the Risk	Residual Risk
Oil, Chemical Spills	Contaminate land and control water bodies (M)	H	H	-Select the location of material storage yard away from the water bodies -Store material on bunded area with impermeable layer -Good housekeeping -Loading and unloading of material should be managed by a competent person -Spill kit should be available to deal with small spills	L
Breach in Cofferdam	Fatality or serious injury of the workers Adverse impact on aquatic life (H)	M	H	-The construction and maintenance of cofferdam should be managed by a competent person -Findings of daily inspection should be recorded and analyzed -Sand bags should be available on site to deal with small damages in the cofferdam -Monitor river quality at downstream of the cofferdam on regular basis	L
Adverse Environmental Impacts on Barrage Pond Area due to Construction Activities	Deteriorate natural habitat of pond area (L)	H	M	-Implementation of the control measures to mitigate impact on biological resources -Select appropriate plant and equipment and enforce the speed limit for site traffic to minimize the noise and dust pollution	L

Hazards	Consequences of Occurrence (Severity-L,M,H)	Probability of Occurrence (L, M, H)	Risk (L, M, H)	Action to Manage the Risk	Residual Risk
Failure in Plant & Equipment e.g. lifting gears etc.	Fatality or serious injury (H)	M	H	-Inspect all the equipment including lifting chains and ropes at the start of the work -A competent person should manage the work on site	L
Extended Canal Closure	Damage the crop within the canal command area (H)	L	M	- Haveli Main Line and Trimmu Sidhnai Link Canals are perennial canals and close only for canal cleaning work. All the work requiring canal closure should be arranged during available canal closure time. If required, use cofferdam or construct temporary bypass arrangement to continue canal water supply as per routine	L
Batching Plant	Deteriorate ambient air quality (M)	H	H	-Select batching plant location away from the living area or construct zero emission plant -Should not operate outside working hours i.e. night time or early morning -All the workers working at the plant should wear proper PPEs (breathing masks, gloves, eye protection etc.)	L
Smoke from Burning	Cause suffocation and diseases of respiratory tract (H)	M	H	-Provide smoke free fuel at labour camp -Cutting and burning of trees shall be prohibited	L
Road Accidents due to Construction Work Activities	Casualty, serious injury, damage to infrastructure (H)	M	H	-Prepare and implement Traffic Management Plan as suggested in IEE	L

Hazards	Consequences of Occurrence (Severity-L,M,H)	Probability of Occurrence (L, M, H)	Risk (L, M, H)	Action to Manage the Risk	Residual Risk
Adverse Social Impacts due to Migrating Labour from Other Parts of the Country	Extra burden on existing welfare facilities. Can Cause communicable diseases (H)	M	H	-Improve and increase the capacity of available existing services to cope with the requirement of additional users -Run a campaign within the labour camp and local community to make people aware of the cause, mode of transmission and consequences of communicable diseases e.g. HIV/AIDS, tuberculosis, typhoid, cholera etc.	L

L: Low; M: Medium; H: High

7.13 TRAINING MODULE

313. The environmental and social training will help to ensure that the requirement of the IEE and EMP are clearly understood and followed by all project personnel. The primary responsibility of providing these training to all project personnel will be that of the Contractor and Supervision Consultants. The training will be given to the different professional groups separately such as manager level group, work supervisors, skilled/unskilled labour etc. The training helps to insure the Project worker understood and followed the IEE and EMP. A Training plan of 10 sessions which will be finalized before the commencement of the project is given below:

Exhibit-6 Training Plan

Trainee	Trainer	Contents	Schedule
Selected field staff of PMO and Supervision Consultant	ESU Specialists; Environmentalist of Supervision Consultant	Environmental and social aspects, particularly sensitivities of the project; Key finding of the IEE; Social and cultural values of the area; Leadership dynamics	Before construction activities
All site personnel • Contractor: Managerial staff, Engineers, Environment, Social, Health and Safety staff • Consultants: Managerial staff and Engineers	Environmentalist of Supervision Consultant	Environmental and social aspects, particularly the sensitivities of the project; Wildlife and vegetation related sensitivities of the project; Key finding of the IEE; Mitigation measures; Contingency plan; Community issues; Social and cultural values of the area	Before and during construction stage
Construction crew	Environmentalist of Supervision Consultant and Environmental Officer of Contractor	EMP; Waste disposal plan; HSE plan	Before and during construction stage
Drivers	Environmental Officer of Contractor; Environmentalist of Supervision Consultant	HSE plan; Road safety; Road restrictions; Vehicle restrictions; Defensive driving; Waste disposal; Social and cultural values of the area.	Before and during the construction
Camp staff	Environmental Officer of Contractor	HSE plan; Camp operation; Waste disposal; Natural resource conservation; Housekeeping	Before and during the construction
Restoration team	Environmentalist of Supervision Consultant	Waste disposal; Site restoration; Leveling and restoration of borrow area	Before the start of the restoration activity

7.14 ENVIRONMENTAL MANAGEMENT COST

314. The cost provided in this section is based on the information available at up-dating feasibility level, which may be amended at detail design stage.

7.14.1 Environmental Monitoring Cost

i. For Construction Phase

315. River water should be tested on quarterly basis at the barrage during barrage structure repair, motorization for gate operating system and bela excavation activities. Samples should be collected from upstream and downstream of the barrage during the construction phase. The samples should be tested for all parameters of NEQS (inland waters) and FAO guidelines (for irrigation, livestock and poultry). The approximate cost of monitoring of river water quality, assuming 3 years of construction phase is Rs. 1,350,000. Dissolved Oxygen, pH and Electrical Conductivity (EC) of the river water should be monitored on monthly basis during construction phase.

316. Groundwater should be tested at quarterly basis. Testing is also required at the start of the project before using the groundwater as a source of water supply. The samples should be collected from all the sources of groundwater use by the Contractor onsite i.e. hand pumps, tubewell etc. The parameters need to be tested include NEQS for drinking water quality and FAO guidelines (for irrigation, livestock and poultry). The approximate cost of monitoring the groundwater over 3 years of construction phase at quarterly basis (considering two sources only) is Rs. 600,000.

317. Laboratory based air quality monitoring (NO_x, SO_x, CO, PM_{10} and $PM_{2.5}$) should be monitored at quarterly basis and visual monitoring of dust pollution should be conducted on daily basis during the project activities which are likely to produce dust. The approximate cost of Ambient Air Monitoring over 3 years of construction phase is Rs. 14, 160, 00. Noise should be monitored once a week throughout the construction phase and 3 times on each working day for every noise producing activity. The approximate cost of the Noise monitoring is Rs. 50,000.

318. Ecological environment of the area shall be monitored by the contractor's environmental team on regular basis during construction phase of the project. Any losses in flora & fauna due to project implementation shall be recorded and documented in the periodic environmental reports. The estimated cost of biological monitoring during three years of construction is Rs. 1.5 million.

319. The approximate cost of the monitoring of the physical & biological environmental parameters during construction phase is Rs. 4.79 million. Social environmental monitoring cost included in RP.

ii. For Operational Phase

River water should be tested once in pre and post monsoon season at the upstream and downstream of the barrage and at the same locations where design and construction phase monitoring was done. The samples should be tested for all the parameters NEQS (inland waters) and FAO guidelines (for irrigation, livestock and poultry). The approximate cost of monitoring of river water quality, assuming 2 years of operational phase is Rs. 400,000.

320. Groundwater should be tested once in pre and post monsoon season at water sources used for construction purposes, dug wells within 1 km from wastewater mud ponds (if any) and at the same location where construction-phase monitoring was done. The parameters need to be tested include NEQS for drinking water quality and FAO guidelines (for irrigation, livestock and poultry).The approximate cost of monitoring the groundwater over 2 years of operational phase is Rs. 400,000.

321. The approximate cost of the monitoring of the physical environmental parameters during operational phase is Rs.0.8 million.

322. The total monitoring cost for construction and operational phases is 5.59 million.

323. The environmental monitoring will be carried out by the contractor during construction phase, whereas it will be the responsibility of the Environment and Social Unit (ESU) team designated by the PMO to carry out the proposed monitoring activities during operational phase.

324. The required environmental monitoring is summarized below in Table 7.1.

Table 7-1 Environmental Monitoring Plan for the Construction and Operational Phases

Sr. #	Description	Monitoring Location	Monitoring Parameters	Frequency of Measurement	Responsibility
i. Construction Phase					
A. Physical Environmental Parameters Monitoring					
1.	Ambient air quality	Barrage, batching plant site and labor camp site	NOx, SOx, CO and particulate matter ($PM_{2.5}$, PM_{10})	Quarterly	Contractor
2.	Quantity and quality of groundwater used for domestic purposes	Camp and officer site and 1 km away from the camp and officer site	Water table depth, discharge, physical-chemical parameters, biological contamination, heavy metals and toxic organic compounds	Quarterly	Contractor
3.	Quality of surface water used for construction activities	At source of surface water used	DO, EC, pH and TDS	Monthly	Contractor
			Full suite of contaminants given in main report of IEE (in ch. 4)	Quarterly	Contractor
4.	Dust emission from the construction activities	Construction sites, camp site, access roads and borrow areas	Visual observations for dust	Throughout construction phase	Contractor
5.	Visual check for exhaust emissions from the vehicles	Construction sites, camp site, access roads, borrow areas	Visible emissions	During routine monitoring	Contractor
6.	Noise	Construction site, camp site, access roads, communities within 500 m of construction site	Noise measurement	Once a week throughout the construction phase	Contractor
7.	Soil erosion	Construction site, camp site, access roads, borrow area	Visual observations for sheet or rill/gully erosion	During routine monitoring of entire project activities especially after rains	Contractor

Sr. #	Description	Monitoring Location	Monitoring Parameters	Frequency of Measurement	Responsibility
8.	Resource utilization	Project site	Quantity of material used including water and fuel	Daily during construction phase	Contractor
9.	Solid waste generation	On camp site and Construction site	Any sign of soil or water contamination; any un-disposed waste	Daily during whole construction phase	Contractor
10.	Wastewater generation	Camp site, offices, colony, River, Canals and construction site	Wastewater generation rate, integrity and maintenance of the septic tanks and soaking pits, any sign of soil or water contamination	To be determined through water management techniques	Contractor
11.	Oil wastes /spills	Oil storage area, vehicle washing lines; any other spill area	Facilities to control the accidental oil spill as per oil spill contingency plan; any sign of soil or water contamination	Daily during construction phase	Contractor
12.	Monitoring of water flows in the Rivers and Canals	Trimmu Barrage and various location in the Canals	Water flows. Also vigilance on any water thefts in particular during low flow periods	Throughout the construction period	Contractor
B. Biological Monitoring					
13.	Visual check for vegetation/tree loss	Construction site, camp site, access roads, borrow area, River bela	Type and number of tree species uprooted	At the beginning of construction activities and as and when required basis	Contractor
14.	Visual check for fauna loss	Construction site, camp site, access roads, borrow area, River bela, fish ladder	Mammals, Reptiles and Amphibians, Fish, Birds Illegal hunting, poaching, killing of mammals and	At the beginning of construction activities and as and when required	Contractor

Sr. #	Description	Monitoring Location	Monitoring Parameters	Frequency of Measurement	Responsibility
			reptiles (river) and water birds	basis	
C. Socio-Economic Monitoring					
15.	Socioeconomic issues	At project locations; settlements	Local people recruited for all manual labor and other jobs for which local skill are available; grievances of and conflicts with communities;	During construction phase	Contractor
16.	Safety measures for local population particularly women, children and elderly people	Haulage routes Entire project area	Accident risks, particularly for local population especially women, children and elderly people	Construction period	Contractor
17.	Vulnerability to accidents, human/animal accident risks	Entire project area	Accident and health risks	Construction period	Contractor
18.	Cultural invasion	Entire project area	Community resistance to Contractor's attitude, outside labor Cultural clashes with outside labor (not observing sanctity of the holy month of Ramdan, prayer timings and local customs and traditions etc.)	Construction period	Contractor
19.	Dispute between outside and	Entire project area	Social disturbance	Construction period	Contractor

Sr. #	Description	Monitoring Location	Monitoring Parameters	Frequency of Measurement	Responsibility
	local labor force for job hunting		because of dissatisfaction with employing outsiders		
ii. Operational Phase					
1.	Restoration	At all project locations (construction sites, camp sites, offices, tracks and others)	Restoration and rehabilitation as per Restoration Plan	At the end of the construction phase	Environmental and Social Unit (ESU) of PMO
2.	Surface water quantity and quality	Upstream and downstream of the Barrage, at the same locations where design- and construction-phase monitoring was done	Flows, pH, conductivity, TSS, TDS, BOD and COD	Once in pre and post monsoon season for 2 years. Flows on a regular basis	ESU of PMO
3.	Groundwater quality	Water sources used for construction purposes and dug wells within 1 km from wastewater soaking pits (if any). At the same location where construction-phase monitoring was done	Physical- chemical parameters, heavy metals and toxic organic compounds	Once in pre and post monsoon season for 2 years.	ESUof PMO
4.	Soil erosion	At project sites and along the aligned borrow areas; at locations prone to soil erosion	Visual observations	After site restoration.	ESUof PMO
5.	Habitat disturbance	Within the project boundaries	Visual Observation	At the end of the construction phase	ESUof PMO
6.	Compensatory tree plantation	According to the tree plantation plan	Survival rate of tree saplings	Once/twice in a year for three years	ESUof PMO

7.14.2 Environmental Audit Cost

325. Environmental Audit should be carried out on annual basis and at the completion of the project by an independent consultant. The approximate cost of this item is 900,000.

7.14.3 Training Cost

326. Training is considered to be an important part of environment awareness and all site management and work supervisors should undertake periodic training.

327. The Contractor will arrange to run a proper campaign among the workers to make people aware of the causes, mode of transmission and consequences of communicable diseases e.g. HIV/AIDS, tuberculosis, typhoid, cholera etc.

328. Contractor will arrange briefing given to all workers regarding the biological resources and wetland area. It should be cleared to the worker that unnecessary and out of bound activities / movements are strictly prohibited in the barrage pond area. All labor, forest and fisheries laws should be explained to the workers.

329. The approximate cost of training the site staff is Rs. 500,000. The cost includes 10 sessions of environment awareness course each cost Rs. 50,000.

7.14.4 Plantation / Environmental Improvement Cost

330. Dismantling of right guide bank, construction of additional bays and provision of canal diversion for Rangpur Canal will require uprooting of trees. Five new trees will be planted for each tree uprooted on site. It is estimated that total 782 mature and 435 young trees will require uprooting, therefore it is proposed to plant minimum 6,085 new plant in the project vicinity. Almost all the trees belong to Irrigation Department. There will be ample space available for new plantation including new guide bank, along RMB and LMB and within the Irrigation colony and offices. The existing public park also need rehabilitation including new plantation, boundary wall etc. The total estimated cost of the plantation/environmental improvement is Rs. 6.970 million.

7.14.5 Cost of Implementation of Emergency Plan

331. The emergency plan will be prepared and presented in the final IEE report. The plan will be prepared to address any emergency conditions occur due to encounter unexpected flood, breach in cofferdam or accidental spill of oil or chemical. The approximate cost of dealing with unforeseen circumstances during construction phase is half a million rupees.

7.14.6 Special Waste Disposal Cost

332. The cost for disposal of domestic waste for 3 years of construction phase including the preparation and maintenance of the temporary storage area and burn pit on site is included in the Contractor’s contractual obligations.

333. Specialized Contractor should be hired to dispose off the special waste i.e. clinical waste, electric batteries, waste oil etc. The approximate cost of the disposal of special waste is Rs. 500,000.

7.14.7 Cost of Drinking Water & Groundwater Monitoring near Disposal Pit

334. It will be one of Contractor’s contractual obligations to arrange the supply of running drinking water at appropriate pressure to the site workers. The access of the drinking water

should be available to every site worker. The cost of this item is included in the Contractor's contractual obligations. Water sample from each water source should be collected and tested on quarterly basis to confirm its suitability for drinking purpose. The approximate cost of this item is Rs. 250,000.

335. It is proposed to treat the domestic wastewater generated from the labour camp, which should be collected with provision of underground sewer system before discharge to control water body. The cost of this item is included in the Contractor's contractual obligations.

336. A groundwater sample from the nearest source of groundwater from soaking pit i.e. tube well, hand pump, open well etc. will be collected and tested on quarterly basis by the Contractor in order to ensure that the wastewater disposal does not adversely affect the groundwater quality. The sample should be collected from the downstream of soaking pit in the envisaged flow direction of groundwater. The allocated cost for this testing is Rs. 250,000.

7.14.8 Site Visits by Regulatory Authorities

337. Inspections by stakeholder and concerned bodies for example WWF, Wildlife, Forest or Fishery Officers etc. should be facilitated in camps to facilitate a proper implementation of relevant laws. The approximate cost of this item is Rs. 500,000.

7.14.9 Traffic Management Cost

338. The Traffic Management Plan will be prepared by the contractor to manage the site traffic and public traffic during construction phase of the project to minimise the interruption in the flow of traffic and its adverse impacts on the environment of area. The approximate cost allocated for this item is 1 million rupees. The cost includes the relocation of toll plaza including construction of rest area (sitting area, kitchen, and wash room), localized road widening and the barrier, provision of installation of temporary traffic signals, controlling dust pollution, provision of barricading fence, safety sign boards and speed breakers.

7.14.10 Restoration Cost

339. The area being under the use of Contractor during construction phase should be restored at the completion of the project to the original level without any additional cost by the Contractor.

Table 7-2 Environmental Management Cost

Sr. #	Activity	Cost (million Rs.)
1	Environment Monitoring Cost	5.59
2	Training Cost	0.5
3	Environmental Audit Cost	0.9
4	Emergency Plan	0.5
5	Plantation / Environmental Improvement Cost	6.970
6	Special Waste Disposal Cost	0.5
7	Cost of Drinking Water & Groundwater Monitoring near Disposal Pit	0.5
8	Site Visits by Regulatory Authorities	0.5
9	Traffic Management Cost	1.5
Total		17.46

Contractor's Obligation

340. The Contactor will carry out the following obligations:

- **Environmentally Responsible Procurement Plan**

341. The Contractor wherever possible, would ensure that the goods and services procured under the Contract have been produced in a responsible manner with a view to resource efficiency, waste minimization and environmental considerations. He shall utilize the borrow pit areas after approval of the Engineer and make every possible effort to avoid using cultivated land for the above purposes. The Engineer will also approve the traffic route/plan for the above purpose to cause least possible inconvenience to the nearby residents/road users.

342. Similarly the Contractor would utilize the aggregate sources subject to the approval of the Engineer and shift the aggregate and other construction material to the site in a responsible and environmentally friendly manner.

- **Disposal of waste construction material**

343. The Contractor shall in consultation and approval with the Supervision Consultant, select and abide by the selection, a site for disposal of waste construction material as well as the material used for construction of coffer dam. Contravention to this clause may tantamount to contravention to contract and the Contractor will be responsible of removing the material dumped on a wrong site, at his own expense as early as possible. In case of delay, the Contractor will pay a fine, suggested by the supervision consultant, for his negligence.

- **Adjustment with unstable locations appearing during construction especially the foundation**

344. In case an unstable location appears during construction, especially the foundation, the Contractor shall immediately inform the Supervision Consultant expressly providing full technical details about the problem. The Supervision Consultant will inspect the site; preferably the same day the report is received and will, if necessary, agree to make modifications and changes in the design to stabilize the situation such as change in the depth of foundation. Contractor will not make any changes in the specification without express approval of Supervision Consultant. Contravention to this provision will mean unauthorized construction carried out for which RE will issue dismantling orders.

- **Location of labour camps, material dumps / depots, equipment and machinery yards, approach roads and routes**

345. Punjab Irrigation Department land is available for labour camps, batching plant, material depots, equipment and machinery yard, link roads or other activities related to these matters. The Contractor will choose particular sites within the overall campus with the consultation with Supervision Consultant and PMO. If the Contractor chooses to locate his facilities on a private land, he will himself be responsible for any compensation, resettlement or rehabilitation process and costs. Supervision Consultant or Punjab Irrigation Department shall not be involved in acquiring or using the land in making any payments for doing so. If the Contractor selects different location for the batching plant, labour camp, borrow area etc.

then the Contractor will develop base line data for the new location on his own cost and resources.

- **Rehabilitation of construction and extraction sites**

346. The Contractor shall carry out construction work exactly on the same site and according to the same design as provided in the Tender Documents. Also the camps site, the material depot, the machinery and equipment yard, link roads, borrow areas and coffer dam shall, after the completion of construction, be restored and rehabilitated and brought to at least the same condition, in which these were handed over to the Contractor. A set of Photographs and a video tape film shall be prepared to show the pre-construction sites and post-construction rehabilitated sites.

- **Drainage, paths, roads, linear fixtures crossed/damaged by machinery moving to and from the construction sites**

347. During the construction, if the Contractor's vehicles moving to and from the construction site(s) cause any damage or disruption of services pertaining to drainage systems, paths, roads linear fixtures e.g., transmission lines and fences, the Contractor shall get the damage repaired and services restored within the shortest possible time of the damages, failing which the Supervision Consultant will get an assessment of the damage and losses and debit that amount to Contractors account and the next payment shall be made to Contractor after deducting the debited amount.

- **Earthen embankments or concrete work vicinity scouring on the protection bunds or on the main sill structure**

348. All such spots where there is a possibility of scouring or soil erosion shall be protected with protection wall or stone rip-rap subject to the Engineer approval, failing which the payment of the Contractor shall be with-held.

- **Discharge spill or dumping on any building, house, graveyard, archaeological site (established or newly found), unstable slopes, un-compacted embankment or leaking into construction area**

349. The Contractor shall be contractually bound to not to allow or cause discharge spill or dumping on any building, house, graveyard, archaeological site (established or newly found), unstable slopes, un-compacted embankment or leakage of material/waste into the construction area. Any such failure shall be duly noted by Supervision Consultant during site inspections and Contractor shall immediately remedy the situation failing which the payment of the Contractor shall be with-held and the damage so caused shall be debited to Contractor's account under the contractual provisions.

- **Diesel and other fluids spilling over to River water from construction machinery**

350. The Contractor shall ensure that his construction machinery is always in first class working order and no spilling of Diesel or any other fluids into the River, is caused by the defective machinery of the Contractor. For any such spill the Contractor shall pay the environmental compensation to be assessed by Supervision Consultant and the said amount shall be debited towards the payment of the Contractor.

- **Protection of construction work from floods**

351. The Contractor shall, throughout the construction work, manage to keep an eye on the flood position of the barrage and shall remain in touch with Flood Control Centre and remain equipped with means and equipment for taking protective measures to protect the works under construction. Punjab Irrigation Department shall not be responsible for any damage caused by floods and any works washed away shall be reconstructed by the Contractor at his own cost and within the tenure of the contract.

- **Providing diversion to maintain routine river and canal flow**

352. The Contractor shall, in consultation with Supervision Consultant provide diversion to maintain canal water flow and cofferdam for maintaining the river flow. Losses caused to construction work due to poor or mismanaged canal diversion shall be considered as negligence on the part of contractor; any damages or losses caused due to this negligence shall be borne by the contractor.

- **Control on air quality by not allowing machinery to cause dust, smoke or noise pollution**

353. The Contractor shall not cause deterioration of air quality by using old or ill maintained machinery which raise excessive dust, produce excessive smoke or cause excessive noise pollution. The Contractor shall follow strict standards of maintenance of machinery, provide qualified and trained drivers and operations for the vehicles. The Contractor shall also sprinkle water on kacha roads to be used as link roads, and sites where the earth is to be dumped. The Contractor shall provide protective masks to his work force. Failure to do so shall be taken as serious contravention of the contract and shall cause the payment to be deferred till the correction of the situation.

- **Control of dust or other pollutants from stored materials, material depots or spoil heaps**

354. The Contractor shall:

(a) Locate his material depots and spoil dump as far away from the villages/community “Deras” as possible.
(b) Keep all such materials covered for effective control of the fugitive dust.

355. Failing to do so, the Contractor will bear the cost which may have to be incurred on arranging remedy to defaults.

- **Use of outdated machinery**

356. The Contractor shall obtain a certificate from Vehicle Examiner working under the Supervision Consultant but paid by the Contractor, that all the machinery employed is either new or in first class fitness condition so as not to cause smoke or oil leakages. Supervision Consultant will not allow the use of any outdated machinery.

- **Protection the Biological Resources**

357. The Contract shall ensure that:

a) Unnecessary and out of bound activities/movements are not done outside the campus allotted to him for setting-up the labour camp, material depots and machinery yard etc.
b) No fire arms are carried by any of the employees or labour.

c) All Environment, Labor, Forest, Wildlife and Fisheries Laws are fully respected and abided by the Contractor and his work force.
d) The Biodiversity is respected and saved on its terrestrial, aquatic and aerial habitats.
e) Necessary sign boards indicating boundaries of the barrage pond area are displayed to make labour, visitors and members of public to remind them of their obligations towards Biota.
f) Inspections by Labor, Wildlife, Forest and Fisheries Officers are facilitated in camps to facilitate a proper implementation of relevant Laws.
g) Communities are given awareness and are involved in proper protection of the Biota inside and around the Project site.

- **Respect for socio-economic and cultural values and heritage**

358. The Contractor shall be bound to:

(a) Ensure that no damage or disruption is caused to the social infrastructure or public services being provided to the people e.g., education, health, electricity supply, drinking water supply, and facilities for public gathering or religious congregations.
(b) Ensure the Contractor or his employees remain above the local Tribal tensions especially the disputes over distribution of canal water and use of aquatic life.
(c) Ensure that existing ownership of land around the Project is respected.
(d) Ensure that if some construction material has to be procured from or through a member of local community, it must be by a proper Social Framework Agreement signed by all the parties.
e) Ensure that no damage or adverse effect is caused to archaeological sites (in case find on site) graveyards and burial places.

- **Public safety, health and safety at construction site, including measures against HIV/AIDS and life insurance**

359. The Contractor shall:

a. Put up temporary but prominent sign boards in all of the project activity area warning people against likely hazards which can be caused due to certain activities. (Also to be reflected in SFA).
b. Arrange to run a proper campaign in the labour camp, to make people aware of the causes, mode of transmission and consequences of HIV/AIDS.
c. Strengthen the existing Basic Health Unit (BHU) for the benefit of the labour as well as the surrounding villages.
d. Ensure proper cleanliness and hygienic conditions at labour camps by ensuring a clean mess, proper drainage and suitable disposal of solid waste. Inoculation against Cholera will be arranged at intervals as recommended by Health Department.
e. Keep all the camps, offices, material depots, machinery yards and work site open for the inspection of health and safety measures, and related documents and include in the contract document the text regarding accessibility to the camps etc.
f. Provide proper overall, helmet, field boots, earplugs and others gears at work site as a precaution against any mishap, and interlink various parts of the construction complex with local wireless telephones, which may also be fitted in the vehicles.
g. Provide a group insurance cover to the workers and labour on site or in the camp, against accidents, mishaps or loss of life on duty.

h. Provision of clean drinking water at site and camp for workers and labors.

- **Employment of locals in the construction work**

360. The Contractor as an obligation of the Contract will employ, subject to availability and work ability, maximum number of local labour for construction work.

- **Impact due to material and waste left behind when construction or dismantling Cofferdam(s)**

361. A careful planning of construction and dismantling is the Contractor's contractual obligation. It is his further obligation to remove all left over material and construction waste. The Contractor shall ensure that turbidity / dissolved oxygen will not exceed from the acceptable levels during construction or dismantling of cofferdam(s). Contractor will consult with the environmentalist from the supervising consultant to get approval of the process of constructing / dismantling of cofferdam(s). It is also obligation of the Contractor to remove at least 50% of the cofferdam construction. Furthermore, all removable sheet piles, if any, will be completely removed or at least underwater cut at river bed level after completing the construction activities. Failure to complete the task will make the Contractor liable to deduction of total cost of the sheet pile left, as well as the cost of the construction of cofferdam left behind lesser than 50%. Disposal site(s) for the dismantled cofferdam(s) will be finalized by RE and ESU.

7.15 CONCLUSION

362. As there are no significant adverse environmental or social issues involved during construction and operational phase of the project it may be concluded that the existing structures of Trimmu Barrage could be rehabilitated and strengthened for the larger betterment of irrigators, whose income would increase due to assured and enhanced irrigation supplies.

8. PUBLIC CONSULTATION

8.1 GENERAL

363. Timely and broad-based stakeholder involvement is an essential element for an effective environmental assessment, as it is linked with Project planning, appraisal and development in general. Public involvement during Initial Environmental Examination (IEE) has a tendency to improve project design environmental soundness and social acceptability.

364. Contrary, IEEs that fail to be inclusive lean to have less influence over planning and implementation and resulted in high environmental and social cost. Considering more stakeholder involvement in IEE process resulted in improving the quality of the environmental assessment (EA). This is due to the prediction of the impacts using IEE often requires many years information and good quality base line data. Environmental Assessment that involves broad-base stakeholder consultation has greater potential to assess wider information resource-base and generation of accumulating knowledge of the local environment.

8.2 LEGAL REQUIREMENT FOR PUBLIC CONSULTATION

365. According to the IEE and EIA Review Regulations 2000 and ADB Environment Policy public consultation is mandatory for environmental assessment study. The public hearing for R & U of Trimmu Barrage was held on 22nd January, 2014 and the minutes of meeting are attached in Appendix 8.1.

8.3 CONSULTATION METHODOLOGY

8.3.1 Stakeholder Identification

366. They are grouped into the following main categories

i. Local Communities
ii. Government & Local Government Bodies
iii. Civil Societies
iv. Private Sector Bodies

367. The groups or institutions identified as stakeholder under each category are listed below

I. Local Communities

a) Local labour (landless)
b) Farmers of all land holding categories
c) Fishing communities
d) Female-head household
e) Small business owner

II. Government

368. There can be many departments who can be indirectly related to the project but those who have high relevance include;

a) Punjab Irrigation Department (including both top and low ranked officers and staff)
b) Punjab Forest Department, Wildlife, Fisheries Department
c) EPA- Punjab

III. Civil Society Institution that may have relevance to the Project includes various NGOs working in the construction and social development

IV. Private sector bodies can be commercial e.g. plantation manager, fishing Contractors etc.

8.3.2 Consultation Process and Technology

369. Public Consultations has been carried out in two phase first during the early stage, reconnaissance survey and subsequently during the preparation of IEE. Consultation with stakeholder will subsequently be carried out throughout the Project cycle by different groups of the project teams at different stages of the study. Consultation process includes focus group discussion, village meetings and semi-structured interviews and one to one meeting or interviewed in the case of government, private and civil society institutions. During the consultation process, the stakeholders were briefed about the project objectives and scope. Their fears and suggestions were recorded. Women consultations was undertaken, under Gender analysis and explained about the benefits of the project.

370. All meetings and discussion were held during day time on working days to ensure the availability and participation of the group/individual being consultant. The consultation is sensitive to the local language and cultural needs and wherever expatriate staff is involved local interpreters will be used, as the staff observed local norms.

8.3.2.1 Stakeholder Consultations

371. Local community and Forestry, Wildlife and Fishery department has been consulted under stakeholder consultation and their point of view and information provided are included in this study. Chronological consultations with all stakeholders are summarized in Table-8.2. After finalization of the scope of work a community consultation was held in November 2013, and the community was informed that the project is now being finalized. In addition to these community and institutional consultations, a formal announced public hearing to experts, community members and civil society was also held, as required by the Punjab Environmental Protection Act 1997 and the Pakistan Environmental Protection Act 1997. The public hearing was held on 22nd January 2014 and environmental assessment was thereafter approved by the Punjab EPD.

8.4 OBJECTIVES ACHIEVED WITH THE PUBLIC CONSULTATIONS

- Eliminate the scare that the canals will remain closed outside the routine closure period during the construction period. It was clarified that due measures will be taken that canals would run as per usual program and canal closure will take place only under the notified canal closure program.

Name of Canal	Status of Canal	Periods when canal would close
Haveli Main Line Canal	Perennial	December to January
Trimmu Sidhnai Link Canal	Perennial	December to January

Rangpur Canal	Non-Perennial	October to March

- No change would ordinarily be made in existing capacity of canals during construction phase, so no impact is anticipated on the canal command area. It was explained that project aimed at rehabilitating the Trimmu Barrage and increase the capacity of the barrage by strengthening embankments, Barrage structure and dredging the silt within the pond area of the barrage. The local community was informed about the surface water quality and the water quality of the existing hand pump is fit for drinking purpose without any treatment as identified in the baseline study.

- Resettlement Plan (RP) will be prepared to acquire private land and facilitate the affectees and submitted to the authorities under different cover.

- Eliminate the fears that the large number of workers and labour will be brought by the Contractor from outside the project area and ensure them that an opportunity of employment generated by the project shall be availed by the people of the area.

- It was clarified that no access roads or public paths damage or alter for the Contractor(s) activities i.e. labour camp, material depot, machinery yard etc.

- It has been ensured to the local community that maximum employment will be offered to the local labour/workers. They were given the following illustrative numbers of skilled and unskilled labour that will be required for the project:

Table 8-1 Employment Opportunity at Trimmu Barrage Rehabilitation and Upgrading Work

	Approximate total no.	Minimum percentage of locals
Skilled Labour	105	As much as possible
Semi Skilled Labour	465	As much as possible
Unskilled Labour	930	As much as possible

a) Fishermen of the community believe that the construction activities would not put adverse effects on fishing industry as most of the Project activities schedule within half kilometer of upstream and downstream of the barrage structure, which is a prohibited area for fishing on commercial basis. However the strengthening of the embankments work will raise the noise level of the surrounding area and could affect the fishing activities next to the embankments.
b) Question was passed by the community that presence of some 1500 male members of labour from general locality of project will not only restrict the chances of women employment, but also cause moral and social problems for the free movement of local women folk in the area. It was clarified that strict discipline would be exercised on the labour force by providing stringent clauses in the contract document. To cut out the possibility of any moral issues or Communicable diseases spread, a well-organized campaign shall be run.

c) Road and kacha paths within the project areas would expose to the heavy traffic due to Project activities. This could raise the road accident and deterioration rate of the roads. It was clarified that due Sinology and traffic management plan would be put into operation to minimize the impacts.
d) With arrival of about 1500 additional persons, the price of accommodation in project area and Trimmu Barrage markets would go up, and price index would go unfriendly for the local villagers. It was clarified that a Labour Camp will be constructed to accommodate for workers. It was also explained to the local community by some trade oriented people that instead of rise in price those would fall because larger market activities reduce the profit margin and price. More economical activities and better employment opportunities will be available for local community due to the rehabilitation and upgrading of the barrage. This will help in lowering the poverty line in the area.

The following points came up in open acceptance of the project:

a) Greater employment opportunity was most welcome
b) Greater economic activity will alleviate poverty
c) Trimmu barrage will be saved and given longer base of life and thus the dependent agriculture
d) Present level of services i.e. electricity, communication, schooling, water supply etc. is likely to improve

Social Framework Agreement

1. This is a Draft Social Framework Agreement between an official representing the Irrigation Department, Government of Punjab and the villagers' Committee, whose names have been inscribed below in their presence and full consent.

Sr. # of Village	Village	Name (Two from each Village)	Father's Name
1.			1.
			2.
2.			1.
			2.
3.			1.
			2.
4.			1.
			2.
5.			1.
			2.
6.			1.
			2.
7.			1.
			2.
8.			1.
			2.
9.			1.
			2.

2. We the committee of village leaders/elders has agreed unanimously to nominate _____ S/O _____ as our Chairman and authorize him to enter into an SFA with PID on our behalf. We understand and pledge that this SFA will be a binding on us and PID throughout the currency of the construction work as well as the operational phase.

Signatures or Thumb Impression (TI) of the Chairman and the Members of the Villagers Committee

Sr. #	Name	Signatures/TI
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		

3. By mutual consent it is agreed that Punjab Irrigation Department
   i) Shall not occupy any agriculture land or acquire any other land during the construction of the project
   ii) Shall not cause any damage or reduction in the water supply in the canals during the construction period of the project, except in case of force majeure e.g. high floods, strong storms or any other act of God
   iii) Shall not cause any disturbance to the wildlife, wetland, archeological heritage or a place of worship
   iv) Shall not interfere in the social political or tribal balance of the area
   v) Shall wherever possible, facilitate better services and supplies to the area e.g. schooling, health, awareness on epidemic and communicable diseases, electricity and road/rail communication

4. Also, by mutual consent it is agreed that all the villagers residing in the area influencing project (name of the villages listed in para 1 above), collectively and severally:
   i) Shall not interfere in the location of labour camps, material depots, equipment yards and all the approach roads to be used during project construction phase, all of which will be located on the lands of PID
   ii) Shall not interfere if the Punjab Irrigation Department decides to shift the construction of works elsewhere on a more suitable site as long as the activity remains on PID's own land
   iii) Shall not receive any discharge of water slurry or oil spills to any graveyard or archaeological site
   iv) Shall not cause any damage to wildlife or forest resources of any wildlife reserve and no villagers will be involved in killing, poaching or illegal hunting

v) Shall not allow reduction or official interference in our existing services and facilities e.g. education, health, electricity, water supply, religious and social congregations
vi) Agree that in case the Contractor wishes to obtain some material from the private lands or wishes to make use of any piece of land outside the Punjab Irrigation Department land that would invoke a new agreement between the villagers and the Contractor and PID or Govt. of the Punjab shall not be involved in that in any way
vii) Agree to respect and observe the cautions on the sign boards displayed by project authorities and shall not remove or cause to be removed any signboards or installations put up by PID or their representatives

(Add more conditions if required as per the prevailing circumstances)

This SFA has been signed this _____ day of _____, at _____

Signatures Resident Engineer (Full name and address)	Signatures Chairman Villagers' Committee (Name and Address)

Counter signed

Signature
Designated Official of Punjab Irrigation Department
(Full name and address)

8.5 GRIEVANCE REDRESS MECHANISM

372. Displaced Persons (DPs) will be fully informed of their rights and the procedures for addressing complaints whether verbally or in writing during consultation, survey and the time of compensation. Proper care will always be taken to prevent grievance rather than going through a redress process. This can be obtained through careful RP preparation and implementation by ensuring full participation and consultation with the APs, extensive communication and coordination with the community, involvement of PMO. During land valuation, compensation and resettlement process, various grievance can arise that might require mitigation. The major grievance that can arise may include;

- DPs not enlisted
- Losses not identified correctly;
- Compensation/ assistance inadequate or not as per entitlement matrix;
- Dispute about ownership
- Delay in disbursement of compensation/ assistance; and
- Improper distribution of compensation/ assistance in case of joint ownership.

373. Thus, the main objective of the grievance redress procedure will be to provide a mechanism to mediate conflict and cut down lengthy litigation, which may delay this

development project. It will also provide a public forum to raise their objections or people who might have objections or concerns about their assistance, through conflict resolution to address these issues adequately.

374. A Grievance Redress Committee (GRC) will be established constituting the representatives of Project Implementation Unit (PIU), Social Safeguard Staff of PMO, Executive Engineer Trimmu and DFs/DPs or local community. This group will organize at the beginning of project implementation under request of PMO and will be trigged by a grievance lodged. The GRC will hear the complaint and if found justified, will support its lodging at the PMO. The Deputy Director Resettlement will be focal person, shall be responsible for co-ordination between the members of the committee and the complaint, shall make all arrangements to convene meetings of the committee, and shall compile the record of each meeting. The GRC will convene its meetings on monthly basis or upon receipt of the grievance complaint as detailed in the Grievance Resolution Mechanism below. Such meeting will be convened either in the office of the chairperson of GRC. As the GRC is not a regular institution, requiring specified premises for office, however in the XEN office space as well as logistics support will be provided to the GRC. Thus, special budget for establishment of the office of the GRC will not be required.

Grievance Redress Process

375. The process of grievance redress is discussed as below:

a) Land/ Crop Compensation Issues:

i. First, complaint resolution will be attempted at site (village level) through the involvement of the PIUs and informal committee
ii. If still unsettled, a grievance can then be lodged to the DO (Revenue)/ LAC who has 14 days to decide on the case
iii. If no solution was reached, a grievance can be lodged with support of the GRC to the PMO. The DP must lodge the complaint within one month of lodging the original complaint with the DO (Revenue)/LAC, and must produce documents supporting his/ her claim. The PMO will provide the decision within 21 days of registering the complaint. The PMO/PMU decision must be in compliance with this LARF provision
iv. In case, the grievance redressal system does not satisfy the DFs/ DPs, they can pursue further by submitting their case to the appropriate court of law as per the process set out in Section 18 to 22 of the LAA 1894

b) Project/ Other Items Compensation Issues

i. First, complaints resolution will be attempted at site (village level) through the involvement of the PIUs and informal committee
ii. If still unsettled, a grievance can be lodged to the GRC, which has 14 days to respond
iii. If no solution reaches, a grievance can be lodged with support of the GRC to the PMO. The DP must lodge the complaint within one month of lodging the original complaint with the GRC and must produce documents supporting his/ her claim. The

PMO will provide the decision within 14 days of registering the complaint. The PMO decision must be in compliance with this LARF provision

iv. If the grievance redressal system does not satisfy the DPs, they can pursue further by submitting their case to the appropriate court of law

376. GRC will meet at least once a month and the decision of GRC would be final. In general, the functions of the GRC shall be to:

I. Provide support to DPs on problems arising out of their land/ property acquisition and/ or eviction from the CoI;
II. Record the grievance of the DPs, Categorize and priorities the grievances that need to be resolved by either committee; and
III. Report to the aggrieved parties about the development regarding their grievances and the decision of the project authorities

377. All expenses incurred in arranging grievance negotiations and meetings of GRC as well as logistics required, shall be arranged by the project executing agency/ implementation agency.

Table 8-2 Public Consultations

Sr. #	Meeting Place	Date	Participants	Main-Concern	Replies
1.	Forest Department Office	21-02-09	District Officer Forest Jhang Representative of PIAIP Consultants Ahsan Iqbal Bela (Environmental Specialist)	Wildlife habitat adversely impacted due to vegetation clearance during construction activities.	The idea of undertaking new plantation was appreciated which will enhance the biodiversity of the area. Ensure that fisheries, wildlife and forest laws will be fully respected and abided by the Contractor and his work force.
2	Wildlife Department Office	21-12-09	District Officer Wildlife Jhang Representative of PIAIP Consultants Ahsan Iqbal Bela (Environmental Specialist)	Wildlife habitat adversely impacted due to the construction activities.	It was explained that all the wildlife, forestry & fishery laws will be implemented on site to avoid adversely affecting the wildlife and flora of the area.
3.	Punjab Irrigation Department at Barrage	22-12-09	Punjab Irrigation Department Staff Malik Mazhar (Sub Engineer) Representative of PIAIP Consultants Ahsan Iqbal Bela (Environmental Specialist)	The concern was raised that the improvement is required in the existing infrastructure including Officer's Colony etc. The canal closure shall be avoided and significance of continuous routine water supply in all canals was highlighted.	It was ensured that all the activities that require canal closure will be carried out during annual canal closure period and if canal closure is required then alternate water supply will be arranged. The labour camp will be a permanent structure which will be handed over to other departments e.g. Irrigation Department.
4.	At the Barrage	03-02-10	Public Members Bahawal Bakhsh (Government Guard) Mazhar Hayat (Khokha Owner) M.Ashraf	The benefits from the project to the local community Arriving of possibly 1500 labour from other part of the country may adversely impact the social life and the local women movement in the area	Protection from flood, leakage of water through the gates will be minimize and so there will be more water in canals Job opportunities to the local community It was clarified that strict discipline would be exercised on the labour force to restrict the possibility of any moral issues or spread of

Sr. #	Meeting Place	Date	Participants	Main-Concern	Replies
			(Shopkeeper) M.Ishfaq (Shopkeeper) Haseeb (Shopkeeper) Noor Jamal (Labour) Allah Ditta (Labour) Haji M. Shaban (Farmer) Representative of PIAIP Consultants Ahsan Iqbal Bela (Environmental Specialist)		communicable diseases.
5.	Head Office Wildlife Department at Lahore	29-05-10	Syed Iftikhar Hussain Shah (Director General) M. Naeem Bhatti (Deputy Director) M. Anwar Mann (Assistant Director) Representative of PIAIP Consultants Ahsan Iqbal Bela (Environmental Specialist)	The barrage pond area is a wildlife habitat. Protect the wildlife habitat by minimizing the vegetation clearance and hunting of species.	The idea of undertaking new plantation was appreciated very much and agreed that this will enhance the biodiversity of the area by the Wildlife Department. It was ensured that the wildlife, forestry & fishery rules & laws will be implemented during design and construction phase of the project to minimize the adverse impacts on the ecology of the area.

Sr. #	Meeting Place	Date	Participants	Main-Concern	Replies
			Nosheen Aslam (Junior Environmentalist) Afaf Ayesha (Junior Environmentalist)		
6.	Head Office Meteorological Department at Lahore	04-04-12	Syed Pervaiz Hussain (Coordinator Officer) Representative of PIAIP Consultants Ahsan Iqbal Bela (Environmental Specialist) Nosheen Aslam (Junior Environmentalist) Afaf Ayesha (Junior Environmentalist)	Heavy rainfall during monsoon (July, August) cause flooding and dust storms occasionally hit during summer season.	It was informed that the emergency response and contingency plan will be prepared to handle emergency conditions (including flooding, dust storms, heat strokes etc.)
7.	Social and Environmental Management Unit (SEMU) at Lahore	06-05-12	Shahid Habeeb (Deputy Director) Representative of PIAIP Consultants Ahsan Iqbal Bela (Environmental Specialist) Nosheen Aslam (Junior Environmentalist) Afaf Ayesha (Junior Environmentalist)	Extra burden on existing services e.g. health facility, education, electricity etc. Worries were expressed by the local community regarding the extended canal closure during construction phase. Project's heavy traffic may damage the roads and kacha paths of the area Possible impact of water logging due to alteration in water level in result of project activities	It was explained that due signage and traffic management plan would be put into operation to minimise the disruption of traffic. Regular spraying of water would be undertaken to minimize the dust pollution. It was clarified that due measures will be taken that canal will run as per usual programme with no effect on the discharge volume and will close only during routine annual closure It was explained that there will be no change in pond water level, therefore inundation or water logging will not be the issue due to implementation of the project.

Sr. #	Meeting Place	Date	Participants	Main-Concern	Replies
8.	Directorate of Land Reclamation (DLR) at Lahore	11-05-12	M. Farooq (Senior Research Officer) Tariq Yameen Representative of PIAIP Consultants Ahsan Iqbal Bela (Environmental Specialist) Nosheen Aslam (Junior Environmentalist) Afaf Ayesha (Junior Environmentalist)	Land productivity may be deteriorated due to change in pond water level or change in groundwater level.	It was ensured that there will be no adverse impact on groundwater quality from project implementation. Pond water level will remain same. Regular monitoring of groundwater and river water will be undertaken during construction phase.
9.	SCARPS Monitoring Organization (SMO) at Lahore	11-05-12	SCARPS Monitoring Organization (SMO) Staff Javaid Abro (Director) Representative of PIAIP Consultants Ahsan Iqbal Bela (Environmental Specialist) Nosheen Aslam (Junior Environmentalist) Afaf Ayesha (Junior Environmentalist)	Land productivity may be deteriorated due to change in pond water level or change in groundwater level.	It was ensured that there will be no adverse impact on groundwater quality from project implementation. Pond water level will remain same. Regular monitoring of groundwater and river water will be undertaken during construction phase.

Appendices

APPENDIX 2.1

NATIONAL ENVIRONMENTAL QUALITY STANDARDS

(1) for Annex, I the following shall be substituted, namely:_____

Annex-I

"NATIONAL ENVIRONMENTAL QUALITY STANDARDS FOR MUNICIPAL AND LIQUID INDUSTRIAL EFFLUENTS (mg/I, UNLESS OTHERWISE DEFINED)

S. No.	Parameter	Existing Standards	Revised Standards Into Inland Waters	Into Sewage Treatment (5)	Into Sea ( )
1	2	3	4	5	6
1.	Temperature or Temperature Increase *	40^0C	≤3°C	≤3°C	≤3°C
2.	pH value (H^+) .	6-10	6-9	6-9	6-9
3.	Biochemical Oxygen Demand $(BOD)_5$ at 20^0C (1)	80	80	250	80**
4.	Chemical Oxygen Demand (COD) (1)	150	150	400	400
5.	Total Suspended Solids (TSS)	150	200	400	200
6.	Total Dissolved Solids (TDS)	3500	3500	3500	3500
7.	Oil and Grease	10	10	10	10
8.	Phenolic compounds (as phenol)	0.1	0.1	0.3	0.3
9.	Chloride (as $C1^-$)	1000	1000	1000	SC***
10.	Fluoride (as F^-)	20	10	10	10
11.	Cyanide (as CN^-) total ..	2	1.0	1.0	1.0
12.	An-ionic detergents (as MBAS) (2)	20	20	20	20
13.	Sulphate (SO_4^{2-})	600	600	1000	SC***
14.	Sulphide (S^{2-})	1.0	1.0	1.0	1.0
15.	Ammonia (NH_3)	40	40	40	40
16.	Pesticides (3)	0.15	0.15	0.15	0.15

1	2	3	4	5	6
17.	Cadmium [4]	0.1	0.1	0.1	0.1
18.	Chromium (trivalent and hexavalent [4] ..	1.0	1.0	1.0	1.0
19.	Cooper [4]	1.0	1.0	1.0	1.0
20.	Lead [4]	0.5	0.5	0.5	0.5
21.	Mercury [4]	0.01	0.01	0.01	0.01
22.	Selenium [4]	0.5	0.5	0.5	0.5
23.	Nickel [4] ..	1.0	1.0	1.0	1.0
24.	Silver [4]	1.0	1.0	1.0	1.0
25.	Total toxic metals	2.0	2.0	2.0	2.0
26.	Zinc	5.0	5.0	5.0	5.0
27.	Arsenic [4] ..	1.0	1.0	1.0	1.0
28.	Barium [4]	1.5	1.5	1.5	1.5
29.	Iron	2.0	8.0	8.0	8.0
30.	Manganese	1.5	1.5	1.5	1.5
31.	Boron [4]	6.0	6.0	6.0	6.0
32.	Chlorine	1.0	1.0	1.0	1.0

Explanations:

1. Assuming minimum dilution 1:10 on discharge, lower ratio would attract progressively stringent standards to be determined by the Federal Environmental Protection Agency. By 1:10 dilution means, for example that for each one cubic meter of treated effluent, the recipient water body should have 10 cubic meter of water for dilution of this effluent.

2. Methylene Blue Active Substances; assuming surfactant as biodegradable.

3. Pesticides include herbicides, fungicides, and insecticides.

4. Subject to total toxic metals discharge should not exceed level given at S. N. 25.

5. Applicable only when and where sewage treatment is operational and BOD_5=80mg/I is achieved by the sewage treatment system.

6. Provided discharge is not at shore and not within 10 miles of mangrove or other important estuaries.

* The effluent should not result in temperature increase of more than 3^0C at the edge of the zone where initial mixing and dilution take place in the receiving body. In case zone is not defined, use 100 meters from the point of discharge.

** The value for industry is 200 mg/I

*** Discharge concentration at or below sea concentration (SC).

Note:_____ 1. Dilution of liquid effluents to bring them to the NEQS limiting values is not permissible through fresh water mixing with the effluent before discharging into the environment.

2. The concentration of pollutants in water being used will be substracted from the effluent for calculating the NEQS limits."

Annex-III (Amended)

NATIONAL ENVIRONMENTAL QUALITY STANDARDS FOR MOTOR VEHICLE EXHAUST AND NOISE

(i) For Inuse Vehicles

S. No.	Parameter	Standards (maximum permissible limit)	Measuring method	Applicability
1	2	3	4	5
1.	Smoke	40% or 2 on the Ringlemann Scale during engine acceleration mode.	To be compared with Ringlemann Chart at a distance of 6 metres or more.	Immediate effect
2.	Carbon Monoxide.	6%	Under idling conditions : Non-dispersive infrared detection through gas analyzer.	
3.	Noise	85 db (A).	Sound-meter at 7.5 meters from the source.	

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EXTRAORDINARY
PUBLISHED BY AUTHORITY

ISLAMABAD, FRIDAY, NOVEMBER 26, 2010

PART II

Statutory Notifications (S. R. O.)

GOVERNMENT OF PAKISTAN

MINISTRY OF ENVIRONMENT

NOTIFICATIONS

Islamabad, the 18th October, 2010

S. R. O. 1062(I)/2010.—In exercise of the powers conferred under clause (c) of sub-section (I) of section 6 of the Pakistan Environmental Protection Act, 1997 (XXXIV of 1997), the Pakistan Environmental Protection Agency, with the prior approval of the Pakistan Environmental Protection Council, is pleased to establish the following National Environmental Quality Standards for Ambient Air.

National Environmental Quality Standards for Ambient Air

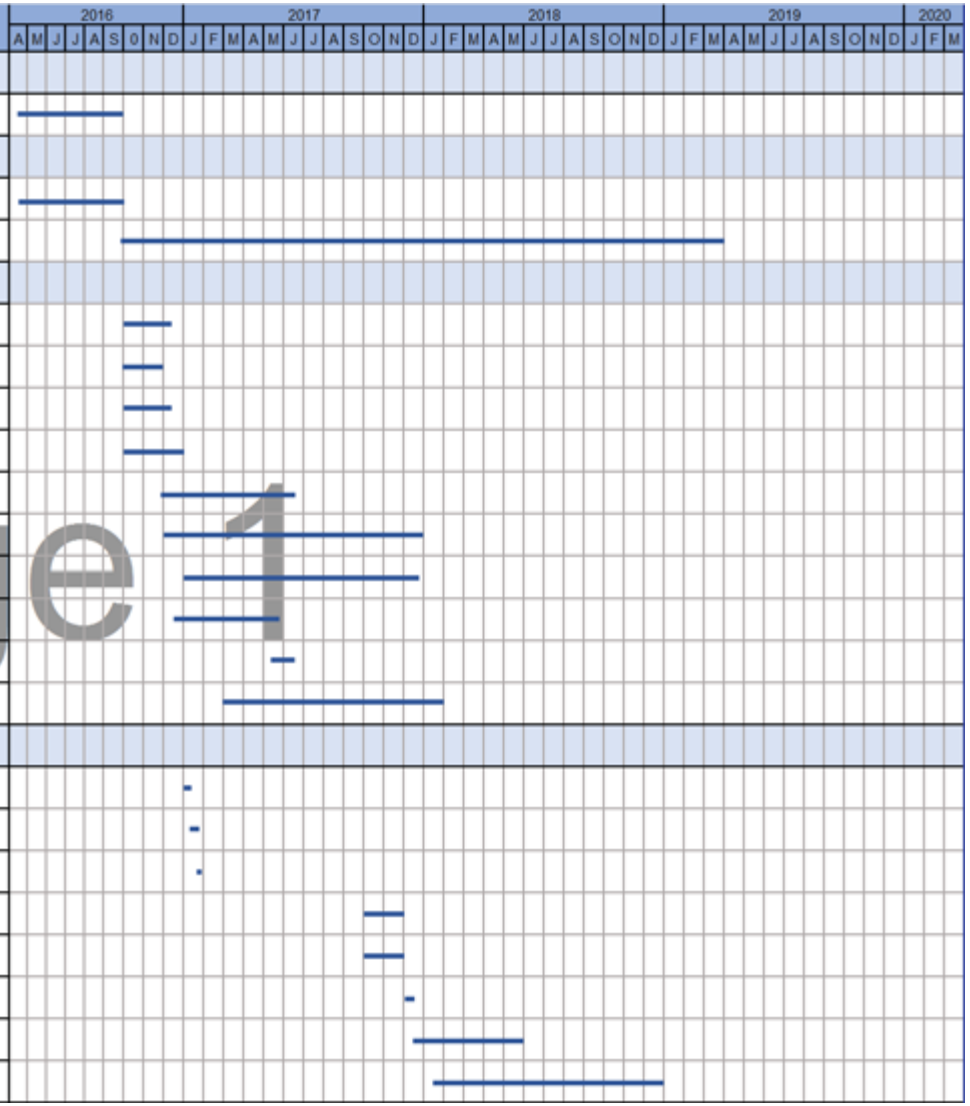
Pollutants	Time-weighted average	Concentration in Ambient Air		Method of Measurement
		Effective from 1st July 2010	Effective from 1st January 2013	
Sulphur Dioxide (SO_2)	Annual Average*	80µg/m^3	80µg/m^3	Ultraviolet Fluorescence Method
	24 hours**	120µg/m^3	120µg/m^3	
Oxides of Nitrogen as (NO)	Annual Average*	40µg/m^3	40µg/m^3	Gas Phase Chemiluminescence
	24 hours**	40µg/m^3	40µg/m^3	
Oxides of Nitrogen as (NO_2)	Annual Average*	40µg/m^3	40µg/m^3	Gas Phase Chemiluminescence
	24 hours**	80µg/m^3	80µg/m3	
Ozone (O_3)	1 hour	180µg/m^3	130µg/m^3	Non disperse UV absorption method

Pollutants	Time-weighted average	Concentration in Ambient Air		Method of Measurement
		Effective from 1st July 2010	Effective from 1st January 2013	
Suspended Particulate Matter (SPM)	Annual Average*	400µg/m^3	360µg/m^3	High Volume Sampling, (Average flow rate not less than 1.1m^3/minute)
	24 hours**	550µg/m^3	500µg/m^3	
Respire able Particulate Matter (PM_{10})	Annual Average*	200µg/m^3	120µg/m^3	ß-Ray Absorption Method
	24 hours**	250µg/m^3	150µg/m^3	
Respireable Particulate Matter ($PM_{2.5}$)	Annual Average*	25µg/m^3	15µg/m^3	ß-Ray Absorption Method
	24 hours**	40µg/m^3	35µg/m^3	
	1 hour	25µg/m^3	15µg/m^3	
Lead (Pb)	Annual Average*	1.5µg/m^3	1µg/m^3	AAS Method after sampling using EPM 2000 or equivalent Filter paper
	24 hours**	2µg/m^3	1.5µg/m^3	
Carbon Monoxide (CO)	8 hours**	5µg/m^3	5µg/m^3	Non Dispersive Infrared (NDIR) method
	1 hour	10mg/m^3	10mg/m^3	
*Annual arithmetic mean of minimum 104 measurements in a year taken twice a week 24 hourly at uniform intervals.				
**24 hourly/8 hourly values should be met 98% in a year. 2% of the time, it may exceed but not on two consecutive days.				

APPENDIX 3.1

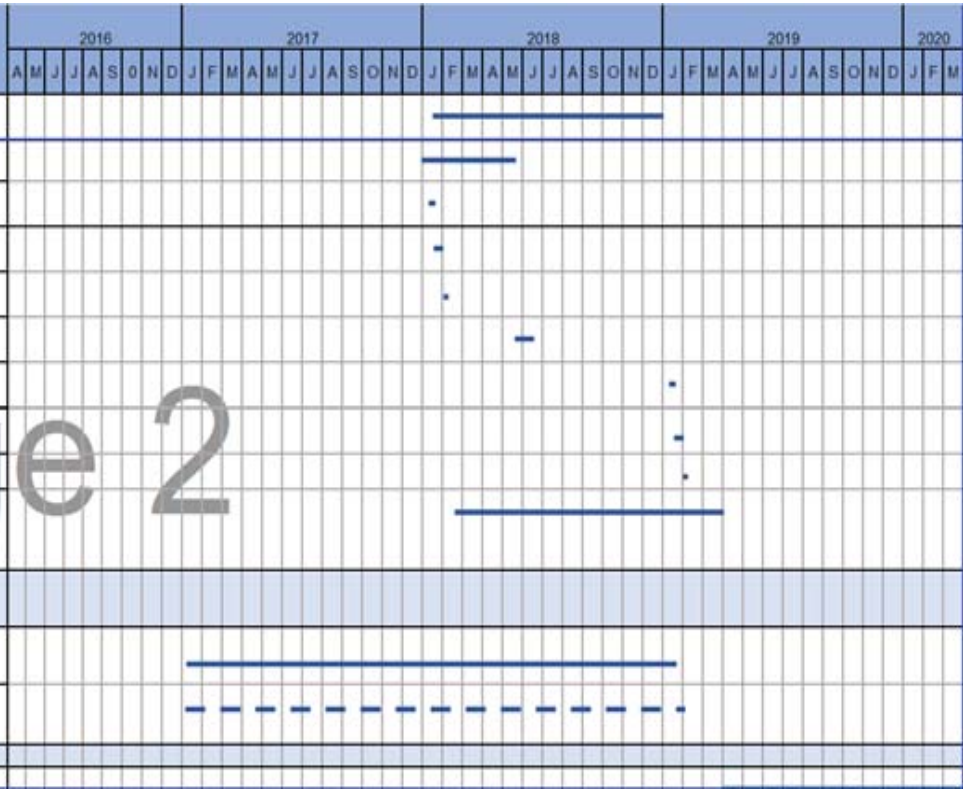
CONSTRUCTION SCHEDULE

Activity ID	ACTIVITY DESCRIPTION	Duration	Earliest Start	Earliest Finish
Additional Facilities				
A 01	Construction of preliminary works and facilities	6 Months	1/4/2016	30/09/2016
Socioenvironment				
ES 01	Implementation of Ressetlement Plan	6 Months	1/4/2016	30/09/2016
ES 02	Implementatrion of Environmental Management Plan	30 Months	30/09/2016	30/03/2019
Right side of Barrage				
RS 01	U/S cofferdams bay No. 25-51 (Top EL495.00)	2.5 Months	1/10/2016	15/12/2016
RS 02	Construction of feeding channel for Rangpur Canal	2 Months	1/10/2016	30/11/2016
RS 03	D/S cofferdams bay No. 25-51 (Top EL492.00)	2.5 Months	1/10/2016	15/12/2016
RS 04	Disposal of Impounded Water	3 Months	1/10/2016	31/12/2016
RS 05	Setting Dewatering arrangements and dewatering	6.5 Months	1/12/2016	15/6/2017
RS 06	Mechanical Works of bay No. 25-51 and canals head Regulators	13 Months	1/12/2016	31/12/2017
RS 07	Deck Slab Replacement	12 Months	1/1/2017	31/12/2017
RS 08	Rehabilitation of civil works in bay No 25-51 on U/S and D/S side	5 Months	20/12/2016	20/05/2017
RS 09	Dismantling U/S and D/S cofferdams	25 Days	20/05/2017	15/06/2017
RS 10	Electrical works of Right portion of Barrage Bay No. 25-51	11 Months	1/3/2017	31/01/2018
Left side of Barrage				
LS 01	Constructing low level cofferdams U/S and D/S in bay No.1-8	10 Days	1/1/2017	10/1/2017
LS 02	Mechanical Works for lefft undersluices and canals	14 Days	11/1/2017	25/01/2017
LS 03	Removing Low cofferdams	5 Days	25/1/2017	1/2/2017
LS 04	U/S cofferdams bay No.9-26 (Top EL495.00)	2 Months	1/10/2017	30/11/17
LS 05	D/S cofferdams bay No.9-26 (Top EL492.00)	2 Months	1/10/2017	30/11/17
LS 06	Bulk Dewatering with in cofferdams	15 Days	1/12/2017	15/12/2017
LS 07	Setting Dewatering arrangements and dewatering	5.5 Months	15/12/2017	31/5/2018
LS 08	Mechanical Works of Bay No. 9-26	11 Months 20 Days	6/1/2018	31/12/2018



Page 1

Activity ID	ACTIVITY DESCRIPTION	Duration	Earliest Start	Earliest Finish
LS 09	Deck Slab Replacement	11 Month 20 Days	6/1/2018	31/12/2018
LS 10	Rehabilitation of civil works in bay No 25-51 on U/S and D/S side	4 Months 20 Days	1/1/2018	20/05/2018
LS 11	Constructing low level cofferdams U/S and D/S in bay No.1-8	8 Days	10/1/2018	17/01/2018
LS 12	Remaining Mechanical Works for left undersluices and canals	14 Days	18/01/2018	31/01/2018
LS 13	Removing Low cofferdams	5 Days	1/2/2018	5/2/2018
LS 14	Dismantling U/S and D/S cofferdams	25 Days	21/05/2018	15/06/2018
LS 15	Constructing low level cofferdams U/S and D/S in bay No.1-8	8 Days	10/1/2019	17/01/2019
LS 16	Remaining Mechanical Works for left undersluices and canals	14 Days	18/01/2019	31/01/2019
LS 17	Removing Low cofferdams	5 Days	1/2/2019	5/2/2019
LS 18	Electrical works of Left portion of Barrage Bay No. 1-25	13 Months 15 days	15/2/2018	31/03/2019
Adding Bays Structure and Bela Removal				
AB 01	Structure for additional bays including Head Regulator Rangpur Canal, new right guide bank, Mechenical gates Installation and other incillary components.	24 Months	6/1/2017	5/1/2019
AB 02	Bela Removal uptill RL 477.50	24 Months 25 Days	6/1/2017	31/1/2019
Defect Notification Period				
DNP 1	Defect Notification period	12 Months	1/4/2019	31/03/2020



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APPENDIX 4.1

BORE HOLE LOG ANALYSIS

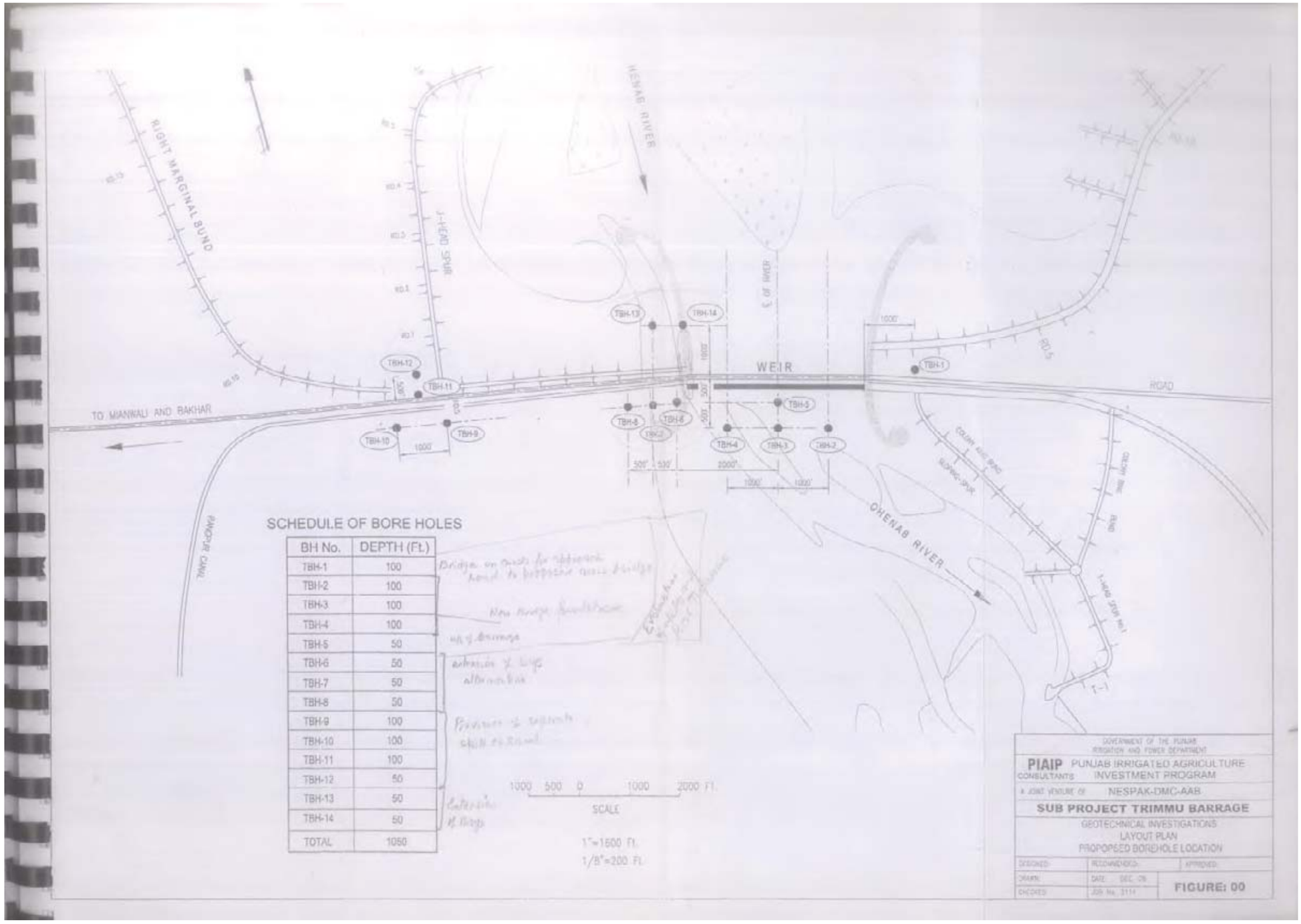
RIGHT MARGINAL BUND
J-HEAD SPUR
CHENAB RIVER
WEIR
TO MIANWALI AND BAKHAR
TRIMMU BRIDGE
CHENAB RIVER
TBH-1
TBH-2
TBH-3
TBH-4
TBH-5
TBH-6
TBH-7
TBH-8
TBH-9
TBH-10
TBH-11
TBH-12
TBH-13
TBH-14
1000'
500'
2000'
SCHEDULE OF BORE HOLES
BH No. | DEPTH (Ft.)
TBH-1 | 100
TBH-2 | 100
TBH-3 | 100
TBH-4 | 100
TBH-5 | 50
TBH-6 | 50
TBH-7 | 50
TBH-8 | 50
TBH-9 | 100
TBH-10 | 100
TBH-11 | 100
TBH-12 | 50
TBH-13 | 50
TBH-14 | 50
TOTAL | 1050
1000 500 0 1000 2000 Ft.
SCALE
1"=1500 Ft.
1/8"=200 Ft.
GOVERNMENT OF THE PUNJAB
IRRIGATION AND POWER DEPARTMENT
PIAIP PUNJAB IRRIGATED AGRICULTURE INVESTMENT PROGRAM
CONSULTANTS
A JOINT VENTURE OF NESPAK-DMC-AAB
SUB PROJECT TRIMMU BARRAGE
GEOTECHNICAL INVESTIGATIONS
LAYOUT PLAN
PROPOSED BOREHOLE LOCATION
DESIGNED
RECOMMENDED
APPROVED
DRAWN
DATE
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FIGURE: 00

EARTH SERVICES

BOREHOLE LOG

Figure No. B-6
Hole No. TBH-5
Sheet 1 of 2

Project: Punjab Irrigated and Agriculture Investment Programme (PIAIP) Trimmu Barrage sub-project

Type of Boring: Straight Rotary Elevation: 470.12 Coordinates: E: 7747.61 N: 7023.4

Dia. of Casing/Hole: 4" Ground Water Table: 0.5 ft

Date: 20-01-2010 to 28-01-2010 Geologist: Rashid Javed

Depth (ft)	Elevation (ft)	Sample No.	Legend	Classification Symbol	DESCRIPTION OF MATERIAL	SPT Blows/Ft.	REMARKS
05		SPT-1		SM/SP-SM	Grey, loose to medium dense, silty SAND to poorly graded SAND with silt, trace mica	10	▽GWT
10		SPT-2				09	
15		SPT-3				06	
20		SPT-4				20	
25		SPT-5				18	
30		SPT-6				11	
35		SPT-7				24	
40		SPT-8				12	

EARTH SERVICES

Figure No. B-6
Hole No. TBH-5
Sheet 2 of 2

Project : Punjab Irrigated and Agriculture Investment Programme (PIAIP)
Trimmu Barrage sub-project

Depth (ft)	Elevation (ft)	Sample No.	Legend	Classification Symbol	DESCRIPTION OF MATERIAL	SPT Blows/Ft.	REMARKS
40		SPT-8		SM/SP-SM/SP	Grey, medium dense to very dense, silty SAND to poorly graded SAND, trace mica	12	
45		SPT-9				15	
50		SPT-10				69	
					BOTTOM OF BOREHOLE		

EARTH SERVICES

BOREHOLE LOG

Figure No. B-13
Hole No. TBH-12
Sheet 1 of 1

Project : Punjab Irrigated and Agriculture Investment Programme (PIAIP) Trimmu Barrage sub-project

Type of Boring: Auger/light percussion Elevation: 482.947 Coordinates: E: 1144.372 N: 10547.452

Dia. of Casing/Hole: 4" Ground Water Table: 5 ft

Date: 31-01-2010 to 31-01-2010 Geologist: Rashid Javed

Depth (ft)	Elevation (ft)	Sample No.	Legend	Classification Symbol	DESCRIPTION OF MATERIAL	SPT Blows/Ft.	REMARKS
					Brown, lean CLAY		
05		SPT-1		SM/SP-SM	Grey, very loose to dense, silty SAND to poorly graded SAND with silt, trace mica	03	GWT
10		SPT-2				06	
15		SPT-3				04	
20		SPT-4				08	
25		SPT-5				13	
30		SPT-6				18	
35		SPT-7				39	
40		SPT-8				35	

BOTTOM OF BOREHOLE

APPENDIX 4.2

SAMPLING PROCEDURE AND TEST RESULTS

SGS

Final Monitoring Report

Ambient Air Quality Monitoring at Trimmu Barrage

Our Ref.: ENV – LHR – 39 / 2010
Intervention Date: February 03 – 04, 2010

For

NES PAK

Environmental Services
SGS Pakistan (Pvt) Ltd.

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Contents

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   - 1.1. **Project Location** 3
   - 1.2. **Scope of Services** 5
     - 1.2.1. Ambient Air Quality Monitoring 5
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   - 1.3. **Schedule** 6
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     - 2.1.1. Sampling and Analysis of Particulate Matter 8
   - 2.2. **Meteorological Conditions** 8
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Annexes:

Annexure – I	Meteorological Data
Annexure – II	Ambient Air Quality Monitoring Data
Annexure – III	Noise Level Monitoring Data
Annexure – IV	USEPA Ambient Air Quality Standards

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1. Introduction

National Engineering Services Pakistan (Pvt) Limited (NESPAK) is one of the leading engineering consultancies of the Pakistan. NESPAK is conducting a project for rehabilitation and up gradation of Trimmu barrage funded by Asian Development Bank. In order to develop baseline of the project site and surroundings, services of SGS Pakistan (Pvt) Ltd have been hired. This report is prepared on the basis of field survey carried out from February 03 to 04, 2010 for ambient air quality monitoring, weather conditions and noise level monitoring at advised locations.

1.1. Project Location

The project location for Trimmu barrage rehabilitation and up gradation is given as **Figure 1**. The site selected for ambient air quality and noise level monitoring was at Trimmu Barrage at advised sampling points. The monitoring was carried out at the selected sites for the duration of 24 hrs in order to examine the environmental conditions of the project site and its surroundings. The obtained data is compared with standards attached as **Annexure- IV** of the report. The photographs of the sampling and monitoring are given in **Figure 2 and 3.**

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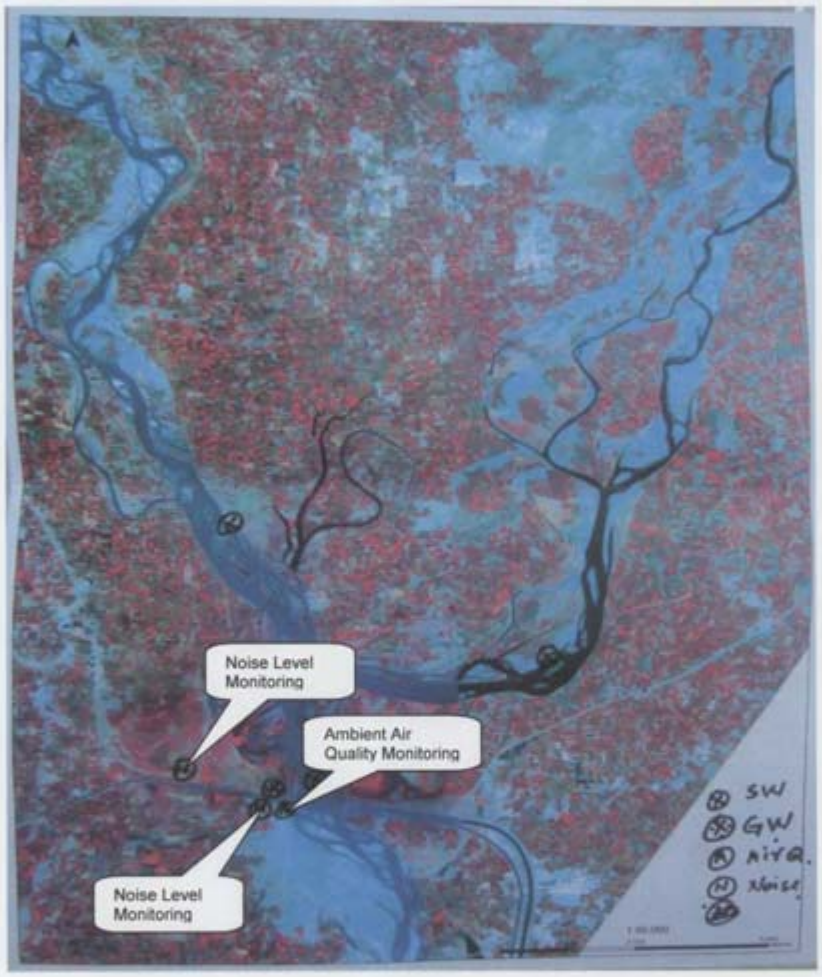
Figure: 1 Project Location



Introduction
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1.2. Scope of Services

Scope of services covered following main components:

- Ambient Air Quality Monitoring
- Weather Conditions
- Noise Level Monitoring

1.2.1. Ambient Air Quality Monitoring

In accordance to USEPA National Ambient Air Quality standards the following priority pollutants would be monitored in the ambient air of the study area:

- Carbon Monoxide (CO)
- Nitrogen Dioxide (NO_2)
- Sulfur Dioxide (SO_2)
- Particulate Matter (PM_{10})

In addition to above mentioned parameters, the weather conditions were also monitored in order to interpret ambient air quality of the study area. For the purpose following parameters would be monitored:

- Ambient Temperature
- Relative Humidity
- Barometric Pressure
- Wind Direction
- Wind Velocity

1.2.2. Noise Level Monitoring

Noise level using portable digital sound meter was monitored at following advised sites:

- At Trimmu Barrage (Point#1)
- At Trimmu Barrage (Point#2)

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1.3. Schedule

In order to cover the above scope of work, following schedule was planned and followed:

Table 1: Schedule

Sr.#	Intervention Date	Activity	Monitoring Location	
			Trimmu Barrage (Point#1)	Trimmu Barrage (Point#2)
Environmental Assessment at Trimmu Barrage				
1	Feb. 03 to Feb. 04,2010	Ambient Air Quality Monitoring		
2	Feb. 03 to Feb. 04,2010	Weather Conditions		
3	Feb. 03 to Feb. 04,2010	Noise Level Monitoring		

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2. Methodology

Following is the brief description of methodology adapted for this environmental assessment:

2.1. Ambient Air Quality

Ambient air quality was monitored with the help of Mobile Air Quality Station equipped with the state of the art ambient air analyzers.

Figure 2: Ambient Air Quality Monitoring at Trimmu Barrage

Locations for the sampling and monitoring were identified and finalized by the NESPAK representative and Field Analyst of the SGS Pakistan (Pvt) Ltd. The methodology adopted for ambient air quality monitoring is as follows:

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Table 2: Methodology of Ambient Air Quality Monitoring

Air Pollutant	Monitoring Technique	Method	Measurement Range	Lowest Detection Limit
Carbon Monoxide (CO)	Gas Filter Correlation CO Analyzer	USEPA Designated Method RFCA-0981-054	0 – 100	0.01 ppm
Sulfur Dioxide (SO_2)	Pulsed Fluorescent Analyzer	USEPA Designated Method EQSA-0486-060	0 – 50 ppb 0 – 1000 ppm	1 ppb
Nitrogen Dioxide (NO_2)	Chemiluminescent Analyzer	USEPA Designated Method RFNA-1289-074	0 – 50 ppb 0 – 1000 ppm	1 ppb
Particulate Matter (PM_{10})	High Volume Sampler	40 CFR 50, App. B (US-EPA)	2 – 750 µg/m^3	2 µg/m^3

2.1.1. Sampling and Analysis of Particulate Matter

Particulate matter concentration in terms of PM_{10} was monitored in the ambient air with the help of high Volume PM_{10} Sampler. Reference method used for PM_{10} determination in ambient air is 40 CFR 50, Appendix J (USEPA).

Air sample for detection of PM_{10} concentration was drawn on fiberglass filter paper and then the collected sample was preserved in protective holder which was transported to SGS lab for further analysis under standard environmental conditions.

2.2. Meteorological Conditions

In addition to the advised parameters for ambient air quality, weather conditions were also monitored continuously for 24 hours with the help of mobile weather station. Selection of sampling points was made considering the wind direction at the advised sampling site.

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2.3. Noise Level Monitoring

Noise level was monitored at the advised sampling points for 24 hours with interval of 1 second and hourly average data is reported. The sound level was monitored with the help of potable Digital sound meter (RION, Model NL – 31, IEC60051 TYPE 1 IE60804 TYPE 1 JIS C 1505).

Figure3: Noise Level Monitoring at Trimmu Barrage

Noise level measurement was performed according to standard operating procedures.

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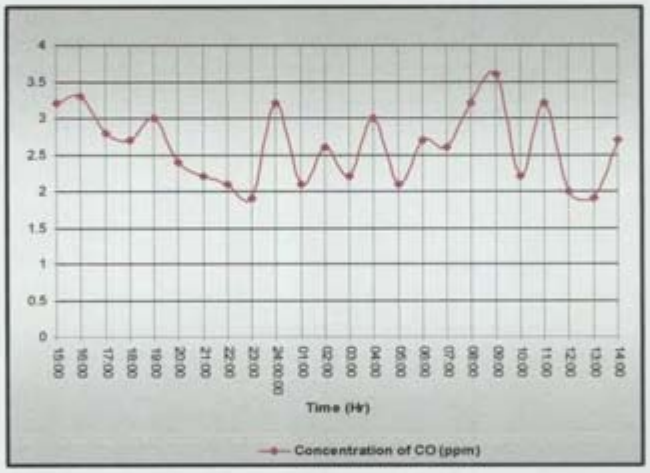
3. Results and Discussion

This section of the report presents results of ambient air quality monitoring, weather conditions and noise level monitoring conducted at Trimmu Barrage. The monitoring results are given in **Annexure I to III of** the report.

The results of ambient air quality monitored for 24 hrs are given in **Annexure II** of the report. USEPA (United State Environmental Protection Agency) ambient air quality standards were used for comparison. The copy of USEPA ambient air quality standards is attached as **Annexure – IV** of the report. The average concentration of carbon monoxide (CO) for 8 hrs according to the USEPA standard should not exceed from 9ppm while for 1 hr monitoring is 35 ppm. **Graph-1** shows prevailing concentration f CO at monitoring location.



Graph 1: CO Concentration during 24 Hrs. Monitoring

The level obtained at monitoring site for 24 hrs average was 2.6 ppm which lies well within the limits specified in USEPA standards for CO.

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Similarly average concentration of nitrogen dioxide and sulphur dioxide was found at 28.9 ppb and 2.8 ppb respectively which are very well within the limits defined in USEPA standards. The 24 hrs average particulate matter PM_{10} was found to be 190.9 $\mu g/m^3$ against standards value of 150 $\mu g/m^3$ for USEPA standard. The project site was near the road. It is anticipated that vehicular emissions and location of sampling point near the road are major contributor for higher concentration of PM_{10}. Concentration of PM_{10} is found to be higher during normal atmospheric conditions in Pakistan due to emission of dust from unpaved surfaces around the roads.

Table 3: Average Obtained Concentrations of Priority Pollutants

Parameter	Unit	Average Obtained Concentration	Duration
Nitrogen Dioxide (NO_2)	ppb	28.9	24Hours
Sulfur Dioxide (SO_2)	ppb	2.8	24 Hours
Carbon Monoxide (CO)	ppm	2.6	24 Hours
Particulate Matter (PM_{10})	$\mu g/m^3$	190.9	24 Hours

Noise level monitoring was conducted at Trimmu Barrage at advised locations (Point#1 & Point#2). Results were attached as **Annexure III** of the report. The noise level was found in range of 55.6 – 69.4 dB (L_{eq}). Maximum noise level was observed during sound level measurement at Trimmu Barrage (Point#2).

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Annexure – I

Meteorological Data

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Meteorological Data

Client : **NESPAK (Pvt) Ltd.**
Sampling Point : **Trimmu Barrage Site (Point#1)**
Date of Intervention : **February 03 – 04, 2010**

Time	Temp	Wind Dir	Wind Speed	Hum	Pressure (mm of Hg)
	°C		m/s	%	
15:00	24	W	1.7	38	760.7
16:00	22	W	2.2	40	760.9
17:00	18	N	0.9	49	760.5
18:00	17	N	0.9	53	760.4
19:00	16	N	0.4	57	760.3
20:00	15	N	0.4	65	760.9
21:00	14	NW	1.8	68	760.2
22:00	14	W	1.3	74	760.5
23:00	14	W	0.9	75	760.0
24:00	13	NW	1.8	77	760.1
01:00	14	NW	1.3	75	760.2
02:00	14	N	1.8	73	760.7
03:00	14	N	1.3	72	760.5
04:00	13	N	1.8	74	760.3
05:00	13	SW	0.9	75	760.0
06:00	12	SW	0.9	86	760.4
07:00	13	SE	1.3	82	760.7
08:00	15	SE	1.3	72	761.5
09:00	16	SE	0.9	68	761.8
10:00	19	SE	1.3	57	761.5
11:00	22	W	2.0	49	761.3
12:00	22	SE	1.9	47	761.2
13:00	24	SE	1.7	45	760.9
14:00	24	S	2.0	40	760.8

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Annexure – II

Ambient Air Quality Monitoring Data

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Ambient Air Quality

Client : **NESPAK (Pvt) Ltd.**
Sampling Point : **Trimmu Barrage Site (Point#1)**
Date of Intervention : **February 03 – 04, 2010**

Time	CO (ppm)	NO_2 (ppb)	SO_2 (ppb)
15:00	3.2	12.7	2.4
16:00	3.3	14.8	2.0
17:00	2.8	34.7	2.1
18:00	2.7	32.1	1.9
19:00	3.0	32.3	2.3
20:00	2.4	27.3	2.5
21:00	2.2	32.2	2.7
22:00	2.1	17.9	4.0
23:00	1.9	34.6	5.0
24:00	3.2	44.9	2.4
01:00	2.1	58.5	3.2
02:00	2.6	51.1	2.9
03:00	2.2	44.1	2.6
04:00	3.0	34.2	2.4
05:00	2.1	25.1	2.9
06:00	2.7	15.5	2.7
07:00	2.6	12.6	2.9
08:00	3.2	14.4	3.1
09:00	3.6	14.6	2.7
10:00	2.2	25.3	2.2
11:00	3.2	30.1	2.7
12:00	2.0	32.7	3.4
13:00	1.9	27.2	3.0
14:00	2.7	24.4	2.9
Average Concentration	**2.6**	**28.9**	**2.8**

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Ambient Air Quality

Client : **NESPAK (Pvt) Ltd.**
Sampling Point : **Trimmu Barrage Site (Point#1)**
Date of Intervention : **February 03 – 04, 2010**

Parameter	Unit	Duration	LDL	Average Obtained Concentration
Nitrogen Dioxide (NO_2)	ppb	24Hours	0.01	28.9
Sulfur Dioxide (SO_2)	ppb	24 Hours	0.01	2.8
Carbon Monoxide (CO)	ppm	24 Hours	1.0	2.6
Particulate Matter (PM_{10})	$\mu g/m^3$	24 Hours	2.0	190.9

$\mu g/m^3$: micrograms per cubic meter
ppm: parts per million
ppb: parts per billion
LDL: Lowest Detection Limit

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Annexure – III

Noise Level Monitoring Data

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Noise Level Monitoring

Client : **NESPAK (Pvt) Ltd.**
Sampling Point : **Trimmu Barrage Site (Point # 01)**
Date of Intervention : **February 03 – 04, 2010**

Sr. #	Time	Leq(dB)	Lmax(dB)	Lmin(dB)
1	15:00	68.6	74.0	62.0
2	16:00	69.4	76.6	60.2
3	17:00	67.2	74.3	62.4
4	18:00	69.2	75.2	61.6
5	19:00	65.4	74.3	58.4
6	20:00	68.9	72.7	54.6
7	21:00	66.8	73.4	55.2
8	22:00	64.7	72.6	56.9
9	23:00	55.6	66.4	51.6
10	24:00	57.3	69.2	52.2
11	01:00	56.4	70.6	52.4
12	02:00	57.7	72.6	53.3
13	03:00	58.9	69.7	52.8
14	04:00	57.8	63.8	54.7
15	05:00	59.4	65.9	53.2
16	06:00	57.9	63.6	53.2
17	07:00	57.1	69.1	52.4
18	08:00	58.9	78.8	55.9
19	09:00	65.8	81.2	59.6
20	10:00	68.2	84.3	61.4
21	11:00	57.2	79.0	53.3
22	12:00	60.1	82.1	55.0
23	13:00	56.0	75.5	52.7
24	14:00	58.3	77.7	50.1

Noise Level Monitoring Data
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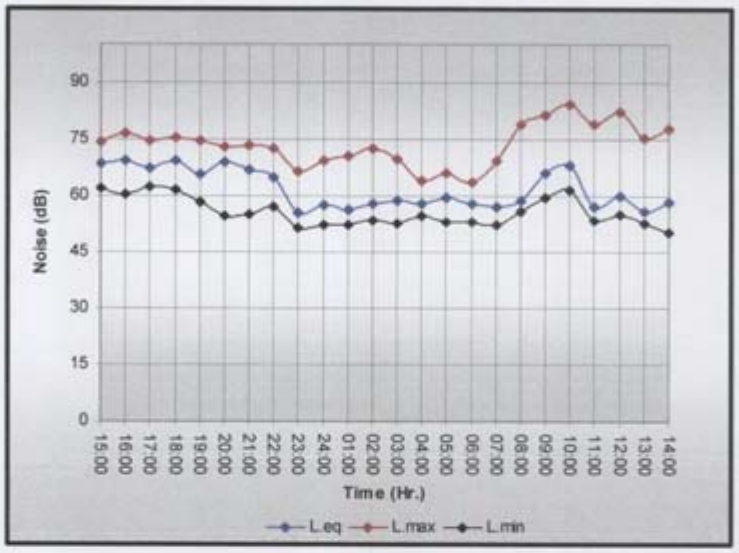

Graph 2: - Variation of Noise with Time

Noise Level Monitoring Data
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Noise Level Monitoring

Client : **NESPAK (Pvt) Ltd.**
Sampling Point : **Trimmu Barrage Site (Point # 02)**
Date of Intervention : **February 03 – 04, 2010**

Sr. #	Time	Leq(dB)	Lmax(dB)	Lmin(dB)
1	15:00	62.1	77.3	54.1
2	16:00	64.5	75.2	52.6
3	17:00	63.8	78.6	51.3
4	18:00	66.3	79.2	54.0
5	19:00	65.4	75.3	52.8
6	20:00	63.3	72.6	53.2
7	21:00	60.1	71.2	51.2
8	22:00	59.7	70.9	50.0
9	23:00	57.1	72.1	49.1
10	24:00	58.0	73.0	50.2
11	01:00	59.1	70.7	50.4
12	02:00	61.2	74.5	52.7
13	03:00	60.3	73.3	51.0
14	04:00	62.7	71.0	49.2
15	05:00	63.9	74.2	53.1
16	06:00	64.0	76.4	54.3
17	07:00	64.6	75.2	52.7
18	08:00	67.2	82.9	56.8
19	09:00	66.6	79.6	54.5
20	10:00	65.9	85.6	59.3
21	11:00	67.9	83.7	62.6
22	12:00	68.0	80.3	57.1
23	13:00	65.1	78.2	56.0
24	14:00	66.3	77.0	56.7

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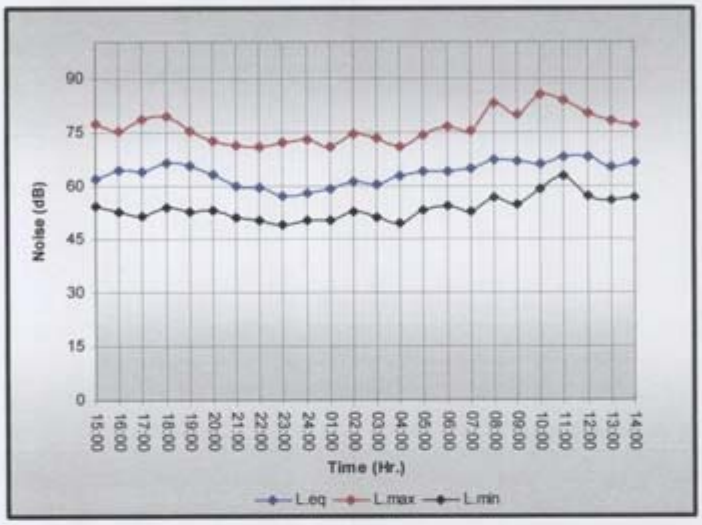

Graph 3: - Variation of Noise with Time

Noise Level Monitoring Data
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Annexure – IV

USEPA Ambient Air Quality Standard

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USEPA National Ambient Air Quality Standard

Following are the limits specified in NAAQS for primary as well as secondary pollutants.

POLLUTANT	STANDARD VALUE *		STANDARD TYPE
Carbon Monoxide (CO)			
8-hour Average	9 ppm	(10 mg/m^3)	Primary
1-hour Average	35 ppm	(40 mg/m^3)	Primary
Nitrogen Dioxide (NO_2)			
Annual Arithmetic Mean	0.053 ppm	(100 µg/m^3)	Primary & Secondary
Ozone (O_3)			
1-hour Average	0.12 ppm	(235 µg/m^3)	Primary & Secondary
8-hour Average	0.08 ppm	(157 µg/m^3)	Primary & Secondary
Lead (Pb)			
Quarterly Average	1.5 µg/m^3		Primary & Secondary
Particulate (PM 10) *Particles with diameters of 10 micrometers or less*			
Annual Arithmetic Mean	50 µg/m^3		Primary & Secondary
24-hour Average	150 µg/m^3		Primary & Secondary
Particulate (PM 2.5) *Particles with diameters of 2.5 micrometers or less*			
Annual Arithmetic Mean	15 µg/m^3		Primary & Secondary
24-hour Average	65 µg/m^3		Primary & Secondary
Sulfur Dioxide (SO_2)			
Annual Arithmetic Mean	0.030 ppm	(80 µg/m^3)	Primary
24-hour Average	0.14 ppm	(365 µg/m^3)	Primary
3-hour Average	0.50 ppm	(1300 µg/m^3)	Secondary

WATER QUALITY ANALYSIS

SGS

ANNEXURE - A
Our Ref.: ENV – LHR – 510 / 2009
Test Report No: 145953
January 11, 2010
Page 01 of 03

MICROBIOLOGICAL ANALYSIS REPORT

Job No :	**Env – Lhr – 510 / 2009**		
Client Name / Address :	**NESPAK (Pvt) Ltd. / NESPAK House 1-C Block N, Model Town Ext. Lahore**		
Description Of Sample :	**Ground Water (As Stated)**		
Marking (If Any) :	**GWT (T-Trimu)**	**No. of sample :**	**01**
Sample Condition Upon Receipt:	**Satisfactory**	**Sample Receiving Date :**	**23-12-09**
Environmental Conditions:	**Temperature : NA**	**Humidity:**	**NA**

Sr. #	Parameters	Procedure	Permissible Limits	Results
01	Total Colony Count	APHA:9215	< 500 cfu / ml	483
02	Total Coli Forms	APHA:9222 B	0 / 100ml	4
03	Faecal Coli Forms (E.Coli)	APHA:9222 B	0 / 100ml	Absent
04	Faecal Streptococci/ Enterococci	APHA: 9230 C	0 / 100ml	Absent

cfu : colony forming unit

NOTE:
WHO/USEPA Guidelines for Drinking Water states that Total or Faecal Coli forms must be absent and are not tolerated in Potable water.

- This report is not valid for any negotiation.
- This report pertains only to the sample (s) supplied and is issued without prejudice.
- The sample(s) to which the findings recorded herein (the "Findings") relate was (were) drawn and / or provided by the Client or by a third party acting at the Client's direction. The Findings constitute no warranty of the sample's representativeness of any goods and strictly relate to the sample(s). The Company accepts no liability with regard to the origin or source from which the sample(s) is/are said to be extracted.

SGS PAKISTAN (PVT.) LTD

E(QA) SH

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ANNEXURE - A
Our Ref.: ENV – LHR – 510 / 2009
Test Report No: 145953
January 11, 2010
Page 02 of 03

CHEMICAL LABORATORY

TEST REPORT

Job No :	**Env – Lhr – 510 / 2009**		
Client Name / Address :	**NESPAK (Pvt) Ltd. / NESPAK House 1-C Block N, Model Town Ext. Lahore**		
Description Of Sample :	**Ground Water (As Stated)**		
Marking (If Any) :	**GWT (T-Trimu)**	**No. of sample :**	**01**
Sample Condition Upon Receipt:	**Satisfactory**	**Sample Receiving Date :**	**23-12-09**
Environmental Conditions:	**Temperature : NA**	**Humidity:**	**NA**

Sr. #	Parameters	Method	Unit	LDL	Test Results	WHO Guidelines
01	pH	APHA-4500H^+ B	-	-	7.87	6.5 – 8.5
02	Color	Visual	-	-	Colorless	-
03	Odor	Organoleptic	-	-	Odorless	-
04	Turbidity	APHA-2130 B	NTU	0.2	2	5 NTU
05	Conductivity	APHA-2150 B	µS	0.1	386	-
06	Total Dissolved Solids (TDS)	APHA-2540 C	mg/L	5.0	280	1000
07	Total Suspended Solids (TSS)	APHA-2540 D	mg/L	5.0	<5.0	-
08	Calcium Hardness	APHA-2340 B & C	mg/L	0.5	90.3	-
09	Magnesium Hardness	APHA-2340 B & C	mg/L	0.5	37.1	-
10	Calcium	APHA-3500Ca B	mg/L	0.5	36.1	-
11	Magnesium	APHA-3500Mg B	mg/L	0.5	9.0	-
12	Chloride (Cl)	APHA-4500Cl^- B	mg/L	0.5	26.8	250
13	Sulfate (SO_4)	APHA-4500SO_4 C	mg/L	5.0	40	250
14	Sulphide	APHA-4500 S^{2-} D	mg/L	0.5	<0.5	-
15	Nitrates (NO_3)	APHA-4500NO_3 B	mg/L	0.003	1.7	50
16	Fluoride (F)	APHA - F^- C	mg/L	0.01	0.8	1.5
17	Sodium Absorption Ratio (SAR)	In-House	-	-	1.57	-
18	Residual Sodium Carbonate (RSC)	In-House	mg/L	-	ND	-

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(QA) SH

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ANNEXURE - A
Our Ref.: ENV – LHR – 510 / 2009
Test Report No: 145953
January 11, 2010
Page 03 of 03

Sr. #	Parameters	Method	Unit	LDL	Test Results	WHO Guidelines
19	Ammonia (NH_3)	APHA-4500NH_3 B	mg/L	0.1	<0.1	-
20	Cyanide (CN)	APHA-4500CN F	mg/L	0.01	<0.01	0.07
21	Grease & Oil	USEPA-1664	mg/L	1.0	<1.0	-
22	Arsenic (As)	APHA-3500 As B	mg/L	0.005	<0.005	0.01
23	Cadmium (Cd)	APHA-3500Cd B	mg/L	0.003	<0.003	0.003
24	Chromium (Cr)	APHA-3500Cr B	mg/L	0.01	<0.01	0.05
25	Copper (Cu)	APHA-3500Cu B	mg/L	0.01	<0.01	1.0 – 2.0
26	Lead (Pb)	APHA-3500Pb B	mg/L	0.01	<0.01	0.01
27	Mercury (Hg)	APHA-3500-Hg B	mg/L	0.001	<0.001	0.001
28	Selenium (Se)	APHA-3500Se C	mg/L	0.01	<0.01	-
29	Nickel (Ni)	APHA-3500-Ni B	mg/L	0.01	<0.01	0.02
30	Silver (Ag)	APHA-3500Ag B	mg/L	0.1	<0.1	-
31	Zinc (Zn)	APHA-3500Zn B	mg/L	0.01	0.03	3.0
32	Iron (Fe)	APHA-3500Fe B	mg/L	0.01	0.07	0.3
33	Barium (Ba)	APHA-3500Ba B	mg/L	0.5	<0.5	-
34	Manganese (Mn)	APHA-3500Mn B	mg/L	0.01	0.02	0.1 – 0.5
35	Chlorine	APHA-4500Cl G	mg/L	0.1	<0.1	-
36	Sodium (Na)	APHA-3500Na B	mg/L	0.5	41	200

LDL: Lowest Detection Limit -: Not Defined <: Less Then ND: Not Defined

Note: SAR is calculated with meq/L

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MICROBIOLOGICAL ANALYSIS REPORT

Job No :	**Env – Lhr – 510 / 2009**		
Client Name / Address :	**NESPAK (Pvt) Ltd. / NESPAK House 1-C Block N, Model Town Ext. Lahore**		
Description Of Sample :	**Surface Water (As Stated)**		
Marking (If Any) :	**SWC (C-Chenab)**	**No. of sample :**	**01**
Sample Condition Upon Receipt:	**Satisfactory**	**Sample Receiving Date :**	**23-12-09**
Environmental Conditions:	**Temperature : NA**	**Humidity:**	**NA**

Sr. #	Parameters	Procedure	Permissible Limits	Results
01	Total Colony Count	APHA:9215	< 500 cfu / ml	840
02	Total Coli Forms	APHA:9222 B	0 / 100ml	17
03	Faecal Coli Forms (E.Coli)	APHA:9222 B	0 / 100ml	4
04	Faecal Streptococci/ Enterococci	APHA: 9230 C	0 / 100ml	Absent

cfu : colony forming unit

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MICROBIOLOGICAL ANALYSIS REPORT

Job No :	**Env – Lhr – 510 / 2009**		
Client Name / Address :	**NESPAK (Pvt) Ltd. / NESPAK House 1-C Block N, Model Town Ext. Lahore**		
Description Of Sample :	**Surface Water (As Stated)**		
Marking (If Any) :	**SWJ (J-Jhelum)**	**No. of sample :**	**01**
Sample Condition Upon Receipt:	**Satisfactory**	**Sample Receiving Date :**	**23-12-09**
Environmental Conditions:	**Temperature : NA**	**Humidity:**	**NA**

Sr. #	Parameters	Procedure	Permissible Limits	Results
01	Total Colony Count	APHA:9215	< 500 cfu / ml	1190
02	Total Coli Forms	APHA:9222 B	0 / 100ml	24
03	Faecal Coli Forms (E.Coli)	APHA:9222 B	0 / 100ml	13
04	Faecal Streptococci/ Enterococci	APHA: 9230 C	0 / 100ml	2

cfu : colony forming unit

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MICROBIOLOGICAL ANALYSIS REPORT

Job No :	**Env – Lhr – 510 / 2009**		
Client Name / Address :	**NESPAK (Pvt) Ltd. / NESPAK House 1-C Block N, Model Town Ext. Lahore**		
Description Of Sample :	**Surface Water (As Stated)**		
Marking (If Any) :	**SWT (T-Trimu)**	**No. of sample :**	**01**
Sample Condition Upon Receipt:	**Satisfactory**	**Sample Receiving Date :**	**23-12-09**
Environmental Conditions:	**Temperature : NA**	**Humidity:**	**NA**

Sr. #	Parameters	Procedure	Permissible Limits	Results
01	Total Colony Count	APHA:9215	< 500 cfu / ml	1250
02	Total Coli Forms	APHA:9222 B	0 / 100ml	28
03	Faecal Coli Forms (E.Coli)	APHA:9222 B	0 / 100ml	14
04	Faecal Streptococci/ Enterococci	APHA: 9230 C	0 / 100ml	4

cfu : colony forming unit

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CHEMICAL LABORATORY
TEST REPORT

Job No :	**Env – Lhr – 510 / 2009**		
Client Name / Address :	**NESPAK (Pvt) Ltd. / NESPAK House 1-C Block N, Model Town Ext. Lahore**		
Description Of Sample :	**Surface Water (As Stated)**		
Marking (If Any) :	**SWC (C-Chenab)**	**No. of sample :**	**01**
Sample Condition Upon Receipt:	**Satisfactory**	**Sample Receiving Date :**	**23-12-09**
Environmental Conditions:	**Temperature : NA**	**Humidity:**	**NA**

Sr. #	Parameters	Method	Unit	LDL	Test Results	Limits as per NEQS
01	pH	APHA-4500H⁺ B	-	-	7.75	06 – 09
02	Odor	Organoleptic	-	-	Odorless	-
03	Turbidity	APHA-2130 B	NTU	0.2	20.30	-
04	Conductivity	APHA-2150 B	µS	0.1	636.00	-
05	Biochemical Oxygen Demand (BOD_5)	ASTM 5210	mg/L	5.0	5.00	80.00
06	Chemical Oxygen Demand (COD)	APHA-5220 D	mg/L	5.0	11.00	150.00
07	Total Suspended Solids (TSS)	APHA-2540 D	mg/L	5.0	18.00	200.00
08	Total Dissolved Solids (TDS)	APHA-2540 C	mg/L	5.0	430.00	3500.00
09	Chloride (Cl)	APHA-4500Cl⁻ B	mg/L	0.5	93.00	1000.00
10	Sulphate (SO_4)	APHA-4500 SO_4 C	mg/L	5.0	64.20	600.00
11	Nitrates (NO_3)	APHA-4500NO_3 B	mg/L	0.003	5.30	-
12	Fluoride (F)	APHA - F⁻ C	mg/L	0.01	0.46	10.00
13	Sodium Absorption Ratio (SAR)	In-House	-	-	4.20	-
14	Residual Sodium Carbonate (RSC)	In-House	mg/L	-	ND	-
15	Calcium	APHA-3500Ca B	mg/L	0.5	39.60	-
16	Magnesium	APHA-3500Mg B	mg/L	0.5	13.58	-

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Sr. #	Parameters	Method	Unit	LDL	Test Results	Limits as per NEQS
17	Grease & Oil	USEPA-1664	mg/L	1.0	<1.0	10.00
18	Ammonia (NH_3)	APHA-4500NH_3 B	mg/L	0.1	<0.1	40.00
19	Bicarbonates	APHA-2320 B	mg/L	0.5	152.30	-
20	Carbonates	APHA-2320 B	mg/L	0.5	<0.5	-
21	Cadmium (Cd)	APHA-3500Cd B	mg/L	0.003	<0.003	00.10
22	Chromium (Cr)	APHA-3500Cr B	mg/L	0.01	<0.01	01.00
23	Copper (Cu)	APHA-3500Cu B	mg/L	0.01	<0.01	01.00
24	Lead (Pb)	APHA-3500Pb B	mg/L	0.01	0.02	00.50
25	Mercury (Hg)	APHA-3500Hg B	mg/L	0.001	<0.001	00.01
26	Selenium (Se)	APHA-3500Se C	mg/L	0.01	<0.01	00.50
27	Nickel (Ni)	APHA 3500 Ni B	mg/L	0.01	<0.01	01.00
28	Silver (Ag)	APHA-3500Ag B	mg/L	0.1	<0.1	01.00
29	Zinc (Zn)	APHA-3500Zn B	mg/L	0.01	0.02	05.00
30	Barium (Ba)	APHA-3500Ba B	mg/L	0.5	<0.5	01.50
31	Iron (Fe)	APHA-3500Fe B	mg/L	0.01	0.80	8.00
32	Manganese (Mn)	APHA-3500Mn B	mg/L	0.01	0.02	01.50
33	Chlorine	APHA-4500Cl G	mg/L	0.1	<0.1	1.00
34	Potassium (K)	APHA-3500K B	mg/L	0.3	3.10	-
35	Sodium (Na)	APHA-3500Na B	mg/L	0.5	121.00	-

LDL: Lowest Detection Limit -: Not Defined <: Less Then ND: Not Defined

Note: SAR is calculated with meq/L

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CHEMICAL LABORATORY

TEST REPORT

Job No : Env – Lhr – 510 / 2009

Client Name / Address : NESPAK (Pvt) Ltd. / NESPAK House 1-C Block N, Model Town Ext. Lahore

Description Of Sample : Surface Water (As Stated)

Marking (If Any) : SWJ (J-Jhelum) **No. of sample :** 01

Sample Condition Upon Receipt: Satisfactory **Sample Receiving Date :** 23-12-09

Environmental Conditions: Temperature : NA **Humidity:** NA

Sr. #	Parameters	Method	Unit	LDL	Test Results	Limits as per NEQS
01	pH	APHA-4500H⁺ B	-	-	7.51	06 – 09
02	Odor	Organoleptic	-	-	Odorless	-
03	Turbidity	APHA-2130 B	NTU	0.2	49.90	-
04	Conductivity	APHA-2150 B	µS	0.1	659.00	-
05	Biochemical Oxygen Demand (BOD_5)	ASTM 5210	mg/L	5.0	8.00	80.00
06	Chemical Oxygen Demand (COD)	APHA-5220 D	mg/L	5.0	15.00	150.00
07	Total Suspended Solids (TSS)	APHA-2540 D	mg/L	5.0	57.00	200.00
08	Total Dissolved Solids (TDS)	APHA-2540 C	mg/L	5.0	438.00	3500.00
09	Chloride (Cl)	APHA-4500Cl⁻ B	mg/L	0.5	95.30	1000.00
10	Sulphate (SO_4)	APHA-4500 SO_4 C	mg/L	5.0	63.80	600.00
11	Nitrates (NO_3)	APHA-4500NO_3 B	mg/L	0.003	4.10	-
12	Fluoride (F)	APHA - F⁻ C	mg/L	0.01	0.44	10.00
13	Sodium Absorption Ratio (SAR)	In-House	-	-	3.90	-
14	Residual Sodium Carbonate (RSC)	In-House	mg/L	-	ND	-
15	Calcium	APHA-3500Ca B	mg/L	0.5	43.56	-
16	Magnesium	APHA-3500Mg B	mg/L	0.5	13.28	-

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CHEMICAL LABORATORY
TEST REPORT

Job No : Env – Lhr – 510 / 2009
Client Name / Address : NESPAK (Pvt) Ltd. / NESPAK House 1-C Block N, Model Town Ext. Lahore
Description Of Sample : Surface Water (As Stated)
Marking (If Any) : SWT (T-Trimu) **No. of sample :** 01
Sample Condition Upon Receipt: Satisfactory **Sample Receiving Date :** 23-12-09
Environmental Conditions: Temperature : NA **Humidity:** NA

Sr. #	Parameters	Method	Unit	LDL	Test Results	Limits as per NEQS
01	pH	APHA-4500H⁺ B	-	-	7.22	06 – 09
02	Odor	Organoleptic	-	-	Odorless	-
03	Turbidity	APHA-2130 B	NTU	0.2	48.00	-
04	Conductivity	APHA-2150 B	µS	0.1	649.00	-
05	Biochemical Oxygen Demand (BOD_5)	ASTM 5210	mg/L	5.0	10.00	80.00
06	Chemical Oxygen Demand (COD)	APHA-5220 D	mg/L	5.0	20.00	150.00
07	Total Suspended Solids (TSS)	APHA-2540 D	mg/L	5.0	59.00	200.00
08	Total Dissolved Solids (TDS)	APHA-2540 C	mg/L	5.0	439.00	3500.00
09	Chloride (Cl)	APHA-4500Cl⁻ B	mg/L	0.5	92.30	1000.00
10	Sulphate (SO_4)	APHA-4500 SO_4 C	mg/L	5.0	65.80	600.00
11	Nitrates (NO_3)	APHA-4500NO_3 B	mg/L	0.003	4.50	-
12	Fluoride (F)	APHA - F⁻ C	mg/L	0.01	0.48	10.00
13	Sodium Absorption Ratio (SAR)	In-House	-	-	3.86	-
14	Residual Sodium Carbonate (RSC)	In-House	mg/L	-	ND	-
15	Calcium	APHA-3500Ca B	mg/L	0.5	41.58	-
16	Magnesium	APHA-3500Mg B	mg/L	0.5	13.28	-

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Sr. #	Parameters	Method	Unit	LDL	Test Results	Limits as per NEQS
17	Grease & Oil	USEPA-1664	mg/L	1.0	<1.0	10.00
18	Ammonia (NH_3)	APHA-4500NH_3 B	mg/L	0.1	1.10	40.00
19	Bicarbonates	APHA-2320 B	mg/L	0.5	158.00	-
20	Carbonates	APHA-2320 B	mg/L	0.5	<0.5	-
21	Cadmium (Cd)	APHA-3500Cd B	mg/L	0.003	<0.003	00.10
22	Chromium (Cr)	APHA-3500Cr B	mg/L	0.01	<0.01	01.00
23	Copper (Cu)	APHA-3500Cu B	mg/L	0.01	<0.01	01.00
24	Lead (Pb)	APHA-3500Pb B	mg/L	0.01	0.02	00.50
25	Mercury (Hg)	APHA-3500Hg B	mg/L	0.001	<0.001	00.01
26	Selenium (Se)	APHA-3500Se C	mg/L	0.01	<0.01	00.50
27	Nickel (Ni)	APHA 3500 Ni B	mg/L	0.01	<0.01	01.00
28	Silver (Ag)	APHA-3500Ag B	mg/L	0.1	<0.1	01.00
29	Zinc (Zn)	APHA-3500Zn B	mg/L	0.01	0.04	05.00
30	Barium (Ba)	APHA-3500Ba B	mg/L	0.5	<0.5	01.50
31	Iron (Fe)	APHA-3500Fe B	mg/L	0.01	0.82	8.00
32	Manganese (Mn)	APHA-3500Mn B	mg/L	0.01	0.02	01.50
33	Chlorine	APHA-4500Cl G	mg/L	0.1	<0.1	1.00
34	Potassium (K)	APHA-3500K B	mg/L	0.3	3.1	-
35	Sodium (Na)	APHA-3500Na B	mg/L	0.5	112.00	-

LDL: Lowest Detection Limit -: Not Defined <: Less Then ND: Not Defined

Note: SAR is calculated with meq/L

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APPENDIX 4.3

WATER QUALITY GUIDELINES AND STANDARDS

National Standards for Drinking Water Quality

Properties/Parameters	Standard Values for Pakistan	Who Standards	Remarks
Bacterial			
All water intended for drinking (e.Coli or Thermotolerant Coliform bacteria)	Must not be detectable in any 100 ml sample	Must not be detectable in any 100 ml sample	Most Asian countries also follow WHO standards
Treated water entering the distribution system (E.Coli or thermo tolerant coliform and total coliform bacteria)	Must not be detectable in any 100 ml sample	Must not be detectable in any 100 ml sample	Most Asian countries also follow WHO standards
Treated water in the distribution system (E. coli or thermo tolerant coliform and total coliform bacteria)	Must not be detectable in any 100 ml sample In case of large supplies, where sufficient samples are examined, must not be present in 95% of the samples taken throughout any 12-month period.	Must not be detectable in any 100 ml sample In case of large supplies, where sufficient samples are examined, must not be present in 95% of the samples taken throughout any 12 month period.	Most Asian countries also follow WHO standards
Physical			
Colour	≤ 15 TCU	≤ 15 TCU	
Taste	Non objectionable/Acceptable	Non objectionable/Acceptable	
Odour	Non objectionable/Acceptable	Non objectionable/Acceptable	
Turbidity	⟨ 5 NTU	⟨ 5 NTU	
Total hardness as $CaCO_3$	< 500 mg/l	---	
TDS	⟨ 1000	⟨ 1000	
pH	6.5 – 8.5	6.5 – 8.5	
Chemical			
Essential Inorganic	***mg/Litre***	***mg/Litre***	
Aluminium (Al) mg/l	≤ 0.2	0.2	

Properties/Parameters	Standard Values for Pakistan	Who Standards	Remarks
Antimony (Sb)	≤ 0.005 (P)	0.02	
Arsenic (As)	≤ 0.05 (P)	0.01	Standard for Pakistan similar to most Asian developing countries
Barium (Ba)	0.7	0.7	
Boron (B)	0.3	0.3	
Cadmium (Cd)	0.01	0.003	Standard for Pakistan similar to most Asian developing countries
Chloride (Cl)	< 250	250	
Chromium (Cr)	≤ 0.05	0.05	
Copper (Cu)	2	2	
Toxic Inorganic	***mg/Litre***	***mg/Litre***	
Cyanide (CN)	≤ 0.05	0.07	Standard for Pakistan similar to Asian developing countries
Fluoride (F)*	≤ 1.5	1.5	
Lead (Pb)	≤ 0.05	0.01	Standard for Pakistan similar to most Asian developing countries
Manganese (Mn)	≤ 0.5	0.5	
Mercury (Hg)	≤ 0.001	0.001	
Nickel (Ni)	≤ 0.02	0.02	
Nitrate (NO_3)*	≤ 50	50	
Nitrite (NO_2)*	≤ 3 (P)	3	
Selenium (Se)	0.01(P)	0.01	
Residual chlorine	0.2-0.5 at consumer-end 0.5-1.5 at source	—	
Zinc (Zn)	5.0	3	Standard for Pakistan similar to most Asian developing countries

* indicates priority health related inorganic constituents which need regular monitoring.

Properties/Parameters	Standard Values for Pakistan	Who Standards	Remarks
Organic			
Pesticides mg/L		PSQCA No. 4639-2004, Page No. 4 Table No. 3 Serial No. 20- 58 may be consulted.***	Annex II
Phenolic compounds (as Phenols) mg/L		≤ 0.002	
Polynuclear aromatic hydrocarbons (as PAH) g/L		0.01 (By GC/MS method)	
Radioactive			
Alpha Emitters bq/L or pCi	0.1	0.1	
Beta emitters	1	1	

*** PSQCA: Pakistan Standards Quality Control Authority.

GUIDELINES FOR INTERPRETATIONS OF WATER QUALITY FOR IRRIGATION[1]

Potential Irrigation Problem				Units	Degree of Restriction on Use		
					None	Slight to Moderate	Severe
Salinity *(affects crop water availability)*[2]							
	EC_w			dS/m	< 0.7	0.7 – 3.0	> 3.0
	(or)						
	TDS			mg/l	< 450	450 – 2000	> 2000
Infiltration *(affects infiltration rate of water into the soil. Evaluate using EC_w and SAR together)*[3]							
SAR	= 0 – 3	**and EC_w**	=		> 0.7	0.7 – 0.2	< 0.2
	= 3 – 6		=		> 1.2	1.2 – 0.3	< 0.3
	= 6 – 12		=		> 1.9	1.9 – 0.5	< 0.5
	= 12 – 20		=		> 2.9	2.9 – 1.3	< 1.3
	= 20 – 40		=		> 5.0	5.0 – 2.9	< 2.9
Specific Ion Toxicity *(affects sensitive crops)*							
	Sodium (Na)[4]						
	surface irrigation			SAR	< 3	3 – 9	> 9
	sprinkler irrigation			me/l	< 3	> 3	
	Chloride (Cl)[4]						
	surface irrigation			me/l	< 4	4 – 10	> 10
	sprinkler irrigation			me/l	< 3	> 3	
	Boron (B)[5]			mg/l	< 0.7	0.7 – 3.0	> 3.0
	Trace Elements (see Table 21)						
Miscellaneous Effects *(affects susceptible crops)*							
	Nitrogen (NO_3 - N)[6]			mg/l	< 5	5 – 30	> 30
	Bicarbonate (HCO_3)						
	(overhead sprinkling only)			me/l	< 1.5	1.5 – 8.5	> 8.5
	pH				**Normal Range 6.5 – 8.4**		

[1] Adapted from University of California Committee of Consultants 1974.

[2] ECw means electrical conductivity, a measure of the water salinity, reported in deciSiemens per metre at 25°C (dS/m) or in units millimhos per centimetre (mmho/cm). Both are equiva-lent. TDS means total dissolved solids, reported in milligrams per litre (mg/l).

[3] SAR means sodium adsorption ratio. SAR is sometimes reported by the symbol RNa. See Figure1 for the SAR calculation procedure. At a given SAR, infiltration rate increases as watersalinity increases. Evaluate the potential infiltration problem by SAR as modified by ECw.Adapted from Rhoades 1977, and Oster and Schroer 1979.

[4] For surface irrigation, most tree crops and woody plants are sensitive to sodium and chlor-ide; use the values shown. Most annual crops are not sensitive; use the salinity tolerance tables (Tables 4 and 5). For chloride tolerance of selected fruit crops, see Table 14. With overhead sprinkler irrigation and low

humidity (< 30 percent), sodium and chloride may be absorbed through the leaves of sensitive crops. For crop sensitivity to absorption, see Tables 18, 19 and 20.

[5] For boron tolerances, see Tables 16 and 17.

[6] NO_3 -N means nitrate nitrogen reported in terms of elemental nitrogen (NH_4 -N and Organic-N should be included when wastewater is being tested).

Source: Water Quality for Agriculture: FAO Irrigation and Drainage Paper 29 by R.S. Ayers and D.W. Westcot 1985

The 1986 criteria statement for bacteriological criteria follows:

EPA Criteria for Bathing (Full Body Contact)
Recreational Waters

Freshwater

Based on a statistically sufficient number of samples (generally not less than 5 samples equally spaced over a 30-day period), the geometric mean of the indicated bacterial densities should not exceed one or the other of the following:[1]

E. coli	126 per 100 ml; or
Enterococci	33 per 100 ml.

No sample should exceed a one sided confidence limit (C.L.) calculated using the following as guidance:

Designated bathing beach 75% C.L.
Moderate use for bathing 82% C.L.
Light use for bathing 90% C.L.
Infrequent use for bathing 95% C.L.

based on a site-specific log standard deviation, or if site data are insufficient to establish a log standard deviation, then using 0.4 as the log standard deviation for both indicators.

Marine Water

Based on a statistically sufficient number of samples (generally not less than 5 samples equally spaced over a 30-day period), the geometric mean of the enterococci densities should not exceed 35 per 100 ml.

No sample should exceed a one sided confidence limit using the following as guidance:

Designated bathing beach 75% C.L.
Moderate use for bathing 82% C.L.
Light use for bathing 90% C.L.
Infrequent use for bathing 95% C.L.

based on a site-specific log standard deviation, or if site data are insufficient to establish a log standard deviation, then using 0.7 as the log standard deviation.

[1]Only one indicator should be used. The regulatory agency should select the appropriate indicator for its conditions.

WATER QUALITY PARAMETERS (WAPDA STANDARDS)

Symbols	Usable	Marginal	Hazardous
EC x 10^6	0 - 1500	1500 - 3000	> 3000
RSC (meq/l)	0 – 2.5	2.5 – 5.0	> 5.0
SAR	0 – 10	10 – 18	> 18

CSR

C = EC x 10^6 (Conductivity)

S= SAR (Sodicity)

R = RSC (Sodicity)

APPENDIX 6.1

RAPID ENVIRONMENTAL ASSESSMENT (REA)

ADB's Environment Policy

Rapid Environmental Assessment (REA) Checklist

IRRIGATION

Country/Project Title: **Pakistan / Trimmu Barrage Rehabilitation and Upgrading**

Prepared by: **Water Resources Division NESPAK (Project Consultant)**

SCREENING QUESTIONS	YES	No	REMARKS
A. Project Siting Is the Project area adjacent to or within any of the following environmentally sensitive areas?			
• Protected Area		✓	
• Wetland	Barrage Pond Area may considered as wetland but it is not a classified wetland		There will be no change in the level of pond only the existing capacity of the barrage will be restored. The pond area will be extended in both options (IEE/EIA Report- Chapter 5: Study of Project Alternatives) due to increasing the barrage width and excavating bela. Therefore wetland area will be increase in these options
• Mangrove		✓	
• Estuarine		✓	
• Buffer zone of protected area		✓	
• Special area for protecting biodiversity		✓	
No permanent adverse environmental impact is anticipated from the Project Siting. All the impacts will be of temporary nature and mitigable.			
B. Potential Environmental Impacts Will the Project cause...			

SCREENING QUESTIONS	YES	No	REMARKS
• Loss of precious ecological values (e.g. result of encroachment into forests/swamp lands or historical/cultural buildings/areas, disruption of hydrology of natural waterways, regional flooding, and drainage hazards)?		✓	
• Conflicts in water supply rights and related social conflicts?		✓	No conflicts in water supply rights are anticipated as there will be no change in water courses
• Impediments to movements of people and animals?	✓		Temporary impediments during construction will be minimized through careful selection of Labour camp locations and provision of alternative routes and access paths if closed or used by the Contractor
• Potential ecological problems due to increased soil erosion and siltation, leading to decreased stream capacity?		✓	
• Insufficient drainage leading to salinity intrusion?		✓	
• Over pumping of groundwater, leading to salinization and ground subsidence?		✓	Over pumping of groundwater is not anticipated. Groundwater pumping for the water supply to the labour camp and batching plant is negligible compare to the available ample source of groundwater. The aquifer would be recovered/recharged easily and will not be affected adversely
• Impairment of downstream water quality and therefore, impairment of downstream beneficial uses of water?		✓	
• Dislocation or involuntary resettlement of people?	Houses / infrastructure will be required to relocate for both options (IEE/EIA Report-Chapter 5: Study of Project Alternatives)		A Resettlement Plan (RP) will be prepared and applied before start of construction of the project
• Potential social conflicts arising from land tenure and land use issues?		✓	
• Soil erosion before compaction and lining of canals?		✓	Canal lining are not included in the scope of work

SCREENING QUESTIONS	YES	No	REMARKS
• Noise from construction equipment?		✓	It will be further ensured that suitable Plant & Equipment use on site, regular noise monitoring during construction phase will minimize noise. The construction area is away from the populated areas
• Dust?	✓		Mitigation through sprinkling water when required. Instrumental dust monitoring at quarterly basis and visual inspection on 24 hours basis is recommended in Environment Monitoring Plan
• Labour-related social problems especially if workers from different areas are hired?		✓	Sufficient local source of labour is available. Outside labour will be employed only for those fields for which local skilled labour is not available. Regular awareness courses will be arranged on communicable disease and HIV/AIDS during construction for project labour
• Waterlogging and soil salinization due to inadequate drainage and farm management?		✓	No water logging and salinization impact is anticipated from the project implementation
• Leaching of soil nutrients and changes in soil characteristics due to excessive application of irrigation water?		✓	
• Reduction of downstream water supply during peak seasons?		✓	Work will be managed during routine canal closure and design provides cofferdams & temporary structure at necessary points
• Soil pollution, polluted farm runoff and groundwater, and public health risks due to excessive application of fertilizers and pesticides?		✓	
• Soil erosion (furrow, surface)?		✓	
• Scouring of canals?		✓	
• Logging of canals by sediments?		✓	
• Clogging of canals by weeds?		✓	
• Seawater intrusion into downstream freshwater systems?		✓	
• Introduction of increase in incidence of waterborne or water related diseases?		✓	No change in quality of water is anticipated from the project activities

APPENDIX 6.2

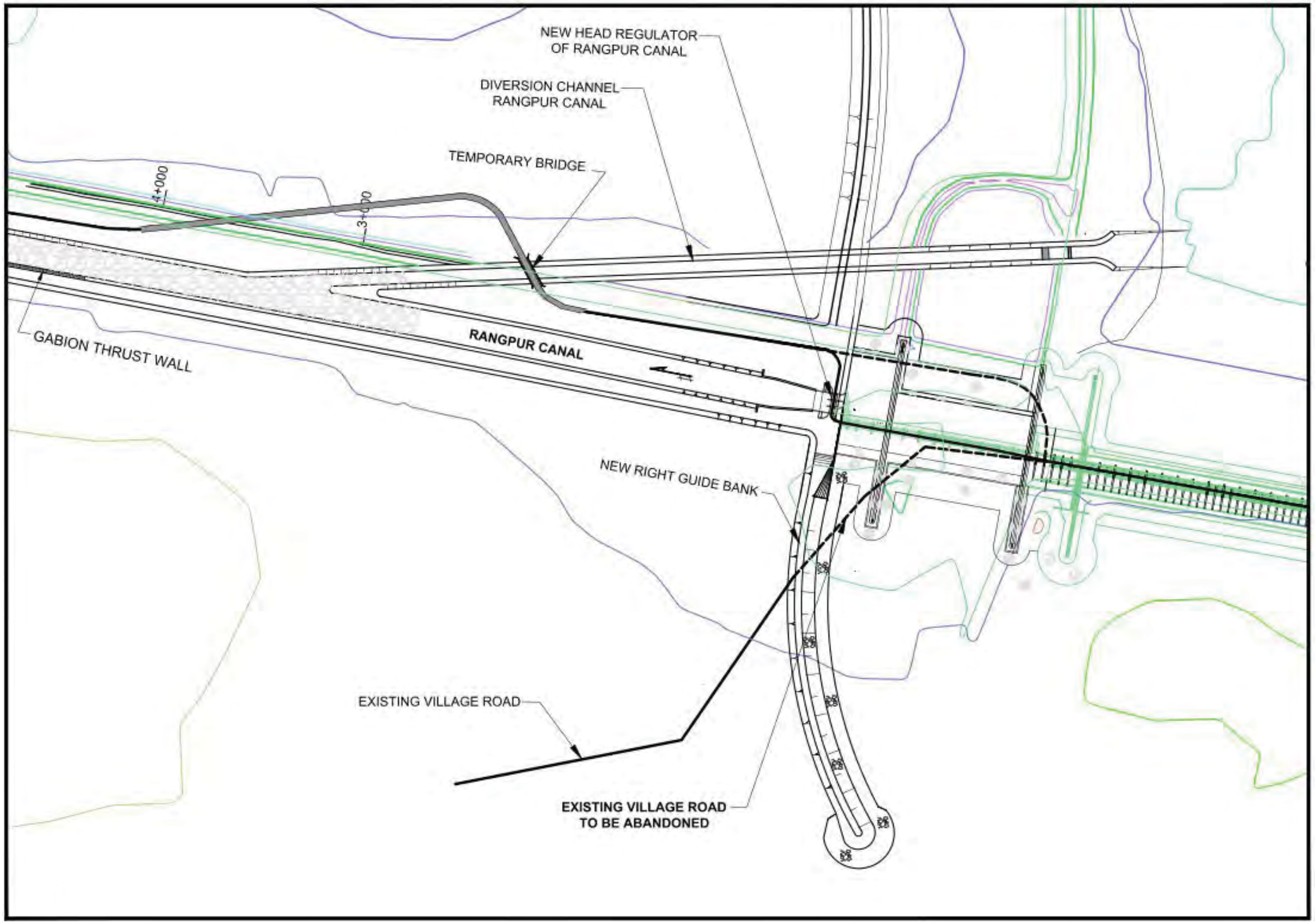
DIVERSION RESTORATION PLAN

A diversion has been proposed and the typical drawing of the diversion channel for Rangpur Canal is attached.

Restoration Plan

The following steps have to be taken by the Contractor for the restoration of diversion areas:

- Systematically, acquiring land and execute the agreement for restoration of land after completion of work
- Record of topographic characteristics in diversion areas
- Pre-construction photographic records of the diversion sites
- Preparation of tree inventory and infrastructure (if any) existing in diversion area
- Planned removal and safe storage of 06 inches top soil
- Storage of excavated soil for filling of channels after completion of work
- Excavation of the channel as per specifications
- Proper filling and compaction of channels after completion of work as per original gradient and according to the satisfaction of the Engineer
- Spreading of stored top soil evenly at the diversion sites
- Restore/ rebuilt infrastructure (if any)



Diversion Channel for Rangpur Canal

APPENDIX 7.1

CHECKLISTS

Checklists for Camp Site

Description	***Status***	***Notes***
Is the camp layout according to the design documents?	Yes ☐ No ☐	
Has the camp site been selected in consultation with the consultants' environmental team?	Yes ☐ No ☐	
Have the photographs been taken to record the pre camping conditions?	Yes ☐ No ☐	
Are there any settlements within 500 meters of the camp site?	Yes ☐ No ☐	
Has the camp been established in the existing clearings / designated area?	Yes ☐ No ☐	
Was the hunting, fishing, or capturing wildlife, or discharging fireman avoided?	Yes ☐ No ☐	
Was the harassment or pushing of wildlife avoided?	Yes ☐ No ☐	
Has any vegetation been cleared? If yes, is the vegetation loss significant? If yes, have mitigation measures been discussed and agreed?	Yes ☐ No ☐ Yes ☐ No ☐ Yes ☐ No ☐	
Has any trees felled?	Yes ☐ No ☐	
Have the trees or bushes been burnt?	Yes ☐ No ☐	
Have bushes been disposed offf in a water body or dry streambed?	Yes ☐ No ☐	
Has the natural drainage been disturbed or blocked?	Yes ☐ No ☐	
Has the septic tank been built for sewerage? Has the soaking pits or sump been built for wastewater disposal?	Yes ☐ No ☐ Yes ☐ No ☐	

Description	***Status***	***Notes***
Has the sump been built in absorbent soil?	Yes ☐ No ☐	
Has the sump been built down-slope from the camp?	Yes ☐ No ☐	
Is the sump covered, in order to reduce access of insects and animals?	Yes ☐ No ☐	
Do the fuel storage facilities have adequate secondary containments arrangements in case of leakage or spilling?	Yes ☐ No ☐	
Is the concrete pad has been constructed for fuel, oils and other chemical liquid transfer?	Yes ☐ No ☐	
Is the updated firefighting equipment available near fuel storage area?	Yes ☐ No ☐	
Is the fuel storage downwind and down slope of the camp?	Yes ☐ No ☐	
Is there any other combustible or flammable material in the fuel storage area?	Yes ☐ No ☐	
Are the fuel tanks properly marked with their contents and precautions?	Yes ☐ No ☐	

Note:

Signature Date

ESU

Consultants' Environmentalist

Contractor's Environmentalist

Checklists for Borrow Areas

Description	***Status***	***Notes***
Is the borrow area is marked according to the design documents?	Yes ☐ No ☐	
Has the borrow area been selected in consultation with the consultants' environmental team?	Yes ☐ No ☐	
Have the photographs been taken to record the pre camping conditions?	Yes ☐ No ☐	
Has the access roads been established in the existing clearings / designated area?	Yes ☐ No ☐	
Has any vegetation been cleared? If yes, is the vegetation loss significant? If yes, have mitigation measures been discussed and agreed?	Yes ☐ No ☐ Yes ☐ No ☐ Yes ☐ No ☐	
Has any trees felled?	Yes ☐ No ☐	
Have the trees or bushes been burnt?	Yes ☐ No ☐	
Has the natural drainage been disturbed or blocked?	Yes ☐ No ☐	
Has the borrow area been fenced to avoid animal access and human safety?	Yes ☐ No ☐	
Is there proper mechanism to control dust pollution?	Yes ☐ No ☐	
Does the borrowed earth used for filling meet the specifications?	Yes ☐ No ☐	

Note:

Signature Date

ESU

Consultants' Environmentalist

Contractor's Environmentalist

Checklists for Access Roads

Description	***Status***	***Notes***
Has the access roads selected in consultation with the consultants' environmental team?	Yes ☐ No ☐	
Have the photographs been taken to record the pre-construction conditions?	Yes ☐ No ☐	
Are there any settlements within 500 meters of the construction?	Yes ☐ No ☐	
Has the access roads been established in the existing clearings or designated site?	Yes ☐ No ☐	
Was the harassment or pushing of wildlife avoided in establishment of access roads?	Yes ☐ No ☐	
Has any vegetation been cleared? If yes, is the vegetation loss significant? If yes, have mitigation measures been discussed and agreed?	Yes ☐ No ☐ Yes ☐ No ☐ Yes ☐ No ☐	
Has any trees felled?	Yes ☐ No ☐	
Has the compacted gravel topping provided access roads?	Yes ☐ No ☐	
Has the excavated earth / silt disposed off properly?	Yes ☐ No ☐	
Do the access roads have sufficient width?	Yes ☐ No ☐	
Do the diversion signs and required signs boards placed on the access roads?	Yes ☐ No ☐	

Note:

Signature Date

ESU

Consultants' Environmentalist

Contractor's Environmentalist

Checklists for Construction Work Site

Description	*Status*	*Notes*
Is the construction site layout is according to the design documents?	Yes ☐ No ☐	
Has the construction site selected in consultation with the consultants' environmental team?	Yes ☐ No ☐	
Have the photographs been taken to record the pre-construction conditions?	Yes ☐ No ☐	
Are there any settlements within 500 meters of the construction?	Yes ☐ No ☐	
Has the construction site been established in the existing clearings or designated site?	Yes ☐ No ☐	
Does the temporary diversion channel built per specifications?	Yes ☐ No ☐	
Was the hunting, fishing, or capturing wildlife, or discharging fireman avoided?	Yes ☐ No ☐	
Was the harassment or pushing of wildlife avoided?	Yes ☐ No ☐	
Was the disposal of waste material in the protected area avoided?	Yes ☐ No ☐	
Has any vegetation been cleared? If yes, is the vegetation loss significant? If yes, have mitigation measures been discussed and agreed?	Yes ☐ No ☐ Yes ☐ No ☐ Yes ☐ No ☐	
Has any trees felled?	Yes ☐ No ☐	
Has the excavated earth / silt disposed off properly?	Yes ☐ No ☐	
Does the borrowed earth used for filling meet the specifications?	Yes ☐ No ☐	

Description	***Status***	***Notes***
Has the natural drainage been disturbed or blocked?	Yes ☐ No ☐	
Has the septic tank been built for wastewater disposal?	Yes ☐ No ☐	
Is the soaking pits or sump covered, in order to reduce access of insects and animals?	Yes ☐ No ☐	
Do the fuel storage facilities have adequate secondary containments arrangements in case of leakage or spilling?	Yes ☐ No ☐	
Is the concrete pad has be constructed for fuel, oils and other chemical liquid transfer?	Yes ☐ No ☐	
Is the firefighting equipment available near fuel storage area?	Yes ☐ No ☐	
Is the fuel storage downwind and down slope of the camp?	Yes ☐ No ☐	
Is there any other combustible or flammable material in the fuel storage area?	Yes ☐ No ☐	
Are the fuel tanks properly marked with their contents?	Yes ☐ No ☐	

Note:

Signature Date

ESU

Consultants' Environmentalist

Contractor's Environmentalist

MONITORING CHECK LISTS

A-Daily Monitoring Checklist

Description	Status	Additional Comments
A-Physical Conditions		
1-Ambient air quality		
Are dust emissions being regulated through sprinkling water on the routes being used by the Contractor?	☐Yes ☐No	
Are vehicle speeds being monitored to avoid excessive dust emissions at dust prone areas?	☐Yes ☐No	
2. Noise Control		
In case excessive noise levels are detected have appropriate mitigation measures been taken?	☐Yes ☐No	
Is restriction on playing tape records and blowing pressure horns etc. is being observed?	☐Yes ☐No	
Are heavily traveled routes watered (where required) on a daily basis to minimize dust?	☐Yes ☐No	
2-Waste Material		
Has any natural drainage been disturbed or altered?	☐Yes ☐No	
Are the waste bins emptied regularly in the burn pit?	☐Yes ☐No	
Is food waste disposed in the open?	☐Yes ☐No	
Is the combustible waste burnt regularly in the burn pit?	☐Yes ☐No	
Is medical waste being stored separately at the camp site?	☐Yes ☐No	
3-Fuel/Lubricant		
Are the fuel tanks properly marked with their contents?	☐Yes ☐No	
Are the fuels and oils handled in a safe manner, ensuring no leakage or spillage?	☐Yes ☐No	
4-Traffic management		
Is vehicle speed limit being followed?	☐Yes ☐No	
Is the movement of all project vehicles and personnel been restricted to within the work areas?	☐Yes ☐No	
Do all vehicles and generators have muffles to reduce noise levels whilst working close to communities?	☐Yes ☐No	

B-Biological Conditions	
1-Flora	
Have trees and branches from canal plantation been used as fuel wood?	☐Yes ☐No
Has vegetation clearing been minimized?	☐Yes ☐No
2-Fauna	
Are the drivers careful and watchful about wild and domestic animals?	☐Yes ☐No
Any damage to animals?	☐Yes ☐No
C-Socio-economic	
1-Community	
During construction have good management practices been adopted by avoiding disturbance to areas adjacent to work area?	☐Yes ☐No
Are complaints from local communities being registered and responded to?	☐Yes ☐No
Have the local communities been formally notified about methods for registering complaints?	☐Yes ☐No

Name _____ Signature _____

Additional Comments: -

B-Weekly Monitoring Checklist

Description	Status	Additional Comments
A-Physical Conditions		
1-Soil Conditions		
Is any soil erosion observed?	☐Yes ☐No	
Has the movement of construction equipment been restricted to work areas to avoid unnecessary disturbance to different soil types in the project area?	☐Yes ☐No	
Have the areas along the access road been visually monitored and show any signs of soil erosion?	☐Yes ☐No	
2-Fuel/Lubricants		
Is regular inspection carried out to check leaks and spills?	☐Yes ☐No	
Is there any other combustible or flammable material in the fuel storage area?	☐Yes ☐No	
Are the fuels and oils handled in a safe manner, ensuring no leakage or spillage?	☐Yes ☐No	
Have the entire oil and fuel storage areas provided with impervious floor underneath to prevent soil contamination from leaks or spills?	☐Yes ☐No	
Are the spilled oil or fuel and used clean-up material being disposed properly?	☐Yes ☐No	
Are the spills and leaks thoroughly cleaned?	☐Yes ☐No	
Is the fuel transfer operation being supervised?	☐Yes ☐No	
3-Waste Material		
Is waste being stored temporarily onsite within a designated area?	☐Yes ☐No	
Is any type of solid waste being disposed off in the field?	☐Yes ☐No	
Are the fuel transfer arrangements protected against spills?	☐Yes ☐No	
Do the vehicles carry adequate containers/trash bags for litter/garbage and are they emptied at the campsite or other designed location regularly?	☐Yes ☐No	
4-Traffic Management		
Are the existing routes being used to access the project area?	☐Yes ☐No	
Is the number of routes kept to a minimum?		
Are short cuts been used?	☐Yes ☐No	

Are all vehicles and construction machinery properly maintained and tuned regularly to confirm NEQS?	☐Yes ☐No
Are pressure horns being used?	☐Yes ☐No
5-Borrow Areas	
Is necessary approval for the borrow areas has been obtained from the Engineer?	☐Yes ☐No
Is the topsoil of the borrow pits removed and conserved for rehabilitation of the borrow area?	☐Yes ☐No
Is the conditions of approval for excavation of the borrow pits are being complied with?	☐Yes ☐No
Is the drainage profile of the area is maintained to avoid impoundment of the agricultural runoff or storm water in the borrow areas?	☐Yes ☐No
6-Camp site	
Are generators in the construction camp properly maintained?	☐Yes ☐No
Is the emergency response plane available on site?	☐Yes ☐No

Name _____ Signature _____

Additional Comments:-

C-Monthly Monitoring Checklist

Description	Status	Additional Comments
A-Physical Conditions		
1-Waste Material		
Do the fuel storage facilities have adequate secondary containment up to 120% capacity in case of leakage or spillage?	☐Yes ☐No	
Does the Camp site have a septic system comprising of septic tank and soak pit?	☐Yes ☐No	
In case the soak pits got filled during the operation, has the grey water been sprinkled?	☐Yes ☐No	
Have the soak pits for laundry, kitchen and showers been built?	☐Yes ☐No	
Have the soak pits been built in absorbent soil?	☐Yes ☐No	
Have the soak pits been designed to accommodate waste water generated during the total duration of the operation?	☐Yes ☐No	
2-Quantity and Quality of Water		
Are prudent water conservation measures being taken on site?	☐Yes ☐No	
Has the quantity of water being used during construction kept to the minimum required level?	☐Yes ☐No	
Is the water well being used for project activities being checked/monitored for signs of water depletion on a regular basis?	☐Yes ☐No	
Can Surface water enter the soak pits?	☐Yes ☐No	
C-Socio-economic		
1-Community		
Is the burn pit located away from the nearest community?	☐Yes ☐No	
Are employment opportunities been provided to local people?	☐Yes ☐No	
Are all community related mitigation measures being adhered to?	☐Yes ☐No	
Do local men accompany the project personnel before entering into or close to communities?	☐Yes ☐No	

Name _____ Signature _____

Additional Comments

D-Quatterly Monitoring Checklist

Description	Status	Additional Comments
A-Physical Conditions		
Has any erosion noticed and controlled in the project area?	☐Yes ☐No	
Has air quality remained under permissible limits?	☐Yes ☐No	
Has water quality remained under desired standards?	☐Yes ☐No	
Are the recyclable wastes including glass, tins, and metal scrap being sent for recycling?	☐Yes ☐No	
Has traffic flow remained satisfactory?	☐Yes ☐No	
Has the construction waste being disposed of properly?	☐Yes ☐No	
Has the camp been maintained properly in terms of safety and hygiene?	☐Yes ☐No	
B. Biological Conditions		
Has vegetation clearance according to the approved schedule?	☐Yes ☐No	
C-Socio-economic		
Have the grievances of the community addressed properly?	☐Yes ☐No	
	☐Yes ☐No	

Name _____ Signature _____

Additional Comments

APPENDIX 7.2

ENVIRONMENTAL ISSUES TRACKING REPORT

Environmental Issues Tracking Report

Tracking No.	Log Date	Source	Location	Issue	Action Required	Responsibility	Target date	Completion Status

APPENDIX 7.3

LIST OF TREES NEED TO BE UPROOTED

No. of Trees	Location			Name of Species		Trees at site		Status (P/G)	Economic Utilization			Condition	Remarks
	Additional Bays	Guide Banks	Diversion Channel	Common Name	Scientific Name	Young (Girth < 24")	Mature (Girth > 24")		Timber	Fuel wood	Fruit Tree		
1		0 to 500 ft		Sheesham	*Dalbergia sissoo*		✔	G	✔			Good	Suitable for High Quality furniture
2		0 to 500 ft		Sheesham	*Dalbergia sissoo*		✔	G	✔			Good	Suitable for High Quality furniture
3		0 to 500 ft		Sheesham	*Dalbergia sissoo*		✔	G	✔			Good	Suitable for High Quality furniture
4		0 to 500 ft		Sheesham	*Dalbergia sissoo*		✔	G	✔			Good	Suitable for High Quality furniture
5		0 to 500 ft		Sheesham	*Dalbergia sissoo*		✔	G	✔			Good	Suitable for High Quality furniture
6		0 to 500 ft		Sheesham	*Dalbergia sissoo*		✔	G	✔			Good	Suitable for High Quality furniture
7		0 to 500 ft		Sheesham	*Dalbergia sissoo*		✔	G	✔			Good	Suitable for High Quality furniture
8		0 to 500 ft		Sheesham	*Dalbergia sissoo*		✔	G	✔			Good	Suitable for High Quality furniture
9		0 to 500 ft		Sheesham	*Dalbergia sissoo*		✔	G	✔			Good	Suitable for High Quality furniture
10		0 to 500 ft		Sheesham	*Dalbergia sissoo*		✔	G	✔			Good	Suitable for High Quality furniture
11		0 to 500 ft		Sheesham	*Dalbergia sissoo*		✔	G	✔			Good	Suitable for High Quality furniture
12		0 to 500 ft		Sheesham	*Dalbergia sissoo*		✔	G	✔			Good	Suitable for High Quality furniture
13		0 to 500 ft		Sheesham	*Dalbergia sissoo*		✔	G	✔			Good	Suitable for High Quality furniture
14		0 to 500 ft		Sheesham	*Dalbergia sissoo*		✔	G	✔			Good	Suitable for High Quality furniture
15		0 to 500 ft		Sheesham	*Dalbergia sissoo*		✔	G	✔			Good	Suitable for High Quality furniture
16		0 to 500 ft		Sheesham	*Dalbergia sissoo*		✔	G	✔			Good	Suitable for High Quality furniture
17		0 to 500 ft		Sheesham	*Dalbergia sissoo*		✔	G	✔			Good	Suitable for High Quality furniture
18		0 to 500 ft		Sheesham	*Dalbergia sissoo*		✔	G	✔			Good	Suitable for High Quality furniture
19		0 to 500 ft		Sheesham	*Dalbergia sissoo*		✔	G	✔			Good	Suitable for High Quality furniture
20		0 to 500 ft		Sheesham	*Dalbergia sissoo*		✔	G	✔			Good	Suitable for High Quality furniture
21		0 to 500 ft		Sheesham	*Dalbergia sissoo*		✔	G	✔			Good	Suitable for High Quality furniture
22		0 to 500 ft		Sheesham	*Dalbergia sissoo*		✔	G	✔			Good	Suitable for High Quality furniture
23		0 to 500 ft		Sheesham	*Dalbergia sissoo*		✔	G	✔			Good	Suitable for High Quality furniture
24		0 to 500 ft		Sheesham	*Dalbergia sissoo*		✔	G	✔			Good	Suitable for High Quality furniture
25		0 to 500 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture

No. of Trees	Location			Name of Species		Trees at site		Status (P/G)	Economic Utilization			Condition	Remarks
	Additional Bays	Guide Banks	Diversion Channel	Common Name	Scientific Name	Young (Girth < 24")	Mature (Girth > 24")		Timber	Fuel wood	Fruit Tree		
26		0 to 500 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
27		0 to 500 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
28		0 to 500 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
29		0 to 500 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
30		0 to 500 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
31		0 to 500 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
32		0 to 500 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
33		0 to 500 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
34		0 to 500 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
35		0 to 500 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
36		0 to 500 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
37		0 to 500 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
38		0 to 500 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
39		0 to 500 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
40		0 to 500 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
41		0 to 500 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
42		0 to 500 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
43		0 to 500 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
44		0 to 500 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
45		0 to 500 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
46		0 to 500 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
47		0 to 500 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
48		0 to 500 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
49		0 to 500 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
50		0 to 500 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture

No. of Trees	Location			Name of Species		Trees at site		Status (P/G)	Economic Utilization			Condition	Remarks
	Additional Bays	Guide Banks	Diversion Channel	Common Name	Scientific Name	Young (Girth < 24")	Mature (Girth > 24")		Timber	Fuel wood	Fruit Tree		
51		0 to 500 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
52		0 to 500 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
53		0 to 500 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
54		0 to 500 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
55		0 to 500 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
56		0 to 500 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
57		0 to 500 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
58		0 to 500 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
59		0 to 500 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
60		0 to 500 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
61		0 to 500 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
62		0 to 500 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
63		0 to 500 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
64		0 to 500 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
65		0 to 500 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
66		0 to 500 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
67		0 to 500 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
68		0 to 500 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
69		0 to 500 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
70		0 to 500 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
71		0 to 500 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
72		0 to 500 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
73		0 to 500 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
74		0 to 500 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
75		0 to 500 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture

No. of Trees	Location			Name of Species		Trees at site		Status (P/G)	Economic Utilization			Condition	Remarks
	Additional Bays	Guide Banks	Diversion Channel	Common Name	Scientific Name	Young (Girth < 24")	Mature (Girth > 24")		Timber	Fuel wood	Fruit Tree		
76		0 to 500 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
77		0 to 500 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
78		0 to 500 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
79		0 to 500 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
80		0 to 500 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
81		0 to 500 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
82		0 to 500 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
83		0 to 500 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
84		0 to 500 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
85		0 to 500 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
86		0 to 500 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
87		0 to 500 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
88		0 to 500 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
89		0 to 500 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
90		0 to 500 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
91		0 to 500 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
92		0 to 500 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
93		0 to 500 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
94		0 to 500 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
95		0 to 500 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
96		0 to 500 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
97		0 to 500 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
98		0 to 500 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
99		0 to 500 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
100		0 to 500 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture

No. of Trees	Location			Name of Species		Trees at site		Status (P/G)	Economic Utilization			Condition	Remarks
	Additional Bays	Guide Banks	Diversion Channel	Common Name	Scientific Name	Young (Girth < 24")	Mature (Girth > 24")		Timber	Fuel wood	Fruit Tree		
101		0 to 500 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
102		0 to 500 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
103		0 to 500 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
104		0 to 500 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
105		0 to 500 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
106		0 to 500 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
107		0 to 500 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
108		0 to 500 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
109		0 to 500 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
110		0 to 500 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
111		0 to 500 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
112		0 to 500 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
113		0 to 500 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
114		0 to 500 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
115		0 to 500 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
116		0 to 500 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
117		0 to 500 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
118		0 to 500 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
119		0 to 500 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
120		0 to 500 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
121		0 to 500 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
122		0 to 500 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
123		0 to 500 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
124		0 to 500 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
125		0 to 500 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture

No. of Trees	Location			Name of Species		Trees at site		Status (P/G)	Economic Utilization			Condition	Remarks
	Additional Bays	Guide Banks	Diversion Channel	Common Name	Scientific Name	Young (Girth < 24")	Mature (Girth > 24")		Timber	Fuel wood	Fruit Tree		
126		0 to 500 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
127		0 to 500 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
128		0 to 500 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
129		0 to 500 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
130		0 to 500 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
131		0 to 500 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
132		0 to 500 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
133		0 to 500 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
134		0 to 500 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
135		0 to 500 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
136		0 to 500 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
137		0 to 500 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
138		0 to 500 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
139		0 to 500 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
140		0 to 500 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
141		0 to 500 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
142		0 to 500 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
143		0 to 500 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
144		0 to 500 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
145		0 to 500 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
146		0 to 500 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
147		0 to 500 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
148		0 to 500 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
149		0 to 500 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
150		0 to 500 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture

No. of Trees	Location			Name of Species		Trees at site		Status (P/G)	Economic Utilization			Condition	Remarks
	Additional Bays	Guide Banks	Diversion Channel	Common Name	Scientific Name	Young (Girth < 24")	Mature (Girth > 24")		Timber	Fuel wood	Fruit Tree		
151		0 to 500 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
152		0 to 500 ft		Date Palm	*Phoenix rubicola*		✔	G			✔	Good	Fruit
153		0 to 500 ft		Date Palm	*Phoenix rubicola*		✔	G			✔	Good	Fruit
154		0 to 500 ft		Date Palm	*Phoenix rubicola*		✔	G			✔	Good	Fruit
155		0 to 500 ft		Pipal	*Ficus religiosa*		✔	G		✔		Good	Suitable for burning and medicines
156		0 to 500 ft		Pipal	*Ficus religiosa*		✔	G		✔		Good	Suitable for burning and medicines
157		0 to 500 ft		Date Palm	*Phoenix*	✔		G			✔	Good	Fruit
158		0 to 500 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
159		0 to 500 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
160		0 to 500 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
161		0 to 500 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
162		0 to 500 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
163		0 to 500 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
164		0 to 500 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
165		0 to 500 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
166		0 to 500 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
167		0 to 500 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
168		0 to 500 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
169		0 to 500 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
170		0 to 500 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
171		0 to 500 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
172		0 to 500 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
173		0 to 500 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
174		0 to 500 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
175		0 to 500 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning

No. of Trees	Location			Name of Species		Trees at site		Status (P/G)	Economic Utilization			Condition	Remarks
	Additional Bays	Guide Banks	Diversion Channel	Common Name	Scientific Name	Young (Girth < 24")	Mature (Girth > 24")		Timber	Fuel wood	Fruit Tree		
176		0 to 500 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
177		0 to 500 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
178		0 to 500 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
179		0 to 500 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
180		0 to 500 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
181		0 to 500 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
182		0 to 500 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
183		0 to 500 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
184		0 to 500 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
185		0 to 500 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
186		0 to 500 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
187		0 to 500 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
188		0 to 500 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
189		0 to 500 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
190		0 to 500 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
191		0 to 500 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
192		0 to 500 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
193		0 to 500 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
194		0 to 500 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
195		0 to 500 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
196		0 to 500 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
197		0 to 500 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
198		0 to 500 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
199		0 to 500 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
200		0 to 500 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning

No. of Trees	Location			Name of Species		Trees at site		Status (P/G)	Economic Utilization			Condition	Remarks
	Additional Bays	Guide Banks	Diversion Channel	Common Name	Scientific Name	Young (Girth < 24")	Mature (Girth > 24")		Timber	Fuel wood	Fruit Tree		
201		0 to 500 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
202		0 to 500 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
203		0 to 500 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
204		0 to 500 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
205		0 to 500 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
206		500 to 700 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
207		500 to 700 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
208		500 to 700 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
209		500 to 700 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
210		500 to 700 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
211		500 to 700 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
212		500 to 700 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
213		500 to 700 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
214		500 to 700 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
215		500 to 700 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
216		500 to 700 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
217		500 to 700 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
218		500 to 700 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
219		500 to 700 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
220		500 to 700 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
221		500 to 700 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
222		500 to 700 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
223		500 to 700 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
224		500 to 700 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
225		500 to 700 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture

No. of Trees	Location			Name of Species		Trees at site		Status (P/G)	Economic Utilization			Condition	Remarks
	Additional Bays	Guide Banks	Diversion Channel	Common Name	Scientific Name	Young (Girth < 24")	Mature (Girth > 24")		Timber	Fuel wood	Fruit Tree		
226		500 to 700 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
227		500 to 700 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
228		500 to 700 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
229		500 to 700 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
230		500 to 700 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
231		500 to 700 ft		Sheesham	*Dalbergia sissoo*		✔	G	✔			Good	Suitable for High Quality furniture
232		500 to 700 ft		Sheesham	*Dalbergia sissoo*		✔	G	✔			Good	Suitable for High Quality furniture
233		500 to 700 ft		Sheesham	*Dalbergia sissoo*		✔	G	✔			Good	Suitable for High Quality furniture
234		500 to 700 ft		Sheesham	*Dalbergia sissoo*		✔	G	✔			Good	Suitable for High Quality furniture
235		500 to 700 ft		Sheesham	*Dalbergia sissoo*		✔	G	✔			Good	Suitable for High Quality furniture
236		500 to 700 ft		Pipal	*Ficus religiosa*		✔	G		✔		Good	Suitable for burning and medicines
237		500 to 700 ft		Pipal	*Ficus religiosa*		✔	G		✔		Good	Suitable for burning and medicines
238		500 to 700 ft		Pipal	*Ficus religiosa*		✔	G		✔		Good	Suitable for burning and medicines
239		500 to 700 ft		Pipal	*Ficus religiosa*		✔	G		✔		Good	Suitable for burning and medicines
240		500 to 700 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
241		500 to 700 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
242		500 to 700 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
243		500 to 700 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
244		500 to 700 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
245		500 to 700 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
246		500 to 700 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
247		500 to 700 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
248		500 to 700 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
249		500 to 700 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
250		500 to 700 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning

No. of Trees	Location			Name of Species		Trees at site		Status (P/G)	Economic Utilization			Condition	Remarks
	Additional Bays	Guide Banks	Diversion Channel	Common Name	Scientific Name	Young (Girth < 24")	Mature (Girth > 24")		Timber	Fuel wood	Fruit Tree		
251		500 to 700 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
252		500 to 700 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
253		500 to 700 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
254		500 to 700 ft		Date Palm	*Phoenix rubicola*	✔		G			✔	Good	Fruit
255		500 to 700 ft		Date Palm	*Phoenix rubicola*	✔		G			✔	Good	Fruit
256		700 to 900 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
257		700 to 900 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
258		700 to 900 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
259		700 to 900 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
260		700 to 900 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
261		700 to 900 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
262		700 to 900 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
263		700 to 900 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
264		700 to 900 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
265		700 to 900 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
266		700 to 900 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
267		700 to 900 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
268		700 to 900 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
269		700 to 900 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
270		700 to 900 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
271		700 to 900 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
272		700 to 900 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
273		700 to 900 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
274		700 to 900 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
275		700 to 900 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture

No. of Trees	Location			Name of Species		Trees at site		Status (P/G)	Economic Utilization			Condition	Remarks
	Additional Bays	Guide Banks	Diversion Channel	Common Name	Scientific Name	Young (Girth < 24")	Mature (Girth > 24")		Timber	Fuel wood	Fruit Tree		
276		700 to 900 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
277		700 to 900 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
278		700 to 900 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
279		700 to 900 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
280		700 to 900 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
281		700 to 900 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
282		700 to 900 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
283		700 to 900 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
284		700 to 900 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
285		700 to 900 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
286		700 to 900 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
287		700 to 900 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
288		700 to 900 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
289		700 to 900 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
290		700 to 900 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
291		700 to 900 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
292		700 to 900 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
293		700 to 900 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
294		700 to 900 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
295		700 to 900 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
296		700 to 900 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
297		700 to 900 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
298		700 to 900 ft		Sheesham	*Dalbergia sissoo*		✔	G	✔			Good	Suitable for Ordinary furniture
299		700 to 900 ft		Sheesham	*Dalbergia sissoo*		✔	G	✔			Good	Suitable for Ordinary furniture
300		700 to 900 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning

No. of Trees	Location			Name of Species		Trees at site		Status (P/G)	Economic Utilization			Condition	Remarks
	Additional Bays	Guide Banks	Diversion Channel	Common Name	Scientific Name	Young (Girth < 24")	Mature (Girth > 24")		Timber	Fuel wood	Fruit Tree		
301		700 to 900 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
302		700 to 900 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
303		700 to 900 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
304		700 to 900 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
305		700 to 900 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
306		700 to 900 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
307		700 to 900 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
308		700 to 900 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
309		700 to 900 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
310		700 to 900 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
311		700 to 900 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
312		700 to 900 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
313		700 to 900 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
314		700 to 900 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
315		700 to 900 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
316		700 to 900 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
317		700 to 900 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
318		700 to 900 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
319		700 to 900 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
320		700 to 900 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
321		700 to 900 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
322		700 to 900 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
323		700 to 900 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
324		700 to 900 ft		Date Palm	*Phoenix rubicola*	✔		G			✔	Good	Fruit
325		700 to 900 ft		Date Palm	*Phoenix rubicola*	✔		G			✔	Good	Fruit

No. of Trees	Location			Name of Species		Trees at site		Status (P/G)	Economic Utilization			Condition	Remarks
	Additional Bays	Guide Banks	Diversion Channel	Common Name	Scientific Name	Young (Girth < 24")	Mature (Girth > 24")		Timber	Fuel wood	Fruit Tree		
326		900 to 1100 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
327		900 to 1100 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
328		900 to 1100 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
329		900 to 1100 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
330		900 to 1100 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
331		900 to 1100 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
332		900 to 1100 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
333		900 to 1100 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
334		900 to 1100 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
335		900 to 1100 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
336		900 to 1100 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
337		900 to 1100 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
338		900 to 1100 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
339		900 to 1100 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
340		900 to 1100 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
341		900 to 1100 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
342		900 to 1100 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
343		900 to 1100 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
344		900 to 1100 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
345		900 to 1100 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
346		900 to 1100 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
347		900 to 1100 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
348		900 to 1100 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
349		900 to 1100 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
350		900 to 1100 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture

No. of Trees	Location			Name of Species		Trees at site		Status (P/G)	Economic Utilization			Condition	Remarks
	Additional Bays	Guide Banks	Diversion Channel	Common Name	Scientific Name	Young (Girth < 24")	Mature (Girth > 24")		Timber	Fuel wood	Fruit Tree		
351		900 to 1100 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
352		900 to 1100 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
353		900 to 1100 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
354		900 to 1100 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
355		900 to 1100 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
356		900 to 1100 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
357		900 to 1100 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
358		900 to 1100 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
359		900 to 1100 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
360		900 to 1100 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
361		900 to 1100 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
362		900 to 1100 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
363		900 to 1100 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
364		900 to 1100 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
365		900 to 1100 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
366		900 to 1100 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
367		900 to 1100 ft		Date Palm	*Phoenix rubicola*	✔		G			✔	Good	Fruit
368		900 to 1100 ft		Sheesham	*Dalbergia sissoo*		✔	G	✔			Good	Suitable for High Quality furniture
369		900 to 1100 ft		Sheesham	*Dalbergia sissoo*		✔	G	✔			Good	Suitable for High Quality furniture
370		900 to 1100 ft		Sheesham	*Dalbergia sissoo*		✔	G	✔			Good	Suitable for High Quality furniture
371		900 to 1100 ft		Beri	*Zizyphus jujube*		✔	G			✔	Good	Fruit
372		1100 to 1300 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
373		1100 to 1300 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
374		1100 to 1300 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
375		1100 to 1300 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture

No. of Trees	Location			Name of Species		Trees at site		Status (P/G)	Economic Utilization			Condition	Remarks
	Additional Bays	Guide Banks	Diversion Channel	Common Name	Scientific Name	Young (Girth < 24")	Mature (Girth > 24")		Timber	Fuel wood	Fruit Tree		
376		1100 to 1300 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
377		1100 to 1300 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
378		1100 to 1300 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
379		1100 to 1300 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
380		1100 to 1300 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
381		1100 to 1300 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
382		1100 to 1300 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
383		1100 to 1300 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
384		1100 to 1300 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
385		1100 to 1300 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
386		1100 to 1300 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
387		1100 to 1300 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
388		1100 to 1300 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
389		1100 to 1300 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
390		1100 to 1300 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
391		1100 to 1300 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
392		1100 to 1300 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
393		1100 to 1300 ft		Sheesham	*Dalbergia sissoo*		✔	G	✔			Good	Suitable for High Quality furniture
394		1100 to 1300 ft		Sheesham	*Dalbergia sissoo*		✔	G	✔			Good	Suitable for High Quality furniture
395		1100 to 1300 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
396		1100 to 1300 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
397		1100 to 1300 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
398		1100 to 1300 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
399		1100 to 1300 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
400		1100 to 1300 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning

No. of Trees	Location			Name of Species		Trees at site		Status (P/G)	Economic Utilization			Condition	Remarks
	Additional Bays	Guide Banks	Diversion Channel	Common Name	Scientific Name	Young (Girth < 24")	Mature (Girth > 24")		Timber	Fuel wood	Fruit Tree		
401		1100 to 1300 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
402		1100 to 1300 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
403		1100 to 1300 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
404		1100 to 1300 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
405		1100 to 1300 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
406		1100 to 1300 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
407		1100 to 1300 ft		Date Palm	*Phoenix*		✔	G			✔	Good	Fruit
408		1300 to 1500 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
409		1300 to 1500 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
410		1300 to 1500 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
411		1300 to 1500 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
412		1300 to 1500 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
413		1300 to 1500 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
414		1300 to 1500 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
415		1300 to 1500 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
416		1300 to 1500 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
417		1300 to 1500 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
418		1300 to 1500 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
419		1300 to 1500 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
420		1300 to 1500 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
421		1300 to 1500 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
422		1300 to 1500 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
423		1300 to 1500 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
424		1300 to 1500 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
425		1300 to 1500 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture

No. of Trees	Location			Name of Species		Trees at site		Status (P/G)	Economic Utilization			Condition	Remarks
	Additional Bays	Guide Banks	Diversion Channel	Common Name	Scientific Name	Young (Girth < 24")	Mature (Girth > 24")		Timber	Fuel wood	Fruit Tree		
426		1300 to 1500 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
427		1300 to 1500 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
428		1300 to 1500 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
429		1300 to 1500 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
430		1300 to 1500 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
431		1300 to 1500 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
432		1300 to 1500 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
433		1300 to 1500 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
434		1300 to 1500 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
435		1300 to 1500 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
436		1300 to 1500 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
437		1300 to 1500 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
438		1300 to 1500 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
439		1300 to 1500 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
440		1300 to 1500 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
441		1300 to 1500 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
442		1300 to 1500 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
443		1300 to 1500 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
444		1300 to 1500 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
445		1300 to 1500 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
446		1300 to 1500 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
447		1300 to 1500 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
448		1300 to 1500 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
449		1300 to 1500 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
450		1300 to 1500 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning

No. of Trees	Location			Name of Species		Trees at site		Status (P/G)	Economic Utilization			Condition	Remarks
	Additional Bays	Guide Banks	Diversion Channel	Common Name	Scientific Name	Young (Girth < 24")	Mature (Girth > 24")		Timber	Fuel wood	Fruit Tree		
451		1300 to 1500 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
452		1300 to 1500 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
453		1300 to 1500 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
454		1300 to 1500 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
455		1300 to 1500 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
456		1300 to 1500 ft		Date Palm	*Phoenix*	✔		G			✔	Good	Fruit
457		1500 to 1700 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
458		1500 to 1700 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
459		1500 to 1700 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
460		1500 to 1700 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
461		1500 to 1700 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
462		1500 to 1700 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
463		1500 to 1700 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
464		1500 to 1700 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
465		1500 to 1700 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
466		1500 to 1700 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
467		1500 to 1700 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
468		1500 to 1700 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
469		1500 to 1700 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
470		1500 to 1700 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
471		1500 to 1700 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
472		1500 to 1700 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
473		1500 to 1700 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
474		1500 to 1700 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
475		1500 to 1700 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture

No. of Trees	Location			Name of Species		Trees at site		Status (P/G)	Economic Utilization			Condition	Remarks
	Additional Bays	Guide Banks	Diversion Channel	Common Name	Scientific Name	Young (Girth < 24")	Mature (Girth > 24")		Timber	Fuel wood	Fruit Tree		
476		1500 to 1700 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
477		1500 to 1700 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
478		1500 to 1700 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
479		1500 to 1700 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
480		1500 to 1700 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
481		1500 to 1700 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
482		1500 to 1700 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
483		1500 to 1700 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
484		1500 to 1700 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
485		1500 to 1700 ft		Sheesham	*Dalbergia sissoo*		✔	G	✔			Good	Suitable for High Quality furniture
486		1500 to 1700 ft		Date Palm	*Phoenix rubicola*	✔		G			✔	Good	Fruit
487		1500 to 1700 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
488		1500 to 1700 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
489		1500 to 1700 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
490		1500 to 1700 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
491		1500 to 1700 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
492		1500 to 1700 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
493		1500 to 1700 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
494		1500 to 1700 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
495		1500 to 1700 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
496		1500 to 1700 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
497		1500 to 1700 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
498		1500 to 1700 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
499		1500 to 1700 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
500		1500 to 1700 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning

No. of Trees	Location			Name of Species		Trees at site		Status (P/G)	Economic Utilization			Condition	Remarks
	Additional Bays	Guide Banks	Diversion Channel	Common Name	Scientific Name	Young (Girth < 24")	Mature (Girth > 24")		Timber	Fuel wood	Fruit Tree		
501		1500 to 1700 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
502		1500 to 1700 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
503		1500 to 1700 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
504		1500 to 1700 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
505		1500 to 1700 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
506		1500 to 1700 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
507		1700 to 1900 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
508		1700 to 1900 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
509		1700 to 1900 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
510		1700 to 1900 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
511		1700 to 1900 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
512		1700 to 1900 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
513		1700 to 1900 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
514		1700 to 1900 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
515		1700 to 1900 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
516		1700 to 1900 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
517		1700 to 1900 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
518		1700 to 1900 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
519		1700 to 1900 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
520		1700 to 1900 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
521		1700 to 1900 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
522		1700 to 1900 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
523		1700 to 1900 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
524		1700 to 1900 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
525		1700 to 1900 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture

No. of Trees	Location			Name of Species		Trees at site		Status (P/G)	Economic Utilization			Condition	Remarks
	Additional Bays	Guide Banks	Diversion Channel	Common Name	Scientific Name	Young (Girth < 24")	Mature (Girth > 24")		Timber	Fuel wood	Fruit Tree		
526		1700 to 1900 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
527		1700 to 1900 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
528		1700 to 1900 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
529		1700 to 1900 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
530		1700 to 1900 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
531		1700 to 1900 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
532		1700 to 1900 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
533		1700 to 1900 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
534		1700 to 1900 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
535		1700 to 1900 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
536		1700 to 1900 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
537		1700 to 1900 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
538		1700 to 1900 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
539		1700 to 1900 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
540		1700 to 1900 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
541		1700 to 1900 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
542		1700 to 1900 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
543		1700 to 1900 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
544		1700 to 1900 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
545		1700 to 1900 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
546		1700 to 1900 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
547		1700 to 1900 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
548		1700 to 1900 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
549		1700 to 1900 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
550		1700 to 1900 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning

No. of Trees	Location			Name of Species		Trees at site		Status (P/G)	Economic Utilization			Condition	Remarks
	Additional Bays	Guide Banks	Diversion Channel	Common Name	Scientific Name	Young (Girth < 24")	Mature (Girth > 24")		Timber	Fuel wood	Fruit Tree		
551		1700 to 1900 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
552		1700 to 1900 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
553		1700 to 1900 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
554		1700 to 1900 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
555		1700 to 1900 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
556		1700 to 1900 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
557		1700 to 1900 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
558		1700 to 1900 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
559		1700 to 1900 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
560		1700 to 1900 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
561		1700 to 1900 ft		Date Palm	*Phoenix rubicola*	✔		G			✔	Good	Fruit
562		1700 to 1900 ft		Beri	*Zizyphus jujube*	✔		G			✔	Good	Fruit
563		1900 to 2100 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
564		1900 to 2100 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
565		1900 to 2100 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
566		1900 to 2100 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
567		1900 to 2100 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
568		1900 to 2100 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
569		1900 to 2100 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
570		1900 to 2100 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
571		1900 to 2100 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
572		1900 to 2100 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
573		1900 to 2100 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
574		1900 to 2100 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
575		1900 to 2100 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture

No. of Trees	Location			Name of Species		Trees at site		Status (P/G)	Economic Utilization			Condition	Remarks
	Additional Bays	Guide Banks	Diversion Channel	Common Name	Scientific Name	Young (Girth < 24")	Mature (Girth > 24")		Timber	Fuel wood	Fruit Tree		
576		1900 to 2100 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
577		1900 to 2100 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
578		1900 to 2100 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
579		1900 to 2100 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
580		1900 to 2100 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
581		1900 to 2100 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
582		1900 to 2100 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
583		1900 to 2100 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
584		1900 to 2100 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
585		1900 to 2100 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
586		1900 to 2100 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
587		1900 to 2100 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
588		1900 to 2100 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
589		1900 to 2100 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
590		1900 to 2100 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
591		1900 to 2100 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
592		1900 to 2100 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
593		1900 to 2100 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
594		1900 to 2100 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
595		1900 to 2100 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
596		1900 to 2100 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
597		1900 to 2100 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
598		1900 to 2100 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
599		1900 to 2100 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
600		1900 to 2100 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture

No. of Trees	Location			Name of Species		Trees at site		Status (P/G)	Economic Utilization			Condition	Remarks
	Additional Bays	Guide Banks	Diversion Channel	Common Name	Scientific Name	Young (Girth < 24")	Mature (Girth > 24")		Timber	Fuel wood	Fruit Tree		
601		1900 to 2100 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
602		1900 to 2100 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
603		1900 to 2100 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
604		1900 to 2100 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
605		1900 to 2100 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
606		1900 to 2100 ft		Date Palm	*Phoenix*	✔		G			✔	Good	Fruit
607		1900 to 2100 ft		Beri	*Zizyphus*	✔		G			✔	Good	Fruit
608		1900 to 2100 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
609		1900 to 2100 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
610		1900 to 2100 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
611		1900 to 2100 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
612		1900 to 2100 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
613		1900 to 2100 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
614		1900 to 2100 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
615		1900 to 2100 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
616		1900 to 2100 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
617		1900 to 2100 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
618		1900 to 2100 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
619		1900 to 2100 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
620		1900 to 2100 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
621		1900 to 2100 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
622		1900 to 2100 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
623		1900 to 2100 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
624		2100 to 2300 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
625		2100 to 2300 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture

No. of Trees	Location			Name of Species		Trees at site		Status (P/G)	Economic Utilization			Condition	Remarks
	Additional Bays	Guide Banks	Diversion Channel	Common Name	Scientific Name	Young (Girth < 24")	Mature (Girth > 24")		Timber	Fuel wood	Fruit Tree		
626		2100 to 2300 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
627		2100 to 2300 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
628		2100 to 2300 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
629		2100 to 2300 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
630		2100 to 2300 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
631		2100 to 2300 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
632		2100 to 2300 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
633		2100 to 2300 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
634		2100 to 2300 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
635		2100 to 2300 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
636		2100 to 2300 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
637		2100 to 2300 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
638		2100 to 2300 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
639		2100 to 2300 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
640		2100 to 2300 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
641		2100 to 2300 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
642		2100 to 2300 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
643		2100 to 2300 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
644		2100 to 2300 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
645		2100 to 2300 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
646		2100 to 2300 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
647		2100 to 2300 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
648		2100 to 2300 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
649		2100 to 2300 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
650		2100 to 2300 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning

No. of Trees	Location			Name of Species		Trees at site		Status (P/G)	Economic Utilization			Condition	Remarks
	Additional Bays	Guide Banks	Diversion Channel	Common Name	Scientific Name	Young (Girth < 24")	Mature (Girth > 24")		Timber	Fuel wood	Fruit Tree		
651		2100 to 2300 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
652		2100 to 2300 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
653		2100 to 2300 ft		Date Palm	*Phoenix rubicola*	✔		G			✔	Good	Fruit
654		2300 to 2500 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
655		2300 to 2500 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
656		2300 to 2500 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
657		2300 to 2500 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
658		2300 to 2500 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
659		2300 to 2500 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
660		2300 to 2500 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
661		2300 to 2500 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
662		2300 to 2500 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
663		2300 to 2500 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
664		2300 to 2500 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
665		2300 to 2500 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
666		2300 to 2500 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
667		2300 to 2500 ft		Beri	*Zizyphus jujube*		✔	G			✔	Good	Fruit
668		2300 to 2500 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
669		2300 to 2500 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
670		2300 to 2500 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
671		2300 to 2500 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
672		2300 to 2500 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
673		2300 to 2500 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
674		2300 to 2500 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
675		2300 to 2500 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning

No. of Trees	Location			Name of Species		Trees at site		Status (P/G)	Economic Utilization			Condition	Remarks
	Additional Bays	Guide Banks	Diversion Channel	Common Name	Scientific Name	Young (Girth < 24")	Mature (Girth > 24")		Timber	Fuel wood	Fruit Tree		
676		2300 to 2500 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
677		2300 to 2500 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
678		2300 to 2500 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
679		2300 to 2500 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
680		2300 to 2500 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
681		2300 to 2500 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
682		2300 to 2500 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
683		2300 to 2500 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
684		2500 to 2700 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
685		2500 to 2700 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
686		2500 to 2700 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
687		2500 to 2700 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
688		2500 to 2700 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
689		2500 to 2700 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
690		2500 to 2700 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
691		2500 to 2700 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
692		2500 to 2700 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
693		2500 to 2700 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
694		2500 to 2700 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
695		2500 to 2700 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
696		2500 to 2700 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
697		2500 to 2700 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
698		2500 to 2700 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
699		2500 to 2700 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
700		2500 to 2700 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture

No. of Trees	Location			Name of Species		Trees at site		Status (P/G)	Economic Utilization			Condition	Remarks
	Additional Bays	Guide Banks	Diversion Channel	Common Name	Scientific Name	Young (Girth < 24")	Mature (Girth > 24")		Timber	Fuel wood	Fruit Tree		
701		2500 to 2700 ft		Date Palm	*Phoenix rubicola*		✔	G			✔	Good	Fruit
702		2500 to 2700 ft		Date Palm	*Phoenix rubicola*		✔	G			✔	Good	Fruit
703		2500 to 2700 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
704		2500 to 2700 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
705		2500 to 2700 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
706		2500 to 2700 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
707		2500 to 2700 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
708		2500 to 2700 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
709		2500 to 2700 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
710		2500 to 2700 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
711		2500 to 2700 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
712		2500 to 2700 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
713		2500 to 2700 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
714		2500 to 2700 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
715		2700 to 3000 ft		Sheesham	*Dalbergia sissoo*		✔	G	✔			Good	Suitable for High Quality furniture
716		2700 to 3000 ft		Sheesham	*Dalbergia sissoo*		✔	G	✔			Good	Suitable for High Quality furniture
717		2700 to 3000 ft		Sheesham	*Dalbergia sissoo*		✔	G	✔			Good	Suitable for High Quality furniture
718		2700 to 3000 ft		Sheesham	*Dalbergia sissoo*		✔	G	✔			Good	Suitable for High Quality furniture
719		2700 to 3000 ft		Sheesham	*Dalbergia sissoo*		✔	G	✔			Good	Suitable for High Quality furniture
720		2700 to 3000 ft		Sheesham	*Dalbergia sissoo*		✔	G	✔			Good	Suitable for High Quality furniture
721		2700 to 3000 ft		Sheesham	*Dalbergia sissoo*		✔	G	✔			Good	Suitable for High Quality furniture
722		2700 to 3000 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
723		2700 to 3000 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
724		2700 to 3000 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
725		2700 to 3000 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture

No. of Trees	Location			Name of Species		Trees at site		Status (P/G)	Economic Utilization			Condition	Remarks
	Additional Bays	Guide Banks	Diversion Channel	Common Name	Scientific Name	Young (Girth < 24")	Mature (Girth > 24")		Timber	Fuel wood	Fruit Tree		
726		2700 to 3000 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
727		2700 to 3000 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
728		2700 to 3000 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
729		2700 to 3000 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
730		2700 to 3000 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
731		2700 to 3000 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
732		2700 to 3000 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
733		2700 to 3000 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
734		2700 to 3000 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
735		2700 to 3000 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
736		2700 to 3000 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
737		2700 to 3000 ft		Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
738		2700 to 3000 ft		Pipal	*Ficus religiosa*		✔	G		✔		Good	Suitable for burning and medicines
739		2700 to 3000 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
740		2700 to 3000 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
741		2700 to 3000 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
742		2700 to 3000 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
743		2700 to 3000 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
744		2700 to 3000 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
745		2700 to 3000 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
746		2700 to 3000 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
747		2700 to 3000 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
748		2700 to 3000 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
749		2700 to 3000 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
750		2700 to 3000 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning

No. of Trees	Location			Name of Species		Trees at site		Status (P/G)	Economic Utilization			Condition	Remarks
	Additional Bays	Guide Banks	Diversion Channel	Common Name	Scientific Name	Young (Girth < 24")	Mature (Girth > 24")		Timber	Fuel wood	Fruit Tree		
751		2700 to 3000 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
752		2700 to 3000 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
753		2700 to 3000 ft		Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
754	RMB (0+000 to 0+964)			Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
755	RMB (0+000 to 0+964)			Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
756	RMB (0+000 to 0+964)			Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
757	RMB (0+000 to 0+964)			Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
758	RMB (0+000 to 0+964)			Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
759	RMB (0+000 to 0+964)			Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
760	RMB (0+000 to 0+964)			Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
761	RMB (0+000 to 0+964)			Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
762	RMB (0+000 to 0+964)			Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
763	RMB (0+000 to 0+964)			Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
764	RMB (0+000 to 0+964)			Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
765	RMB (0+000 to 0+964)			Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
766	RMB (0+000 to 0+964)			Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
767	RMB (0+000 to 0+964)			Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
768	RMB (0+000 to 0+964)			Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
769	RMB (0+000 to 0+964)			Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
770	RMB (0+000 to 0+964)			Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
771	RMB (0+000 to 0+964)			Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
772	RMB (0+000 to 0+964)			Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
773	RMB (0+000 to 0+964)			Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
774	RMB (0+000 to 0+964)			Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
775	RMB (0+000 to 0+964)			Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture

No. of Trees	Location			Name of Species		Trees at site		Status (P/G)	Economic Utilization			Condition	Remarks
	Additional Bays	Guide Banks	Diversion Channel	Common Name	Scientific Name	Young (Girth < 24")	Mature (Girth > 24")		Timber	Fuel wood	Fruit Tree		
776	RMB (0+000 to 0+964)			Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
777	RMB (0+000 to 0+964)			Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
778	RMB (0+000 to 0+964)			Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
779	RMB (0+000 to 0+964)			Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
780	RMB (0+000 to 0+964)			Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
781	RMB (0+000 to 0+964)			Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
782	RMB (0+000 to 0+964)			Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
783	RMB (0+000 to 0+964)			Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
784	RMB (0+000 to 0+964)			Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
785	RMB (0+000 to 0+964)			Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
786	RMB (0+000 to 0+964)			Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
787	RMB (0+000 to 0+964)			Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
788	RMB (0+000 to 0+964)			Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
789	RMB (0+000 to 0+964)			Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
790	RMB (0+000 to 0+964)			Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
791	RMB (0+000 to 0+964)			Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
792	RMB (0+000 to 0+964)			Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
793	RMB (0+000 to 0+964)			Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
794	RMB (0+000 to 0+964)			Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
795	RMB (0+000 to 0+964)			Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
796	RMB (0+000 to 0+964)			Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
797	RMB (0+000 to 0+964)			Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
798	RMB (0+000 to 0+964)			Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
799	RMB (0+000 to 0+964)			Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
800	RMB (0+000 to 0+964)			Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture

No. of Trees	Location			Name of Species		Trees at site		Status (P/G)	Economic Utilization			Condition	Remarks
	Additional Bays	Guide Banks	Diversion Channel	Common Name	Scientific Name	Young (Girth < 24")	Mature (Girth > 24")		Timber	Fuel wood	Fruit Tree		
801	RMB (0+000 to 0+964)			Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
802	RMB (0+000 to 0+964)			Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
803	RMB (0+000 to 0+964)			Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
804	RMB (0+000 to 0+964)			Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
805	RMB (0+000 to 0+964)			Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
806	RMB (0+000 to 0+964)			Sheesham	*Dalbergia sissoo*		✔	G	✔			Good	Suitable for High Quality furniture
807	RMB (0+000 to 0+964)			Sheesham	*Dalbergia sissoo*		✔	G	✔			Good	Suitable for High Quality furniture
808	RMB (0+000 to 0+964)			Sheesham	*Dalbergia sissoo*		✔	G	✔			Good	Suitable for High Quality furniture
809	RMB (0+000 to 0+964)			Sheesham	*Dalbergia sissoo*		✔	G	✔			Good	Suitable for High Quality furniture
810	RMB (0+000 to 0+964)			Sheesham	*Dalbergia sissoo*		✔	G	✔			Good	Suitable for High Quality furniture
811	RMB (0+000 to 0+964)			Sheesham	*Dalbergia sissoo*		✔	G	✔			Good	Suitable for High Quality furniture
812	RMB (0+000 to 0+964)			Sheesham	*Dalbergia sissoo*		✔	G	✔			Good	Suitable for High Quality furniture
813	RMB (0+000 to 0+964)			Sheesham	*Dalbergia sissoo*		✔	G	✔			Good	Suitable for High Quality furniture
814	RMB (0+000 to 0+964)			Sheesham	*Dalbergia sissoo*		✔	G	✔			Good	Suitable for High Quality furniture
815	RMB (0+000 to 0+964)			Sheesham	*Dalbergia sissoo*		✔	G	✔			Good	Suitable for High Quality furniture
816	RMB (0+000 to 0+964)			Date Palm	*Phoenix rubicola*		✔	G			✔	Good	Fruit
817	RMB (0+000 to 0+964)			Date Palm	*Phoenix rubicola*		✔	G			✔	Good	Fruit
818	RMB (0+000 to 0+964)			Date Palm	*Phoenix rubicola*		✔	G			✔	Good	Fruit
819	RMB (0+000 to 0+964)			Date Palm	*Phoenix rubicola*		✔	G			✔	Good	Fruit
820	RMB (0+000 to 0+964)			Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
821	RMB (0+000 to 0+964)			Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
822	RMB (0+000 to 0+964)			Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
823	RMB (0+000 to 0+964)			Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
824	RMB (0+000 to 0+964)			Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
825	RMB (0+000 to 0+964)			Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning

No. of Trees	Location			Name of Species		Trees at site		Status (P/G)	Economic Utilization			Condition	Remarks
	Additional Bays	Guide Banks	Diversion Channel	Common Name	Scientific Name	Young (Girth < 24")	Mature (Girth > 24")		Timber	Fuel wood	Fruit Tree		
826	RMB (0+000 to 0+964)			Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
827	RMB (0+000 to 0+964)			Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
828	RMB (0+000 to 0+964)			Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
829	RMB (0+000 to 0+964)			Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
830	RMB (0+000 to 0+964)			Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
831	RMB (0+000 to 0+964)			Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
832	RMB (0+000 to 0+964)			Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
833	RMB (0+000 to 0+964)			Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
834	RMB (0+000 to 0+964)			Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
835	RMB (0+000 to 0+964)			Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
836	RMB (0+000 to 0+964)			Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
837	RMB (0+000 to 0+964)			Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
838	RMB (0+000 to 0+964)			Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
839	RMB (0+000 to 0+964)			Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
840	RMB (0+000 to 0+964)			Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
841	RMB (0+000 to 0+964)			Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
842	RMB (0+000 to 0+964)			Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
843	RMB (0+000 to 0+964)			Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
844	RMB (0+000 to 0+964)			Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
845	RMB (0+000 to 0+964)			Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
846	RMB (0+000 to 0+964)			Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
847	Modify river training works			Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
848	Modify river training works			Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
849	Modify river training works			Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
850	Modify river training works			Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture

No. of Trees	Location			Name of Species		Trees at site		Status (P/G)	Economic Utilization			Condition	Remarks
	Additional Bays	Guide Banks	Diversion Channel	Common Name	Scientific Name	Young (Girth < 24")	Mature (Girth > 24")		Timber	Fuel wood	Fruit Tree		
851	Modify river training works			Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
852	Modify river training works			Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
853	Modify river training works			Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
854	Modify river training works			Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
855	Modify river training works			Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
856	Modify river training works			Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
857	Modify river training works			Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
858	Modify river training works			Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
859	Modify river training works			Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
860	Modify river training works			Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
861	Modify river training works			Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
862	Modify river training works			Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
863	Modify river training works			Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
864	Modify river training works			Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
865	Modify river training works			Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
866	Modify river training works			Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
867	Modify river training works			Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
868	Modify river training works			Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
869	Modify river training works			Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
870	Modify river training works			Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
871	Modify river training works			Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
872	Modify river training works			Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
873	Modify river training works			Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
874	Modify river training works			Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
875	Modify river training works			Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning

No. of Trees	Location			Name of Species		Trees at site		Status (P/G)	Economic Utilization			Condition	Remarks
	Additional Bays	Guide Banks	Diversion Channel	Common Name	Scientific Name	Young (Girth < 24")	Mature (Girth > 24")		Timber	Fuel wood	Fruit Tree		
876	Modify river training works			Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
877	Modify river training works			Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
878	Modify river training works			Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
879	Modify river training works			Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
880	Modify river training works			Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
881	Modify river training works			Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
882	Modify river training works			Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
883	Modify river training works			Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
884	Modify river training works			Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
885	Modify river training works			Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
886	Modify river training works			Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
887	Modify river training works			Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
888	Modify river training works			Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
889	Modify river training works			Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
890	Modify river training works			Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
891	Modify river training works			Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
892	Modify river training works			Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
893	Modify river training works			Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
894	Modify river training works			Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
895	Modify river training works			Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
896	Modify river training works			Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
897	Modify river training works			Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
898	Modify river training works			Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
899	Modify river training works			Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
900	Modify river training works			Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning

No. of Trees	Location			Name of Species		Trees at site		Status (P/G)	Economic Utilization			Condition	Remarks
	Additional Bays	Guide Banks	Diversion Channel	Common Name	Scientific Name	Young (Girth < 24")	Mature (Girth > 24")		Timber	Fuel wood	Fruit Tree		
901	Modify river training works			Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
902	Modify river training works			Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
903	Modify river training works			Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
904	Modify river training works			Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
905	Modify river training works			Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
906	Modify river training works			Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
907	Modify river training works			Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
908	Modify river training works			Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
909	Modify river training works			Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
910	Modify river training works			Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
911	Modify river training works			Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
912	Modify river training works			Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
913	Modify river training works			Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
914	Modify river training works			Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
915	Modify river training works			Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
916	Modify river training works			Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
917	Modify river training works			Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
918	Modify river training works			Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
919	Modify river training works			Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
920	Modify river training works			Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
921	Modify river training works			Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
922	Modify river training works			Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
923	Modify river training works			Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
924	Modify river training works			Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
925	Modify river training works			Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture

No. of Trees	Location			Name of Species		Trees at site		Status (P/G)	Economic Utilization			Condition	Remarks
	Additional Bays	Guide Banks	Diversion Channel	Common Name	Scientific Name	Young (Girth < 24")	Mature (Girth > 24")		Timber	Fuel wood	Fruit Tree		
926	Modify river training works			Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
927	Modify river training works			Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
928	Modify river training works			Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
929	Modify river training works			Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
930	Modify river training works			Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
931	Modify river training works			Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
932	Modify river training works			Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
933	Modify river training works			Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
934	Modify river training works			Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
935	Modify river training works			Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
936	Modify river training works			Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
937	Modify river training works			Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
938	Modify river training works			Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
939	Modify river training works			Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
940	Modify river training works			Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
941	Modify river training works			Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
942	Modify river training works			Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
943	Modify river training works			Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
944	Modify river training works			Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
945	Modify river training works			Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
946	Modify river training works			Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
947	Modify river training works			Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
948	Modify river training works			Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
949	Modify river training works			Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
950	Modify river training works			Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture

No. of Trees	Location			Name of Species		Trees at site		Status (P/G)	Economic Utilization			Condition	Remarks
	Additional Bays	Guide Banks	Diversion Channel	Common Name	Scientific Name	Young (Girth < 24")	Mature (Girth > 24")		Timber	Fuel wood	Fruit Tree		
951	Modify river training works			Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
952	Modify river training works			Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
953	Modify river training works			Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
954	Modify river training works			Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
955	Modify river training works			Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
956	Modify river training works			Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
957	Modify river training works			Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
958	Modify river training works			Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
959	Modify river training works			Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
960	Modify river training works			Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
961	Modify river training works			Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
962	Modify river training works			Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
963	Modify river training works			Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
964	Modify river training works			Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
965	Modify river training works			Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
966	Modify river training works			Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
967	Modify river training works			Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
968	Modify river training works			Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
969	Modify river training works			Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
970	Modify river training works			Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
971	Modify river training works			Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
972	Modify river training works			Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
973	Modify river training works			Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
974	Modify river training works			Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
975	Modify river training works			Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture

No. of Trees	Location			Name of Species		Trees at site		Status (P/G)	Economic Utilization			Condition	Remarks
	Additional Bays	Guide Banks	Diversion Channel	Common Name	Scientific Name	Young (Girth < 24")	Mature (Girth > 24")		Timber	Fuel wood	Fruit Tree		
976	Modify river training works			Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
977	Modify river training works			Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
978	Modify river training works			Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
979	Modify river training works			Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
980	Modify river training works			Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
981	Modify river training works			Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
982	Modify river training works			Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
983	Modify river training works			Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
984	Modify river training works			Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
985	Modify river training works			Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
986	Modify river training works			Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
987	Modify river training works			Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
988	Modify river training works			Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
989	Modify river training works			Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
990	Modify river training works			Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
991	Modify river training works			Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
992	Modify river training works			Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
993	Modify river training works			Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
994	Modify river training works			Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
995	Modify river training works			Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
996	Modify river training works			Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
997	Modify river training works			Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
998	Modify river training works			Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
999	Modify river training works			Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
1000	Modify river training works			Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture

No. of Trees	Location			Name of Species		Trees at site		Status (P/G)	Economic Utilization			Condition	Remarks
	Additional Bays	Guide Banks	Diversion Channel	Common Name	Scientific Name	Young (Girth < 24")	Mature (Girth > 24")		Timber	Fuel wood	Fruit Tree		
1001	Modify river training works			Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
1002	Modify river training works			Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
1003	Modify river training works			Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
1004	Modify river training works			Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
1005	Modify river training works			Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
1006	Modify river training works			Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
1007	Modify river training works			Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
1008	Modify river training works			Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
1009	Modify river training works			Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
1010	Modify river training works			Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
1011	Modify river training works			Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
1012	Modify river training works			Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
1013	Modify river training works			Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
1014	Modify river training works			Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
1015	Modify river training works			Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
1016	Modify river training works			Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
1017	Modify river training works			Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
1018	Modify river training works			Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
1019	Modify river training works			Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
1020	Modify river training works			Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
1021	Modify river training works			Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
1022	Modify river training works			Date Palm	*Phoenix rubicola*		✔	G			✔	Good	Fruit
1023	Modify river training works			Date Palm	*Phoenix rubicola*		✔	G			✔	Good	Fruit
1024	Modify river training works			Date Palm	*Phoenix rubicola*		✔	G			✔	Good	Fruit
1025	Modify river training works			Date Palm	*Phoenix rubicola*		✔	G			✔	Good	Fruit

No. of Trees	Location			Name of Species		Trees at site		Status (P/G)	Economic Utilization			Condition	Remarks
	Additional Bays	Guide Banks	Diversion Channel	Common Name	Scientific Name	Young (Girth < 24")	Mature (Girth > 24")		Timber	Fuel wood	Fruit Tree		
1026	Modify river training works			Date Palm	*Phoenix rubicola*		✔	G			✔	Good	Fruit
1027	Modify river training works			Date Palm	*Phoenix rubicola*		✔	G			✔	Good	Fruit
1028	Modify river training works			Date Palm	*Phoenix rubicola*		✔	G			✔	Good	Fruit
1029	Modify river training works			Date Palm	*Phoenix rubicola*		✔	G			✔	Good	Fruit
1030	Modify river training works			Date Palm	*Phoenix rubicola*		✔	G			✔	Good	Fruit
1031	Modify river training works			Date Palm	*Phoenix rubicola*		✔	G			✔	Good	Fruit
1032	Modify river training works			Date Palm	*Phoenix rubicola*		✔	G			✔	Good	Fruit
1033	Modify river training works			Date Palm	*Phoenix rubicola*		✔	G			✔	Good	Fruit
1034	Modify river training works			Date Palm	*Phoenix rubicola*		✔	G			✔	Good	Fruit
1035	Modify river training works			Date Palm	*Phoenix rubicola*		✔	G			✔	Good	Fruit
1036	Modify river training works			Date Palm	*Phoenix rubicola*		✔	G			✔	Good	Fruit
1037	Modify river training works			Date Palm	*Phoenix rubicola*		✔	G			✔	Good	Fruit
1038	Modify river training works			Date Palm	*Phoenix rubicola*		✔	G			✔	Good	Fruit
1039	Modify river training works			Sheesham	*Dalbergia sissoo*		✔	G	✔			Good	Suitable for High Quality furniture
1040	Modify river training works			Sheesham	*Dalbergia sissoo*		✔	G	✔			Good	Suitable for High Quality furniture
1041	Modify river training works			Sheesham	*Dalbergia sissoo*		✔	G	✔			Good	Suitable for High Quality furniture
1042	Modify river training works			Sheesham	*Dalbergia sissoo*		✔	G	✔			Good	Suitable for High Quality furniture
1043	Modify river training works			Sheesham	*Dalbergia sissoo*		✔	G	✔			Good	Suitable for High Quality furniture
1044	Modify river training works			Sheesham	*Dalbergia sissoo*		✔	G	✔			Good	Suitable for High Quality furniture
1045	Modify river training works			Sheesham	*Dalbergia sissoo*		✔	G	✔			Good	Suitable for High Quality furniture
1046	Modify river training works			Sheesham	*Dalbergia sissoo*		✔	G	✔			Good	Suitable for High Quality furniture
1047	Modify river training works			Sheesham	*Dalbergia sissoo*		✔	G	✔			Good	Suitable for High Quality furniture
1048	Modify river training works			Sheesham	*Dalbergia sissoo*		✔	G	✔			Good	Suitable for High Quality furniture
1049	Modify river training works			Sheesham	*Dalbergia sissoo*		✔	G	✔			Good	Suitable for High Quality furniture
1050	Modify river training works			Sheesham	*Dalbergia sissoo*		✔	G	✔			Good	Suitable for High Quality furniture

No. of Trees	Location			Name of Species		Trees at site		Status (P/G)	Economic Utilization			Condition	Remarks
	Additional Bays	Guide Banks	Diversion Channel	Common Name	Scientific Name	Young (Girth < 24")	Mature (Girth > 24")		Timber	Fuel wood	Fruit Tree		
1051	Modify river training works			Sheesham	*Dalbergia sissoo*		✔	G	✔			Good	Suitable for High Quality furniture
1052	Modify river training works			Sheesham	*Dalbergia sissoo*		✔	G	✔			Good	Suitable for High Quality furniture
1053	Modify river training works			Sheesham	*Dalbergia sissoo*		✔	G	✔			Good	Suitable for High Quality furniture
1054	Modify river training works			Sheesham	*Dalbergia sissoo*		✔	G	✔			Good	Suitable for High Quality furniture
1055	Modify river training works			Sheesham	*Dalbergia sissoo*		✔	G	✔			Good	Suitable for High Quality furniture
1056	Modify river training works			Sheesham	*Dalbergia sissoo*		✔	G	✔			Good	Suitable for High Quality furniture
1057	Modify river training works			Sheesham	*Dalbergia sissoo*		✔	G	✔			Good	Suitable for High Quality furniture
1058	Modify river training works			Sheesham	*Dalbergia sissoo*		✔	G	✔			Good	Suitable for High Quality furniture
1059	Modify river training works			Sheesham	*Dalbergia sissoo*		✔	G	✔			Good	Suitable for High Quality furniture
1060	Modify river training works			Sheesham	*Dalbergia sissoo*	✔		G		✔		Good	Suitable for burning and fodder
1061	Modify river training works			Sheesham	*Dalbergia sissoo*	✔		G		✔		Good	Suitable for burning and fodder
1062	Modify river training works			Sheesham	*Dalbergia sissoo*	✔		G		✔		Good	Suitable for burning and fodder
1063	Modify river training works			Sheesham	*Dalbergia sissoo*	✔		G		✔		Good	Suitable for burning and fodder
1064	Modify river training works			Sheesham	*Dalbergia sissoo*	✔		G		✔		Good	Suitable for burning and fodder
1065	Modify river training works			Sheesham	*Dalbergia sissoo*	✔		G		✔		Good	Suitable for burning and fodder
1066	Modify river training works			Sheesham	*Dalbergia sissoo*	✔		G		✔		Good	Suitable for burning and fodder
1067	Modify river training works			Sheesham	*Dalbergia sissoo*	✔		G		✔		Good	Suitable for burning and fodder
1068	Modify river training works			Sheesham	*Dalbergia sissoo*	✔		G		✔		Good	Suitable for burning and fodder
1069	Modify river training works			Sheesham	*Dalbergia sissoo*	✔		G		✔		Good	Suitable for burning and fodder
1070	Modify river training works			Sheesham	*Dalbergia sissoo*	✔		G		✔		Good	Suitable for burning and fodder
1071	Modify river training works			Sheesham	*Dalbergia sissoo*	✔		G		✔		Good	Suitable for burning and fodder
1072	Modify river training works			Sheesham	*Dalbergia sissoo*	✔		G		✔		Good	Suitable for burning and fodder
1073	Modify river training works			Sheesham	*Dalbergia sissoo*	✔		G		✔		Good	Suitable for burning and fodder
1074	Modify river training works			Sheesham	*Dalbergia sissoo*	✔		G		✔		Good	Suitable for burning and fodder
1075	Modify river training works			Sheesham	*Dalbergia sissoo*	✔		G		✔		Good	Suitable for burning and fodder

No. of Trees	Location			Name of Species		Trees at site		Status (P/G)	Economic Utilization			Condition	Remarks
	Additional Bays	Guide Banks	Diversion Channel	Common Name	Scientific Name	Young (Girth < 24")	Mature (Girth > 24")		Timber	Fuel wood	Fruit Tree		
1076	Modify river training works			Sheesham	*Dalbergia sissoo*	✔		G		✔		Good	Suitable for burning and fodder
1077	Modify river training works			Sheesham	*Dalbergia sissoo*	✔		G		✔		Good	Suitable for burning and fodder
1078	Modify river training works			Sheesham	*Dalbergia sissoo*	✔		G		✔		Good	Suitable for burning and fodder
1079	Modify river training works			Sheesham	*Dalbergia sissoo*	✔		G		✔		Good	Suitable for burning and fodder
1080	Modify river training works			Sheesham	*Dalbergia sissoo*	✔		G		✔		Good	Suitable for burning and fodder
1081	Modify river training works			Sheesham	*Dalbergia sissoo*	✔		G		✔		Good	Suitable for burning and fodder
1082	Modify river training works			Sheesham	*Dalbergia sissoo*	✔		G		✔		Good	Suitable for burning and fodder
1083	Modify river training works			Sheesham	*Dalbergia sissoo*	✔		G		✔		Good	Suitable for burning and fodder
1084	Modify river training works			Sheesham	*Dalbergia sissoo*	✔		G		✔		Good	Suitable for burning and fodder
1085	Modify river training works			Sheesham	*Dalbergia sissoo*	✔		G		✔		Good	Suitable for burning and fodder
1086	Modify river training works			Sheesham	*Dalbergia sissoo*	✔		G		✔		Good	Suitable for burning and fodder
1087	Modify river training works			Sheesham	*Dalbergia sissoo*	✔		G		✔		Good	Suitable for burning and fodder
1088	Modify river training works			Sheesham	*Dalbergia sissoo*	✔		G		✔		Good	Suitable for burning and fodder
1089	Modify river training works			Sheesham	*Dalbergia sissoo*	✔		G		✔		Good	Suitable for burning and fodder
1090	Modify river training works			Sheesham	*Dalbergia sissoo*	✔		G		✔		Good	Suitable for burning and fodder
1091	Modify river training works			Mulberry	*Morus alba*		✔	G			✔	Good	Fruit
1092	Modify river training works			Mulberry	*Morus alba*		✔	G			✔	Good	Fruit
1093	Modify river training works			Mulberry	*Morus alba*		✔	G			✔	Good	Fruit
1094	Modify river training works			Mulberry	*Morus alba*		✔	G			✔	Good	Fruit
1095	Modify river training works			Mulberry	*Morus alba*		✔	G			✔	Good	Fruit
1096	Modify river training works			Mulberry	*Morus alba*	✔		G			✔	Good	Fruit
1097	Modify river training works			Mulberry	*Morus alba*	✔		G			✔	Good	Fruit
1098	Modify river training works			Mulberry	*Morus alba*	✔		G			✔	Good	Fruit
1099	Modify river training works			Mulberry	*Morus alba*	✔		G			✔	Good	Fruit
1100	Modify river training works			Mulberry	*Morus alba*	✔		G			✔	Good	Fruit

No. of Trees	Location			Name of Species		Trees at site		Status (P/G)	Economic Utilization			Condition	Remarks
	Additional Bays	Guide Banks	Diversion Channel	Common Name	Scientific Name	Young (Girth < 24")	Mature (Girth > 24")		Timber	Fuel wood	Fruit Tree		
1101	Modify river training works			Mulberry	*Morus alba*	✔		G			✔	Good	Fruit
1102	Modify river training works			Mulberry	*Morus alba*	✔		G			✔	Good	Fruit
1103	Modify river training works			Mulberry	*Morus alba*	✔		G			✔	Good	Fruit
1104	Modify river training works			Mulberry	*Morus alba*	✔		G			✔	Good	Fruit
1105	Modify river training works			Mulberry	*Morus alba*	✔		G			✔	Good	Fruit
1106	Modify river training works			Mulberry	*Morus alba*	✔		G			✔	Good	Fruit
1107	Modify river training works			Neem	*Azadira indica*		✔	G	✔			Good	Suitable for timber, fodder, in medicines and insecticide
1108	Modify river training works			Neem	*Azadira indica*		✔	G	✔			Good	Suitable for timber, fodder, in medicines and insecticide
1109	Modify river training works			Neem	*Azadira indica*		✔	G	✔			Good	Suitable for timber, fodder, in medicines and insecticide
1110	Modify river training works			Neem	*Azadira indica*		✔	G	✔			Good	Suitable for timber, fodder, in medicines and insecticide
1111	Modify river training works			Neem	*Azadira indica*		✔	G	✔			Good	Suitable for timber, fodder, in medicines and insecticide
1112	Modify river training works			Neem	*Azadira indica*		✔	G	✔			Good	Suitable for timber, fodder, in medicines and insecticide
1113	Modify river training works			Neem	*Azadira indica*		✔	G	✔			Good	Suitable for timber, fodder, in medicines and insecticide
1114	Modify river training works			Neem	*Azadira indica*		✔	G	✔			Good	Suitable for timber, fodder, in medicines and insecticide
1115	Modify river training works			Neem	*Azadira indica*		✔	G	✔			Good	Suitable for timber, fodder, in medicines and insecticide
1116	Modify river training works			Neem	*Azadira indica*		✔	G	✔			Good	Suitable for timber, fodder, in medicines and insecticide
1117	Modify river training works			Neem	*Azadira indica*		✔	G	✔			Good	Suitable for timber, fodder, in medicines and insecticide
1118	Modify river training works			Neem	*Azadira indica*		✔	G	✔			Good	Suitable for timber, fodder, in medicines and insecticide
1119	Modify river training works			Neem	*Azadira indica*		✔	G	✔			Good	Suitable for timber, fodder, in medicines and insecticide
1120	Modify river training works			Neem	*Azadira indica*		✔	G	✔			Good	Suitable for timber, fodder, in medicines and insecticide

No. of Trees	Location			Name of Species		Trees at site		Status (P/G)	Economic Utilization			Condition	Remarks
	Additional Bays	Guide Banks	Diversion Channel	Common Name	Scientific Name	Young (Girth < 24")	Mature (Girth > 24")		Timber	Fuel wood	Fruit Tree		
1121	Modify river training works			Neem	*Azadira indica*		✔	G	✔			Good	Suitable for timber, fodder, in medicines and insecticide
1122	Modify river training works			Neem	*Azadira indica*		✔	G	✔			Good	Suitable for timber, fodder, in medicines and insecticide
1123	Modify river training works			Neem	*Azadira indica*		✔	G	✔			Good	Suitable for timber, fodder, in medicines and insecticide
1124	Modify river training works			Neem	*Azadira indica*		✔	G	✔			Good	Suitable for timber, fodder, in medicines and insecticide
1125	Modify river training works			Neem	*Azadira indica*		✔	G	✔			Good	Suitable for timber, fodder, in medicines and insecticide
1126	Modify river training works			Neem	*Azadira indica*		✔	G	✔			Good	Suitable for timber, fodder, in medicines and insecticide
1127	Modify river training works			Neem	*Azadira indica*		✔	G	✔			Good	Suitable for timber, fodder, in medicines and insecticide
1128	Modify river training works			Neem	*Azadira indica*		✔	G	✔			Good	Suitable for timber, fodder, in medicines and insecticide
1129	Modify river training works			Neem	*Azadira indica*		✔	G	✔			Good	Suitable for timber, fodder, in medicines and insecticide
1130	Modify river training works			Neem	*Azadira indica*		✔	G	✔			Good	Suitable for timber, fodder, in medicines and insecticide
1131	Modify river training works			Neem	*Azadira indica*		✔	G	✔			Good	Suitable for timber, fodder, in medicines and insecticide
1132	Modify river training works			Neem	*Azadira indica*		✔	G	✔			Good	Suitable for timber, fodder, in medicines and insecticide
1133	Modify river training works			Neem	*Azadira indica*		✔	G	✔			Good	Suitable for timber, fodder, in medicines and insecticide
1134	Modify river training works			Neem	*Azadira indica*		✔	G	✔			Good	Suitable for timber, fodder, in medicines and insecticide
1135	Modify river training works			Neem	*Azadira indica*		✔	G	✔			Good	Suitable for timber, fodder, in medicines and insecticide
1136	Modify river training works			Neem	*Azadira indica*	✔		G	✔			Good	Suitable for timber, fodder, in medicines and insecticide
1137	Modify river training works			Neem	*Azadira indica*	✔		G	✔			Good	Suitable for timber, fodder, in medicines and insecticide
1138	Modify river training works			Neem	*Azadira indica*	✔		G	✔			Good	Suitable for timber, fodder, in medicines and insecticide
1139	Modify river training works			Neem	*Azadira indica*	✔		G	✔			Good	Suitable for timber, fodder, in medicines and insecticide
1140	Modify river training works			Neem	*Azadira indica*	✔		G	✔			Good	Suitable for timber, fodder, in medicines and insecticide

No. of Trees	Location			Name of Species		Trees at site		Status (P/G)	Economic Utilization			Condition	Remarks
	Additional Bays	Guide Banks	Diversion Channel	Common Name	Scientific Name	Young (Girth < 24")	Mature (Girth > 24")		Timber	Fuel wood	Fruit Tree		
1141	Modify river training works			Neem	*Azadira indica*	✔		G	✔			Good	Suitable for timber, fodder, in medicines and insecticide
1142	Modify river training works			Neem	*Azadira indica*	✔		G	✔			Good	Suitable for timber, fodder, in medicines and insecticide
1143	Modify river training works			Neem	*Azadira indica*	✔		G	✔			Good	Suitable for timber, fodder, in medicines and insecticide
1144	Modify river training works			Neem	*Azadira indica*	✔		G	✔			Good	Suitable for timber, fodder, in medicines and insecticide
1145	Modify river training works			Neem	*Azadira indica*	✔		G	✔			Good	Suitable for timber, fodder, in medicines and insecticide
1146	Modify river training works			Neem	*Azadira indica*	✔		G	✔			Good	Suitable for timber, fodder, in medicines and insecticide
1147	Modify river training works			Neem	*Azadira indica*	✔		G	✔			Good	Suitable for timber, fodder, in medicines and insecticide
1148	Modify river training works			Neem	*Azadira indica*	✔		G	✔			Good	Suitable for timber, fodder, in medicines and insecticide
1149	Modify river training works			Beri	*Zizyphus jujube*		✔	G			✔	Good	Fruit
1150	Modify river training works			Beri	*Zizyphus jujube*		✔	G			✔	Good	Fruit
1151	Modify river training works			Beri	*Zizyphus jujube*		✔	G			✔	Good	Fruit
1152	Modify river training works			Beri	*Zizyphus jujube*		✔	G			✔	Good	Fruit
1153	Modify river training works			Beri	*Zizyphus jujube*	✔		G		✔		Good	Fruit
1154	Modify river training works			Beri	*Zizyphus jujube*	✔		G		✔		Good	Fruit
1155	Modify river training works			Beri	*Zizyphus jujube*	✔		G		✔		Good	Fruit
1156	Modify river training works			Pipal	*Ficus religiosa*		✔	G		✔		Good	Suitable for burning and medicines
1157	Modify river training works			Pipal	*Ficus religiosa*		✔	G		✔		Good	Suitable for burning and medicines
1158			At confluence of RMB and temporary canal diversion	Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
1159			At confluence of RMB and temporary canal diversion	Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
1160			At confluence of RMB and temporary canal diversion	Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture

No. of Trees	Location			Name of Species		Trees at site		Status (P/G)	Economic Utilization			Condition	Remarks
	Additional Bays	Guide Banks	Diversion Channel	Common Name	Scientific Name	Young (Girth < 24")	Mature (Girth > 24")		Timber	Fuel wood	Fruit Tree		
1161			At confluence of RMB and temporary canal diversion	Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
1162			At confluence of RMB and temporary canal diversion	Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
1163			At confluence of RMB and temporary canal diversion	Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
1164			At confluence of RMB and temporary canal diversion	Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
1165			At confluence of RMB and temporary canal diversion	Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
1166			At confluence of RMB and temporary canal diversion	Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
1167			At confluence of RMB and temporary canal diversion	Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
1168			At confluence of RMB and temporary canal diversion	Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
1169			At confluence of RMB and temporary canal diversion	Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
1170			At confluence of RMB and temporary canal diversion	Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
1171			At confluence of RMB and temporary canal diversion	Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
1172			At confluence of RMB and temporary canal diversion	Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
1173			At confluence of RMB and temporary canal diversion	Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
1174			At confluence of RMB and temporary canal diversion	Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
1175			At confluence of RMB and temporary canal diversion	Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
1176			At confluence of RMB and temporary canal diversion	Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
1177			At confluence of RMB and temporary canal diversion	Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
1178			At confluence of RMB and temporary canal diversion	Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
1179			At confluence of RMB and temporary canal diversion	Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
1180			At confluence of RMB and temporary canal diversion	Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture

No. of Trees	Location			Name of Species		Trees at site		Status (P/G)	Economic Utilization			Condition	Remarks
	Additional Bays	Guide Banks	Diversion Channel	Common Name	Scientific Name	Young (Girth < 24")	Mature (Girth > 24")		Timber	Fuel wood	Fruit Tree		
1181			At confluence of RMB and temporary canal diversion	Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
1182			At confluence of RMB and temporary canal diversion	Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
1183			At confluence of RMB and temporary canal diversion	Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
1184			At confluence of RMB and temporary canal diversion	Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
1185			At confluence of RMB and temporary canal diversion	Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
1186			At confluence of RMB and temporary canal diversion	Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
1187			At confluence of RMB and temporary canal diversion	Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
1188			At confluence of RMB and temporary canal diversion	Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
1189			At confluence of RMB and temporary canal diversion	Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
1190			At confluence of RMB and temporary canal diversion	Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
1191			At confluence of RMB and temporary canal diversion	Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
1192			At confluence of RMB and temporary canal diversion	Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
1193			At confluence of RMB and temporary canal diversion	Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
1194			At confluence of RMB and temporary canal diversion	Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
1195			At confluence of RMB and temporary canal diversion	Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
1196			At confluence of RMB and temporary canal diversion	Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
1197			At confluence of RMB and temporary canal diversion	Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
1198			At confluence of RMB and temporary canal diversion	Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
1199			At confluence of RMB and temporary canal diversion	Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
1200			At confluence of RMB and temporary canal diversion	Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning

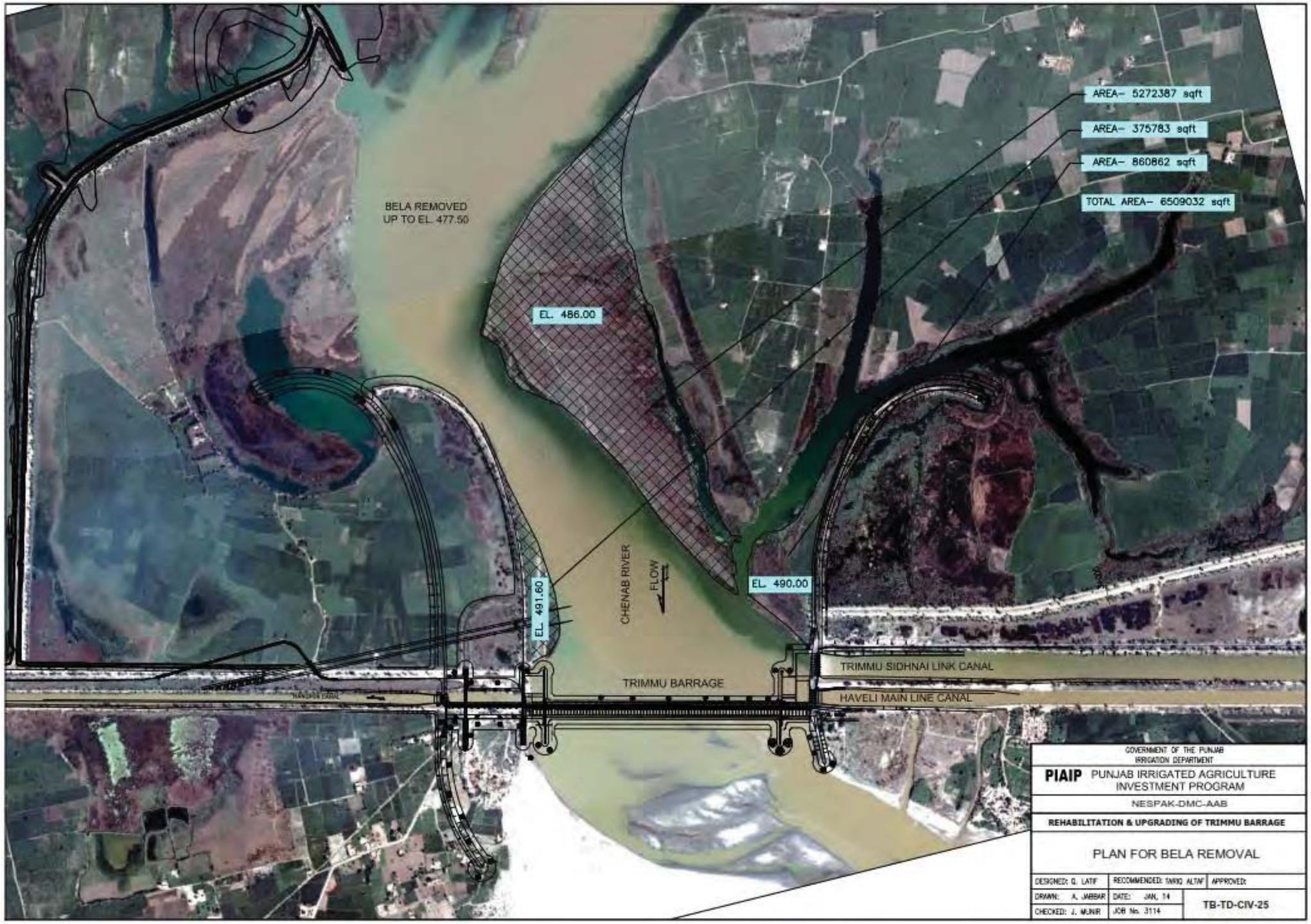
No. of Trees	Location			Name of Species		Trees at site		Status (P/G)	Economic Utilization			Condition	Remarks
	Additional Bays	Guide Banks	Diversion Channel	Common Name	Scientific Name	Young (Girth < 24")	Mature (Girth > 24")		Timber	Fuel wood	Fruit Tree		
1201			At confluence of RMB and temporary canal diversion	Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
1202			At confluence of RMB and temporary canal diversion	Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
1203			At confluence of RMB and temporary canal diversion	Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
1204			At confluence of RMB and temporary canal diversion	Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
1205			At confluence of RMB and temporary canal diversion	Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
1206			At confluence of RMB and temporary canal diversion	Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
1207			At confluence of RMB and temporary canal diversion	Kikar	*Acacia nilotica*	✔		G		✔		Good	Suitable for burning
1208			At confluence of existing canal bank and temporary canal diversion	Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
1209			At confluence of existing canal bank and temporary canal diversion	Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
1210			At confluence of existing canal bank and temporary canal diversion	Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
1211			At confluence of existing canal bank and temporary canal diversion	Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
1212			At confluence of existing canal bank and temporary canal diversion	Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
1213			At confluence of existing canal bank and temporary canal diversion	Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
1214			At confluence of existing canal bank and temporary canal diversion	Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
1215			At confluence of existing canal bank and temporary canal diversion	Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
1216			At confluence of existing canal bank and temporary canal diversion	Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture
1217			At confluence of existing canal bank and temporary canal diversion	Kikar	*Acacia nilotica*		✔	G	✔			Good	Suitable for Ordinary furniture

APPENDIX 7.4

BIODIVERSITY SURVEY REPORT

APPENDIX 7.5

BELA REMOVAL AT TRIMMU BARRAGE


AREA– 5272387 sqft
AREA– 375783 sqft
AREA– 860862 sqft
TOTAL AREA– 6509032 sqft
BELA REMOVED
UP TO EL. 477.50
EL. 486.00
EL. 490.00
EL. 491.60
CHENAB RIVER
FLOW
TRIMMU BARRAGE
TRIMMU SIDHNAI LINK CANAL
HAVELI MAIN LINE CANAL
GOVERNMENT OF THE PUNJAB
IRRIGATION DEPARTMENT
PIAIP PUNJAB IRRIGATED AGRICULTURE INVESTMENT PROGRAM
NESPAK-DMC-AAB
REHABILITATION & UPGRADING OF TRIMMU BARRAGE
PLAN FOR BELA REMOVAL
DESIGNED: Q. LATIF
RECOMMENDED: TARIQ ALTAF
APPROVED:
DRAWN: A. JABBAR
DATE: JAN, 14
CHECKED: J. MUNIR
JOB No. 3114
TB-TD-CIV-25

APPENDIX 8.1

MINUTES OF PUBLIC HEARING

047-9200376

No. 2575 /DOE/JNG
ENVIRONMENTAL PROTECTION AGENCY
H. NO. 705/A MOHALLAH KAPAIAN WALA
TEHSIL AND DISTRICT JHANG.
Dated : 23/01/2014

To

The Deputy Director (EIA),
EPA Punjab, Lahore.

Subject: **MINUTES OF PUBLIC HEARING OF REHABILITATION & UP-GRADATION OF TRIMMU BARRAGE PROJECT, DISTRICT JHANG.**
Ref:- No. DD(EIA)/EPA/F-48(EIA)/2013/2122, Dated: 18-12-2013.

Please refer to the letter under reference, the Public Hearing of the said project was scheduled to be held on 22nd January, 2014 at 11:a.m hours at Trimmu Barrage, District Jhang.

The under signed was directed telephonically to chair the above said Public Hearing and submit Minutes of Meeting accordingly. The Minutes of Meeting of the said public hearing are as under;

1. The Public Hearing was started with the recitation of Holy Quran.
2. Participants like representatives of different Government departments, NGOs, media and locals of the area participated in the Public Hearing. The attendance sheet of the participants is enclosed.
3. Mr. Ahsan Iqbal Bela, Environmental Specialist, PIAIP Consultant gave the briefing about the said project.
4. He gave the briefing about the objective of the project, its environmental and social issues and their remedial measures that are mentioned in the EIA report.
5. The consultant also distributed the project summery in Urdu language among the participants.
6. After the briefing, the undersigned (District Officer Environment, Jhang) added some more aspects of the project and its environmental issues in general understanding words and then asked the participants to put up their questions/ concerns about the said project.
7. The question answer session started then.
8. Miss Shgufta, District Coordinator Doaba Foundation raised the question to make the negative impacts of the project clearer. She also added that what measures will be adopted to counter the social impacts of the project and concerns of the local.

9. Mr. Nazim Hussain Shah, Director (Social & Environment) (PMO), Punjab Barrages Rehabilitation & Modernization Project, Irrigation Department, Lahore satisfied the said lady with his answer about the negative impacts of the project and their remedial measures. He also briefly described about the social concerns of the project and resettlement policy of the locals of the affected area.
10. Mr. Mazhar Abbas, District Officer Social Welfare Jhang, asked about the traffic problem during construction of the project.
11. Mr. Nazim Hussain Shah explained the plane that includes a diversion road to avoid the traffic problem during construction phase of the project.
12. Miss Zarina Sheikh, District Coordinator Human Rights NGO asked that whether the locals of the area were taken onboard about the said project or not?
13. Mr. Nazim Hussain Shah satisfied the said lady by his explanation in this regard.
14. Some other locals of the area asked about the job opportunity for the locals during the project.
15. Mr. Nazim Hussain Shah said that the jobs will be provided to the locals of the areas on priority basis according to the job/ employment policy.
16. The participants were satisfied with the project briefing and the Public Hearing was ended with the mutual vote of thanks.

Report is hereby submitted for your kind information and further process in this regard.

(Engr. Anjum Riaz)
District Officer Environment
Jhang

C.C:

1. The District Coordination Officer, Jhang.
2. PA to the Director General, EPA Punjab, Lahore.
3. Mr. Ahsan Iqbal Bela, Environmental Specialist, PIAIP Office NESPAK. House No. 38, N Block, Model Town, Lahore.

Attendance sheet

Public Hearing for Rehabilitation and Upgrading of Trimmu Barrage

Date: 22nd January 2014

Sr. #	Name of the Participant	Department/ Designation	Contact Number	Signature
1.	Khalid Mahmood	District Wild Life Officer Jhang	0300 6058674	22/1/2014
2.	Shafiq-ur-Rehman	Inspector Environment	0346-7276875	22/1/14
3.	Muhammad Siddiqui	Inspector Environment	03007677028	22/01/14.
4.	Abid-ur-Rehman	Field Assistant Environment	0301-7690565	22-01-2014
5.	Jamshed TIRMIZI	International Resettlement Specialist		22/01/2014
6.	NAZIM HUSSAIN SHAH	TPBIP Pro Barrages IRRIGATION DEPTT Dir (SC Env)	0301-8739287	22/01/13
7.	AHSAN IQBAL BELA	Environmental Specialist PIAIP Consultant	03364355559	
8.	Ghazanfar Hussain	Wildlife I/C Pond Area	0301-7224850	
9.	بیاول بخش ولد بخشانہ RIO جنڈوالہ تحصیل			بیاول بخش
10.	صوفی سرفراز علی		0301-2362127	صوفی سرفراز علی
	Haroon-ur-Rashid	ADC Ok	0332-8905008	

Sr. #	Name of the Participant	Department/ Designation	Contact Number	Signature
11.	مظفر اقبال		0302-7226201	مظفر اقبال
12.	السفرو		0300-5856244	السفرو
13.	عامر رشید		0305-9798223	عامر رشید
14.	ریحان سرور		0303-4876011	ریحان سرور
15.	اویس		0301-6859609	اویس
16.	خالد عباس		0347-5256155	خالد عباس
17.	محمد ظفر			محمد ظفر
18.	نور حسن		0341-7711586	نور حسن
19.	خرم عارف		03074754038	خرم عارف
20.	غلام سرور		0303-6282922	غلام سرور
21.	عبدالحمید	میٹ	0345-5735142	
22.	علی بخش		0301-6992693	علی بخش

Sr. #	Name of the Participant	Department/ Designation	Contact Number	Signature
23.	محمد اقبال		0301-3690141	
24.	چوہدری محمد عامر		03007011830	M. Amir
25.	محمد صفدر		0342-7848176	
26.	محمد فضل		0346746045	
27.	محمد صادق		0306-7117561	
28.	محمد ہارون خان	Driver	03449442963	
29.	محمد خالد سعید		0306-3259513	
30.	ظفر عباس		03073788133	Zafar
31.	محمد اکرم		0307-7690161	
32.	مزمل حسین		03137185376	Muzamil Hussain
33.	عاشق علی		03007507085	Ashiq Ali
34.	Sohail Haider	Sociologist		

Sr. #	Name of the Participant	Department/ Designation	Contact Number	Signature
	Shagufta	Doaba foundation	0300-8813 20	
35.	Azhar Abbas	Social welfare	0321-6013716	22/1/14
36.	Zasima Sh		03672273-8	
37.	Zainaib		03336753168	Zainaib
38.	Mrs. Abida Begum	Chairman P.C	0300 8822436	
39.	Shahzad Ali	DO (E&IP)	0333-8222921	
40.	Fatima Tanwer	PIAIP Consultants		
41.	Tayyba Seerwab	PIALP Consultants		
42.	Ajaf Sajeeha	PGAGP Consultants		
43.	Mr. ASHIQ. RASOOL	Social.	0306-6421114	
44.	Naeem Akhtar	Asst to DO (E&IP)	0331-7768711	
45.	سجاد حسین		0342-3789542	سجاد حسین
46.	قمر اقبال	Computer operator I.T.	0333-6504010	22/01/14

Sr. #	Name of the Participant	Department/ Designation	Contact Number	Signature
47.	Anjum Rinz	Environment (DOE)	0333-6926261	
48.				
49.				
50.				

SNAPS OF PUBLIC HEARING OF REHABILITATION & UP-GRADATION OF TRIMMU BARRAGE PROJECT, DISTRICT JHANG DATED 22-01-2014.