



**RAVI URBAN DEVELOPMENT AUTHORITY
(RUDA)**

**WASTEWATER TREATMENT PLANT (WWTP) AT
MAHMOOD BOOTI/SHADBAGH LAHORE**



**ENVIRONMENTAL IMPACT ASSESSMENT (EIA)
STUDY**

SEPTEMBER 2021



Wastewater Treatment Plant (WWTP) at Mahmood Booti/Shadbagh, Lahore

ENVIRONMENTAL IMPACT ASSESSMENT (EIA) STUDY

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LIST OF ABBREVIATIONS

AL	Aerated Lagoons
AOI	Area of Influence
AQI	Air Quality Index
ASP	Activated Sludge Process
BOD	Biochemical Oxygen Demand
COD	Chemical Oxygen Demand
CDM	Clean Development Mechanisms
CDA	Canal and Drainage Act
DC	Deputy Commissioner
DCRs	District Census Reports
DMCs	Developing Member Countries
EC	Environmental Committee
EIA	Environmental Impact Assessment
ECO	Economic Cooperation Organization
EE	Environmental Expert
EMMM	Environmental Mitigation and Management Matrix
EMMP	Environmental Management and Monitoring Plan
EMP	Environmental Management Plan
EPA	Environmental Protection Agency
ERP	Emergency Response Plan
ESEs	Environmental and Social Experts
GBV	Gender Based Violence
GoPb	Government of Punjab
GC	Grit Chamber
GHG	Green House gas
HH	House Holds
HVAC	Heating, Ventilation, Air Conditioning
HSE	Health, Safety and Environment
IA	Implementing Agency
IAQ	Indoor Air Quality
IEE	Initial Environmental Examination
IFC	International Finance Corporation
ILO	International Labour Organization
LAA	Land Acquisition Act
LPS	Lightning Protection System
MBR	Membrane Biological Reactor
MBT	Main Boundary Thrust
MSL	Mean Sea Level
NCS	National Conservation Strategy
NEQS	National Environmental Quality Standards
NESPAK	National Engineering Services Pakistan
NDMA	National Disaster Management Authority
NOC	No Objection Certificate
NPZs	Noise Perimeter Zones



OHSAS	Occupation Health and Safety Assessment Series
OHS	Occupational Health and Safety
O&M	Operation and Maintenance
OD	Oxidation Ditch
OIC	Organization of the Islamic Conference
PAPs	Project Affected Persons
PEPA	Pakistan Environmental Protection Act
PEQS	Punjab Environmental Quality Standards
PHA	Punjab Horticulture Authority
<hr/>	
PPE	Personnel Protective Equipment
PGA	Peak Ground Acceleration
PSC	Project Steering Committee
PST	Primary Sedimentation Tank
RE	Resident Engineer
RUDA	Ravi Urban Development Authority
RRUDP	Ravi Riverfront Urban Development Project
R _o W	Right of Way
SC	Supervisory Consultants
SDGs	Sustainable Development Goals
SSEMP	Site Specific Environmental Management Plan
STDs	Sexually-Transmitted Disease
SOPs	Standard Operating Procedure
TC	Tehsil Council
TF	Trickling Filters
UC	Union Council
UCC	Upper Chenab Canal
UNO	United Nations Organization
WSPs	Waste Stabilization Ponds
WWTP	Wastewater Treatment Plant



EXECUTIVE SUMMARY

ES-1 Introduction and Project Background

The River Ravi pollution is a great threat to ecosystem, and risk to downstream users. In view of river water pollution, Government of the Punjab (GoPb) has planned to install waste water treatment plants for Lahore City.

Waste water treatment system is the sub-project of the Ravi Riverfront Urban Development Project (RRUDP) that converts dying River Ravi into perennial fresh water body. In order to achieve the objective of perennial fresh water in River Ravi, the Wastewater Treatment Plant (WWTP) will be established at Mahmood Booti/Shadbagh, Lahore.

Ravi Urban Development Authority (RUDA) has engaged National Engineering Services Pakistan (NESPAK) Limited to provide Consultancy Services for the preparation of design and feasibility study of the proposed WWTP.

ES-2 Legal and Administrative Frameworks

The submission of EIA and its approval from Environmental Protection Agency (EPA) is mandatory according to Section 12 of Punjab Environmental Protection (Amendment) Act, 2012. The study has been conducted in accordance with Environmental Protection Agency (EPA) and Government of Pakistan (GoP) Guidelines.

The Government of Pakistan (GoP) has promulgated laws/acts, regulations and standards for the protection, conservation, rehabilitation and improvement of the environment. In our current studies, the applicable environmental policies are National Environment Policy, 2005; National Sanitation Policy, 2006; National Climate Change Policy, 2012 and National Resettlement Policy, 2002. The relevant laws, regulations and acts to the proposed project are: Pakistan Environmental Protection Act (PEPA), 1997; IEE/EIA Regulations, 2000; Pakistan Environmental Assessment Procedures, 1997; Punjab Environmental Protection Act (Amended 2012 & 2017); Punjab Environmental Quality Standards (PEQS) 2016; Punjab Local Government Ordinance, 2001; Canal and Drainage Act, 1873; Pakistan Penal Code, 1860; Guidelines for Solid Waste Management (2005); Sectoral Guidelines (1997); The Punjab Wildlife Protection, Preservation, Conservation & Management Act (1974); Protection of Tress and Brushwood Act, 1949; Cutting of Tress (Prohibition) Act 1975; Disaster Management Act, 2010; The Motor Vehicles Rules, 2000; National Clean Air Act, 2000; Land Acquisition Act, 1984; Seismic Building Code of Pakistan, 2007; Toxic or Hazardous Waste and Preservation of Cultural Heritage.

The Implementing Agency (IA) of the proposed project is Ravi Urban Development Authority (RUDA). The management of RUDA will ensure that all the proposed mitigation measures are effectively implemented at the design, construction, and operation stages of the proposed project.



ES-3 Project Description and Analysis of Alternatives

The proposed Project site for the Wastewater Treatment Plant (WWTP) is located in North West of Lahore. The proposed site is easily accessible from Lahore Ring Road Toll Plaza (2.5 Km away). The site is surrounded by three settlements named as Jhuggian Jodha, Bhamma and Khokhar Pind.

The components of the proposed Project include:

- Wastewater Treatment Plant
- Conveyance System
- Treated Effluent Channel

The proposed wastewater treatment plant will be comprised of screen chamber, Grit Chamber, Primary sedimentation tanks, Aeration tanks, Secondary sedimentation tanks, Sludge Thickener, Centrifuges, etc. Wastewater treatment plant will be constructed at Shadbagh over an area of 280 acres.

Based on previous experience approx. 16 - 18 MW power would be required during operational phase and it would be taken from WAPDA. Total man power required for the proposed project is estimated as 300 numbers during construction phase. Whereas, estimated workers / employees during operation phase will be 50 number. The proposed Project is expected to be completed within three (03) years. The tentative cost of the construction works of proposed Project is Rs. 120,000 million PKR. The process flow diagram of the proposed WWTP is given in Figure 3.2:

Alternatives

The following seven alternatives were considered for the proposed Project:

- Alternative I : No Project Option
- Alternative II : Waste Stabilization Ponds (WSPs)
- Alternative III : Conventional Activated Sludge Process (CAS)
- Alternative IV : Aerated Lagoons (AL)
- Alternative V : Trickling Filters (TF)
- Alternative VI : Oxidation Ditch (OD) system
- Alternative VII : Membrane Biological Reactor (MBR)

Comparison of all the alternatives shows that:

- Large area requirement along with nuisance issues and probability of ground water contamination issues makes the WSP options unsuitable;
- ALs requiring comparatively large areas and inability to remove nutrients and nuisance problem make it less desirable option;
- High capital cost, odour problem, higher potential of clogging makes TF an undesirable option;



- Oxidation Ditch system for being producing high suspended solids is not suitable for discharge into River Ravi as it will prove a hindrance to aquatic life, hence not a desirable option;
- MBR option being very expensive along with membrane fouling and clogging issues becomes an undesirable option; and
- CAS require less area, not so expensive, no odour issues or production of high suspended solids is the most suitable option. However, sludge production is high in this option.

Therefore, 'Conventional Activated Sludge' with proper sludge disposal mechanism, has been selected as most suitable option.

ES-4 Description of the Environment

The existing environment in and around the project area has been studied with respect to the physical, biological and socio-economic conditions.

Physical Environment

Lahore is generally flat and slopes towards south and south-west at an average gradient of 1:3000. The general height varies from 150 to 200 meters above the Mean Sea Level (MSL). It is divided into two parts i.e., the low lying area along River Ravi and the comparatively upland area in the east, away from Ravi. The low lands are generally inundated by the river water during intense rainfall events. The soil in the project area is cohesion less and is of alluvial type deposited by Ravi River. The types of soil layers that are present below the ground level includes: silt, silty clay, silty sand, poorly graded sand with silt and lean clay.

According to Building code of Pakistan 2007, the project area falls in Seismic Zone 2A of Pakistan (low to moderate damage) with peak ground acceleration (PGA) from 0.08 to 0.16 g.

The Project area has moderate to extreme climate conditions, with hot summers and cold winters. The summer starts from April and lasts till September, with mean minimum and maximum temperature ranges from 27°C to 47°C. The winter seasons lasts from November to March, with mean minimum and mean maximum temperature ranges from 2°C to 18 °C.¹

The project area receives rains in all the seasons but monsoon rain is pronounced rainy season between the month of July and September. The average rainfall is about 1,172 mm per year.

The environmental parameters for ambient air, noise level, surface water and groundwater were monitored at the proposed Project site from January 10, 2021 to January 15, 2021 for establishing the baseline profile of the Study Area. The results of ambient air quality indicates that all parameters are well within the permissible limits of PEQS, 2016, except Particulate Matter (PM₁₀ & PM_{2.5}) due to the emissions of particulate matter from vehicles other fugitive dust emissions. Noise level results show that the average noise values at day and night time are well within prescribed limits of PEQS, 2016. The wastewater quality was measured at two

¹ Meteorological Data for Lahore (1981-2010), Pakistan Meteorological Department.



(02) different locations i.e. Mahmood Booti and Shad Bagh Drains. The monitoring results of wastewater indicate that the values of BOD₅, COD, TSS and Sulfide are high in the study area with respect to prescribed limits of the PEQS, 2016.

Ecological Environment

The Vegetation of the project area shows that it is suitable for plantation of native species along the agriculture fields. Variation in diversity is caused due to climate, heterogeneity, biotic interaction and habitat. The proposed treatment plant area is situated in semi-arid region of Pakistan. The region is characterized by dry climate both in summer and winter season. . Natural vegetation of the area, which consisted of tropical thorn forest, has long ago been replaced completely by agricultural crops. The land owners also raised trees like Kikar (*Acacia Arabica*), Shisham or Tahli (*Dalbergia sissoo*), Beri (*Zizyphus jujube*), Toot (*Morus alba*), Sharin (*Albizzia lebbek*), Dherek (*Melia azedarach*), etc., along the boundaries of their agricultural fields. Pipal (*Ficus religiosa*) and Bohr (*Ficus benghalensis*) are grown for shade in their houses or deras.

Shrubs and herbs which are commonly found in the study area are Jawan (*Alhagi maurorum*), Bhakra (*Tribulus terrestris*), AK (*Calotropis procera*) Lana (*Sueda fruticosa*), Phogs (*Calligonum polygonoides*), Jantar (*Sesbania aculeata*) and Tumba (*Citrullus colocynthis*).

The Study Area being agricultural land is not very rich in wildlife mammals. However, common mammals are Jackal (*Canis aureus*), Squirrel (*Funambulus*), Fox (*Vulpes vulpes*), Rats (*Mus musculus*) and Mongoose (*Herpestes auropunctatus*). Wild bear (*Sus scrofa*) is also reported in the area, but its number has been reduced to a bare minimum as a result of extensive hunting and shooting. Porcupine (*Hystrix indica*) is common and causes lot of damage to young plants and crops.

Important bird species found in the tract are Common Crow, Common Mynah, House Sparrow and Common Teal and are frequently sighted. Bulbul and Koel were also noticed in the project area and the study area during field visits.

No endangered flora and fauna is found in the project area.

Socioeconomic Environment

The socioeconomic baseline covers the demography, administrative and political settings, religious and cultural, economic aspects, infrastructure and facilities, and gender aspects.

To document the socio-economic conditions of the population settled in the Project Area, social surveys of the selected House Holds (HH) were carried out. One of the major steps after the identification of the affected areas and their estimated populations during the initial survey of September, 2021 was the calculation of sample size. Total two (02) main settlements fall near the Project Area comprising population about 16,000.

Socio-economic survey was carried out at Khokhar Pind and Bhamma Village to take maximum information of the Project Area.



Based on the District Census Report, 2017, Lahore has a population of 11,126,285 while it was 6,318,745 as per 1998 census. The household surveys, indicated that household size is 7.1 persons. Based on the social survey, the maximum population falls in the age group between 20 and 39 years and it is the group which is responsible for most of daily life routine activities.

The educational facilities in the AOI comprises Middle schools for boys and girls. However, to avail higher secondary level education facilities locals have to go nearby areas of Lahore city. Health facilities are generally inadequate in the AOI. Bad sanitary conditions, contaminated underground water, insufficient medical facilities and meagre parental care, all contribute to the prevalence of ill health in the area. To avail health facilities, locals go to Lahore. Wastewater is disposed of in the open spaces just outside the houses in the studied villages i-e Khokhar Pind and Bhamma. However, other areas have proper drainage facility.

Women in the AOI are also vulnerable through economic, social and psychological poverty. Economic poverty is due to lack of assets and low endowment of human capital. Information which was collected through secondary sources and group discussion with locals shows that major problems faced by women in the area are lack of primary health care and the lack of education opportunities. Other problems include laborious work such as helping male members in preparation of fodder and managing livestock. These tasks not only affect their health but also take up major portion of their time.

ES-5 Public/Stakeholder Consultation

The objectives of stakeholder consultation were to contribute to the openness, transparency and dialogue. Special efforts were made to ensure that the communication with the public should be efficient and well balanced. The concerned stakeholder groups were identified to participate in the assessment process.

The primary stakeholders of this project that were consulted include project owner and the Project Affected Persons (PAPs). Secondary stakeholders are people or groups that are indirectly affected from the project activities or other stakeholders in the proposed project such as Punjab-EPA, Agriculture Department, Forest Department, Wildlife Department, Irrigation Department, Fisheries Department, WASA, Revenue Department and other various line agencies / departments of GoP.

Extensive consultations were conducted with the local communities and project PAPs in the Project area to record their views and incorporating in the project planning. Consultations were held with the participants of three villages in the proposed project area. During the consultations, initially participants were informed/briefed about the project objectives and extensive question and answer sessions were conducted to clarify the project related works and activities to resolve the environmental, social and resettlement issues. The concerns and their possible solutions presented by the participants regarding proposed project were recorded to make further possible recommendations.



ES-6 Impacts and Mitigation Measures

The construction of the proposed project will have both positive and negative impacts during the construction and operational phases, for which appropriate mitigation measures have been proposed. During the field survey, significant efforts were made to identify the main social, cultural and environmental issues related to the construction of the proposed project. Following is the list of main issues and concerns which have been considered in the study report:

Impacts:

- The total land required for the construction of the proposed WWTP is about 280 Acres, 201 Acres land is available and in process, whereas, 79 Acres additional land will also be required for the proposed project.
- Traffic congestion and time delays may occur on the access roads during the construction phase of the project;
- Air quality will be deteriorated by the dust generation and emissions from vehicles and construction machinery due to construction activities, which will be temporary in nature;
- Increased noise levels due to different construction activities may cause nuisance to the residents of the project area, which will be temporary in nature;
- During the construction phase of the proposed project, improper traffic management may result in traffic jams and cause inconvenience to the people passing due to movement of vehicles carrying construction materials and different construction activities but Traffic Management Plan will be developed.;
- Approximately 472 numbers of trees of different species will be removed during implementation of the proposed project, compensation Tree plantation will be carried out as per Tree Plantation Plan;
- Temporary disruption of existing public utilities during construction phase;
- Health and safety issues of the workers and public may also arise during the construction phase of the proposed project; and
- Improper construction camp location and mismanagement of construction camp activities can lead to various social and environmental impacts which include health and safety, traffic problems, soil degradation, loss of vegetation and assets on the selected land, solid waste and water pollution in the vicinity settlements;
- The operation of proposed WWTP will result in generation of odour from biological tanks, sludge holding areas and dewatering units; and
- The proposed WWTP shall generate huge quantities of sludge which require due consideration for its management.

Mitigation Measures

All the adverse impacts of the proposed project during different phases have been properly addressed which include but not limited to, judicious compensation to the affectees as per law, preparation of Site Specific Management Plan, Traffic Management Plan & its implementation; construction Waste Management Plan, Tree Plantation Plan, strict compliance of HSE protocols during the construction phase, camp site management practices, application of dust suppression techniques during the construction phase; monitoring of air & noise quality



according to the prescribed schedule in EMMP; traffic management during operation phase for road and public safety. Some important mitigation measures are:

- Careful site selection by the design team to minimize the impacts by avoiding the residences of affected families. The Land Acquisition Act (LAA) of 1894 is the main law regulating land acquisition for public purpose.
- A tree plantation program (1:10) shall be formulated to boost tree plantation.
- Movement of vehicles carrying construction materials and equipment/machinery will be restricted during the daytime to reduce noise, traffic load and inconvenience to the local population;
- The project will seek to avoid sitting camps where their presence might contribute to any conflicts with locals;
- All vehicles, machinery, equipment and generators used during construction activities should be kept in good working condition as per standards and be properly tuned and maintained in order to minimize the exhaust emissions;
- For the case of Mahmood Booti/Shad Bagh WWTP, Mono Fills (sludge storage ponds) shall be proposed in which dried sludge from sludge drying beds will be disposed of.
- Operation and maintenance of machinery and equipment shall be controlled and handled by efficient management, staff training, and other preventive measures;
- Emergency Response Plan shall be formulated for the WWTP and strictly implemented by the management;
- CH₄ gas produced during operation phase shall be recycled, it can reduce GHG emissions as CH₄ is a renewable energy source, which meets the energy requirements of the consumers and it can also reduce power consumption and reduce costs.
- Emergency Response Plans for floods, earthquakes, and manmade disasters will be prepared, in consultation with Fire Fighting Department (FFD), Rescue 1122 Services and National Disaster Management Authority (NDMA);

A comprehensive Environmental Management Plan (EMP) has been formulated. The implementation of EMP will help to reduce the adverse impacts of the proposed project.

ES-7 Environmental Mitigation and Monitoring Plan

The key players involved during construction phase of the proposed Project are the RUDA as employer/proponent, EPA, the Supervisory Consultants (SC) and the Contractor. The roles and responsibilities of these organizations are outlined below. The following staff will be involved in the implementation of EMP:

- RUDA/Proponent/Employer;
- SC's; and
- Contractor's Environmental Manager.



EMP, the part of EIA will be part of the bidding documents and the contractor will implement the EMP under contract clause with the Employer/Proponent (RUDA) and the Supervisory Consultants (SC). The employer/proponent (RUDA) will make a Project Steering Committee (PSC) comprising Chairman RUDA, Project Director RUDA and Deputy Director, RUDA will provide overall guidance and oversight and will be responsible for ensuring effective implementation of the project.

Environmental and Social Experts (ESEs) of SC will oversee the performance of contractor to make sure that the contractor is carrying out the work in accordance with EMP as mentioned in the contract documents.

The proposed Project will be administrated by RUDA during the O&M phase. RUDA has established District Support & Monitoring Department to monitor the development works of every district and for technical support for District Government. Therefore; it is suggested that the Project Director of the proposed Project shall depute / hire Environment and Social Expert through District Support & Monitoring Department to monitor and implement EMP during operation phase.

Under the proposed monitoring strategy, it is recommended RUDA should be responsible for all the monitoring activities. All the findings and results in the form of monitoring report will be finally shared with Punjab-EPA.

Various Site-Specific Environmental Management Plans (SSEMP) will be prepared by Contractor as a part of EMP for the better management and implementation of EMP during all phases of the proposed Project. However, approval of these site-specific plans from RUDA should be sought before start of construction activities.

For an effective implementation of environmental mitigation measures during construction and operational phase, it is very important to provide sufficient funds for the implementation of environmental and social mitigation measures, monitoring and training. The estimated cost of environmental and social mitigation measures, monitoring and training is about PKR 35.07 Million.

The cost for EMP will be part of the contract document with the Contractor. The same may also be included in the total project cost for the implementation of EMP.

ES-8 Conclusion and Recommendations

The proposed Project will improve condition of River Ravi water by reducing the pollution load and will prevent the spread of diseases resulting from improper disposal of wastewater.

Apart from the positive impacts, the proposed project may also have potential adverse environmental and social impacts during the construction and operational phases.

Proper implementation of EMMP should be ensured during all three phases of the proposed Project. A comprehensive Tree Plantation Plan and compensation to the PAPs as per law will both enhance value to the project. In addition, EMMP should be a part of contract document



of Contractor(s). Moreover, the cost for environmental management, monitoring and training has been estimated and proposed in the study which should be included in the PC-I or overall Project Cost. The implementation of EMP will ensure that the project is executed in an environmentally sustainable manner.

1 INTRODUCTION

1.1 PROJECT BACKGROUND

Lahore is the second largest city of Pakistan and the provincial capital of the Punjab with population of approximately 10 million that generates wastewater which is discharged directly into the River Ravi without any treatment and is substantially the biggest pollution source in river. The pollution in the river is a great threat to ecosystem, and risk to downstream users. In view of river water pollution, Government of the Punjab (GoPb) has planned to install waste water treatment plants for Lahore City.

Waste water treatment system is the sub-project of the Ravi Riverfront Urban Development Project (RRUDP) that converts dying River Ravi into perennial fresh water body. In order to achieve the objective of perennial fresh water in River Ravi, the Wastewater Treatment Plant (WWTP) will be established at Mahmood Booti/Shadbagh, Lahore.

Ravi Urban Development Authority (RUDA) has engaged National Engineering Services Pakistan (NESPAK) (Pvt.) Limited to provide Consultancy Services for the preparation of design and feasibility study of the proposed WWTP.

1.2 REQUIREMENT FOR EIA STUDY OF THE PROPOSED PROJECT

The Proposed Project is located in Punjab Province, therefore, the Punjab Environmental Protection Act, 1997 (Amended 2012 & 2017) is the core environmental law for the proposed Project. Under Section 12 (1) of Punjab Environmental Protection Act (PEPA), EIA is mandatory for the subject project, which states that:

“No proponent of a project of public and private sector shall commence construction or operation unless he has filed an Initial Environmental Examination / Environmental Impact Assessment with the Punjab Environmental Protection Agency, as the case may be, or, where the project is likely to cause adverse environmental effects; and has obtained approval from the Provincial Agency in respect thereof”.

According to the Pakistan Environmental Protection Agency (Review of EIA and EIA) Regulations 2000, the proposed project falls under Category ‘F’ of “Water supply and Treatment” of the Schedule-II. This category requires an EIA study to be conducted for construction of treatment plants related projects to initiate the process of environmental approval.

1.3 OBJECTIVES OF EIA

The prime objective of the EIA study is to fully meet the statutory requirements set forth by the Punjab Environmental Protection Act, 1997 (PEPA-Amended 2012 & 2017) to facilitate decision making by the EPA regarding grant of No Objection Certificate (NOC)/Environmental Approval for the Proposed Project.

Specific objectives of this EIA report are to:

Title of Document

Environmental Impact Assessment (EIA)

- Facilitate proponents of the project in ensuring environmental and social sustainability of the project;
- Establish a baseline of existing social and environmental conditions prior to project initiation by collecting secondary data/information on physical, biological and socioeconomic environment of the project area;
- Identify potentially significant environmental and social impacts (both positive and negative) during all stages of the Project;
- Avoid, minimize, and suggest mitigation measures for significant adverse impacts;
- Conduct, record and report and ensure consultations with major stakeholders; and
- Provide an Environmental Monitoring Framework and institutional arrangements for the proposed project as a tool for the implementation of the suggested measure and evaluation mechanism with adequate resources including implementing agencies capacity building.

1.4 NATURE, SIZE AND LOCATION OF THE PROJECT

The proposed Project is a non-linear project that involves construction of WWTP at Mahmood Booti/Shadbagh, Lahore.

Figure 1.1 shows the Location Map of the proposed Project.

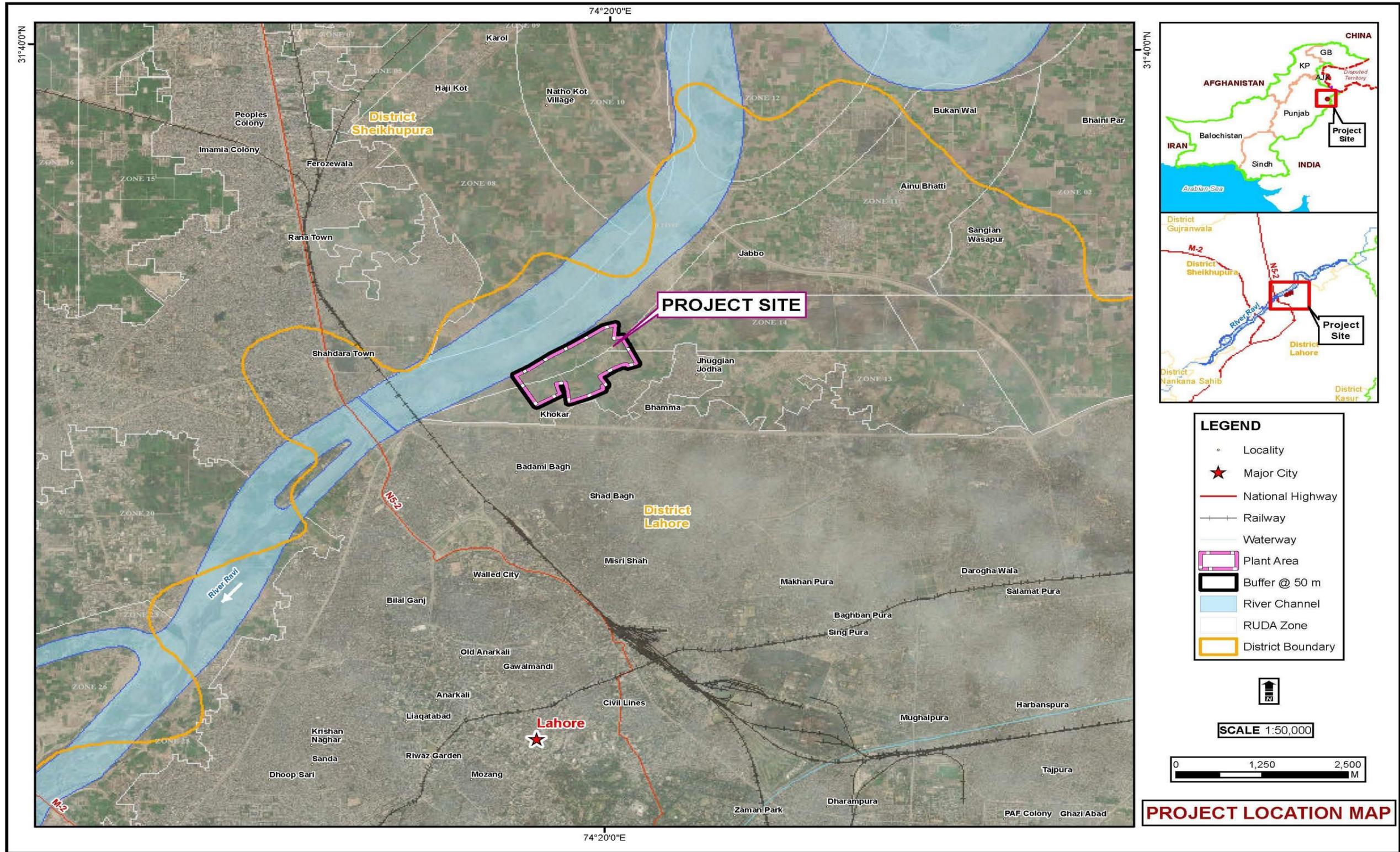


Figure 1.1: Location Map of the Proposed Project



1.5 PROJECT PROPONENT

Details of the Proponent of the proposed Project are provided here under:

Chairman/ Project Director
River Ravi Urban Development Project
Ravi Urban Development Authority (RUDA)
Government of the Punjab
51 N Gurumangat Rd, Block N Gulberg III, Lahore, Punjab
Tel: +92 42 99263541

1.6 PROJECT CONSULTANT

The details of the Consultants are provided below:

National Engineering Services Pakistan (Pvt.) Limited (NESPAK)
NESPAK House: 1-C, Block-N, Model Town Extension, Lahore, 54700,
(P.O. Box 1351), Pakistan
Telephone Number: 92-42-99090233 Fax
Number: 92-42-99231950
E-mail Address: info@nespak.com.pk
Website: www.nespak.com.pk

1.7 CONSULTANT'S EIA TEAM

Based on the requirements of the study, NESPAK formed a team of experts comprising a team leader (Environmental Specialist) with professional support from the Environmental Engineer, Environmental Scientists, Sociologist and Ecologist. The professional staff was involved in analyzing the data, impact assessment and mitigation measures and report compilation. In addition, the EIA team worked in close coordination with the design team and several inputs were provided by the design specialists to the EIA team.

1.8 APPROACH AND METHODOLOGY

The following approach and methodology was adopted for carrying out the EIA study of the proposed project:

1.8.1 Orientation

Meetings and discussions were held among the members of the EIA Consulting Team. This activity was aimed at achieving a common ground of understanding of various issues of the study. Subsequent to the concept clarification and understanding, a detailed data acquisition plan was developed for the internal use of the EIA consulting team. The plan identified specific data requirements and their sources; determined time schedules and responsibilities for their collection; and indicated the logistics and facilitation needs for the execution of the data acquisition plan.



1.8.2 Desktop Studies

Prior to mobilization, the consultants conducted a desktop study through collection and review of guidelines, data and reports related to the proposed project, that included (a) review of National Environmental Legislations; (b) Google Earth Satellite Imagery; (c) Relevant District Census Reports (DCR) and other relevant documents/drawings; and (d) Data available in previously conducted studies; *Census Survey by Pakistan Bureau of Statistics, 1998 and 2017 for socio-economic data; and other design data provided by the Client.*

1.8.3 Review of Environmental Laws and Institutional Requirements

All applicable national and international laws, legislations, guidelines along with relevant international protocols were reviewed relevant to the proposed project components.

1.8.4 Delineation of Study Area / AOI

For an EIA Study, a clear delineation of the Study Area / Area of Influence (AOI) is required. Study Area / AOI is the area within which the potentially significant impacts of the proposed Project activities (direct or indirect) are envisaged. In this report, the Study Area / AOI is the area where the Project impacts has been accessed on the environment due to the proposed Project activities.

Based on the available Google Earth Imagery and ARC GIS software, Project footprints were overlaid on the existing Project Area Imagery. Utilizing the information collected through the detailed site visit, consultations with the locals and concerned departments and foreseen impacts of the proposed Project, a tentative AOI was delineated.

1.8.5 Survey of AOI

A team of Environmental Scientists, Ecologist and Sociologist carried out the environmental and social survey of the AOI from Sep 09 to Sep 14, 2021 to familiarize themselves with the local conditions and the environmental settings. During the survey, the information regarding the topography, soils, surface water, groundwater, flora & fauna, affected infrastructure, social settings and major settlements along the AOI were observed.

1.8.6 Environmental Baseline Survey of the Project

Detailed environmental and social survey was carried out within the AOI as mentioned above. For data collection, formal meetings were held and data collected through visual observations, interviews with the local residents and officials. In order to collect the relevant published information, government offices were also visited.

Prior to the start of field activities comprehensive checklists, proformas and maps were developed to collect the information related to following parameters:



Physical Environment

The information acquired for the establishment of physical environment baseline included the following main parameters:

- Land resources (including landuse pattern, soil composition, contamination of soil and soil erosion etc.);
- Water resources (including available surface and groundwater resources and natural streams, hydrology, spring water, water supply, water contamination etc.);
- Climate data (including temperature, rainfall, humidity, wind speed and direction etc.);
- Ambient air quality and noise level monitoring data;
- Existing solid waste management and effluents disposal practices and storm water drainage;
- Buildings and infrastructure details, including residential, commercial and animal shed for complete/partial relocation;
- Religious, cultural and heritage information (mosques, shrines, graveyards);
- Presence of any archaeological monuments in the AOI; and
- Other private/public infrastructures such as roads, telephone poles, hand pumps, tube wells etc.

Ecological Environment

The status of the flora and fauna of the study area were determined by a review of literature of the area, and an assessment of both terrestrial and aquatic environments.

a) Flora

The vegetative communities were identified and classified into community types. Identification was carried out of dominant tree species, assessment of stage of growth (mature or sapling), etc.

b) Fauna

Information on fauna was gathered from existing literature on reported species as well as observations in the field.

Socio-Cultural Environment

The consultants utilized a combination of literature, field investigations, census report, meetings through public consultation and interviews to describe the existing social environment and assessment of the potential impact of the construction of the proposed project. Data was gathered on the following aspects of the social environment:

- Land use and Municipal Status;
- Demographics;
- Livelihoods;
- Community Facilities;
- Solid Waste Management;
- Proposed Developments;
- Archaeological and Cultural Heritage; and



- Identification and Evaluation of Environmental Impacts.

CAPACITY OF PROPOSED WWTP

The treatment capacity of proposed WWTP is about 143 MGD for year of 2035.

1.8.7 Stakeholder Consultations

The Consultant identified Project stakeholders and held meetings with them during the surveys to receive feedback on the expected environmental issues related to the Project and suggested mitigation measures. Meetings were carried out with the PAPs, other stakeholders including Environment Protection Department, Forest and Wildlife Department, Fisheries Department, etc. to discuss the issues/constraints and get their views and feedback to mitigate the potential environmental as well as social impacts associated with the implementation and operation of the Project.

1.8.8 Screening of Potential Environmental Impacts and Mitigation Measures

Based on the generally established baseline conditions in the adjacent as well as in the Project Area, potential physical, ecological and social impacts of the proposed Project were identified, evaluated and quantified, wherever possible. A logical and systematic approach was adopted for impact identification and assessment by utilizing a combination of the secondary data, satellite imagery, environmental checklists, socioeconomic survey proformas, field observations and discussion with the local residents of the Project Area. To mitigate the significant adverse impacts, adequate mitigation measures and implementation framework were proposed so that the proponent could incorporate them beforehand in the design phase.

1.8.9 Environmental Management Plan (EMP)

An EMP has been prepared to ensure the adequacy and effectiveness of the proposed protocol by clearly identifying the roles and responsibilities of the agencies, responsible for implementation, monitoring and auditing of EMP activities, existing and suggested framework, necessary approvals and the required further studies. EMP also include organizational setup, a monitoring mechanism, monitoring plan, environmental and social parameters to be monitored with their frequency. Similarly, costs for environmental monitoring and social component/social mitigation measures were also included as part of the EMP. Environmental monitoring, evaluation, auditing and reporting mechanism were also proposed in the EMP.

1.9 STRUCTURE OF THE REPORT

Section 1 “**Introduction**” briefly presents the project background, objectives, methodology and need of the EIA study.

Section 2 “**Policy, Legal and Administrative Framework**” comprises policy guidelines, statutory obligations and roles of institutions concerning EIA study of the proposed Project.



Section 3 **“Description of Project and Alternative”** furnishes information about the studied alternatives, location of the proposed project, cost and size of the project, its major components and alternatives considered for the proposed project to select at the preferred alternative for detailed environmental assessment.

Section 4 **“Environmental Baseline”** describes physical, biological and socio-economic conditions prevalent in the project area.

Section 5 **“Public Consultation”** identifies the main stakeholders and their concerns raised through scoping sessions, and deals with the measures to mitigate the social impacts.

Section 6 **“Anticipated Environmental Impacts and Mitigation Measures”** identifies and evaluates impacts of the project activities during the construction and operation stages and recommends with the measures proposed to mitigate potential environmental impacts of the road project.

Section 7 **“Environmental Management Plan”** outlines roles and responsibilities for the implementation of the proposed mitigation measures, training needs of the staff for implementation of the mitigation measures, monitoring requirements, monitoring cost etc.

Section 8 **“Conclusion and Recommendations”** elaborates the conclusion of subject environmental study and suggests the recommendations to address the issues raised from proposed construction activities.

2 POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORKS

2.1 General

This section provides an overview of the policy framework and legislation that applies to control the environmental consequences as a result of proposed project implementation and operation. The project needs to comply with all the applicable environmental policies, laws, guidelines, acts and legislations of Government of Pakistan and provincial government. There are also available International guidelines i.e., World Bank (WB) Operation Policy, Asian Development Bank (ADB) safeguard policy and IFC's Performance Standards for guidance, if required.

2.2 Summary of Relevant Strategies, Policies, Acts and Legislation

The summary of major relevant strategies, policies, acts and legislation from environmental perspective are briefly described in Tables 2.1 & 2.2 below:

Table 2.1: Main Strategies/Policies Related to Environment and their Relevance to the Project

Sr. No.	Policy/Strategy	Brief Coverage	Relevance to Project
1	National Conservation Strategy, 1992	Pakistan National Conservation Strategy (NCS), which was approved by the federal cabinet in March 1992, is the principal policy document on environmental issues in the Country. The NCS outlines the Country's primary approach towards encouraging sustainable development, conserving natural resources and improving efficiency in the use and management of resources. The NCS has 68 specific programs in 14 core areas in which policy intervention is considered crucial for the preservation of Pakistan's natural and physical environment.	The core areas that are relevant in the context of the proposed project are pollution prevention during construction, conserving biodiversity and supporting forestry and plantation.
2	National Environmental Policy, 2005	In March 2005, GoP launched its National Environmental Policy, which provides a framework for addressing the environmental issues. Section 5 of the policy commits for integration of environment into development planning as instrument for achieving the objectives of National Environmental Policy. It also provides broad guidelines to the Federal Government, Provincial Governments, Federally Administered Territories and Local Governments to address their environmental concerns and to ensure	Clause (b) of sub-section 5.1 states that Environmental Assessment related provisions in Environmental Protection Act, 1997, will be diligently enforced for all developmental projects.

		effective management of their environmental resources.	
3	National Climate Change Policy, 2012	<p>The National Climate Change Policy provides a framework for addressing the issues that Pakistan faces or will face in future due to the changing climate. In view of Pakistan's high vulnerability to the adverse impacts of climate change, in particular extreme events, adaptation effort is the focus of this policy document. The vulnerabilities of various sectors to climate change have been highlighted and appropriate adaptation measures spelled out.</p> <p>The policy covers measures to address issues in various sectors such as water, agriculture, forestry, coastal areas, biodiversity and other vulnerable ecosystems.</p> <p>Notwithstanding the fact that Pakistan's contribution to global Greenhouse Gas (GHG) emissions is very small, its role as a responsible member of the global community in combating climate change has been highlighted by giving due importance to mitigation efforts in sectors such as energy, forestry, agriculture and livestock.</p> <p>Furthermore, appropriate measures relating to disaster preparedness, capacity building, institutional strengthening; technology transfer; introduction of the climate change issue in higher education curricula; ensuring environmental compliance through Initial IEE and EIA in the development process; addressing the issue of deforestation and illegal trade in timber; promoting Clean Development Mechanisms (CDM); and raising Pakistan's stance regarding climate change at various international forums, have also been incorporated as important components of the policy.</p> <p>The policy thus provides a comprehensive framework for the development of Action</p>	<p>This policy document is a 'living' document and will be reviewed and updated regularly to address emerging concepts and issues in the ever-evolving science of climate change.</p> <p>This policy will accelerate due to the emissions from the construction machinery and equipment.</p>

Sr. No.	Policy/Strategy	Brief Coverage	Relevance to Project
4	National Drinking Water Policy, 2009	The National Drinking Water Policy provides a framework for addressing the key issues and challenges facing Pakistan in the provision of safe drinking water to the people. Drinking water is the constitutional responsibility of the provincial governments and the specific provision function has been devolved to specially created agencies in cities and Town and Tehsil Municipal Administrations under the Local Government Ordinance 2001.	This policy is applicable for the proposed project during construction phase in terms of regular water quality monitoring.
5	National Water Policy, 2018	The National Water Policy aims at efficient management and conservation of existing water resources, optimal development of potential water resources, steps to minimize time and cost overruns in completion of water sector projects, improving urban water management by increasing system efficiency and reducing non-revenue water through adequate investments to address drinking water demand, sewage disposal, handling of wastewater and industrial effluents; equitable water distribution in various areas and canal commands, measures to reverse rapidly declining groundwater levels in low-recharge areas, increased groundwater exploitation in high recharge areas, effective drainage interventions to maximize crop production, improved flood control and protective measures, steps to ensure acceptable and safe quality of water, minimization of salt build-up and other environmental hazards in irrigated areas, institutional reforms to make the managing organizations more dynamic and responsive.	The core areas that are relevant in the context of the proposed project are drinking water demand, sewage disposal, handling of wastewater.

Sr. No.	Policy/Strategy	Brief Coverage	Relevance to Project
6	National Forest Policy, 2015	<p>The goal of this policy is to expansion, protection and sustainable use of national forests, protected areas, natural habitats and watersheds for restoring ecological functions, improving livelihoods and human health in line with the national priorities and international agreements.</p> <p>In line with the Federal functions of national policy, planning and implementation of international agreements, specific objectives of the National Forest Policy include:</p> <ol style="list-style-type: none"> a) Promoting ecological, social and cultural functions of forests through sustainable management and use of forest produce including wood and non-wood forest products; b) Implementing a national level mass afforestation programme to expand and maintain optimum forest cover; c) Maximizing forest areas by investing in available communal lands/ shamlat, and Guzara forests and urban forestry; d) Facilitating and harmonizing interprovincial movement, trade and commerce of wood and non-wood forest products through the Federal Forestry Board; e) Inter-linking natural forests, protected areas, wetlands and wildlife habitats to reduce fragmentation; f) Enhancing role and contribution of forests in reducing carbon emissions and enhancing forest carbon pools; g) Facilitating implementation of international conventions and agreements related to Forestry, Wetlands, Biodiversity and Climate Change; and h) Promoting standardized and harmonized scientific forest planning, research and education including for community-based management. 	<p>The proposed Project dose not involve any national forests, protected areas, natural habitats and watersheds, so this policy is not applicable.</p>
7	Pakistan Labour Policy, 2010	<p>The main objective of the Labour Policy, 2010 is the social and economic well-being of the labour of Pakistan. The Labour Policy, 2010 has following 4 parts:</p> <ul style="list-style-type: none"> • Legal Framework; • Advocacy: rights of workers and employers; • Skill development and employment; and • Manpower export. 	<p>The labour force will be employed for construction of the proposed Project. The provision of policy will apply to all the employed labourers.</p>

Sr. No.	Policy/Strategy	Brief Coverage	Relevance to Project
8	National Disaster Risk Reduction Policy, 2013	NDMA, being the lead focal agency for disaster preparedness and management, has therefore, embarked upon formulation of a comprehensive National Disaster Risk Reduction Policy through wider consultations with all stakeholders including all provinces, state of AJ&K and regions. This policy covers disasters risk reduction in a more holistic way and introduces a proactive and anticipatory approach by laying special emphasis on risk assessment and prevention.	This policy will be elicited if any unforeseen natural and manmade disaster occurs during construction and operation phase.
9	National Action Plan for COVID-19 Pakistan	<p>Government of Pakistan has launched the National Action Plan for COVID-19 Pakistan to combat the challenge of prevailing virus, also available at https://www.nih.org.pk/wpcontent/uploads/2020/03/COVID-19-NAPV2-13-March-2020.pdf.</p> <p>The Government of Pakistan has launched the real-time data portal for COVID-19 http://covid.gov.pk/. These measures are mostly relating to the containment and awareness and capacity building. Besides this COVID-19 daily situation report is also available at https://www.nih.org.pk/wpcontent/uploads/2020/04/COVID-19-DailyUpdated-SitRep-03-April-2020.pdf.</p>	This Action Plan for COVID-19 is applicable to the proposed project as it is being launched during this pandemic.

Table 2.2: Main Legislation/Acts Related to Environment and their Relevance to the Project

Sr. No.	Act	Brief Coverage	Relevance to Project
1	Punjab Environmental Protection Act, 1997 (Amended, 2012 & 2017)	<p>The Punjab Environmental Protection Act, 1997 (Amended, 2012 & 2017) is comprehensive legislation and provides the legislative framework for protection, conservation, rehabilitation and improvement of the environment. The ‘environment’ has been defined in the Act as: (a) air, water and land; (b) all layers of the atmosphere; (c) all organic and inorganic matter and living organisms; (d) the ecosystem and ecological relationships; (e) buildings, structures, roads, facilities and works; (f) all social and economic conditions affecting community life; and (g) the interrelationships between any of the factors specified in sub-clauses ‘a’ to ‘f’.</p> <p>The notable points of the law are:</p> <ul style="list-style-type: none"> • No proponent of a project shall commence construction or operation unless he has filed an IEE/EIA with the Provincial Agency designated by the Provincial EPAs an EIA, and has obtained an approval; • Establishment and formation of the Punjab Environmental Protection Council (PEPC); • Prohibition of certain discharges or emissions; • Punjab Environmental Quality Standards (PEQS) for wastewater, air emissions and noise; and • Provincial Government can issue notices and enforce them to protect the environment. <p>In the recent amendment of 2012, legislative powers related to environment and ecology are given to provincial governments from the Federal government. The provinces are required to enact their own legislation for environmental protection. Other amendments include increasing the penalties for violations.</p>	<p>The provision of the act is applicable to proposed Project for conducting an EIA according to section 12 and to obtain environmental approval from the EPA.</p> <p>The section 11 of the act is applicable in term of compliance with Punjab Environmental Quality Standards (PEQS). Similarly, section 13 of the act prohibits the import of hazardous waste. The provisions of section 16 are also applicable to comply with the discharge or emission of any effluent, waste, air pollutant or noise or disposal of waste or handling of hazardous substance. Under section 17, penalties will apply if anyone fails to comply with the provisions of section 11, 12, 13 and 16.</p>

		For the proposed Project, Environmental Protection Department (EPD)/Environmental Protection Agency (EPA), Government of the Punjab (GoPb) is the concerned authority. The capability of regulatory institutions for environmental management is ultimately responsible for the success of environmental assessments and that development projects are environmentally sound and sustainable.	
2	Pakistan Environmental Protection Agency, (Review of IEE and EIA) Regulations, 2000	<p>These regulations set out:</p> <ul style="list-style-type: none"> • Key policy and procedural requirements for filing an EIA; • The purpose of environmental assessment; • The goals of sustainable development; • The requirement that environmental assessment be integrated with feasibility studies; • The jurisdiction of the Federal and Provincial EPA's and Planning & Development (P&D) Departments; • The responsibilities of proponents; • Duties of responsible authorities; • Provides schedules of proposals that the project requires either IEE or an EIA; • The environmental screening process of the projects under schedule I, II and III; and <p>The procedure for the environmental approval for filing the case with the concerned EPA for granting NOC.</p>	The provisions of these regulations are applicable for environmental screening of the project, which implies that an EIA is required for the proposed project. The process described in the regulation will be useful for RUDA to follow the procedure to file an EIA with Punjab EPA and to understand its review process along with timelines to be followed.
3	Punjab Environmental Quality Standards (PEQS), 2016	<p>PEQS promulgated recently in 2016. Specified standards under PEQS are for:</p> <ul style="list-style-type: none"> • Drinking Water; • Ambient Air; • Noise; • Industrial Gaseous Emissions; • Municipal and Liquid Industrial Effluents; • Motor vehicle exhaust and noise; and <p>Treatment of Liquid and Bio-Medical Waste.</p>	All projects to be implemented in Punjab must conform to PEQS during all the phases i.e., construction and operation.

4	Guidelines for the Preparation and Review of Environmental Reports, 1997	<p>These guidelines describe the format and content of IEE/EIA reports to be submitted to EPA for obtaining NOC/approval.</p> <p>The guidelines present:</p> <ul style="list-style-type: none"> • The environmental assessment report format; • Assessing impacts; • Mitigation and impact management and preparing an Environmental Management Plan; • Reporting; <p>Review and decision making; □ Monitoring and auditing; and □ Project Management.</p>	The guidelines are applicable for the preparation of EIA.
5	Guidelines for Environmental Assessment	<p>Pak-EPA has published a set of environmental guidelines for conducting environmental assessments and the environmental management of different types of development Projects. The guidelines that are relevant to the proposed Project are listed below.</p> <ul style="list-style-type: none"> • Guidelines for the Preparation and Review of Environmental Reports, Pakistan Environmental Protection Agency, 1997; • Guidelines for Public Consultation, Pakistan Environmental Protection Agency, May, 1997; and • Sectoral Guidelines: Pakistan Environmental Assessment Procedures, Pakistan Environmental Protection Agency, October 1997. 	The guidelines are applicable for the preparation of the EIA.

6	Ravi Urban Development Authority Act 2020	<p>The Ravi Urban Development Authority Act 2020 (the “Act 2020”) was promulgated to establish Ravi Urban Development Authority (the “Authority”) for carrying out the purposes of the Act <i>ibid</i>.</p> <p>The Act 2020 focuses on the administrative, procedural and operational activities of the Authority with certain prohibitions attached to its functions. The preamble of the Act 2020 is exhaustive in nature pointing out the entire actions in public interest for the purpose of comprehensive system of planning and development in the area specified in Master Plan of the Project so as to improve the quality of life as per legislative objectives and further to establish an integrated modern and regional development approach and a continuing process of planning and development to achieve the highest environmental standards, quality of life and modern standard facilities so as to make a healthy and prosperous community in the designated area duly determined by the Government to rehabilitate water aquifer and the dying Ravi River into fresh perennial water body with a state-of-the-art water front and urban development on reclaimed and adjoining lands. The objectives of the Act 2020 are to provide quality life along with developed infrastructure and modern standard facilities.</p>	This Act is directly related to the establishment of proposed WWTP as it falls under jurisdiction of RUDA.
7	Punjab Wildlife Act, 1974	The Punjab Wildlife Act (1974) is developed for the regulation of activities relating to protection, conservation and management of wildlife in Punjab.	The proposed project involves the cutting of trees which may result in loss of habitat, therefore, the provisions of this law are applicable.
8	Punjab Plantation and Maintenance of Trees Act, 1974	The Punjab Plantation and Maintenance of Trees Act, (1974) regulates tree plantations and enforces measures for their protection.	The requirements of this act are applicable in terms of planting new trees and their maintenance by the occupier of the existing land who would have the physical possession.
9	Protection of Trees and Brushwood Act, 1949	The Protection of Trees and Brushwood Act, 1949 prohibits cutting or chopping of trees and brushwood without prior permission of the relevant department in the provincial government.	The proposed Project may involve tree cutting, therefore, the provisions of this law will be applicable.

Sr. No.	Act	Brief Coverage	Relevance to Project
10	Pakistan Antiquities Act 1975 Antiquities Amendment 2012	<p>The Punjab Antiquities Amendment Act, 2012 is adopted from the Pakistan Antiquities Act of 1975 with a few minor changes. The Antiquities Act, 1975 (amended in 1990) states the following:</p> <ul style="list-style-type: none"> • “Ancient” is any object that is at least 75 years old; • All accidental discoveries of artefacts must be reported to the Federal Department of Archaeology; • The Government is the owner of all buried antiquities discovered on any site, whether protected or otherwise; • All new construction within a distance of 200 feet from protected antiquities is forbidden; • No changes or repairs can be made to a protected monument, even if it is owned privately, without approval of the responsible authorities; and • The cultural heritage laws of Pakistan are uniformly applicable to all categories of sites regardless of their state of preservation and classification as monuments of national or world heritage. 	<p>The law will be applicable to the project mainly due to its two provisions:</p> <ul style="list-style-type: none"> ▪ According to the law, any construction activity within 61 m or 200 ft. of protected antiquities, are prohibited. <p>The provisions of this act would also be applicable, if any accidental archaeological discoveries may occur during the excavation works for the construction of proposed Project.</p>
11	The Punjab Special Premises (Preservation), Ordinance, 1985	<p>The Punjab Special Premises (Preservation), Ordinance (1985) provides the legal framework for preservation of premises of historical, cultural, archaeological, and architectural value in the Punjab province. This legislation empowers the provincial government to notify heritage sites and sites of cultural and archaeological importance and to prohibit implementation of developmental schemes or new constructions within the notified areas around the special premises. So far 246 sites stand notified under the Punjab Ordinance.</p>	<p>The provision of the ordinance is applicable for protection and conservation of special premises declared by department of Youth Affairs, Sports, Archeology & Tourism, Punjab. The ordinance is applicable in terms of land acquisition, entrance, exploitation and destruction of special premises near site.</p>

Sr. No.	Act	Brief Coverage	Relevance to Project
12	Pakistan Penal Code, 1860	<p>The Code deals with the offences where public or private property or human lives are affected due to intentional or accidental misconduct of an individual or organization. The Code also addresses control of noise, noxious emissions and disposal of effluents.</p>	<p>The provisions of the Penal Code, 1860 are applicable to the project in terms of penalties for effecting human lives and public property. It also addresses the control of noise, air emissions and effluent disposal.</p>
13	Labour Laws as part of Constitution of Pakistan 1973,	<p>The Constitution of Pakistan contains a range of provisions with regards to labour rights, in particular:</p> <ul style="list-style-type: none"> • Article 11 of the Constitution prohibits all forms of slavery, forced labour and child labour; • Article 17 provides a fundamental right to exercise the freedom of association and the right to form unions; • Article 25 lays down the right to equality before the law and prohibition of discrimination on the grounds of sex alone; and • Article 37(e) makes provision for securing just and human conditions of work, ensuring that children and women are not employed in vocations unsuited to their age or sex, and for maternity benefits for women in employment. <p>Labour law is controlled at both provincial and national levels with compulsory employment agreements containing the terms set out by the labour laws. The labour laws are a comprehensive set of laws in Pakistan dealing with the following aspects:</p> <ul style="list-style-type: none"> • Contract of Employment; • Termination of Contract; • Working Time and Rest Time; • Working hours; • Paid Leave; • Maternity Leave and Maternity Protection; • Other Leave Entitlements; • Minimum Age and Protection of Young Workers; 	<p>The labour laws will be relevant as it would deal with employment of labour for the construction of propose project. Following are the major labour laws which are applicable to the project:</p> <ul style="list-style-type: none"> • Bonded Labour System (Abolition) Act, 1992 • Employment of Child Act, 1991 • Minimum Wages Ordinance, 1961 • Industrial Relations Act, 2010 • West Pakistan Minimum Wages for Unskilled Workers' Ordinance, 1969

Sr. No.	Act	Brief Coverage	Relevance to Project
		<ul style="list-style-type: none"> • Equality • Pay Issues; • Workers' Representation in the Enterprise; • Trade Union and Employers Association Regulation; and □ Other Laws. 	
14	Employment of Children Act, 1991	<p>Article 11(3) of the Constitution of Pakistan prohibits employment of children below the age of 14 years in any construction, or any other hazardous employment.</p> <p>In accordance with this Article, the Employment of Child Act 1991 prohibits child labour (a child is under 14 years old).</p>	The relevance of this act to the project will be to prohibit child employment for construction of the proposed project.
15	Pakistan Climate Change Act, 2017	This Act aims to meet obligations under international conventions relating to climate change and to provide for adoption of comprehensive adaptation and mitigation policies, plans, programmes, projects and other measures required to address the effects of climate change and for matters connected herewith and ancillary thereto.	This Act will accelerate due to the emissions from the construction machinery.
16	National Clean Air Program, 2000	The Act aims to control vehicular emissions, pollution from industry, and indoor air pollution in rural and urban areas.	This Act will trigger if vehicles and machinery used for construction activities emanate air pollutants above the permissible limit.
17	Punjab Parks and Horticulture Authority Act, 2012	This act entails regulation, development, and maintenance of public parks, green belts and green areas in the Punjab; regulation of billboards, sky signs and outdoor advertisements; to promote open and unrestricted views of the Punjab.	This act will trigger as green belts along the proposed project route will be affected during construction phase.

18	Land Acquisition Act (LAA), 1894 Including Later Amendments	The Land Acquisition Act, 1894, is a “law for the acquisition of land needed for public purposes and for companies and for determining the amount of compensation to be paid on account of such acquisition”. The exercise of the power of acquisition has been limited to public purposes. The principles laid down for the determination of compensation, as clarified by judicial pronouncements made from time to time, reflect the anxiety of the law-giver to compensate those who have been deprived of property, adequately. The land needed for the construction of development projects will be acquired under normal conditions based on prevailing market prices or negotiated prices between client and the owners of land. Section 17(4) of the LAA will not be used in the absence of an emergency. Instead, the land will be purchased under willing-seller willing-buyer deal at agreed upon market rates and the seller will have the option not to sell the land, in case an acceptable deal for both the parties is not reached.	This Act will anticipate if proposed project involves permanent acquisition of land in the project area.
19	Punjab Municipal Water Act, 2014	The basic aim of the Act is to recognize, regulate and manage present and future municipal water supply and sanitation services and to establish rights of access to basic water supply and basic sanitation, and to ensure conservation of water resources in the Province. This Act is in draft stage.	This Act will elicit if there is misappropriation of water supply during construction activities.
20	The Punjab Water Act, 2019	This act ensures comprehensive management and regulation of water resources in the Punjab in the interest of conservation and sustainability.	This this act will be triggered as Main Canal is existed in and around the Project area.
21	Punjab Environmental Protection (Motor Vehicles) Rules, 2013	Subject to the provisions of this act, and the rules and regulations, no person shall operate a motor vehicle from which air pollutants and noise are being emitted in an amount, concentration or level which is in excess of the Punjab Environmental Quality Standards, or where applicable the standards established under clause (g) of subsection (1) of section 6 of the act.	This act will be elicited during construction and operational phase due to use of motor vehicles that produces air pollutants and noise.

Sr. No.	Act	Brief Coverage	Relevance to Project
22	ISO 18001 Occupation Health and Safety Assessment Series (OHSAS)	OHSAS 18001 is an Occupation Health and Safety Assessment Series for health and safety management systems to help organizations to control occupational health and safety risks. The OHSAS specifications are applicable to any institute that desires to establish an OH&S management system to eradicate or reduce risk to employees and other interested parties who may be exposed to the risks allied with the project activities. The construction of the proposed project may involve various health and safety issues to construction labour, therefore these ISO 18001 guidelines will be applicable and pertinent.	This series will be elicited during construction and operational phase to ensure health and safety of workers associated with the project activities.
23	The Punjab Occupational Safety And Health Act, 2019	This Act entails provision of occupational safety and health of the workers at workplace and to protect them against risks arising out of the occupational hazards; to promote safe and healthy working environment catering to the physiological and psychological needs of the employees at workplace.	The Act will trigger during construction and operational phase to ensure health and safety of workers at workplace associated with the project activities.
24	Punjab Restriction on Employment of Children Act, 2016	According to the sub-section 11(a) of this Act, an occupier who employs or permits a child (person under the age of 15 years) to work in an establishment shall be liable to punishment with imprisonment for a term which may extend to six months, but which shall not be less than seven days, and a mandatory fine between 10,000 and 50,000 rupees.	This Act will trigger if contractor hire skilled and unskilled labour under age 15.
25	Electricity Act, 1910	The Act provides a legal basis for distribution of Power. It enables a licensee to conduct operations for supply of electricity and binds the licensee to payment of compensation in respect of any damages caused during the construction, Operation and Maintenance (O&M) of Power distribution facilities.	This act will be applicable if any damages occur during construction of the power facilities.
26	Cutting of Trees (Prohibition) Act, 1975	The Act was enforced in 1975 to place restrictions on cutting of trees in order to restrain unchecked trend of tree felling without replacement plantations.	This act will be applicable to the subject project where the illegal/unauthorized cutting of trees will be involved.
27	The Punjab Protected Areas Act, 2020	The Act provides provisions for the protection, preservation, conservation and management of ecologically important areas such as National parks, Nature reserves, Wildlife sanctuaries, Wilderness areas, Buffer zone, Wetlands, etc.	This act will not be triggered as there is no protected area in and around the study area.

Sr. No.	Act	Brief Coverage	Relevance to Project
28	The Canal and Drainage Act, 1873	The Canal and Drainage Act 1873 (CDA) focuses on construction and maintenance of drainage channels and defines powers to prohibit obstruction or order their removal. It also covers issues related to canal navigation. It briefly addresses issues relating to environmental pollution. Section 70(5) of the CDA clearly states that no one is allowed to “corrupt or foul the water of any canal so as to render it less fit for the purposes for which it is ordinarily used.” In addition, Section 73 of the CDA gives power to arrest without warrant or to be taken before the magistrate a person who has wilfully damaged or obstructed the canal or “rendered it less useful.”	This act will be applicable as the proposed project is at near premises of the main canal through which water is being utilized at local level.
29	The Punjab Emergency Service Act, 2006	It deals with the establishment of emergency service for a purpose of maintaining a state of preparedness to deal with emergencies, to provide timely response, rescue and emergency medical treatment to the affected persons and recommending measures to be taken by related organizations to avoid any emergency situation. It describes procedures to establish emergency service, emergency board, emergency fund, emergency ambulance and rescue vehicles, offence and punishment, etc.	This act is applicable to the proposed project to provide timely response, rescue and emergency medical treatment to the affected persons during construction and operation phase of project.
30	National Disaster Management Act, 2010	National Disaster Management Act, 2010 was passed by Parliament of Pakistan in 2010. The Act applies to whole Pakistan. The Act was passed in backdrop of 2010 Floods in Pakistan and strengthens Disaster Management system.	This act is applicable to the proposed project. The proposed project will require special consideration to disasters and risk management strategies as per the Act.
31	Hazardous Substance Rule, 2003	The rule describes the procedure of handling, transportation and disposal of hazardous substances and hazardous waste. Inter alia, general safety precautions for handling hazardous substances as well as safety precautions for workers, and notification requirements in the event of an accident are described in these rules. Requirements for project waste management plans are also defined. These include a requirement for updating the plan every three years, the need to provide for management of hazardous waste in a manner that will prevent adverse environmental impacts and to ensure that hazardous and non-hazardous waste are not mixed.	This rule is applicable to the proposed project due to involvement of hazardous waste handling, use and disposal during the construction stage.

Sr. No.	Act	Brief Coverage	Relevance to Project
32	Building Code of Pakistan, 2007	The provision of Building Code of Pakistan shall apply for engineering design of building like structure and related components. The construction in violation of the Building code shall be deemed as violation of professional engineering work. Moreover, a certificate for the proposed action will be obtained from Provincial Building Control Authority.	These codes shall be used in structural design of building area components constructed under this proposed project.
33	Seismic Building Code of Pakistan 2007	This code stipulates the minimum requirements for seismic safety of building and structures and the provisions of the Building Code of Pakistan (Seismic Provisions-2007) shall apply for engineering design of buildings, like structures and related components. Construction of buildings shall be considered as violation of professional engineering work specified under clause (XXV) of section 2 of the Act.	This Code is applicable to the proposed project as it includes the formation of structures.

2.3 International Protocol / Conventions

As Pakistan is a member of a number of international organizations such as United Nations Organization (UNO), Organization of the Islamic Conference (OIC), South Asian Association for Regional Cooperation (SAARC), Economic Cooperation Organization (ECO) etc., so it has to follow the international protocols and obligations related to the environment. The major protocols, ratification dates by Pakistan and obligations related to the proposed project are provided in the Table 2.3 below:

Table 2.3: International Agreements/Conventions Relevant to the Project

Sr. No	Agreement/Convention	Ratification	Description/Relevance
1.	UNESCO Convention on the Protection of the World's Cultural and Natural Heritage, 1972 Web Link: http://whc.unesco.org/en/%20convention%20text/	Pakistan ratified this convention on 23 July 1976.	Convention concerning the Protection of the World Cultural and Natural Heritage - requires parties to adopt a general policy on the protection of the natural and cultural heritage, to set up services for such protection, to develop scientific and technical studies, to take appropriate legal, technical, scientific and administrative measures and to foster training and education for such protection.

2.	<p>The Rio Declaration, 1992</p> <p>Web Link: http://www.unesco.org/education/pdf/RIO_E.PDF</p>	<p>Pakistan signed the treaty on 13Jun 1992 and ratified on 1 June 1994</p>	<p>The Rio Declaration comprises 27 principles which address important issues such as; sustainable development to integrate environmental protection into the development process; common but differentiated responsibilities to conserve, protect and restore the earth's ecosystems; public participation and information access at the national level, reduce and eliminate unsustainable patterns of production and consumption.</p>
3.	<p>Kyoto Protocol, 1992</p> <p>Web Link: https://unfccc.int/kyoto_protocol</p>	<p>Pakistan has ratified Kyoto Protocol in 2005</p>	<p>The Kyoto Protocol is a protocol to reduce Greenhouse gasses that cause climate change. It was agreed on 11th December, 1997 at the 3rd Conference of the countries to the treaty when they met in Kyoto, and entered into force on 16th February, 2005. As of November 2007, 175 countries have ratified the protocol.</p> <p>One hundred and thirty-seven (137) developing countries have ratified the protocol, including Brazil, China, India and Pakistan but have no obligation beyond monitoring and reporting emissions.</p>
4.	<p>Convention on Biological Diversity, 1994</p> <p>Web Link: https://www.cbd.int/</p>	<p>Pakistan signed this treaty in 1992 and it was ratified by cabinet in 1994.</p>	<p>The Convention on the Biological Diversity (CBD) has three main goals: Conservation of biological diversity (or biodiversity); sustainable use of its components; and fair and equitable sharing of benefits arising from genetic resources.</p>
5.	<p>UN Convention to Combat Desertification (UNCCD), 1994</p> <p>Web Link: https://www.unccd.int/</p>	<p>Pakistan signed the Convention on 15th October 1994 and ratified it on 24 February, 1997</p>	<p>The UNCCD is a Convention to combat desertification and mitigate the effects of drought through national action programs that incorporate long-term strategies supported by international cooperation and partnership arrangements.</p>
6.	<p>Stockholm Convention on Persistent Organic Pollutants (POPs), 2004</p> <p>Web Link: https://www.un.org/press/en/2004/unep204.doc.htm</p>	<p>The Stockholm Convention on Persistent Organic Pollutants was signed on 22 May 2001 and entered in to force on 17 May, 2004.</p> <p>Pakistan signed the convention on December 6, 2001</p>	<p>Convention seeks to protect human health and the environment from POPs as set out in Article-1, which are chemicals that remain intact in the environment for long periods, become widely distributed geographically and accumulate in the fatty tissue of humans and wildlife.</p>

7.	Paris Agreement, 2015	<p>The Paris Agreement's central goal is to strengthen the global response to the threat of climate change by keeping a global temperature rise this century well below two degrees Celsius above pre-industrial levels and to pursue efforts to limit the temperature increase even further to one and half degrees Celsius. Additionally, the agreement aims to increase the ability of countries to deal with the impacts of climate change, and at making finance flows consistent with a low GHG emissions and climate-resilient pathway.</p>	<p>The implementation of the proposed project will reduce the emission of greenhouse gases (GHG) due to the construction of the proposed project.</p>
8.	Sustainable Development Goals (SDGs)	<p>At the Sustainable Development Summit on 25th September 2015, UN Member States adopted the 2030 Agenda for Sustainable Development, which includes a set of 17 Sustainable Development Goals (SDGs) to end poverty, fight inequality and injustice, and tackle climate change by 2030.</p> <p>Pakistan has displayed commendable commitment to the 2030 Agenda for Sustainable Development as it was one of the first countries to endorse it globally in 2015. On 16th February 2016, the Parliament unanimously approved the Sustainable Development Goals (SDGs) as the national development agenda.</p>	<p>The SDGs that will prevail for the proposed project are as follows:</p> <ul style="list-style-type: none"> • Promote Gender Equality and Empower Women: The contractor during construction phase will be responsible to hire women for construction activities to elude gender discrimination and to promote women empowerment where suitable for women and provide congenial environment. • Combat HIV/AIDS Malaria and Other Diseases: Contractor will be responsible to conduct medical surveillance of the workers before hiring to combat HIV/AIDS Malaria and other diseases. • Ensure Environmental Sustainability: Contractor will be responsible to ensure environmental sustainability of the proposed Project Areas by ensuring implementation of EMP to mitigate adverse environmental impacts from construction activities during construction phase.



2.4 ADMINISTRATIVE FRAMEWORK

2.4.1 Ravi Urban Development Authority (RUDA)

The implementing agency of the proposed project is Ravi Urban Development Authority (RUDA). The management of RUDA will ensure that all the proposed mitigation measures are effectively implemented at the design, construction, and operation stages of the proposed project.

2.4.2 Environmental Protection Agency (EPA), Punjab

Pakistan Environmental Protection Agency is meant for the enforcement of environmental laws in Pakistan. They have delegated powers to provincial environmental protection agencies for review, approval and monitoring of environmental examination/assessment projects. As the proposed Project also falls in Lahore District therefore Punjab-EPA will be responsible for reviewing the report, issuing environmental approval and overall/broad based monitoring of the proposed project activities.



3 PROJECT DESCRIPTION AND ALTERNATIVES

3.1 GENERAL

This Chapter presents the detailed project description along with project cost, land acquisition, implementation schedule, workforce and water requirements, etc.

3.2 OBJECTIVES OF THE PROJECT

Objectives of WWTP Project are as follows:

- To improve condition of River Ravi by reducing the pollution load;
- To prevent the aquatic life of River Ravi;
- To make the water fit for agriculture reuse, fishing, recreation, etc.;
- Prevent the spread of diseases resulting from improper disposal of wastewater;
- Prevent the prevalence of conditions offensive to sight and smell;
- To protect the groundwater recharge source of Lahore; and
- Prevent and control soil and groundwater pollution.
- To provide treated water to Lahore and RUDA jurisdiction

3.3 PROJECT ADMINISTRATIVE JURISDICTION

The proposed Project falls under administrative jurisdiction of District Lahore.

3.4 PROJECT LOCATION

The proposed Project site for the Wastewater Treatment Plant (WWTP) is located in North West of Lahore. The proposed site is easily accessible from Lahore Ring Road Toll Plaza (2.5 Km away). The site is surrounded by three settlements named as Jhuggian Jodha, Bhamma and Khokhar. In the west of the proposed site, River Ravi flows. The accessibility map of the proposed project is shown in Figure 3.1.

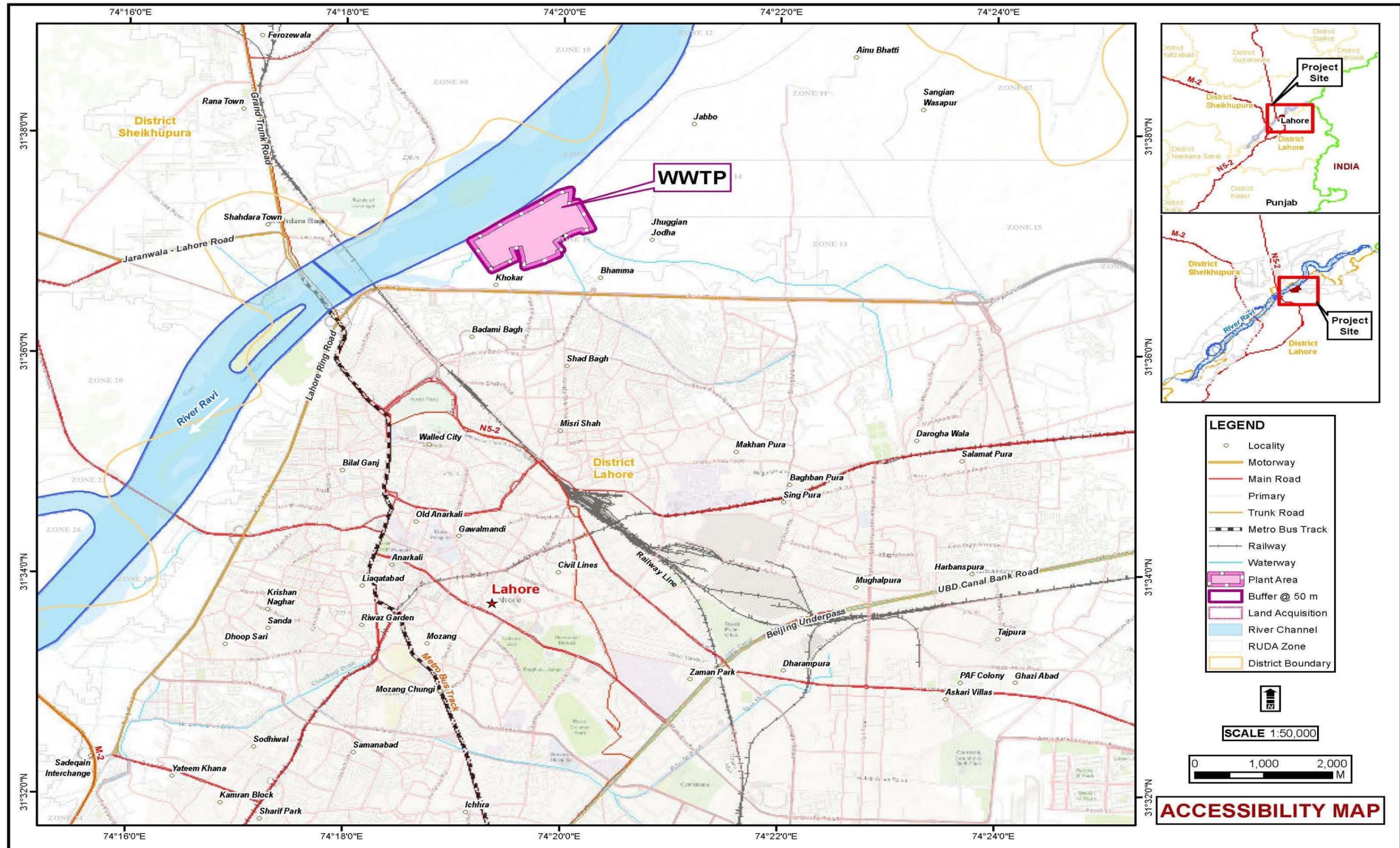


Figure 3.1: Accessibility Map of the Proposed Project



3.5 DESIGN ASPECTS

3.5.1 Project Components

The component of the proposed project includes:

- Wastewater Treatment Plant
- Conveyance System
- Treated Effluent Channel

The proposed wastewater treatment plant will be comprised of screen chamber, Grit Chamber, Primary sedimentation tanks, Aeration tanks, Secondary sedimentation tanks, Sludge Thickener, Centrifuges, etc. Detail of various project components are given under following headings:

3.5.1.1 Proposed Wastewater Treatment Plant

Wastewater treatment plant will be constructed at Shadbagh over an area of 280 acres. A brief description of WWTP components is shown in process flow diagram in Figure 3.2.

Following are the major components of WWTP designed as per the requirement of the current study to meet the desired effluent quality standards and to make the system technically and financially viable:

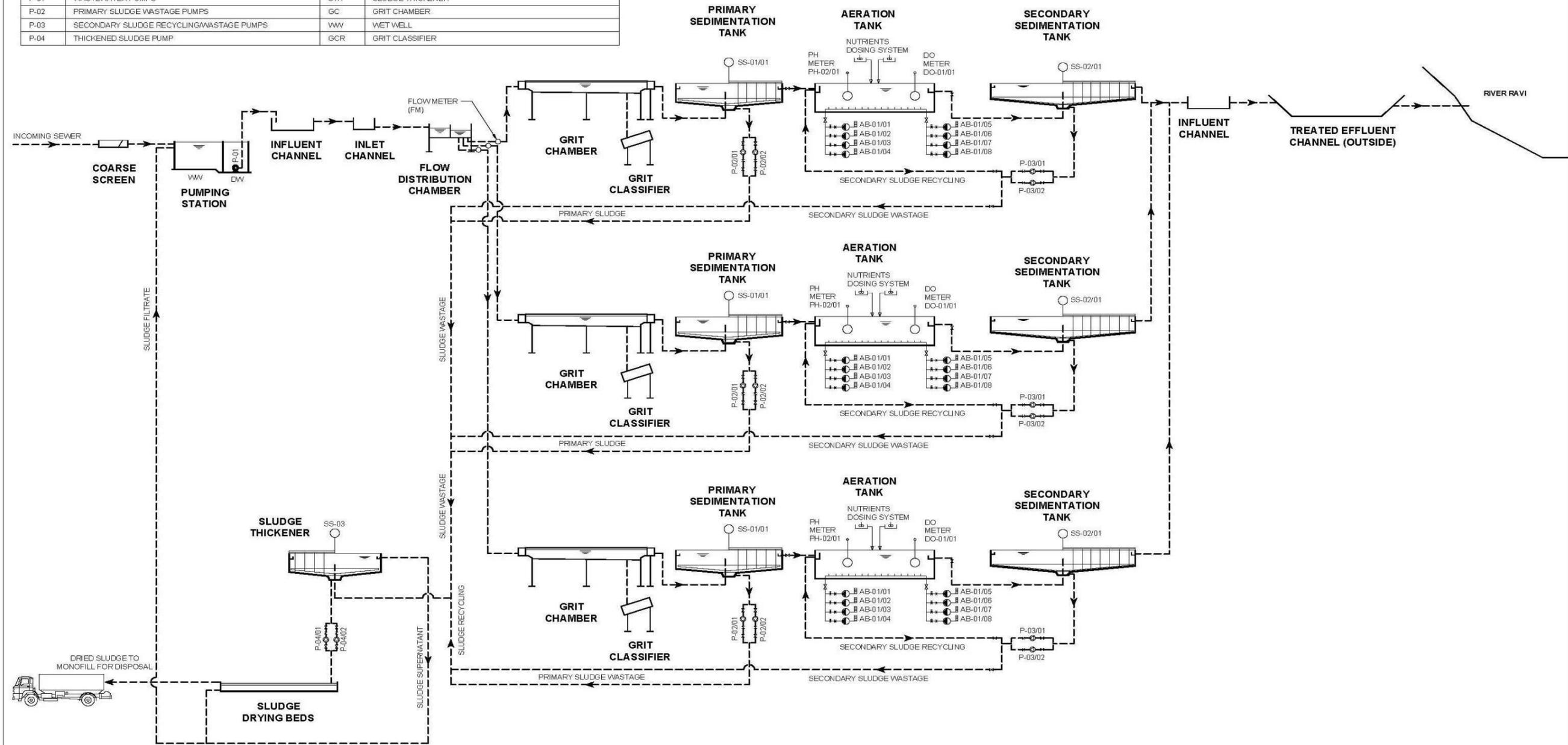
3.5.1.2 Preliminary Treatment Technologies

I. Screens and Screening Chambers

The first unit operation generally provided in WWTPs is screening. Screens consist of steel bars with openings, generally of uniform size, that are used to retain floating matter and particles found in the influent wastewater. Screens and racks are used to remove coarse pollutants that may damage downstream operations or clog V-notch weirs, pipes and valves. In particular, physical damage and wear and tear of pumps and aerators will ultimately reduce the treatment plant efficiency or negatively affect the aesthetics of the treatment plant.

Two types of screens are used for the preliminary wastewater treatment i.e., a) Coarse Screens and b) Fine Screens.

LIST OF ABBREVIATION			
AB	AIR BLOWER	PH-01	PH METER IN AERATION TANK
AT	AERATION TANK	PST	PRIMARY SEDIMENTATION TANK
CS	COARSE SCREEN IN SCREEN CHAMBER	SDB	SLUDGE DRYING BED
DO	DO METER IN AERATION TANK	SS-01	HALF BRIDGE END DRIVEN SLUDGE SCRAPER IN PST
DW	DRY WELL	SS-02	HALF BRIDGE END DRIVEN SLUDGE SCRAPER IN SST
FM	FLOW METER	SS-03	HALF BRIDGE END DRIVEN SLUDGE SCRAPER IN ST
FDC	FLOW DISTRIBUTION CHAMBER	SST	SECONDARY SEDIMENTATION TANK
P-01	WASTEWATER PUMPS	STH	SLUDGE THICKENER
P-02	PRIMARY SLUDGE WASTAGE PUMPS	GC	GRIT CHAMBER
P-03	SECONDARY SLUDGE RECYCLING/WASTAGE PUMPS	VWV	WET WELL
P-04	THICKENED SLUDGE PUMP	GCR	GRIT CLASSIFIER



PROCESS FLOW DIAGRAM

Figure 3.2: Process Flow Diagram of WWTP



II. Grit Chamber (GC)

GCs are designed to remove grit, consisting of sand, gravel, cinders or other heavy solids that have subsiding velocities or specific gravities substantially greater than those of the organic putrescible solids in wastewater. GCs are most commonly located after bar screens and before primary sedimentation tanks.

It is desired to remove grit from raw sewage in the early stage within the treatment plant to:

- Prevent wear and tear of pumps and other mechanical equipment and transport pipes.
- Reduce deposit formation and consequent clogging in downstream unit operations and transport pipes.
- Avoid accumulation of inert solids in the primary sludge as it will eventually deposit a thick sand layer in sludge digester.

The most common GC is the horizontal flow grit chamber shown in Figure 3.3. GCs have been provided prior to primary sedimentation tanks in each module.

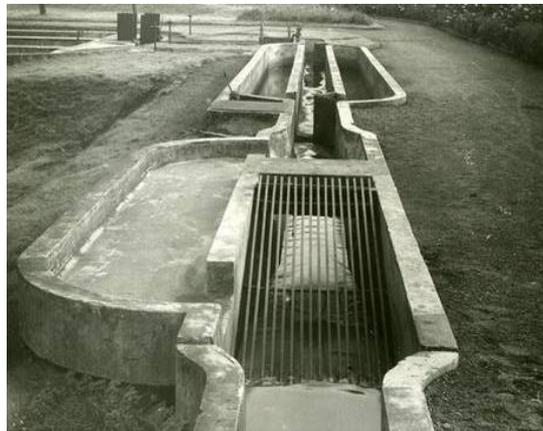


Figure 3.3: Horizontal Flow Grit Chambers in Series

3.5.1.3 Primary Treatment Components

I Primary Sedimentation Tank (PST)

The objective of treatment by sedimentation is to remove readily settleable solids and floating material that remains after preliminary treatment. Almost all treatment plants use mechanically cleaned sedimentation tanks of standardized circular or rectangular design. Sludge at the bottom of PSTs is generally removed through scrapers which push the sludge towards a sludge pocket from where it is pumped out of the tank.



3.5.1.4 Secondary Treatment Components

I. Activated Sludge Process (ASP)

ASP is the approved wastewater treatment technology for Shadbagh WWTP. ASP is employed to reduce the colloidal BOD which remains after PSTs. In an activated sludge process, microorganisms are mixed with the organic matter so that they can grow and stabilize the influent organic matter. As the microorganisms, recirculated from secondary clarifier, are mixed with incoming wastewater and oxygen is supplied by aeration, the individual organisms flocculate to form an active mass of microbial floc called activated sludge. The mixture of activated sludge and wastewater is aerated in aeration tank for a specified detention time and flows to the secondary clarifier where it is settled. The treated effluent is separated from the settled solids in the secondary clarifier and carried for either further treatment or disposal. Figure 3.4 presents a functional aeration tank.



Figure 3.4: Aeration Tanks

3.5.2 Sludge Handling/ Disposal Components

The solid content in the sludge of primary treatment and various types of secondary treatment process varies considerably. Depending on the characteristics of the sludge, the method of operation for sludge removal is decided. Sludge handling is a challenging job in the wastewater treatment processes producing large amounts of sludge on regular bases.

Most of the operational problems arise during WWTPs operations are related to handling of the sludge. Following are some important facilities generally used for sludge handling/ disposal.

I. Sludge Thickeners

Wastewater treatment plants based on ASP process commonly use thickening devices to increase the solids concentration of sludge wasted from the secondary clarifier. The main objective of thickening sludge is to reduce the volume of sludge by reducing moisture content to minimize the load on the downstream processes.

II. Sludge Drying Beds



Sludge drying beds are used to dewater thickened sludge. After drying, the solids are removed and either disposed of in a landfill or use as soil conditioner. Conventional sludge drying beds will be provided in Shadbagh WWTP to dewater the thickened sludge. Conventional sludge drying beds use sand and gravel layer of certain size over which the thickened sludge is left for few days for dewatering through draining the water and evaporation. Drained water is collected in the undertrains and returned to WWTP. Figure 3.5 provides view of different sludge drying beds commonly used.



Figure 3.5: Conventional Sludge Drying Beds

III. Sludge Digestion

Sludge Digestion Processes can be employed to recover energy from the sludge and to reuse the energy in electricity generation. For the case of Shadbagh WWTP, an assessment for energy recovery and its monetary payback will be evaluated. A waste to energy project is also underway from RUDA.

3.6 LAND ACQUISITION

The land required for the construction of the proposed WWTP is about 280 Acres, 201 Acres land is available and under process, whereas, 79 Acres additional land will also be required for the proposed project.

3.7 CONSTRUCTION ASPECTS

3.7.1 Construction Materials

The materials used in construction of Wastewater Treatment Plant would include clay, coarse aggregates (crush), fine aggregates (sand), steel, water, asphalt, reinforcement, cement and excavated material from ponds etc.

Coarse aggregates (crush), fine aggregates (sand), steel, water, asphalt, reinforcement, cement will be used for the construction of the office building, channelization, and other physical structures. Clay will be used as liner of the ponds the coefficient of permeability of the clay should not be more than 1×10^{-7} . Excavated earthen material will be used for the construction of the flood protection dykes. The material for civil works will be bought from local market.



3.7.2 Construction Equipment

The list of the machinery and the equipment required for the proposed project is provided in Table 3.1.

Table 3.1: Machinery and Equipment Requirement for the Proposed Project

Sr. No.	Machinery/ Equipment	Sr. No.	Machinery/ Equipment
1	Dump Truck	10	Self-Propelled Pneumatic Roller
2	Front End Loader	11	Concrete Transit Truck
3	Dozer	12	Concrete Pump
4	Grader	13	Excavator
5	Vibratory Roller	14	Water Pumps
6	Water Tankers	15	Vibrators
7	Agg. Spreader	16	Generators
8	Three Wheel Rollers	17	Paver
9	Tandem Roller		

3.7.3 Construction Camps

Camp sites will be selected keeping in view the availability of adequate area for establishing camp sites, including parking areas for machinery, stores and workshops, access to communication and local markets, and an appropriate distance from sensitive areas in the vicinity. Keeping in view the following criteria guidelines, the Contractor has to identify the construction camp sites before start of the construction activities:

- There should be no resettlement issue for the location of the camps;
- Selection of sites for construction camps shall be near the project area having proper access to the nearby main/link road;
- The camps must be located in a place where the drainage from and through the camps will not threaten any domestic or public water supply but will manage their own sewerage facilities as per approved layout;
- Camp site must be adequate in size to prevent overcrowding of necessary structures;
- The camp site should consider avoiding any damage of property, vegetation, irrigation, and drinking water supply systems;
- The camp site must not be subject to periodic flooding; and
- There should not be any ecological sensitive areas e.g., wildlife sanctuaries, game reserves, national parks, forest areas, etc. near to the construction camp site.

3.8 POWER REQUIREMENT/ POWER SOURCE

The main source of electricity/electric power during construction phase will be arranged by the contractor for construction camps and construction machinery.

Based on previous experience approx. 16 - 18 MW power would be required during operational phase and it would be taken from WAPDA.



3.9 WORK FORCE

Man power demand estimation is an essential component to facilitate deployment of manpower. Total man power required for the proposed project is estimated as 300 numbers during construction phase. Whereas, estimated workers / employees during operation phase will be 50 number.

3.10 WATER REQUIREMENT

The source of water during the construction phase will be managed by the Contractor while taking temporary supply connection from the Client and / or WASA. The water consumption is estimated to be 12,000 liters /day² for 300 construction workers for the proposed Project.

The water requirement during operational phase will be 2,000 liters / day for Portable water for 50 number of workers.

3.11 WASTEWATER GENERATION

The wastewater generation is estimated to be 9,600 liters/day for 300 construction workers.

3.12 SOLID WASTE ESTIMATION

Due to construction activities waste will be generated at construction site and contractor's camp. The contractor will provide the estimated quantity of excavation material during the construction phase. These wastes will be generated due to the construction activities and the excavated materials will be reused at maximum, where applicable, for construction purposes. Solid waste generated during construction and camp sites shall be safely disposed in demarcated waste disposal sites.

The solid waste generation is estimated to be 135 kg/day (as per 0.45 kg/capita/day waste generation)³ for 300 construction workers.

3.13 PROJECT IMPLEMENTATION SCHEDULE

The proposed Project is expected to be completed within three (03) years.

3.14 COST OF THE PROJECT

The tentative cost of the construction works of proposed Project is Rs. 120,000 million PKR.

² . Tentative Work Force Requirements Including Client and Contractor Staff"
= (300) x (40) = 12,000 liters/day
= (300) x (80% of wastewater) =9,600 liters/day

³ . Source: The World Bank Report 2012 – What a Waste: A global review of solid waste management. Based on UNEP estimates for waste generation in the Asia Pacific. Average is 0.45 kg/capita/day



3.15 PROJECT ALTERNATIVES

Alternative I	: No Project Option
Alternative II	: Waste Stabilization Ponds (WSPs)
Alternative III	: Conventional Activated Sludge Process (ASP)
Alternative IV	: Aerated Lagoons (AL)
Alternative V	: Trickling Filters (TF)
Alternative VI	: Oxidation Ditch (OD) System
Alternative VII	: Membrane Biological Reactor (MBR)

3.15.1 Alternative I: No Project Option

Presently, wastewater generated in south and southwest Lahore is disposed of in the River Ravi without any treatment. The discharge of untreated wastewater is deteriorating the River Ravi water quality which is detrimental for public health and the surrounding environment. With the increase in population and associated future projections of wastewater generations, the situation is expected to become worse if not managed immediately.

No Project Option (NPO) would mean abandonment of the project altogether and continuing with the existing position. This option could save the entire project cost of billions of rupees. However, No Project Option will result in further deterioration of River Ravi water quality, public health issues, and aquatic life.

Thus, “No Project Option” is not the feasible option in terms of environmental and socioeconomic benefits.

3.15.2 Alternative II: Waste Stabilization Ponds (WSPs)

This alternative consists of simplest and easily operated wastewater treatment units i.e. Waste Stabilization Ponds (WSPs). Waste Stabilization Ponds are among the common systems adopted around the world especially in developing countries. Low construction and operating cost make this option a financially attractive alternative as compared to other treatment systems. WSP comprises a single series of anaerobic, facultative and maturation ponds or several such series in parallel. Secondary treatment takes place in facultative ponds.

Facultative ponds are employed for medium organic loadings where a mutual relationship prevails between algae, which provide oxygen, and facultative bacteria, which provide nutrients for the algal growth. Organic matter is consumed primarily by the facultative bacteria. Resulting effluent, thus, have very less BOD. Facultative ponds are provided after anaerobic ponds.

Primarily, anaerobic and facultative ponds are designed for BOD removal and maturation ponds are designed for pathogens removal, although, some BOD removal also occurs in maturation ponds and some pathogen removal in anaerobic and facultative ponds. In many instances, only anaerobic and facultative ponds are required when relatively less polluted wastewater is to be treated prior to surface water discharge.



In general maturation ponds are required only when the treated wastewater is to be used for irrigation and has to comply with WHO guidelines and when highly polluted wastewater is to be treated prior to surface water discharge. WSP can attain filtered effluent BOD in the range of 20-25 mg/L. Figure 3.6 shows process flow diagram of WSP treatment system.

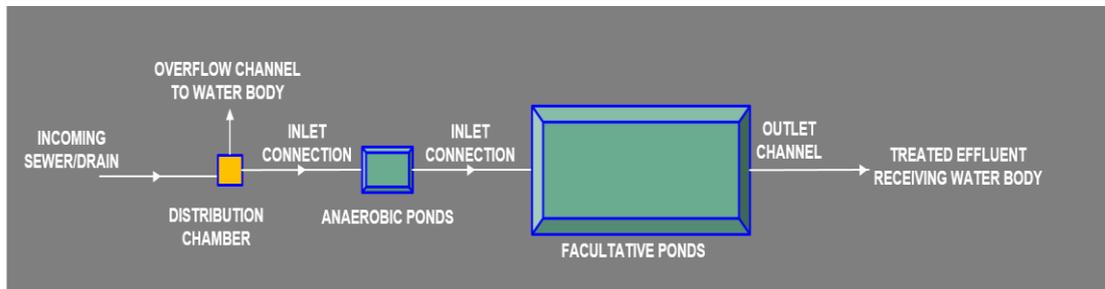


Figure 3.6: Process Flow Diagram of WSP System

Merits and demerits of WSP system are discussed in Table 3.2.

Table 3.2: Merits and Demerits of Waste Stabilization Ponds

Merits	Demerits
Operational cost is very less	High land requirement and capital cost
Very low energy requirement	Potential odour problem in anaerobic ponds
Easy to operate and maintain	Less effective for nutrient removal
Can absorb shock loads	Treated effluent may contain Algae
Very effective for pathogen removal	Efficiency depends on climatic conditions
High performance in hot climates	Seepage from Pond may pollute groundwater

3.15.3 Alternative III - Conventional Activated Sludge Process (ASP)

Alternative III i.e., Conventional Activated Sludge Process is employed to reduce the colloidal BOD which remains after Primary Sedimentation Tanks (PSTs). In an activated sludge process, Micro-Organisms (MO) are mixed with the organic matter so that they can grow and stabilize the influent organic matter. As the microorganisms, re-circulated from secondary clarifier, are mixed with incoming wastewater and oxygen is supplied by aeration, the individual organisms flocculate to form an active mass of microbial floc called activated sludge. The mixture of activated sludge and wastewater is aerated in aeration tank for a specified detention time and flows to the secondary clarifier where it is settled. The treated effluent is separated from the settled solids in the secondary clarifier and carried for either further treatment or disposal. The principal types of biological reactors are plug flow, complete mix and arbitrary flow. Completely mix ASP are more commonly used. Figure 3.7 presents typical process flow diagram of ASP.

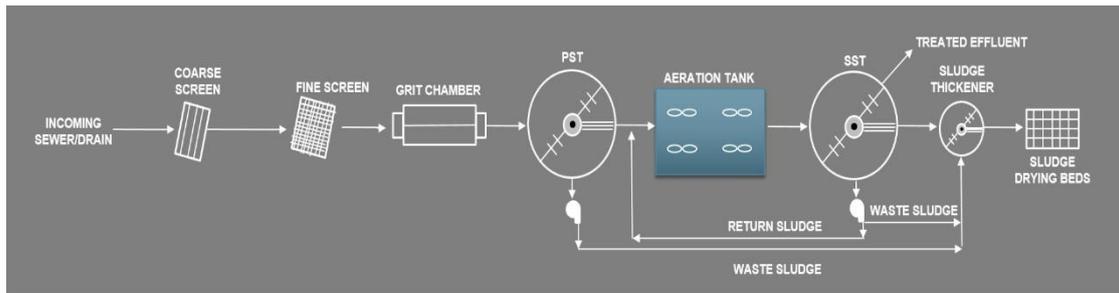


Figure 3.7: Process Flow Diagram of ASP System

and demerits associated with activated sludge process technology are listed below in Table 3.3

Table 3.3: Merits and Demerits of Activated Sludge Process (ASP)

Merits	Demerits
High degree of process control	Capital and operational cost is high
Can absorb shock loads	High and uninterrupted power is required
Requires less area of land as compared with WSP & AL	Requires skilled human resource
Capable of meeting stringent effluent standards	Requires frequent sludge treatment and disposal

3.15.4 Alternative IV - Aerated Lagoons

Aerated Lagoons (ALs) are relatively shallow earthen basin varying in depth from 2 to 5 m, and consist of mechanical aerators. The principal types of suspended growth lagoons based on the way of solid are being handled include the following:

- Completely mix Aerated Lagoons
- Aerobic Flow through partial mixing
- Facultative partially mixed
- Aerobic with solid recycle

In aerated lagoons, aeration is required for biological process and complete mixing. For low strength domestic wastewater, the aeration requirement for complete mixing exceeds to that of biological process. Therefore, the aeration requirement for ALs is comparable to other mechanical process including ASP and OD or sometimes may exceed them.

Aerobic lagoons with recycling are essentially the same as the extended aeration ASP with the exception that earthen basins are used in place of concrete tanks. Figure 3.8 presents typical process flow diagram of AL.

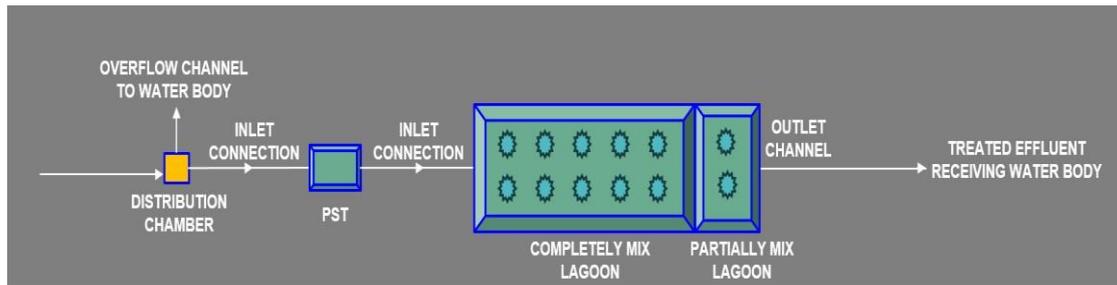


Figure 3.8: Process Flow Diagram of AL System

Merits and demerits of AL system are discussed in Table 3.4

Table 3.4: Merits and Demerits of Aerated Lagoons

Merits	Demerits
Capital and operational cost is low compared with other mechanized systems	Operational cost is high as compared with WSP
During power outage, will function as WSP with lesser efficiency	Area requirement is more than mechanized treatment systems
Sludge disposal is required after 1 to 2 years	Less effective for nutrient removal
Requires moderately skilled human resource compared with ASP	High and uninterrupted power requirement
Less mechanical equipment is required as compared to other mechanized systems	

Aerated lagoons are the advanced forms of WSPs and can also be opted to enhance the capacity of WSPs in later stages of operation.

3.15.5 Alternative V - Trickling Filters

The Trickling Filter (TF) consists of a shallow bed filled with crushed stones or synthetic media and employ attached growth process for wastewater treatment. Wastewater is applied on the surface by means of a self-propelled or mechanical rotary distribution system. The organics are removed by the attached layer of microorganism (slime layer) that develops over media. The under-drain system collects the trickled liquid that also contains the biological solids detached from the media. Detached solids settle in the secondary clarifier and removed through pumping as sludge. Usually, water from the secondary clarifier is recirculated to dilute the concentrations of pollutants in the influent. Figure 3.9 presents typical process flow diagram of TF.

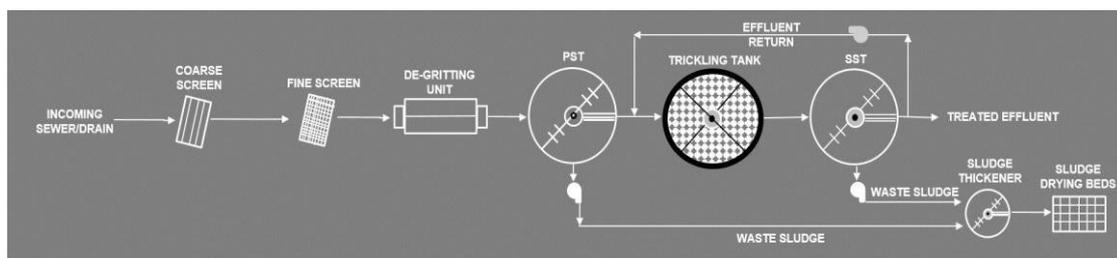


Figure 3.9: Process Flow Diagram of TF System

TF tank is constructed on/slightly above ground level to provide space for air circulation beneath the tank. For dilution of incoming influent wastewater, recirculation of trickling filter effluent is required in the range of 100 - 300 %age of influent wastewater flow which also contributes in capital and operational costs of the WWTP. Merits and demerits of TF system are discussed in Table 3.5.

Table 3.5: Merits and Demerits of Trickling Filters

Merits	Demerits
Less operational cost compared with ASP	Capital cost is very high
Require less land than WSP & AL	Prone to flies, snails and odour problems
Suitable for small to moderate populated communities	Relatively higher potential of clogging
	Requires skilled human resource
	Regular operator attention is needed

3.15.6 Alternative VI - Oxidation Ditch

Extended aeration/oxidation ditch systems are the modified ASP treating municipal or industrial wastewater, ideal for carbon oxidation plus various degrees of biological nitrogen and phosphorus removal as these processes do only occur if food-to-microorganism ratio is sufficiently lowered allowing specific bacteria to accumulate and perform these processes. Biological nutrient removal involves the biomass to be sequentially exposed to anaerobic, anoxic and aerobic conditions. It needs careful operational control to fully utilize its potential capacities. Primary sedimentation tank is usually not provided before oxidation ditch. Due to long solid retention time, less sludge is produced as compared to ASP. Figure 3.10 provides flow diagram of oxidation ditch system.

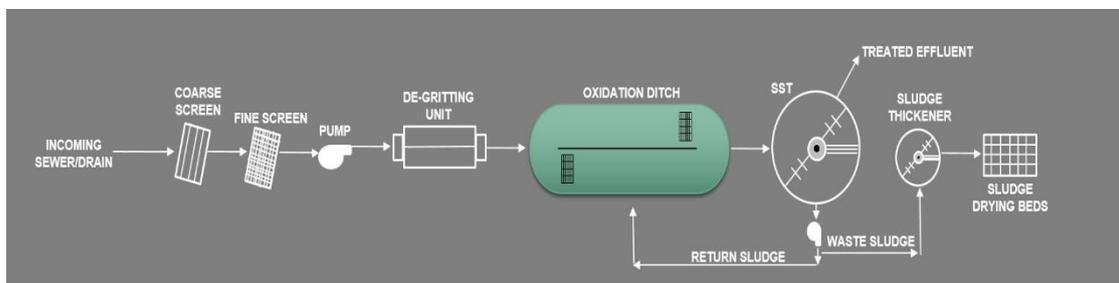


Figure 3.10: Process Flow Diagram of OD System

Merits and demerits of Oxidation Ditch system are discussed in Table 3.6

Table 3.6: Merits and Demerits of Oxidation Ditch

Merits	Demerits
Can absorb shock loads	Capital and operational cost is very high
Requires less area as compared to WSP & AL	High and uninterrupted power is required
Produces less sludge	Requires skilled human resource
Can achieve nutrient removal in the reactor	Produce comparatively high suspended solids than ASP

3.15.7 Alternative VII - Membrane Biological Reactor (MBR)

Membrane Bioreactors (MBR) are treatment processes, which integrate a perm-selective or semi-permeable membrane with a biological process. It is the combination of a membrane process like microfiltration or ultrafiltration with a suspended growth bioreactor, and is now widely used for municipal and industrial wastewater treatment. With the MBR technology, it is possible to upgrade old wastewater plants.

It is possible to operate MBR processes at higher mixed liquor suspended solids (MLSS) concentrations compared to conventional settlement separation systems, thus reducing the reactor volume to achieve the same loading rate. Two MBR configurations exist: internal/submerged, where the membranes are immersed in and integral to the biological reactor; and external/side stream, where membranes are a separate unit process requiring an intermediate pumping step.

Recent technical innovation and significant membrane cost reduction have enabled MBRs to become an established process option to treat wastewaters. Membrane bioreactors can be used to reduce the footprint of conventional activated sludge sewage treatment system by removing some of the liquid component of the mixed liquor. Figure 3.11 provides flow diagram of MBR. Merits and demerits of MBR system are discussed in Table 3.7.

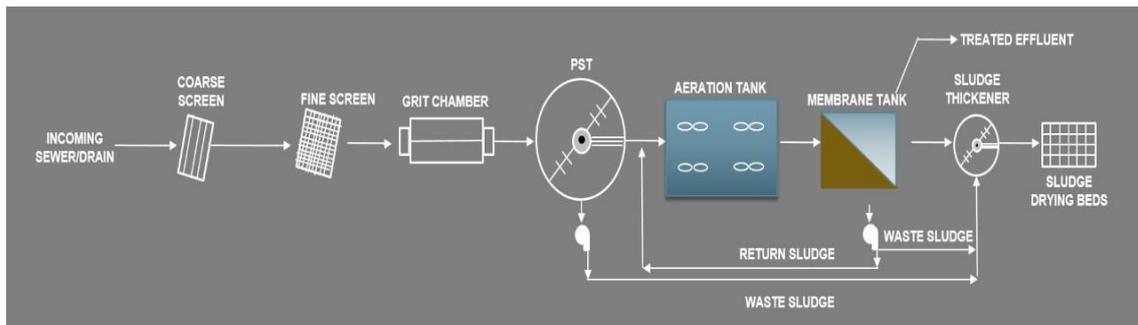


Figure 3.11: Process Flow Diagram of MBR System

Table 3.7: Merits and Demerits of MBR

Merits	Demerits
High removal efficiency	Capital and operational cost is very high
Better effluent quality	Membrane channel clogging
Ability to remove bacteria, and suspended solids	Membrane surface fouling
Less land requirement	Process complexity
Produces high quality effluent	High and uninterrupted power requirement



3.16 SELECTED OPTION

All the alternatives have been studied in detail from technical, environment and socioeconomic aspects in the previous section. Table 3.8 provides a comparison of various options studied in the earlier section.

Table 3.8: Comparison of Various Wastewater Treatment Technologies

Sr. No.	Parameter	WSP	ASP	AL	TF	OD	MBR
General							
1	Area requirement	Very large	Low	Large	Medium	Medium	Medium
2	Economic Viability	High	Medium	Medium	Low	Medium	Very Low
3	Odour & Nuisance Issues	Yes	No	Yes	Yes	No	No
4	Treatment Efficiency	Low	Medium	Low	Medium	Medium	High
5	Land Acquisition	Required	Not required	Not required	Not required	Not required	Not required
6	Utility disturbance	Yes	No	Yes	No	No	No
7	Ground Water Contamination Probability	Yes	No	Yes	No	Yes	No
8	Sludge Disposal Issue	No	Yes	Yes	Yes	Yes	Yes
9	Tree Cutting/ Removal of Green Cover	High	Low	High	Medium	Low	Low

Comparison of all the alternatives shows that:

- Large area requirement along with nuisance issues and probability of ground water contamination issues makes the WSP options unsuitable;
- ALs requiring comparatively large areas and inability to remove nutrients and nuisance problem make it less desirable option;
- High capital cost, odour problem, higher potential of clogging makes TF an undesirable option;
- Oxidation Ditch system for being producing high suspended solids is not suitable for discharge into River Ravi as it will prove a hindrance to aquatic life, hence not a desirable options;
- MBR option being very expensive along with membrane fouling and clogging issues becomes an undesirable option; and



- ASP require less area, not so expensive, no odour issues or production of high suspended solids is the most suitable option. However, sludge production is high in this option.

Conventional Activated Sludge Process with proper sludge disposal mechanism, has been selected as ***most suitable option***.

4 DESCRIPTION OF THE ENVIRONMENT

4.1 GENERAL

For any development project, the prevailing environmental conditions need to be assessed prior to the stages of planning, designing and execution of the project. Identification of physical, ecological and social aspects of environment and collection of relevant data is essentially important for the evaluation of impacts as well as for the suggestion of adequate mitigation measures, which forms the basis for the implementation of the proposed project in terms of prevailing environmental and social conditions in the study area.

The existing environmental conditions of the proposed project have been considered within the AOI as shown in Figure 4.1 with respect to physical, biological and socio-economic aspects. The Study Area/AOI of the proposed project is selected as 50m from project boundary on the basis of the Project's potential environmental and social impacts on the local resources. Information has been collected from variety of sources, including published literature, DCRs, field observations and surveys, conducted specifically for this Project have been analyzed for this study. Consultations were also held with the general public and stakeholders of the project area in order to seek the public opinion on the implementation of the proposed Project. Various questionnaires and checklists were utilized as a tool for baseline data collection during field visit which are attached as **Annex-I**

4.2 PHYSICAL RESOURCES

The following section provides an overview of the information on physical environment of the proposed Project study area collected from primary as well as secondary sources. The major parameters covered include Physiographic and Topography, Geology, Soil, Seismicity, Climate and Meteorology, Ambient Air & Noise, Water Resources, Solid Waste, and Land Use.

4.2.1 Topography

Lahore is generally flat and slopes towards south and south-west at an average gradient of 1:3000. The general height varies from 150 to 200 meters above the Mean Sea Level (MSL). It is divided into two parts i.e., the low lying area along River Ravi and the comparatively upland area in the east, away from Ravi. The low lands are generally inundated by the river water during intense rainfall events.

Figure 4.2 represents the topography of the study area of the proposed Project.

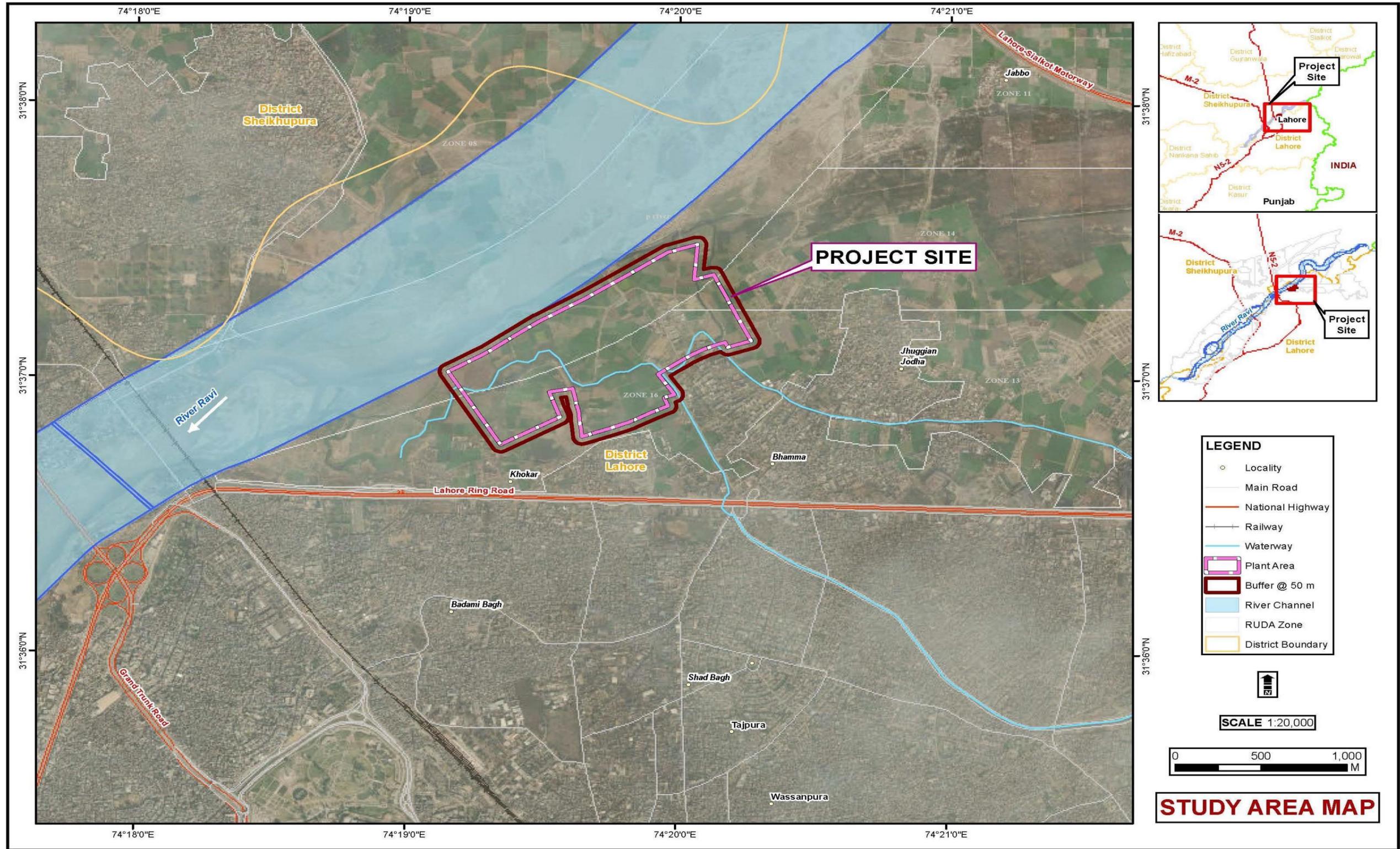


Figure 4.1: Study Area (AOI) Map of the proposed Project

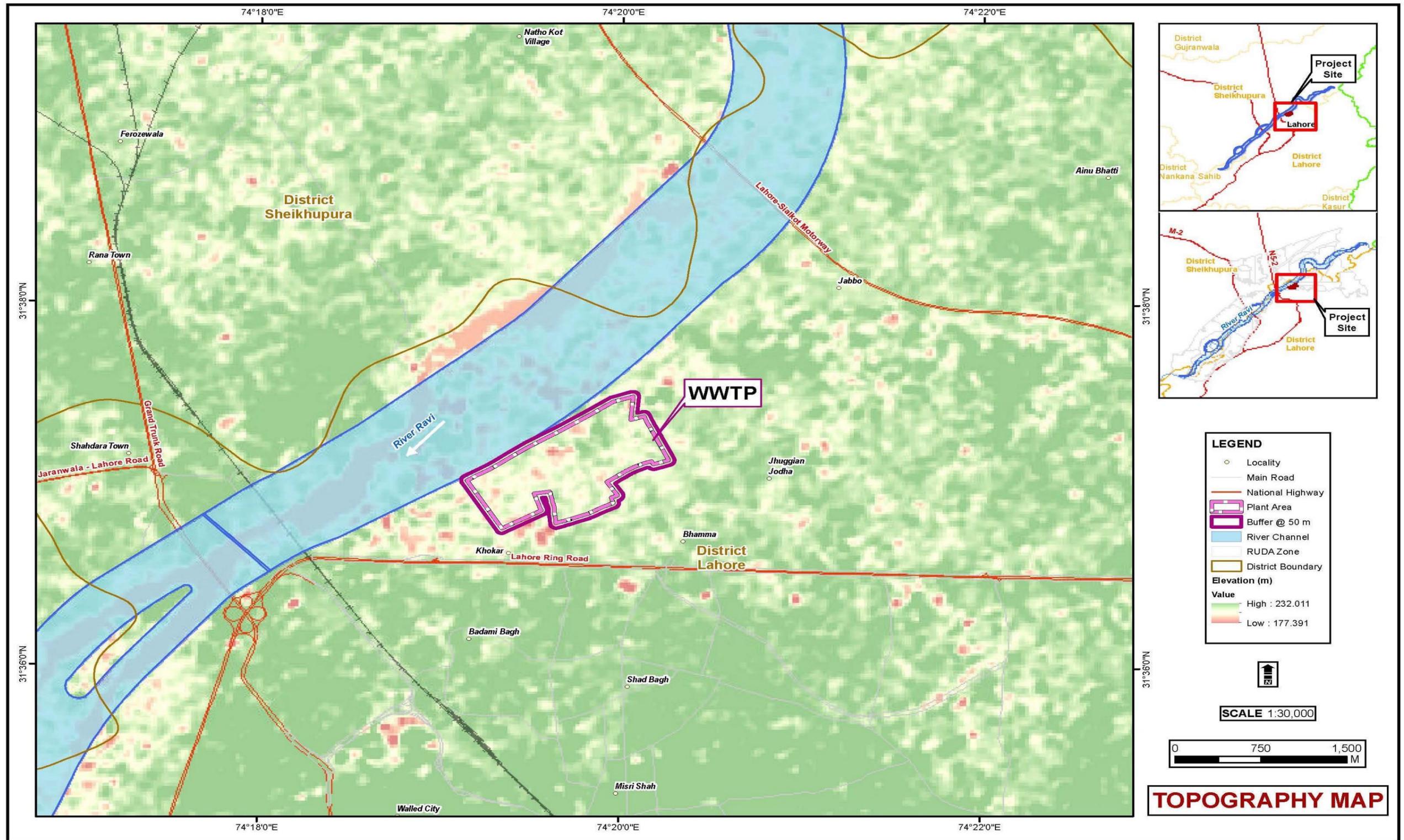


Figure 4.2: Topography Map of the Study Area

4.2.2 Geology

Lahore city lies on the alluvial plain called Bari Doab⁴. Doab is a local word for area between rivers. Bari Doab is a part of the Indo-Gangatic alluvial plain formed by the Indus River and its tributaries. It is bounded by Ravi and Chenab rivers in the northwest and west, and Sutlej River in the Southeast. A northeastern boundary of Doab lies near the foothills of the Himalayan Ranges.

The Bari Doab is covered by quaternary alluvium which overlies semi-consolidated tertiary rocks or metamorphic and igneous rocks of Precambrian age. Except for a small area in the northeastern part of Doab where basement rock was encountered no information is available at present regarding the distribution of tertiary and Precambrian rocks in the Doab.

The thickness of alluvial deposits in Lahore is reported to be more than 300 meter. These alluvial deposits are underlain by the basement rocks of the Indian shield. The alluvial deposits mainly consist of sands, with intercalation of silt and clay layers of varying thickness. Project site is located in meander belt deposits.

The project area does not have any valuable minerals. Although, scientific in depth, investigations haven't been carried out, yet the surveys conducted have failed to discover any minerals worth the name till to-date.

The only minerals worth to value are kallar and kankar⁵ in the district Lahore. Kallar is the grey powdery substance collected and taken out from the old village sites and other deserted abodes in the district. It is used for the manufacture of crude saltpeter and also as manure for the top dressing of young cotton and tobacco plants (no longer in the line of extensive cultivation). With the passage of time the demand for Kallar diminished and its use as a trading commodity is on the decline. Kankar is used for metaling Roads and its smaller particulars are burnt for lime. It is a kind of limestone gravel and is found, after being dug out at a depth varying from one to eight feet, in many parts of the district particularly the uplands. However; the project area does not have any valuable minerals. Figure 4.3 shows the regional geological map of the study area.

4.2.3 Soil

The soil in the project area is cohesion less and is of alluvial type deposited by Ravi River. The types of soil layers that are present below the ground level includes: silt, silty clay, silty sand, poorly graded sand with silt and lean clay. The soil map of the study area is shown in Figure 4.4.

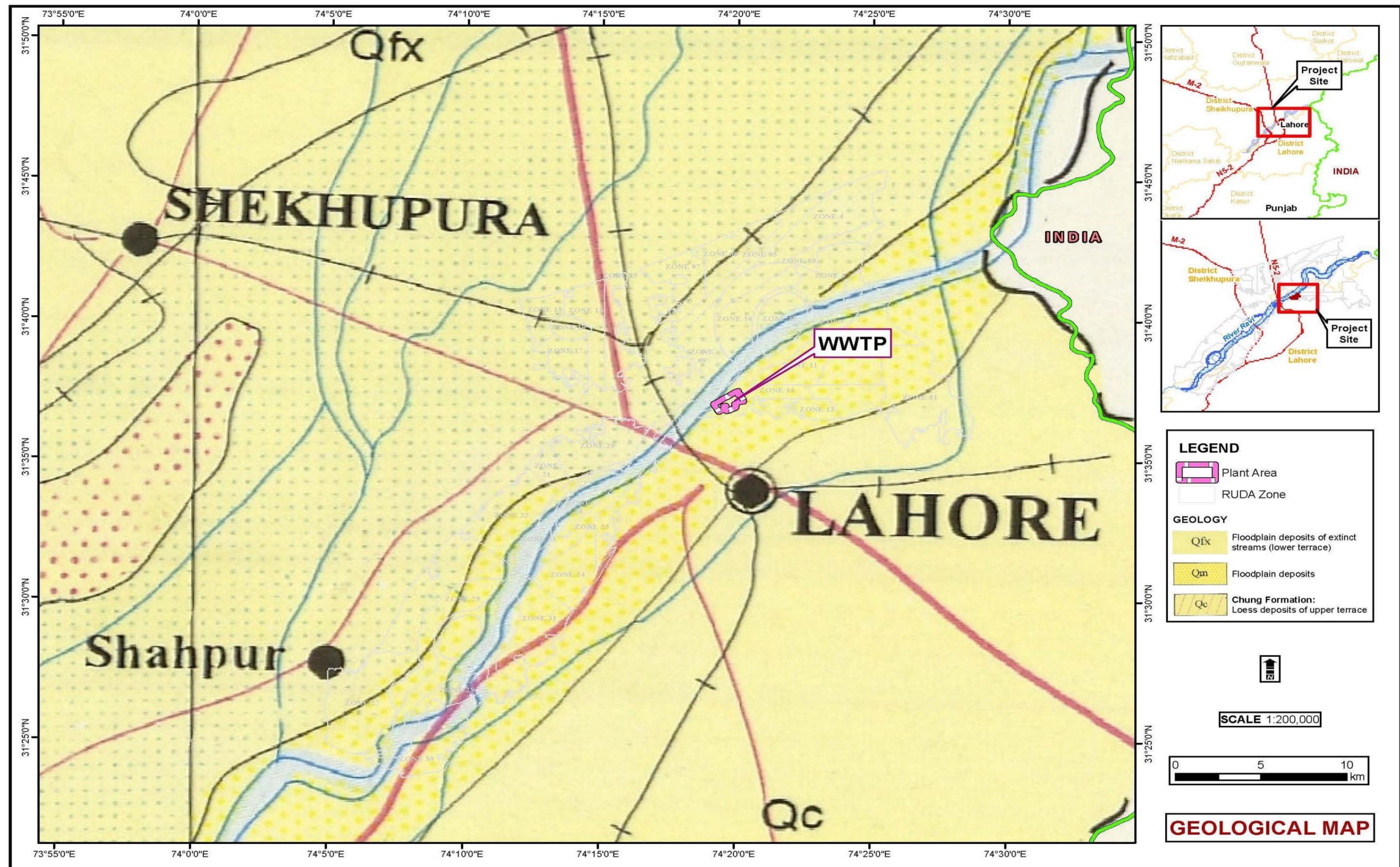


Figure 4.3: Regional Geological Map of the Study Area

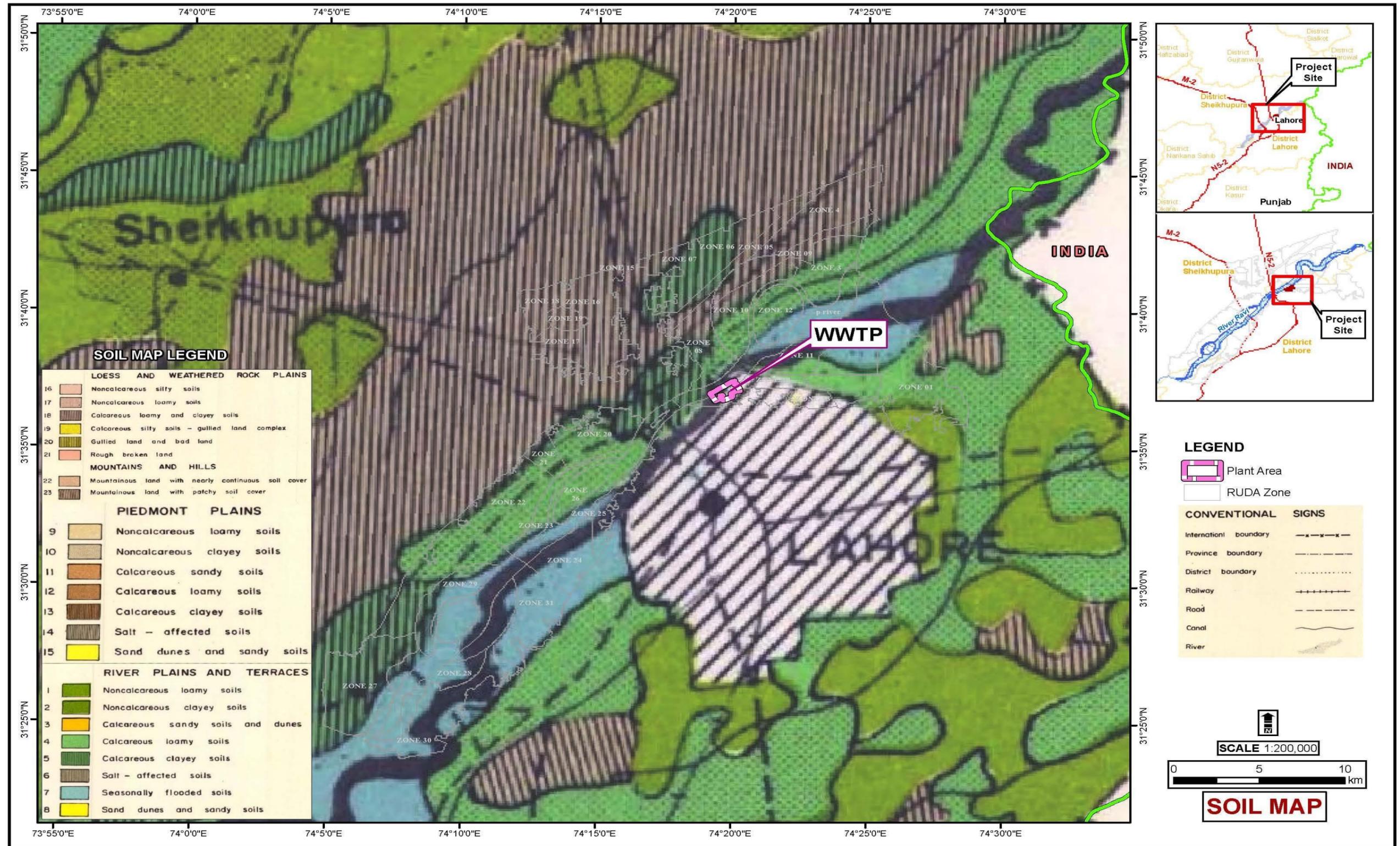


Figure 4.4: Soil Map of the Study Area



4.2.4 Seismology

The project site falls in the Punjab plain, which has low to moderate level of seismicity. The project region has been subjected to severe shaking in the past due to earthquakes in the Himalayas. The known main active fault of the Himalayas is the Main Boundary Thrust (MBT). The epicenters of low to moderate magnitude earthquakes, recorded in the Punjab plain are associated with the subsurface fractures in the basement rocks, which are concealed by thick alluvial deposits.

According to Building code of Pakistan 2007, the project area falls in Seismic Zone 2A of Pakistan (low to moderate damage) with peak ground acceleration (PGA) from 0.08 to 0.16 g. Figure 4.5 shows the seismic zoning map of the study area.



Figure 4.5: Seismic Zoning Map of the Study Area



4.2.5 Climate and Meteorology

The seasonal climatic conditions must be considered for the design and execution of the developmental projects. The climate including air, temperature, precipitation, humidity and evaporation are an influencing factor, affecting the construction of engineering structures. However, to determine the overall effect of the climatic stresses, daily and seasonal temperature changes, site altitude, direct solar radiation, and precipitation must be considered.

The Project area has moderate to extreme climate conditions, with hot summers and cold winters. The summer starts from April and lasts till September, with mean minimum and maximum temperature ranges from 27°C to 47°C. The winter seasons lasts from November to March, with mean minimum and mean maximum temperature ranges from 2°C to 18 °C.⁴

The project area receives rains in all the seasons but monsoon rain is pronounced and constitutes rainy season between the month of July and September. The average rainfall is about 1,172 mm per year.

Based on climatic elements, five seasons are recognized in the Project area i.e.:

i) Pre-monsoon Season

Pre-monsoon refers to the period from April to June prior to the setting in of the monsoon. This is the hottest and the driest season, with persistent dry and hot winds. Day time temperature rises to 42°C. The flows in the rivers begin to rise simultaneously due to snow-melt water in the high mountains. The water table falls to the maximum depth.

ii) Monsoon Season

Monsoon is the main rainy period, which starts at the beginning of July, reaches its climax in August and gradually, subsides in September. The intense rainfall events cause soil erosion, which is a function of erosivity and erodibility. The cool monsoon winds followed by heavy showers lower the temperature to great extent. The part of rain percolates into the soil and is conserved in the subsoil, and adds to the groundwater. The conserved moisture in the soils is generally sufficient to rejuvenate the vegetation. All plants grow rapidly and mature towards the end of the season. With the start of monsoon season, the rivers flow at their peak level. The groundwater level is improved towards the end of the season in September and October.

iii) Post-Monsoon Season

Post monsoon season refers to autumn (October-November). The temperature starts falling but the extreme aridity prevents plants to flower early and set seed towards mid-seasons. Groundwater level rises as a result of infiltration from rainfall.

⁴ Meteorological Data for Lahore (1981-2010), Pakistan Meteorological Department.



iv) Winter Season

Winter refers to the period from December to January. The lowest temperature is less than 2°C, and cold winds characterize this season. The plants become dormant and most of them dry out. Most of the trees shed their leaves and few remain green or partly green. Sometimes this season becomes severe due to cold Siberian winds. Groundwater level declines in this season due to low flows in the rivers, and no or little rains which usually fall in light showers causing little soil erosion.

v) Spring Season

Spring refers to the period from February to March. Temperatures become pleasant. The mean maximum temperature is 24.5°C. Some light showers of rain may also fall without generating run off. The vegetation sprouts again because of conserved moisture from winter and spring rains (if any), and the water table starts falling.

Study Area

Temperature, precipitation, relative humidity, evaporation, wind speed and wind direction of the study area (District Lahore) is discussed below.

Temperature

Table 4.1 and 4.2 shows mean minimal and maximal temperatures observed for each month between year 2010 to 2020 in the study area. The highest temperature measured is 47°C in June, 2014, and the lowest temperature was observed in December, 2020 i.e. 7°C. Moreover, Figure 4.6 shows the graphical presentation of mean temperatures in the Study Area for the year 2010-2020.

Table 4.1: Mean Maximum Temperatures (°C) between 2010 and 2020⁵

Year	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
2010	24	25	36	42	45	46	42	28	37	36	31	25
2011	22	23	31	37	44	44	40	36	35	34	30	25
2012	19	20	29	35	42	46	45	38	37	36	30	24
2013	22	22	31	37	44	46	43	38	40	36	29	25
2014	22	23	28	36	41	47	44	42	36	35	29	22
2015	22	26	28	6	43	42	39	39	38	36	30	24
2016	24	28	31	37	43	45	41	40	40	39	32	28
2017	21	27	31	40	44	43	41	41	41	39	30	26
2018	25	27	33	38	43	44	40	40	39	36	30	24
2019	20	22	27	38	41	45	41	39	39	36	28	22
2020	18	25	27	36	41	45	44	40	41	38	28	23

⁵ Meteorological Data for Lahore (2010-2020)

Table 4.2: Mean Minimal Temperatures (°C) between 2010 and 2020⁶

Year	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
2010	9	11	18	24	28	30	30	28	25	23	17	11
2011	8	10	15	20	29	32	31	27	26	23	19	13
2012	7	8	14	22	28	33	33	29	26	23	18	13
2013	9	11	15	22	30	34	33	28	27	25	17	13
2014	9	9	14	22	28	34	32	3	26	23	17	10
2015	9	12	15	23	30	33	31	30	26	25	18	13
2016	10	12	16	23	31	34	32	30	28	24	18	14
2017	9	11	15	24	30	32	32	31	29	26	20	16
2018	13	14	19	25	31	35	32	31	28	25	20	14
2019	11	12	16	26	30	34	31	29	27	24	19	13
2020	10	13	16	24	30	35	34	31	30	26	18	14

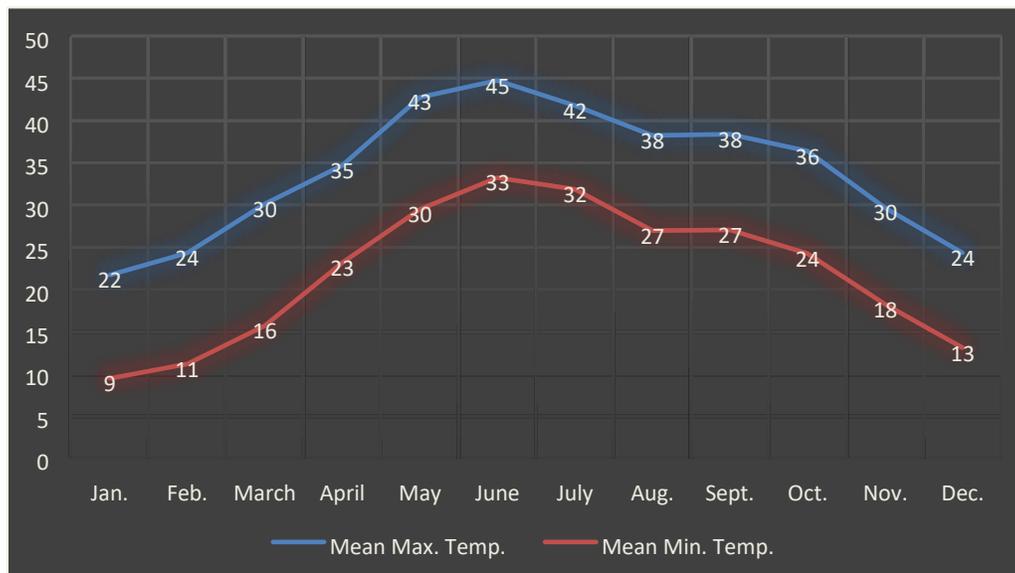


Figure 4.6: Mean Maximum and Minimum Temperature in the Study Area (2010-2020))

Precipitation (Rainfall)

Table 4.3 shows mean monthly precipitation observed in the study area from 2010 to 2020 with an annual average rainfall of 409.2 mm. Figure 4.7 shows the mean monthly precipitation in the study area for the year 2010-2020.

⁶ Meteorological Data for Lahore (2010-2020) - <https://www.worldweatheronline.com/gujrat-weatheraverages/punjab/pk.aspx>



Table 4.3: Mean Monthly Precipitation (2010-2020)⁷

Month	Precipitation (millimeters)
January	19.7
February	31.2
March	28.3
April	18.5
May	21.6
June	42.7
July	70.2
August	83.2
September	77.9
October	3.8
November	5.2
December	6.9
Annual	409.2

⁷ Meteorological Data for Lahore (2010-2020)

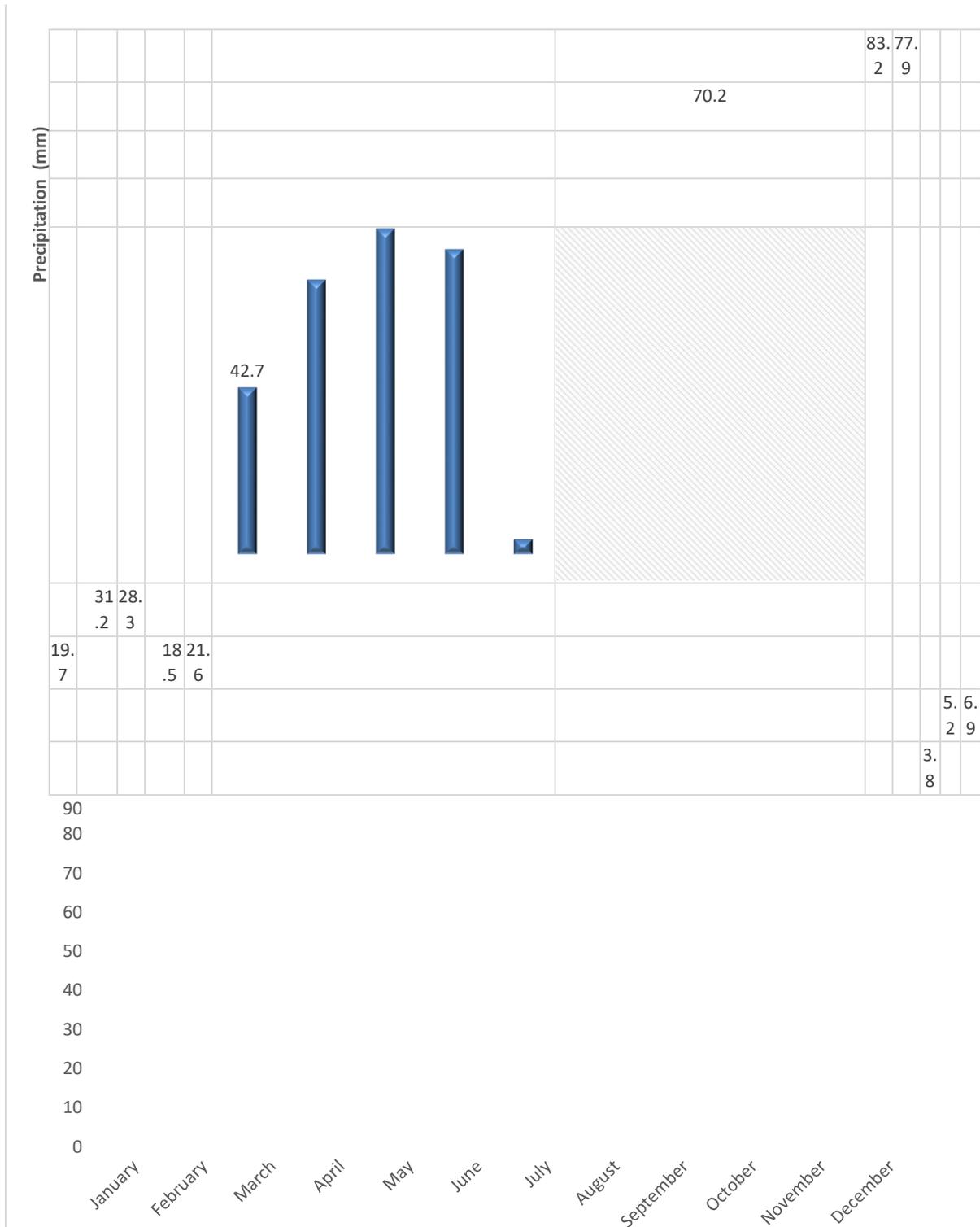


Figure 4.7: Average Precipitation in the Study Area (2010-2020)

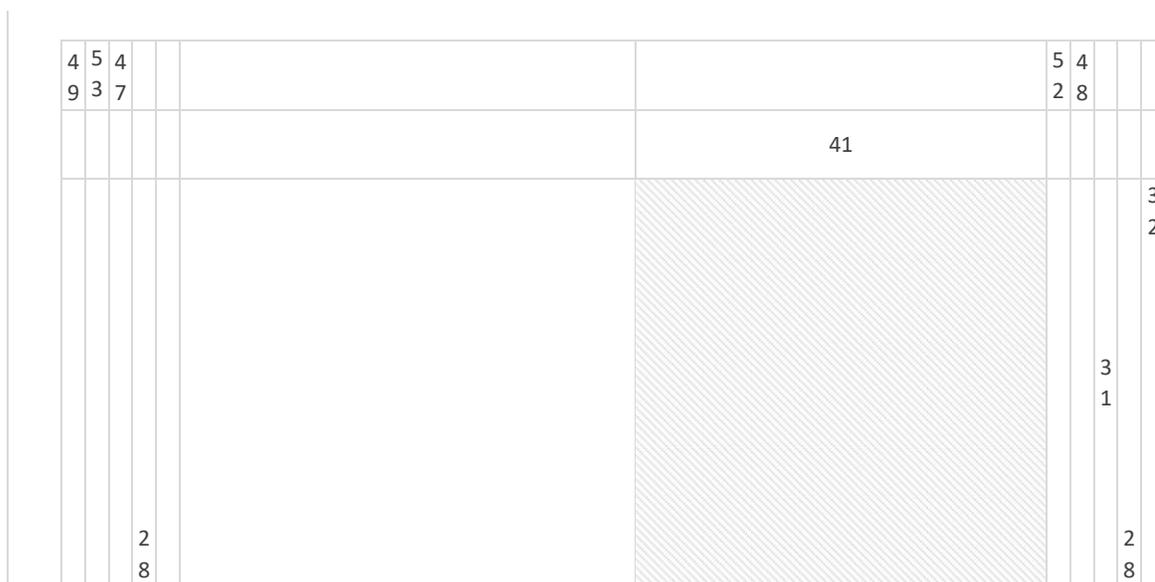


Relative Humidity

A mean daily data of humidity on a monthly basis from 2010 to 2020 is shown in Table 4.4 and Figure 4.8.

Table 4.4: Mean Relative Humidity (%) in the Study Area (2010-2020)⁸

Year	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
2010	49	53	40	20	18	20	44	63	61	44	28	32
2011	50	64	49	34	25	34	47	68	68	41	36	32
2012	59	59	51	39	20	17	35	58	54	32	27	40
2013	47	68	52	26	16	25	38	59	45	39	27	36
2014	51	61	52	31	24	20	34	40	58	38	27	33
2015	48	47	53	33	16	24	44	49	39	30	26	29
2016	43	37	42	23	21	25	42	44	35	21	19	27
2017	53	45	36	21	20	29	40	39	30	18	24	27
2018	32	38	30	25	17	28	43	47	45	25	25	27
2019	45	63	51	27	19	20	46	54	51	34	41	39
2020	59	47	57	33	24	22	34	53	38	16	24	35



⁸ Meteorological Data for Lahore (2010-2020)

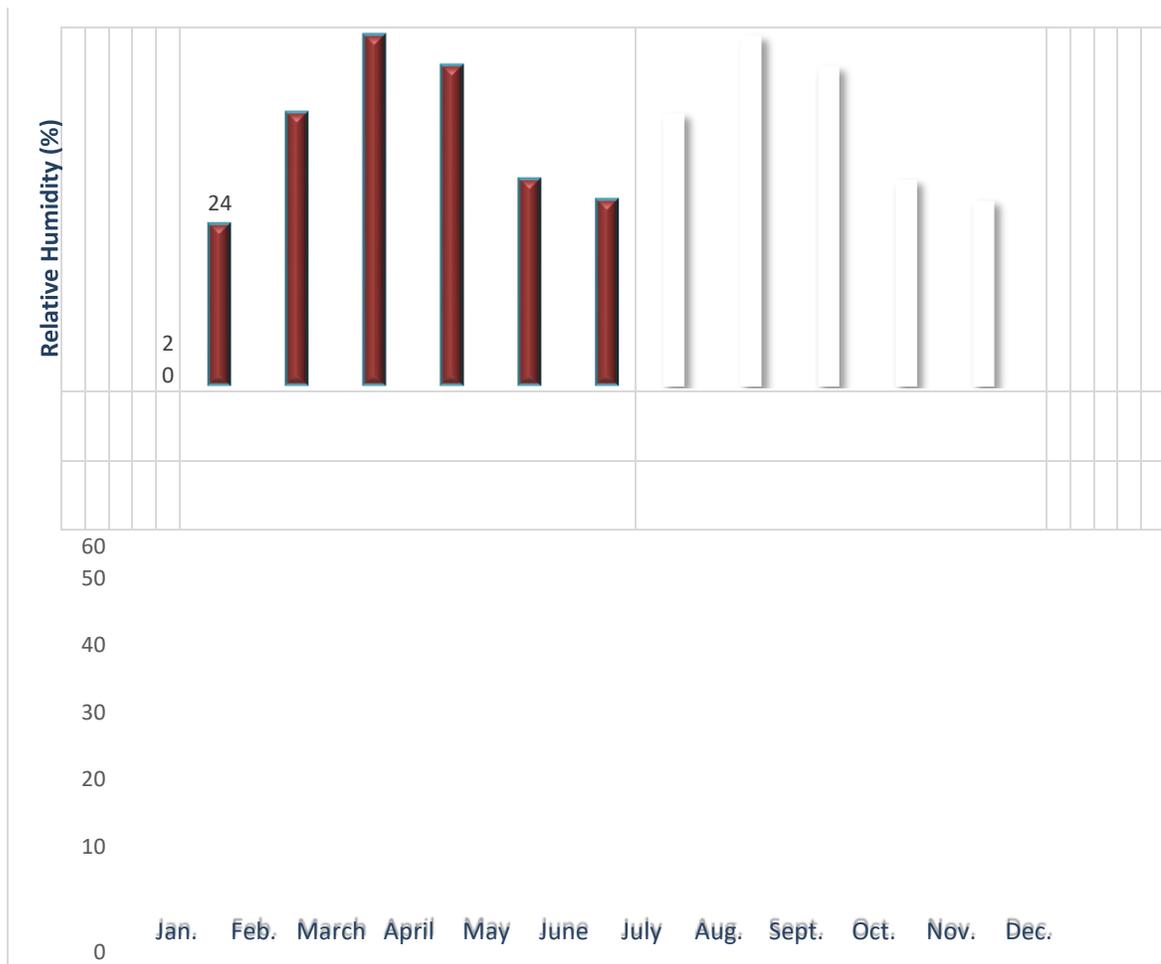


Figure 4.8: Mean Relative Humidity in the Study Area (2010-2020)

Wind Speed and Wind Gust

Table 4.5 and Figure 4.9 depicts average wind speed on a monthly basis in the study area from year 2010 to 2020.

Table 4.5: Mean Wind Speed (Km/h) in the Study Area (2010-2020)⁹

Year	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
2010	7	8.5	7.5	8.4	8.7	7	8	6.4	5.7	5.3	6.6	6.7
2011	7.2	8.3	8.2	8.3	8.2	8.4	6.8	6.9	5.1	5.6	6.1	6.3
2012	7.3	9.5	8.9	8	8.6	7.2	6.8	6.4	5.4	5.5	7	8.4
Year	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
2013	7.4	9.2	8	8.4	8.6	7	7.3	6.6	5.4	5.1	7.4	7.4

⁹ Meteorological Data for Lahore (2010-2020)



2014	7.4	7.3	8.8	8.9	7.8	7.5	6.6	5.8	5.6	5.8	7.6	7
2015	7.3	9.5	8.7	9.7	9.2	8.9	9.8	8.2	7.3	6.7	7.6	7.4
2016	6.5	8.2	9.9	10.9	10.3	9.4	7.7	6.8	7	5.6	6.9	6.3
2017	7.4	8.1	8.1	10.3	8.6	8.7	7.9	7.4	5.3	5	4.7	6.2
2018	5.9	6.9	7.9	9.2	10	9.4	8.3	8.5	7.5	5.8	6.9	5.2
2019	6.6	7.2	8.1	9.3	9.2	10.3	11.9	9.9	11.4	7.5	6.9	4.9
2020	6.7	7.7	9.8	9.8	11.8	10.6	9.9	10.3	7.4	6.1	7	7.1

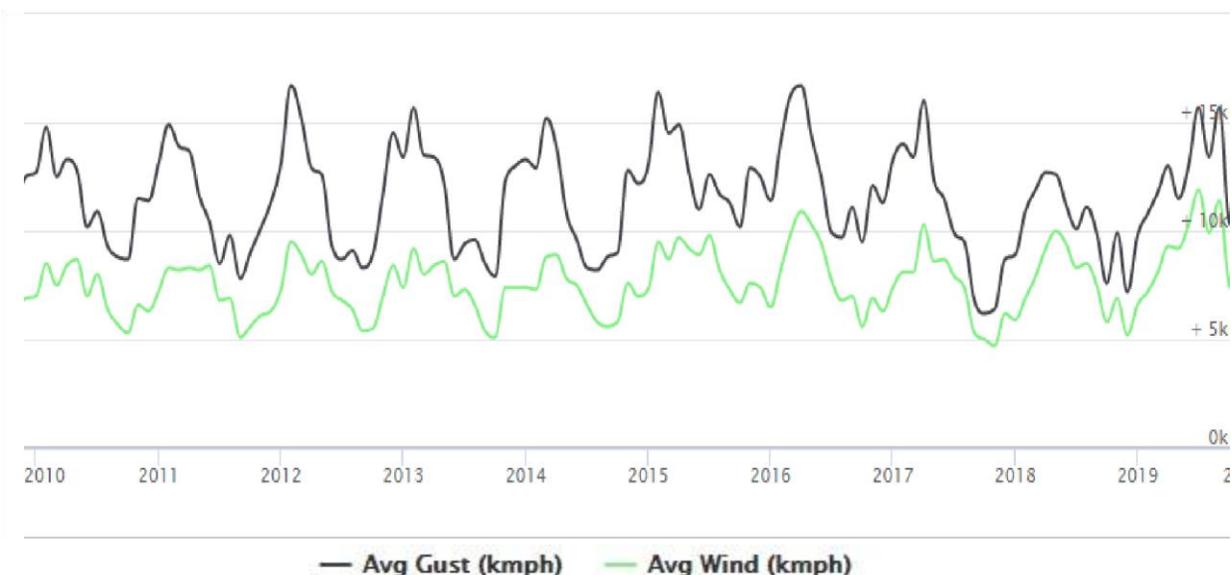


Figure 4.9: Average Wind Speed and Gust in the Study Area from 2010 to 2020

4.2.6 Ground Water

Presently main clean water source in Lahore is ground water that meets all the requirements including domestic, industrial and commercial, which is being extracted through tubewells installed in the city at about 600 ft. depth.

Water and Sanitation Agency (WASA) is the competent authority for the planning, designing, development and maintenance of water supply, sewerage and drainage system in Lahore. WASA is responsible for:

- Rehabilitation and augmentation of the existing system.
- Operation and maintenance of water supply, sewerage & drainage system.
- Undertaking bulk production, filtration/treatment, transmission and retail distribution of purifying water.
- Collection, pumping, treatment & disposal of sewage & industrial waste.



- Enforcement against defaulters and unauthorized connections etc.
- Short term and long-term planning for tapping additional water sources & its implementation to meet water supply and sewerage demand projected.

WASA Lahore maintains a wide network of about 3,200 Km pipelines for water supply providing water to the residents of Lahore city including Project Area. WASA have installed 316 tubewells in the city for provision of pure and hygienic water to the residents. Average daily water supply to the Lahore city is about 329 MGD through 610,000 water connections.¹⁰

4.2.7 Surface Water Hydrology

The main surface water resources in the Lahore city are Ravi River, Lahore Branch Canal, Khaira Distributary and the BRBD canal.

I. Ravi River

The Ravi River is a trans-boundary river crossing north western India and eastern Pakistan. It is one of six rivers of the Indus system in Punjab region. The Ravi River having a total length of about 720 kilometer flows across the city of Lahore. However, besides monsoon season the river is mostly dry due to the fact that water is diverted in India for irrigation and domestic purposes by constructing dams. In the past, River Ravi was the main source for recharge of groundwater aquifer, but due to increasing water demand and diversion of its water in India, it can no longer meet the required aquifer recharge of Lahore city. The quality of water of Ravi River has a direct impact on quality of water present in the adjacent aquifer.

II. BRBD Canal

BRBD canal flows in the East of Lahore, from North to South. It crosses Grand Trunk (GT) Road, at a distance of about 6 kilometer; from Lahore Ring Road. The Canal takes off from Upper Chenab Canal (UCC) at Bambanwala, itself off takes from Marala Barrage with full discharge. The BRBD is about 175 kilometer long. It is an earthen channel except a short lined central segment. Although design capacity at head is 7,260 cusecs, the maximum discharge is around 4,600 cusecs. Among others, one of the reasons of limiting discharge to 4,600 cusecs is the limited design capacity of Syphon for crossing of River Ravi. The Canal is brick lined from RD 260 to RD 373 and crosses the River Ravi and GT road at RDs 281 and 325¹¹ respectively.

III. Lahore Branch Canal

The other surface water source is the Lahore Branch Canal (LBC), which takes off from BRBD canal at about RD 230. LBC is an open channel with lining at both sides. Due to its limited discharge of about 400 cusecs, this canal cannot be considered as surface water source for Lahore, even to draw 100 cusec discharge.

¹⁰ https://wasa.punjab.gov.pk/infodesk_watersupply

¹¹ Final Feasibility Study Report on Lahore Water and Wastewater Management Project-February, 2019



IV. Khaira Distributary

This water source lies in the south of Lahore and it also takes off from BRBD canal, and flows from East to West, its flow is even less than the Lahore Branch Canal. Figure 4.10 shows the Surface Water Resources Map of the study area.

4.2.8 Drainage

There are total eight (08) major drains in the Lahore city i.e. Sattu Kattla drain, Lakshami Drain, Suk Nehar Drain, Upper Chota Ravi Drain, Lower Chota Ravi Drain, Siddique Pura Drain, Cantonment Drain and Shahdara Drain along with 76 minor drains which finally fall into aforementioned major drains. At present, all these drains collect wastewater from different areas of Lahore and finally fall into River Ravi and greatly deteriorated the quality of river water.

The Shalimar Drain, Shadbagh Drain and Chota Ravi Drain are flowing through the project area in which minor drains of the study area falls. Figure 4.10 shows the major drains in the study area.

4.2.9 Solid Waste

Lahore Waste Management Company (LWMC) is responsible to ensure efficient collection, transportation, recovery, treatment and disposal of solid waste generated in Lahore. LWMC renders following sanitation services throughout the Lahore city:

- Collection of waste by placement of containers & bins and through door to door collection;
- Collection and removal of waste to the approved disposal sites;
- Manual / Mechanical sweeping of main and arterial roads, streets and squares with vacuumed vehicles; and
- Mechanical washing.

LWMC has placed waste storage containers at different points in the study area, waste collected by pickup from these containers and unloaded into nearby compactor or transfer station. Plate 4.1 shows the services of LWMC in the study area. Estimated solid waste generation rate in the study area is about 0.6 kg/person/day¹².

However, from the field survey, it was observed that the situation of solid waste dumping/collection in the study area is not satisfactory as waste was dumped as open heaps along the road sides and in open plots by the public (as shown in Plate 4.2).

¹² <https://www.lwmc.com.pk/uc-plan.php>



Plate 4.1: SWM Services of LWMC in the Study Area



Plate 4.2: A view of Waste Dumping in the Project Area

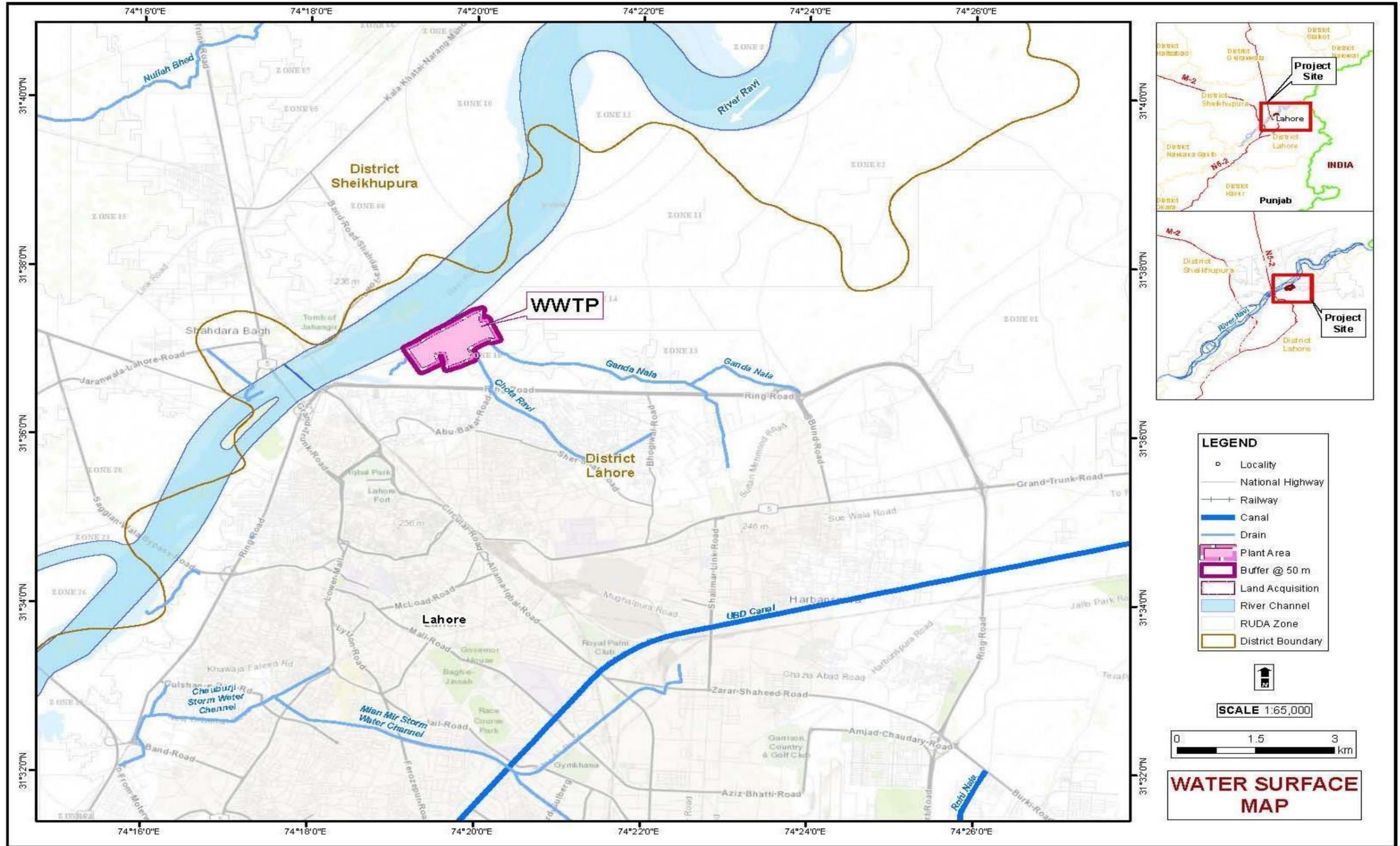


Figure 4.10: Surface Water Resources Map of the Study Area

4.3 ENVIRONMENTAL PARAMETERS FOR MONITORING

The environmental monitoring of parameters like ambient air quality, noise level, surface water and groundwater help us to analyze the prevailing environment conditions in and around the study area, and to protect it from any adverse activities due to the proposed Project implementation.

The environmental parameters for ambient air, noise level, surface water and groundwater were monitored at the proposed Project site from January 10, 2021 to January 15, 2021 for establishing the baseline profile of the Study Area.

The sampling locations of the above-mentioned parameters are shown in Figure 4.11. Environmental monitoring reports are attached as Annex-II.

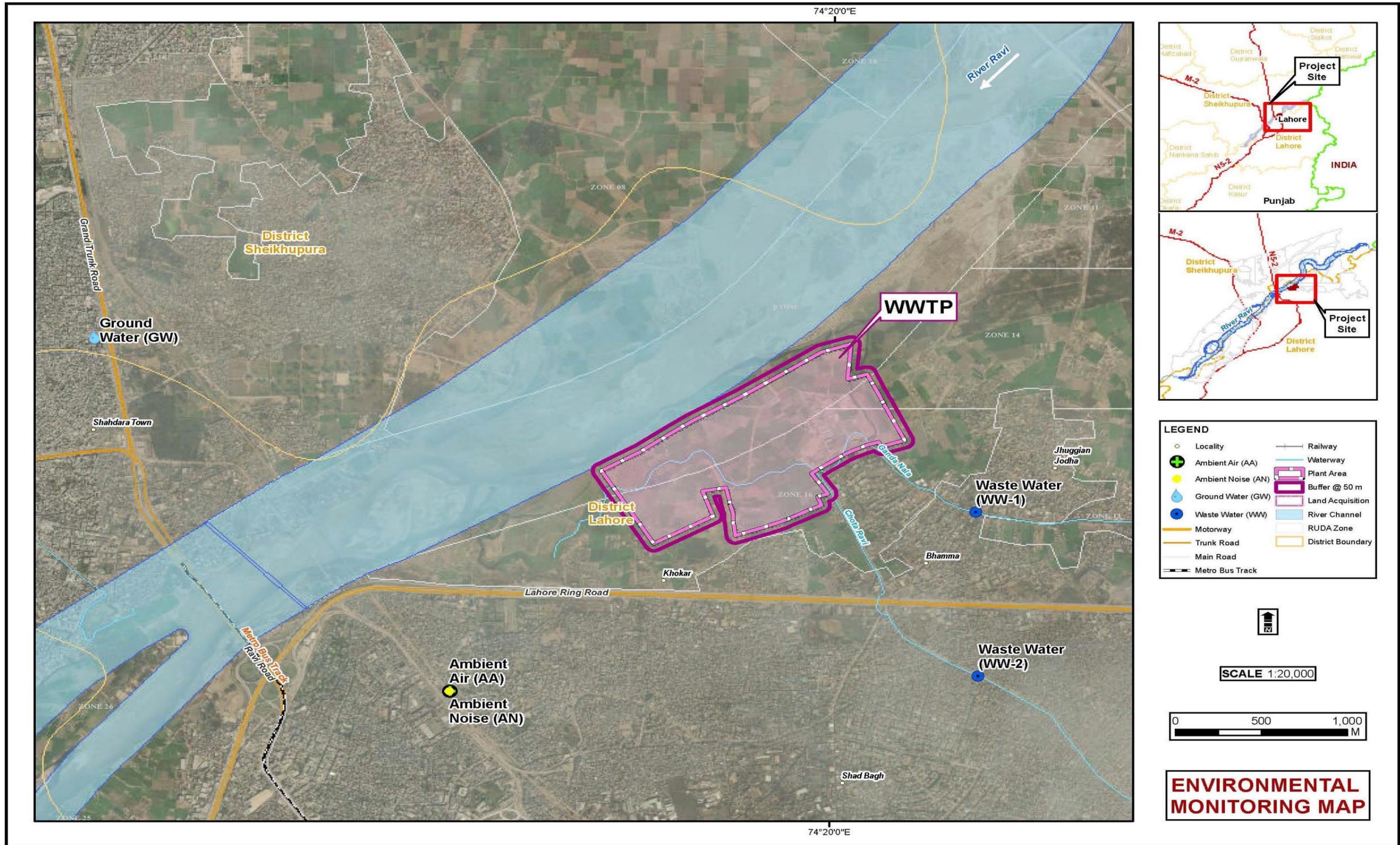


Figure 4.11: Sampling Location Map of Environmental Monitoring

4.3.1 Air Quality

The Ambient Air Quality monitoring for Nitrogen Dioxide (NO₂), Nitrogen Oxide (NO), Sulfur Dioxide (SO₂), Carbon Monoxide (CO), Ozone (O₃), Particulate Matter (PM_{2.5}), Particulate Matter (PM₁₀) and Suspended Particulate Matter (SPM) was carried at the proposed Project Site. The sampling was conducted for 24 hours duration for NO₂, NO, SO₂, PM_{2.5}, PM₁₀ and SPM, 1 hour for O₃ and 8 hours for CO.

The detailed results of ambient air quality monitoring have been attached in Annex-II, while the average concentrations of ambient air pollutants are given in Table 4.6.

Table 4.6: Average Concentration of Ambient Air Pollutants

Parameter	Unit	Monitoring Duration	Average Concentration of Pollutants (Railway Station, Shahdara)	Limits as Per PEQS, 2016
Nitrogen Dioxide (NO ₂)	µg/m ³	24 Hours	20.84	80 µg/m ³ for 24 Hours
Nitrogen Oxide (NO)	µg/m ³	24 Hours	13.50	40 µg/m ³ for 24 Hours
NOx	µg/m ³		34.35	120 µg/m ³ for 24 Hours
Sulfur Dioxide (SO ₂)	µg/m ³	24 Hours	19.21	120 µg/m ³ for 24 Hours
Carbon Monoxide (CO)	mg/m ³	08 Hours	1.68	5.0 µg/m ³ for 8 Hours
Particulate Matter (PM _{2.5})	µg/m ³	24 Hours	59.3	35 µg/m ³ for 24 Hours
Particulate Matter (PM ₁₀)	µg/m ³	24 Hours	164.8	150 µg/m ³ for 24 Hours
Suspended Particulates Matter (SPM)	µg/m ³	24 Hours	325.8	500 µg/m ³ for 24 Hours

µg/m³: micrograms per cubic meter

PEQS: Punjab Environmental Quality Standards

Table 4.6 indicates that all parameters are well within the permissible limits of PEQS, 2016, except Particulate Matter (PM₁₀, PM_{2.5}) due to the emissions of particulate matter from vehicles other fugitive dust emissions.

4.3.2 Noise Level

Noise level monitoring was carried out in the study area. Major sources of noise observed at the site were vehicular traffic in and around the study area.

The detailed results of noise monitoring have been attached in Annex-II, while the average concentrations of noise level are given in Table 4.7.

Table 4.7: Average Concentration of Noise Level

Averaging Time	PEQS, 2016	Unit	Average Value in dB (A)
			Average Concentration of Noise Level
	Category B (Commercial Area)	db (A)	Commercial Area
Day-time	65		61.7
Night-time	55		48.66

The above results show that the average noise values at day and night time are well within prescribed limits of PEQS, 2016.

4.3.3 Drinking / Ground Water Quality

Drinking water samples were taken near project site (Shahdara Town) and was analyzed for physical and chemical parameters. **Table 4.8** shows the results of ground water analysis.

Table 4.8: Results of Ground Water Analysis (Shahdara Town)

Parameter	Unit	Test Results (Ground Water)	Punjab Standards for Drinking Water Quality, 2016
pH	-	7.76	6.5-8.5
Odor	-	Non Objectionable	Non-Objectionable
Taste	-	Non Objectionable	Non-Objectionable
Color	Pt-Co	1.0	≤ 15 TCU
Turbidity	NTU	1.0	< 5 NTU
Total Hardness	mg/l	126	< 500 mg/l
Total Dissolved Solids	mg/l	220	< 1000
Chloride	mg/l	7.99	< 250
Cyanide (Cn)	mg/l	0.0	≤ 0.05
Fluoride (F)	mg/l	0.05	≤ 1.5
Nitrite	mg/l	0.0	≤ 3
Nitrate	mg/l	1.03	≤ 50
Phenolic Compound	mg/l	0.0	-
Residual Chlorine	mg/l	0.0	0.2-0.5
Aluminum (Al)	mg/l	0.005	≤ 0.2

Cadmium	mg/l	0.006	0.01
Copper	mg/l	0.164	2
Chromium	mg/l	0.004	≤ 0.05
Mercury	mg/l	< 0.001	≤ 0.001
Parameter	Unit	Test Results (Ground Water)	Punjab Standards for Drinking Water Quality, 2016
Antimony (Sb)	mg/l	0.005	≤ 0.005
Nickel	mg/l	< 0.02	≤ 0.02
Zinc	mg/l	0.028	5.0
Arsenic	mg/l	0.048	≤ 0.05
Barium	mg/l	0.0035	0.7
Boron	mg/l	0.02	0.3
Manganese	mg/l	0.054	≤ 0.5
Lead	mg/l	0.005	≤ 0.05
Selenium	mg/l	< 0.01	0.01
Total Coliforms	CFU45/ 100ml	Absent	Must not be detectable in any 100ml Sample
E. Coli	CFU/ 100ml	+ve	

mg/l: Milligram per Liter

The above table illustrates that all physical and chemical parameters are well within permissible limits of Punjab Standards for Drinking Water Quality, 2016 except E. Coli.

4.3.4 Wastewater Quality

The wastewater quality was measured at two (02) different locations i.e., Mahmood Booti and Shad Bagh Drains. The water samples were analyzed for the parameters specified in PEQS, 2016. The detailed wastewater results are given in Table 4.9.

Table 4.9: Surface Water Quality Monitoring

Parameter	Test Results (Mahmood Booti)	Test Results (Shad Bagh)	PEQS, 2016
pH	7.33	7.33	6-9
Biochemical Oxygen Demand (BOD ₅)	372	658	80
Chemical Oxygen Demand (COD)	755	1420	150
Total Suspended Solids (TSS)	232	270	200
Total Dissolved Solids (TDS)	808	738	3500
Phenolic Compounds (as Phenols)	0.0	0.0	0.1
Grease and Oil	0.0	0.8	10
Chloride (Cl ⁻)	55	60.9	1000
Fluoride (F ⁻)	0.0	0.0	10
Cyanide (CN ⁻)	0.6	0.6	1.0
An-ionic Detergents (as MBAs)	2.8	2.0	20

Sulfate (SO ₄ ²⁻)	52	58	600
Sulfide (S ²⁻)	4.52	2.6	1.0
Ammonia (NH ₃)	8.4	0.0	40
Cadmium (Cd)	0.006	0.006	0.1
Chromium (Cr)	0.04	0.26	1.0
Copper (Cu)	0.283	0.164	1.0
Lead (Pb)	0.005	< 0.005	0.5
Mercury (Hg)	0.001	0.001	0.01
Parameter	Test Results (Mahmood Booti)	Test Results (Shad Bagh)	PEQS, 2016
Selenium (Se)	0.078	0.019	0.5
Nickel (Ni)	0.07	0.005	1.0
Silver (Ag)	0.06	0.017	1.0
Total Toxic Metals	0.779	1.325	2.0
Zinc (Zn)	0.014	0.063	5.0
Arsenic (As)	0.052	0.032	1.0
Barium (Ba)	0.0038	0.11	1.5
Iron (Fe)	0.94	1.76	8.0
Manganese (Mn)	0.158	0.141	1.5
Boron (B)	0.18	0.71	6.0
Residual Chlorine (Cl ₂)	0.0	0.0	1.0

It is evident from the monitoring results that the values of BOD₅, COD, TSS and Sulfide are high in the study area with respect to prescribed limits of the PEQS, 2016.

4.4 LAND USE PATTERN

The land use of the study area is a mix of barren and commercial area. Table 4.10 depicts land use cover of the study area. The land use map of the proposed Project site is shown in Figure 4.12(a) & (b). Pictorial view of current land use are provided in Plate 4.3.

Table 4.10: Land Use Cover of the Study Area

Land Use Type	Area (Acres)
Builtup	56.26
Culvert	0.02
Agriculture	323.55
Drain	11.83
River	43.96
Road	25.67
Nullah	0.14
Pond	4.60
Open Land	29.57
Graveyard	0.31
Total	495.91



Plate 4.3: Landuse of the Project Area

4.5 ENVIRONMENTAL SENSITIVE RECEPTORS

Sensitive receptors are mainly people or other organisms that may have a significantly increased sensitivity and exposure to the pollutants and social disturbance, due to the developmental projects. Thus, sensitive receptors are necessary to be identified, to evaluate the potential impacts of the proposed project on public health and the surrounding environment.

The sensitive receptors identified for the proposed project within AOI is only graveyard as shown in Figure 4.13. The graveyard will be protected by taking protective measures.

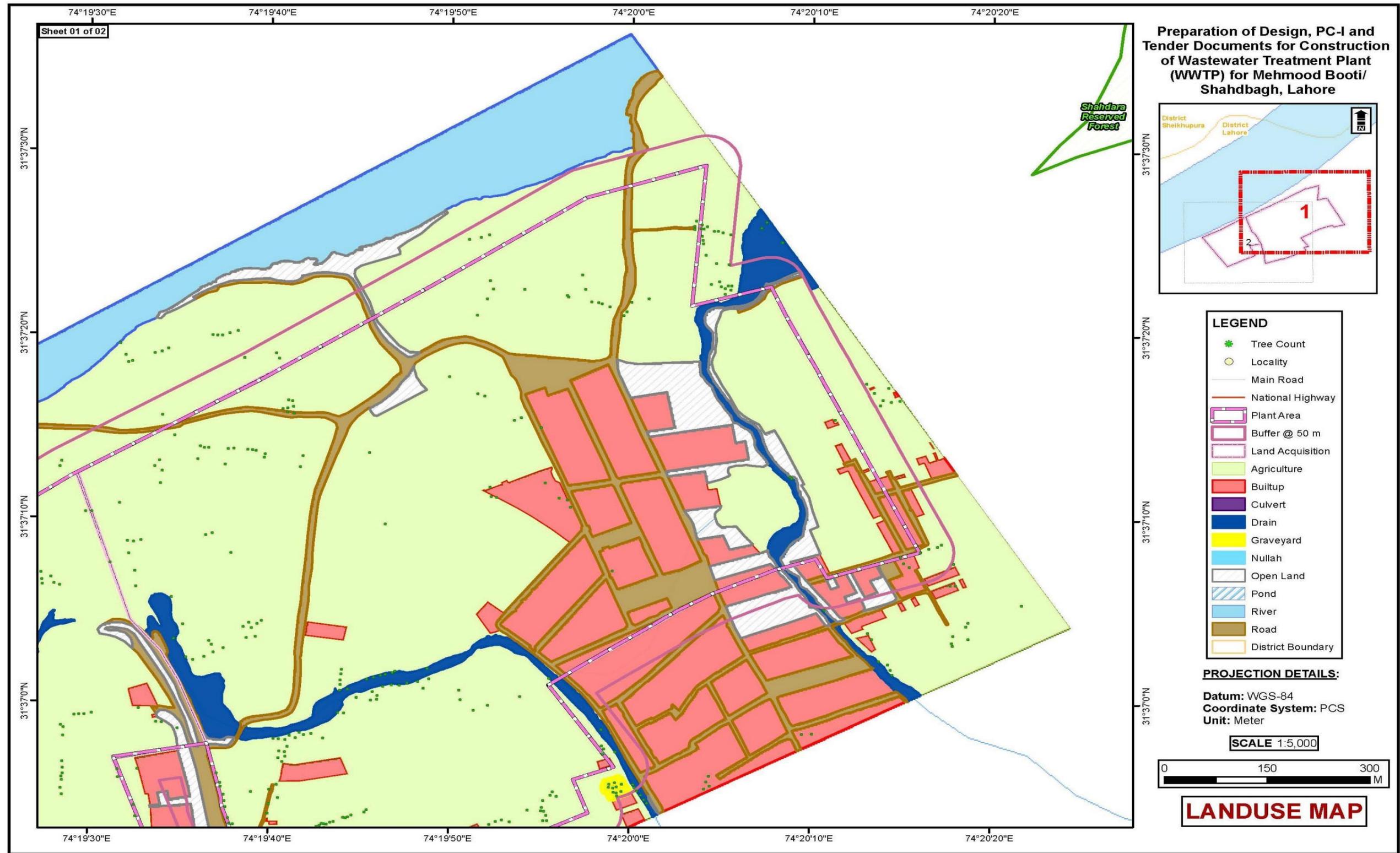


Figure 4.12 (a): Land Use Map of the Study Area

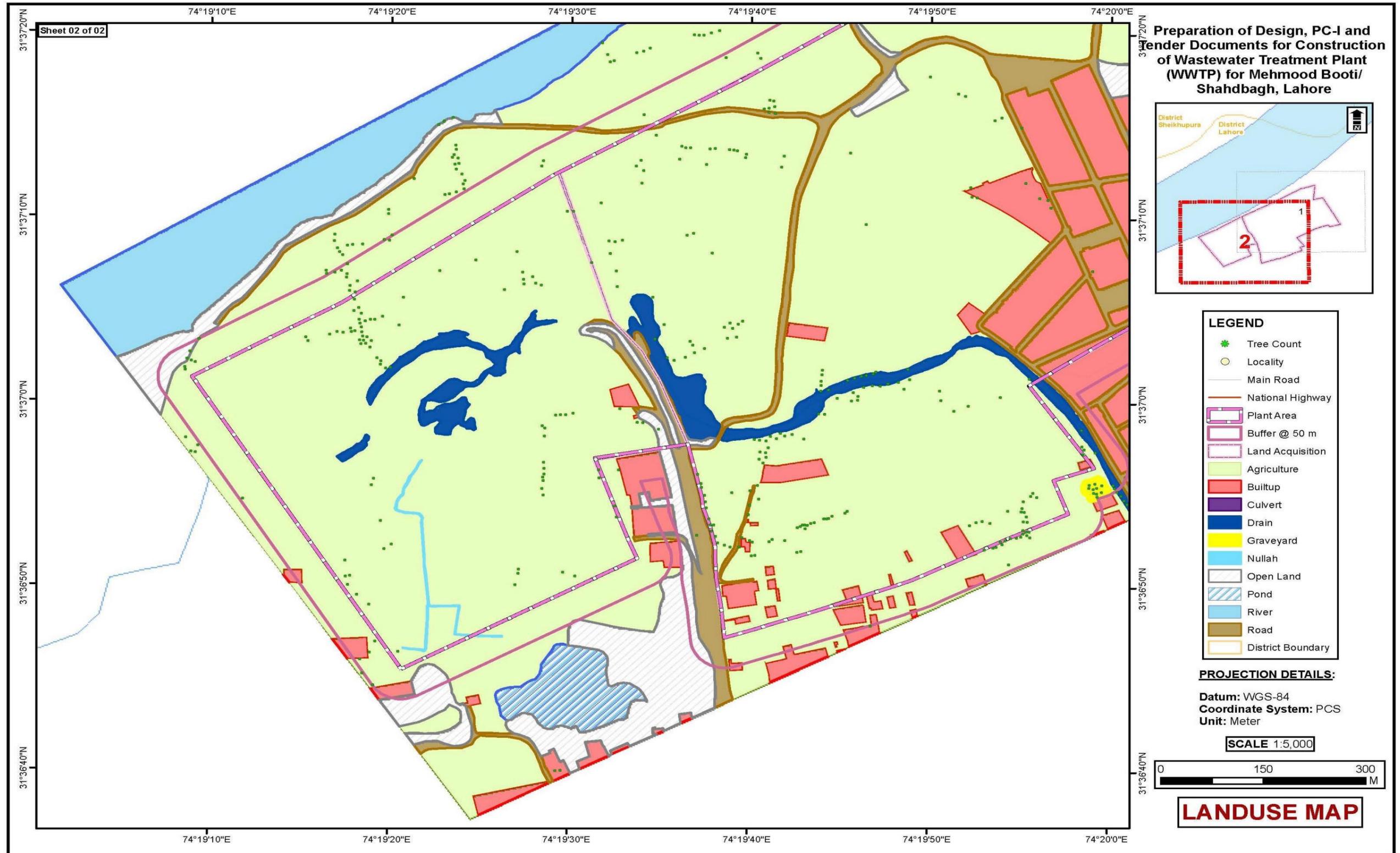


Figure 4.12 (b): Land Use Map of the Study Area

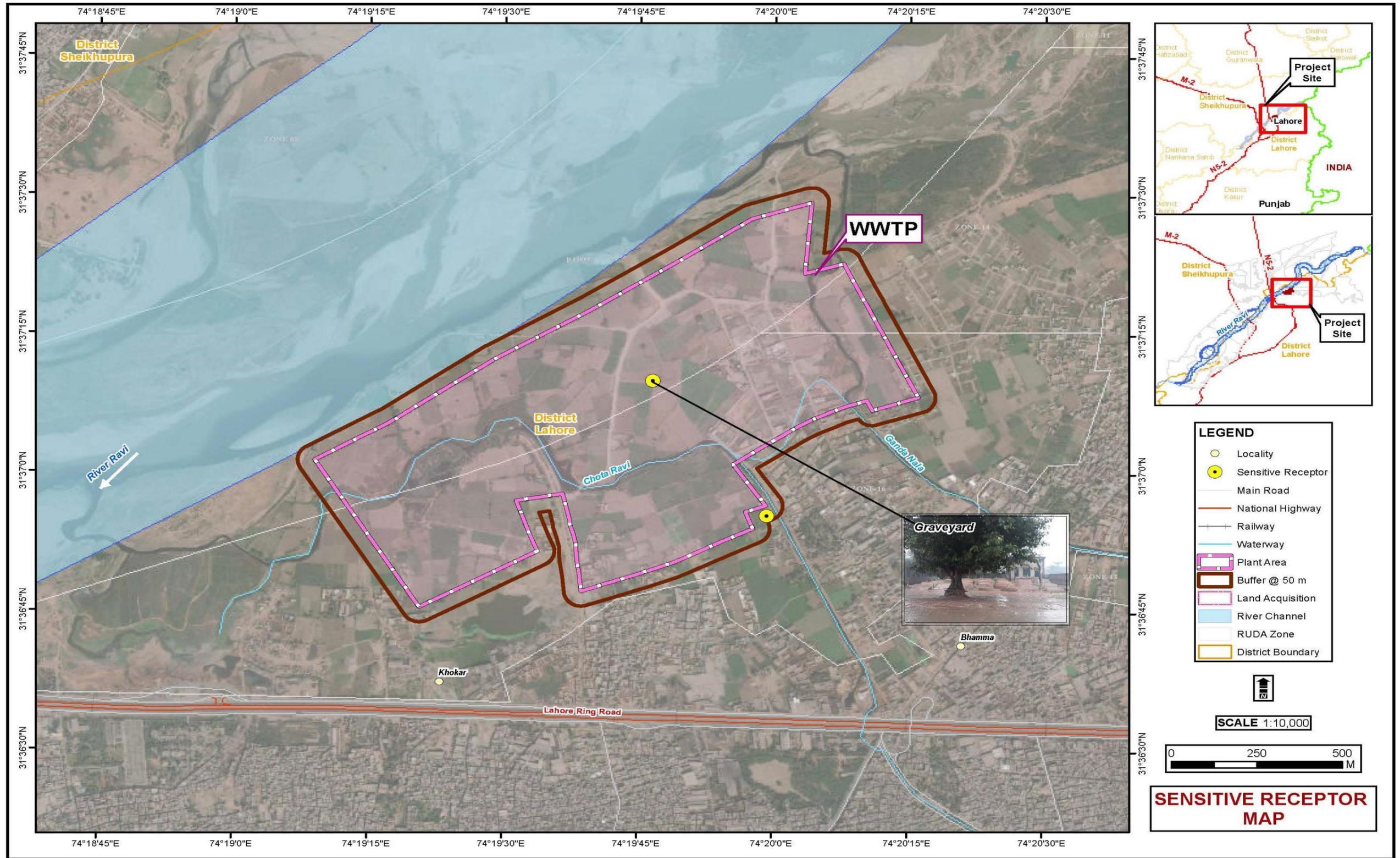


Figure 4.13: Sensitive Receptor Map of the Study Area



4.6 ECOLOGICAL ENVIRONMENT

Ecological study of the area has been conducted using standard ecological assessment technique based on primary and secondary information and inclusion of additional information collected during site visit, discussion with Government departments and meetings with groups of communities/public living in and around Project Area coupled with expert visual observations. The area is also witnessed to dumping wastes and waste water drain which is a threat to local biodiversity and ecological chain. This condition is high threat to local ecosystem and needs attention. Following is the description of the baseline ecological environment of the area.

4.6.1 Flora

The Vegetation of the project area shows that it is suitable for plantation of native species along the agriculture fields. Variation in diversity is caused due to climate, heterogeneity, biotic interaction and habitat. In the past, the area was covered with huge amount of ground vegetation and dominated by trees but now the conditions are at the adverse side because the original or natural habitat has been modified and converted into barren land for construction and for agricultural purposes. This particular area has been accessible to humans for a long time resulting in low diversity and wildlife abundance.

The proposed treatment plant area is situated in semi-arid region of Pakistan. The region is characterized by dry climate both in summer and winter season. The precipitation is in the form of occasional and seasonal rains, rainy season include monsoon (i.e., July– September).

Some of the older stands of trees, consisting of these species still survive onslaught of urbanization in remote barren areas or in graveyards. There is probably little natural vegetation left in tract. The land owners also raised trees like Kikar (*Acacia Arabica*), Shisham or Tahli (*Dalbergia sissoo*), Beri (*Zizyphus jujube*), Toot (*Morus alba*), Sharin (*Albizzia lebbek*), Dherek (*Melia azedarach*), etc., along the boundaries of their agricultural fields. Pipal (*Ficus religiosa*) and Bohr (*Ficus bengalensis*) are grown for shade in their houses or deras. Pilchhi (*Tamarix dioica*) is found on moist sandy soil along the river and is used for wicker work and basket making.

Humid climate in ecological characteristics and agriculture potential: The climate tends to have hot and sometimes extremely hot summers and mild warm winters. The soils are very fertile therefore, climate supports variety of agricultural crops and vegetables, with scarce growth of indigenous flora and grasses.

a) Trees

No compact plantation or woodlots exist in the Project Area, but scattered trees are growing in the farm lands in scattered form consisting of Kikar, Shisham, Rubber plant, Eucalyptus and sumbal etc. Common trees found in the area are given in Table 4.11.



Table 4.11: Flora in the Study Area

Sr. No.	Common Name	Scientific Name
1.	Kikar	<i>Acacia nilotica</i>
2.	Shisham	<i>Dalbergia sissoo</i>
3.	Ber	<i>Zizyphus sp.</i>
4.	Sufeda	<i>Eucalyptus camaldulensis</i>
5.	Mulberry	<i>Morus alba</i>
6.	Neem	<i>Azadirachta indica</i>
7.	Sirris	<i>Albizia lebbek</i>
8.	Dherek	<i>Melia azedarach</i>
9.	Date Palm	<i>Phoenix dactylifera</i>
10.	Jaman	<i>Syzygium cumini</i>
11.	Bakain	<i>Melia azadirachta</i>
12	Mango	<i>Mangifera indica</i>
12	Guava	<i>Psidium guajava</i>
13	Sumbal	<i>Bombac Cieba</i>

The above mentioned trees now exist only in graveyards or barren places and as their further planting is discouraged, these trees need protection as they are symbol of our culture and past history.

b) Shrubs and Herbs

Shrubs and herbs which are commonly found in the study area are Jawan (*Alhagi maurorum*), Bhakra (*Tribulus terrestris*), AK (*Calotropis procera*) Lana (*Suaeda fruticosa*), Phogs (*Calligonum polygonoides*), Jantar (*Sesbania aculeata*) and Tumba (*Citrullus colocynthis*).

A list of Shrubs and Herbs found in the Study Area is given in Table 4.12.

Table 4.12 : Shrubs and Herbs in the Study Area

Sr. No.	Common Name	Scientific Name
1.	Jawan	<i>Alhagi maurorum</i>
2.	Bhakra	<i>Tribulus terrestris</i>
3.	AK	<i>Calotropis procera</i>
4.	Lana	<i>Suaeda fruticosa</i>
5.	Phog	<i>Calligonum polygonoides</i>
6.	Jantar	<i>Sesbania aculeata</i>
7.	Tumba	<i>Citrullus colocynthis</i>
8.	Bathu	<i>Chenopodium botrys</i>
9.	Arind	<i>Ricinus communis</i>
10.	Pilchhi	<i>Tamarix dioica</i>

Jantar (*Sesbania bispinosa*), Tumba (*Citrullus colocynthis*) and Bathua (*Chenopodium album*) are found mostly grown in left over agricultural fields, while Arind (*Ricinus communis*) is present mostly along the water channels. The remaining shrubs and herbs grow in open places.



c) Grasses

The most common grass of the tract is Khabbal (*Cynodon dactylon*). It is a useful fodder grass. Other grasses found in the area are Khawi (*Cymbopogon jwarancusa*), Sinn (*Elionorus hirsutus*), Gam or Mali (*Panicum antidotale*), Kana (*Saccharum munja*) and Dib (*Typha angustata*) along the water courses or in moist places. Grasses found in the study area are given in Table 4.13.

Table 4.13: Grasses in the Study Area

Sr. No.	Common Name	Scientific Name
1.	Khabbal	<i>Cynodon dactylon</i>
2.	Gam or Mali	<i>Panicum antidotale</i>
3.	Sinn or Gorkha	<i>Elionorus hirsutus</i>
4.	Khawi	<i>Cymbopogon jwarancusa</i>
5.	Dib	<i>Typha angustata</i>
6.	Kana	<i>Saccharum munja</i>
7.	Chhimber	<i>Eleusine flagellifera</i>
8.	Kai	<i>Saccharum spontaneum</i>
9.	Dub	<i>Desmostachya bipinnata</i>

4.6.2 Fauna

The study area is not so rich in multi species fauna but include some commonly found animals.

a) Mammals

The Study Area being agricultural land is not very rich in wildlife mammals. However, common mammals are Jackal (*Canis aureus*), Squirrel (*Funambulus*), Fox (*Vulpes vulpes*), Rats (*Mus musculus*) and Mongoose (*Herpestes auropunctatus*). Wild bear (*Sus scrofa*) is also reported in the area, but its number has been reduced to a bare minimum as a result of extensive hunting and shooting. Porcupine (*Hystrix indica*) is common and causes lot of damage to young plants and crops.

Domestic animals include goats, sheep, camels, cows and buffaloes. Another important domestic animal of the area is donkey which is used for pulling carts etc., a common sight in the tract. A list of Mammals found in the area is given in Table 4.14.

Table 4.14: Mammals in the Study Area

Sr. No.	Common Name	Scientific Name	Status
1.	Jackal	<i>Canis aureus</i>	Least Concern
2.	Fox	<i>Vulpes bengalensis</i>	Least Concern
3.	Porcupine	<i>Hystrix indica</i>	Least Concern
4.	Squirrel	<i>Sciuridae</i>	----
5.	Mouse	<i>Funambulus pennanti</i>	----
6.	Mongoose	<i>Herpestes javanicus</i>	Least Concern



Sr. No.	Common Name	Scientific Name	Status
7.	Wild Boar	<i>Sus scrofa</i>	Least Concern
8	Hog Deer	<i>Axis porcinus</i>	Endangered
9.	Wolf	<i>Canis lupus</i>	Least Concern

b) Reptiles

Common reptiles found in the Study Area include snakes like Cobra (*Naja naja*), Rattle Snakes and Rat Eater Snakes. Small and medium sized lizards are also a common sight. These include Spiny Tailed Lizard (*Uromastyx hardwickii*) and Finged Toed Lizard (*Acanthodactylus cantoris*). Turtles are common during short rainy season and along moist place. A list of Reptiles found in the area is given in Table 4.15.

Table 4.15: Reptiles in the Study Area

Sr. No.	Common Name	Scientific Name	Status
1.	Indian Cobra	<i>Naja naja</i>	----
2.	Spiny tailed Lizard	<i>Uromastyx hardwickii</i>	----
3.	Fringed Toed Lizard	<i>Acanthodactylus cantoris</i>	Least Concern
4.	Turtle	<i>Kachuga smithii</i>	Near Threatened
5.	Indian Krait	<i>Bungarus caeruleus</i>	----

c) Birds - Avifauna

Important bird species found in the tract are Common Crow, Common Mynah, House Sparrow and Common Teal and are frequently sighted. Bulbul and Koel were also noticed in the project area and the study area during field visits. Grey and black partridges, though present in the area have been reduced to a minimum quantity due to excessive hunting. Other birds include Indian Roller (Chai) and Quail (*Coturnix ypsilophora*).

These include little and medium sized Egrets, Mallard (*Anas platyrhynchos*) and White-Breasted Waterhen (*Amauornis phoenicurus*). Birds seen and reported in the tract are given in Table 4.16.

Table 4.16: Common Birds

Sr. No.	Common Name	Scientific Name	Status
1.	Mynah	<i>Acridotheres tristis</i>	Least Concern
2.	House Crow	<i>Corvus splendens</i>	Least Concern
3.	House sparrow	<i>Passer domesticus</i>	Least Concern
4.	Koel	<i>Eudynamys scolopacea</i>	Least Concern
5.	Parrot	<i>Psittacula krameri</i>	Least Concern
6.	Pigeon	<i>Columba livia</i>	Least Concern
7.	Patridge Grey	<i>Francolinus pondicerianus</i>	Least Concern
8.	Patridge Black	<i>Francolinus francolinus</i>	Least Concern
9.	Quil	<i>Coturnix coturnix</i>	Least Concern
Sr. No.	Common Name	Scientific Name	Status
10.	Little Egret	<i>Egretta garzetta</i>	Least Concern
11.	Mallard	<i>Anas platyrhynchos</i>	Least Concern



12.	Jal Kookri	<i>Fulica atra</i>	<i>Least Concern</i>
13.	Bulbul	<i>Pycnonotus cafer</i>	<i>Least Concern</i>
14.	Hoo poe	<i>Upupa epops</i>	<i>Least Concern</i>
15.	Indian Roller or Blue Jay	<i>Coracias benghalensis</i>	<i>Least Concern</i>

4.6.3 Endangered Species

No endangered flora and fauna is found in the project area.

4.6.4 Agriculture

Agriculture in the study area is predominantly irrigated agriculture. The project area depends upon a tube wells, installed in the area for its irrigation, as the natural water is not available for all the potential land here. As a result of ground water availability, lush green crops of wheat, fodder and vegetables give a substantial yield. Vegetables grown in the project area and the study area include, potato, sweet pepper, Brinjal, cucumber, okra, bitter gourd, turmeric, ginger, cabbage, carrot, onion, radish, turnip, peas, spinach, etc.

a) Crops

The agriculture and livestock is the main economic activity in the area. The main crops during Rabi are wheat, potato, fodder and rice, whereas guava, are the major fruits of the area. As per cropping pattern, wheat and sugarcane are the highest grown crops in the area. Due to high water usage crops, other crops are also used like fodder etc.

b) Cropping Pattern

The crop pattern followed in the study area is Rabi crop which is sown during the months of November and December and harvested during May to June. Kharif crop is sown during June, July and is harvested in the month of October and November. Major Rabi crop is wheat and major Kharif crops are fodder and rice.

4.7 SOCIO-ECONOMIC ASPECTS

The socioeconomic baseline covers the demography, administrative and political settings, religious and cultural, economic aspects, infrastructure and facilities, and gender aspects.

To document the socio-economic conditions of the population settled in the Project Area, social surveys of the selected House Holds (HH) were carried out. One of the major steps after the identification of the affected areas and their estimated populations during the initial survey of September, 2021 was the calculation of sample size. Total two (02) main settlements fall near the Project Area with population about 16,000. Socio-economic survey was conducted in these areas. Socio-economic survey was carried out at Khokhar Pind and Bhamma Village to take maximum information of the Project Area. Based on social survey, approximate number of HH and their population were estimated.



The basic objectives of the social survey were to:

- Observe and document the existing socio-cultural settings of the study area;
- Identify the potential impacts associated with the implementation of the proposed project;
- Get feedback from community about existing and potential social issues; and
- Evaluate the possibilities of addressing them in the report.

Socio-economic survey of the selected households of the study area was carried out. Baseline information was collected from direct and indirect affectees during the field visit. The people whose land, houses and shops or any other structure will be directly affected called direct Project Affected Persons (PAPs) while indirectly affected are those people who will have to face impacts of proposed project. Persons who are directly affected due to the land acquisition are termed as PAPs in the report.

4.7.1 General Description of the Project Area

The Project Area of proposed project falls in Ravi Town, District Lahore. PAPs socio-economic condition, family size, educational status and concerns related to the project are same as people of Study Area.

4.7.2 Study Area included the following major settlements

- Khokhar Pind; and
- Bhamma Village;
- Jhuggian

4.8 METHODOLOGY

Relevant secondary data/information was collected from various departments at the central and the provincial level was cross checked to establish their authenticity.

Both qualitative and quantitative assessments were done for the social assessment study covering different social environment parameters of the project location by interacting with social groups and relevant stakeholders of the project area. Quantitative survey methods involved filling up of questionnaires at local areas and household levels by sociologists and enumerators. The questionnaires contained mostly structured questions for collection of the required data.

The study area for socio-economic survey includes the areas which will be directly and indirectly affected due to the proposed Project activities. Estimated population for the calculation of sample size for social survey in the study area is taken from the locals through social survey.

The sample size of ninety five (95) households was calculated based on the Standard Statistical Formula using a confidence level of 95% (which is frequently used in social research) and confidence interval of 10%. The calculated sample size was distributed



proportionately among the nearby settlements. The houses of these settlements were identified and counted by using available Google Earth imagery and verified by conducting socio-economic field surveys. The households were selected by using random sampling technique, a type of probability sampling. Questionnaires were developed to collect the baseline data, based on the demographic and socio-economic indicators. Interviewing technique was used as a tool for data collection. In order to quantify the existing baseline conditions of the study area, collected data was digitized and analyzed. The sample socioeconomic proformas are attached as Annex-I.

In addition, the survey was followed by public consultations at the village level through group discussions, key informant interviews, participatory observation and by using a structured proformas.

The survey was conducted in study area in the month of September, 2021, interviewing 95 sample respondents at household level covering nearby above mentioned settlements.

4.8.1 Task Specific Approach

In conducting the social survey, full concentration was given to identify area of impacts and collection of necessary data/information on the existing social environment (economic, social, cultural etc.). This was done by holding discussions / meetings followed by in-depth survey and administering structured / semi-structured questionnaires. Assessment was also made about the project impact on the livelihood of the people.

4.8.2 Discussion with Officials

The Consultant had frequent discussions with the client and the concerned project officers to get a clear understanding about the project. This facilitated sharing of ideas, conceptual clarity and minimized constraints in carrying out the task.

4.8.3 Reconnaissance Field visit

A reconnaissance visit to the project, before conducting detailed survey was conducted in September, 2021 by the consultant, that helped in collection of necessary data/information for primary assessment through consultations with project stakeholders including project beneficiaries and project affected persons.

4.8.4 Data Collection and Field Survey

The Consultant conducted field survey/investigation on various socio-economic aspects to assess the existing socio-economic environment of the project as well as identify likely impacts under a changing situation with and without the proposed Project. Accordingly, the social study covered the beneficiaries, the affected people and concerned stakeholders in the area and elicited their views / suggestions for mitigation / enhancement of different types of impacts.

4.8.5 Community/Stakeholders' Participation



Community consultations with different stakeholders, beneficiaries and affected communities of the Project Area were organized to facilitate stakeholders' / peoples' participation in the project activities of the proposed Waste Water Treatment Plant and their views and feedbacks were incorporated for planning/preparation of the project. Such consultations would strengthen the commitment of a wide cross-section of the affected people, public representatives, government employees and professional groups by giving them an opportunity to participate in key decisions.

4.9 ADMINISTRATIVE AND POLITICAL SETTINGS

The Mayor of Lahore is the leader of the municipal government of Lahore (Metropolitan Corporation Lahore) in Lahore, Punjab. The mayor is directly-elected in municipal elections every four years alongside nine (09) deputy town mayors. The mayor is responsible for the administration of government services, the composition of councils and committees overseeing Lahore City District Departments and serves as the chairperson for meeting of Lahore Council.

The mayor is responsible for the administration of government services, the composition of councils and committees overseeing Lahore City District departments and serves as the chairperson for meeting of Lahore Council. The mayor also functions to help devise long term development plans in consultation with other stakeholders and bodies to improve the condition, livability and sustainability of urban areas.

Lahore comprises five tehsils i.e. Lahore city and Lahore Cantt, Model Town, Raiwind Tehsil and Shalimar Tehsil. While these tehsils are further divided into nine towns as under: i. Nishtar Town; ii. Gulberg Town; iii. Aziz Bhatti Town; iv. Allama Iqbal Town; v. Ravi Town; vi. Shalamar Town; vii. Samanabad Town; viii. Wahgah Town; ix. Data GunjBakhsh Town.

Union Councils (UC) is the lowest tier of the local government and fifth tier of government in Pakistan; in rural areas, UCs are often known as "village councils". The territory represented by a village council usually comprises a large village and surrounding areas, often including nearby small villages. The term "union council" may be used for localities that are part of cities. A village council is an elected local government body headed by a mayor and a deputy mayor. Tehsil Council is the next tier of local government. About 4 to 5 UCs fall in the Tehsil Council (TC). Tehsil is a sub-unit of the district, which is the highest tier of the local government system, dealing with the administrative matters at district level.

A district is composed of Tehsils and is governed by the Deputy Commissioner (DC). Like other districts of the Punjab, the local government system of Lahore comprises UCs consisting of members directly elected by people through an open competition, which is also from the Electoral College for the selection of the members for the next higher tier.

4.10 DEMOGRAPHY

4.10.1 Population and Family Size



Based on the District Census Report, 2017, Lahore has a population of 11,126,285 while it was 6,318,745 as per 1998 census. The household surveys, indicated that household size is 7.1 persons. Based on the social survey, the gender wise distribution of the 95 respondent's families is given in Table 4.17.

Table 4.17: Gender and Age of the Population

Sr. No.	Age Group (Years)	Male		Female		Total	
		No.	Percentage	No.	Percentage	No.	Percentage
1	0-4	42	6.2	39	5.8	81	12.0
2	5-9	32	4.7	29	4.3	61	9.0
3	10-19	57	8.4	64	9.5	121	17.9
4	20-39	79	11.7	87	12.9	166	24.6
5	40-49	72	10.7	61	9.0	133	19.7
6	50-59	37	5.5	34	5.0	71	10.5
7	60 and above	23	3.4	19	2.8	42	6.2
	Total	342	50.7	333	49.3	675	100.0

Based on the social survey, the maximum population falls in the age group between 20 and 39 years and it is the group which is responsible for most of daily life routine activities.

The gender ratio is an important demographic indicator, which is defined as the “number of males per hundred females”. The gender ratio based on the household was 103 males per 100 females. The gender ratio depends on the factors such as the gender ratio at birth, differential mortality rates between the gender at different ages, and losses and gains through migration. In the local culture, sons are preferred because (i) they have a higher wage-earning capacity, (ii) they continue the family line; and (iii) they are generally recipients of inheritance. Girls are also contributing in their families when resources are becoming scarce.

4.10.2 Marriage and Marital Status

Endogamy is the prevalent style of marriage. Most of the people are monogamous, or polygamy is also found as allowed in the law. As per social survey, the majority of respondents (i.e., 81%) were married and 19% were unmarried.

Table: 4.18 shows the marital status of the respondents.

Table 4.18: Marital Status of the Respondents

Sr. No.	Marital Status	Number	Percentage
1	Married	77	81
2	Un-Married	18	19
	Total	95	100



4.10.3 Literacy

Educational distribution of the respondents shows that Fifteen (15%) of the respondents were illiterate. 22% were educated up to primary level. However, 24% and 18% were educated up to middle and matric level respectively. Moreover, 14% respondents were educated up to intermediate and 7% respondents described their education level up to graduation and above. Educational level of the respondents is shown in Table 4.19.

Table 4.19: Educational Level of the Respondents

Sr. No.	Education of the Respondent	Number	Percentage
1	Illiterate	14	15
2	Primary	21	22
3	Middle	23	24
4	Matric	17	18
5	Intermediate	13	14
6	Graduation and above	7	7
Total		95	100

Based on the field survey and discussion with the locals, it is noted that female literacy rate was lower compared to males. Locals give least importance to female education. However, proposed project area falls in Lahore and considered semi urban area. In the Khokhar Pind and Bhamma village, low income families do not send their girls to school. Although, there are number of schools and colleges in local area available in public and private sectors. Following are the reasons of low literacy rate among women in the area:

- The major cause of women illiteracy is increase in population, which is playing a negative role in this deprivation of female education. A family having more children and less income will prefer to educate the boys of the family, while the girls will be given embroidery or sewing skills;
- There is also misconception that females have to manage home after marriage whereas males have to earn for livelihood, so education matters only for males and not for females;
- Some families do not like their daughters to study in co-education institutes thus depriving them of higher education;
- The social setup is male dominated and girls restricted to homes and cannot go out freely etc. This sometimes seems difficult to them. There is also a sharp division between female oriented work and male oriented work. Females are not allowed to work in all sectors therefore their education is not considered valuable; and
- The number of schools and colleges for females are less as compared to males. Girls have to travel a long distance to reach the schools or colleges. For this reason, most parents prefer to give them religious education.

4.10.4 Languages Spoken

Punjabi is the predominant language being spoken in the Area while Urdu is a common language.



4.10.5 Housing

A mix housing pattern was observed among the project DPs where 24% of the respondents were living in semi pacca houses, while 69% respondents had pacca houses. Only 6% of the respondents mentioned that they were living in kutcha houses, made with mud and low cost construction material. Table 4.20 shows construction pattern of houses of the respondents.

Table 4.20: Housing Conditions

Sr. No.	Type of House	Number	Percentage
1	Semi Pacca ¹³	23	24
2	Pacca ¹⁶	66	69
3	kutcha ¹⁴	6	6
	Total	95	100

The majority of the respondents had 2-3 rooms in their houses; few of them were having 4 or more rooms.

The type of the toilet used by the household indicates living conditions and is strongly related to the health and hygiene of the household members. All the people (100%) had squatting plate or pan and trap type of latrine.

4.11 ECONOMIC ASPECTS

4.11.1 Occupations

Occupation of the respondents were also asked during the field survey. Majority (31%) of the respondents were associated with farming. Thirteen (13%) of the respondents were running their shops while 5% of the respondents were mechanic of different fields. Almost 7% were engaged with different types of labor including agriculture, industrial and general labor for earning their livelihood, while 27% were engaged with private jobs to earn their livelihood. Rest of the respondents were associated with their own business and government jobs as reflected in Table 4.21.

Table 4.21: Occupation of the Respondents

Sr. No.	Profession	Number of Respondent	Percentage
1	Farmers	29	31
2	Shopkeepers	12	13
3	Mechanic	5	5
4	Laborers	7	7
5	Private Service	26	27
6	Business	11	12

¹³ Constructed using a combination of pacca (strong, high-quality) and kutcha (inferior) materials. ¹⁶ Pacca housing refers to dwellings that are designed to be solid and permanent, built of substantial material such as stone, brick, cement, concrete, or timber.

¹⁴ Constructed of mud and kutcha (locally available) materials



7	Govt. Service	5	5
Total		95	100

4.11.2 Income Levels

Socioeconomic findings of the survey revealed that 12% of the respondents were falling in the low-income group of up to rupees 17,500. On the other hand, 37% were earning in the range of 17,501 to 30,000 rupees, and 20% of the respondents were earning their monthly income between the ranges of 30,001 to 40,000 rupees per month. Whereas, 18% of the respondents were earning between 40,001 to 50,000 and 14% were earning above 50,000 per month. Table 4.22 shows the average monthly income of the respondents.

Table 4.22: Average Monthly Income of the Respondents

Sr. No.	Average Monthly Income (Rs.)	Number of Respondent	Percentage
1	Up to 17,500	11	12
2	17,501 – 30,000	35	37
3	30,001 – 40,000	19	20
4	40,001-50,000	17	18
5	Above 50,000	13	14
Total		95	100

During the field surveys, it was observed that in case of farming households, the major sources of income were from crops and livestock (dairy products). For non-farm or landless households, the main sources of income were activities, such as business, shopkeeper, government employment, private employment, and labor work

4.11.3 Expenditure

Household expenditure depends on the earning of the household members, about 15% of respondents reported their monthly expenditure up to 17,500, and 41% respondents found within the range of 17,501- 30,000 per month. While, 21% were falling between the expenditure range of 30,001 to 40,000 and 16% recorded their monthly expenditures between the ranges of 40,001-50,000 per month. However, 7% of the respondents were having their expenses more than 50,000 per month. Table 4.23 shows the average monthly expenditures of the respondents.

Table 4.23: Range of Monthly Expenditures of the Respondents

Sr. No.	Average Monthly Expenditures	Number of Respondent	Percentage
1	Up to 17,500	14	15
2	17,501 – 30,000	39	41
3	30,001 – 40,000	20	21



4	40,001-50,000	15	16
5	Above 50,000	7	7
Total		95	100

The monthly expenditure and pattern of the expenditure provides an indication for assessing the standard of living of a household. The expenditure on food items includes cereals, pulses, flour, sugar, cooking oil/ ghee, and milk while the expenditure on non-food items are education, medical treatment, clothes, shoes, and toiletries.

4.11.4 Money Borrowed

Table 4.24 shows that significant majority i.e., 92% of respondents did not borrow money during the fiscal year 2020-2021. While only 8% borrowed money during that time.

Table 4.24: Money Borrowed

Sr. No.	Last Year Borrow Money	Number	Percentage
1	No	87	92
2	Yes	8	8
	Total	95	100

Generally, the credit is obtained to supplement the income to meet the routine and some extra expenditure of the household including investment, social needs and other unforeseen situations such as illness (medical care), marriage, education, COVID and livestock. Credit is also obtained for agricultural needs (such as equipment, seeds and fertilizers) from both the formal (banks) and informal sources (e.g., friends, relatives, and landowners).

4.11.5 Agriculture Practice

In the proposed Project Area, groundwater is being supplied through tube wells, or river water for agriculture purposes which are the main source of irrigation water however, sewerage water is also used for agriculture purpose. Local farmers use traditional methods for farming (i.e., ploughing, tilling etc.) coupled with use of tractors and modern machinery for cultivation and harvesting. They grow almost all types of vegetables and fodder crops for their domestic animals. Milk selling is one of the major sources of livelihood for the local people, hence, they are used to grow fodder crops on major portion of their agricultural land. There are no fruit orchards in proposed Project's AOI.

The major agricultural machinery being used was tractors. There has been a consistent increase in the number of privately-owned agricultural machines. The farmers seem to consider increased mechanization of agriculture as they are buying more agricultural machinery, especially tractors. Scythes, sickle-type western hand tools are also being used for cutting of Barseem and other fodder crops. Fertilizers such as urea and ammonium phosphate are used by farmers to increase the crop productivity.



4.12 RELIGIOUS AND CULTURAL ASPECTS

4.12.1 Religion, Ethnic and Minority Groups

The population of the settlements in AOI is predominantly Muslim and followed by Christians. The core unit of social organization is the caste system (“biraderi” in local language) in which groups are either defined on the basis of specific occupation or lineage. Occupationally defined caste groups are considered as lower status in the social setup. For instance, occupationally defined baradari/caste groups are Mochi (cobbler), Machi (fisherman), Nai (barber), Julahay (weavers) while lineage based baradari/caste groups are e.g., Khokhar, Gujjar, Malik, Rajput, Bhatti, Jutt, Kullah, Mian, Khurral, Syed, and Cheema. The social life of the local population is traditionally on rural and urban lines.

Based on the household survey, the population in the AOI has many castes due to semi urban area of Lahore. The major caste/ethnic groups are Khokhar, Gujjar, Jutt, Arian, Sheikh, Malik, Rehmani, Muslim Sheikh, Mochi, and Rana. Among all the castes mentioned, Khokhar, Jutt and Gujjar are the dominant castes of the AOI. Minority groups like Christians were also found in AOI.

During the field survey, it became apparent that the major castes were important because they have a key role in decision-making regarding the resolution of social issues of family matters. For instance, landlords as well as the head/or elder of the respective caste generally make decisions related to the social issues at local level as well as the social development works in their areas. Prior to any Project/ program to be initiated, it is essential to involve these groups right from start of the Project i.e., planning, design, implementation and operation, to make the Project successful. In the AOI, local councilors, chairman and deputy chairman are the influential persons.

4.12.2 Culture

The culture of Lahore is a manifestation of the lifestyle, festivals, literature, music, language, politics, cuisine and socio-economic conditions of its people. It is characterized by the blending of South Asian, Middle Eastern, Central Asian and Western influences. Lahore's culture is unique. It is sometimes referred as the cultural capital or the heart of Pakistan. Presently, it is the capital of the Punjab province of Pakistan. In the AOI, locals are very warm-hearted.

People had strong beliefs in reputable saints, black magic, and other superstitions (“pirfaqeers”, “jogi”, “taweez”, “manat-ka-dhaga” in local language). However, recently due to increase in literacy, people have become somewhat factual. Locals have strong belief in caste system but people are getting educated, and the boundaries / differences are getting blurred. In the AOI, old men wear Pagri (turban), dhoti/lacha, kurta (long shirt), khusa (handcrafted footwear) while women wear colourful shalwar kameez, paranda (colorful hanging worn by the Punjabi women in their hair), choli/duppata (scarf) and kola puri chappal (hand-crafted slippers with embroidery). The young generation (men and women) follow latest trends and fashion; mostly they wear different styles of shalwar kameez. Trouser and shirts are also worn by the locals but in less proportion as compared to shalwar kameez.



The extensive cuisine is both vegetarian and non-vegetarian. In rural areas along the river Ravi, locals use ghee or clarified butter and different spices extensively. Traditional food is also eaten such as, Desi Ghee Paratha (flat bread in clarified butter), Makai ki Rotti (flat bread made from corn flour), Sarson ka Saag (vegetable dish made from mustard leaves).

4.12.3 Family System

Joint family system is the dominant culture in the AOI. It was observed that the family structure in the area was very strong and members played a pivot role in solving their social and cultural problems.

Most of the families are living in joint family system, whereas only a small percentage of families are living as a single family (nuclear family system). Although the joint family system is generally undergoing a radical change, with a greater influence of media and education and people of the AOI do not feel good about this change. The major reason is that by living in a joint family system a lot of emotional attachments are enhanced and they feel that by separating in nuclear family system, their relationships will be damaged and family ties will be weakened.

As per the locals, joint family system is basically a form of organization. In this organization, there are defined norms and values to be followed strictly by all the members. All the members have their defined tasks and responsibilities to perform. There is equal share of each and every member of the family in the available resources in the form of money, food and other requirements and locals feels better in joint family system as compared to nuclear family. During the discussion with the locals, it was clarified that large family size is also treated as the strength of the family.

4.12.4 Decision-making Methods and Conflict Resolutions System

The methods for decision-making about social conflicts in the AOI are “Panchayat” (an assembly of wise and respected elders), court, “Jirga” (traditional assembly of leaders that make decisions by consensus), caste groups and others (method constituted on the spot considering major issues and scope of the conflicts).

People prefer “Panchayat” in the AOI compared to court or other legal system because this method is more effective. “Panchayat” provides timely justice while other methods are complex and require time as well as money.

The people have a tradition to help each other in the hour of need. Common conflicts arise from time to time which are solved by the community at the local level through Councillor or Deputy Mayor of the UC. Generally, in case of a conflict between two individuals, only the families or closest friends take sides of the conflicting rivals so there are rare chances that personal conflict will transform into an ethnic dispute.



4.13 INFRASTRUCTURE FACILITIES

4.13.1 Educational Facilities

The educational facilities in the AOI comprises Middle schools for boys and girls. However, to avail higher secondary level education facilities locals have to go nearby areas of Lahore city. There are number of educational institutions exist in private and public sector in nearby areas. The proposed Project is close to Lahore City where almost every type of educational facilities are available. Educational facilities in Lahore are mainly being provided by the Government of the Punjab, the city government, the private sector and voluntary organizations. To a limited extent, the high school education is also being managed by the Federal Government through the operation of few institutes located in the cantonment area.

There are number of colleges and universities dealing with all fields of Science and arts. The Educational Facilities located from Qaddafi stadium to Data Darbar include The Educators, Joan McDonald School, Punjab College, ICMAP, Central Model High School, Yaki gate school, Virtual University, M.A.O College, Punjab University, G.C. University, and University of Education etc.

During the field visit, it was noted that few institutions (private sector) provide education at matric or secondary level. Locals prefer to go to other areas of Lahore for higher education as it is a renowned place of learning in Pakistan.

4.13.2 Health Facilities

Health facilities are generally inadequate in the AOI. Bad sanitary conditions, contaminated underground water, insufficient medical facilities and meagre parental care, all contribute to the prevalence of ill health in the area. To avail health facilities, locals majorly go to Mayo hospital, Kot Khawaja Saeed hospital, Shahdara Hospital, Mian Munshi Hospital etc. Lahore.

Ample medical and health facilities are available in the Lahore Metropolitan Corporation area and its suburbs. Shaukat Khanam Hospital and Pakistan Kidney and Liver Institute and Research Center (PKLI&RC) are the latest addition in the medical care facilities in Lahore for cancer and the most dangerous disease of liver and kidney in the country. There are also other hospitals of voluntary organizations which provide health cover to the general public. Sheikh Zaid Hospital is also a very advanced addition in the medical care for Lahore. Among the prominent hospitals are General Hospital, Lady Willington Hospital, Mayo Hospital, Fatima Jinnah Hospital, The Children Hospital, Services Hospital, and Ganga Ram Hospital etc.

4.13.3 Civic Facilities

Wastewater is disposed of in the open spaces just outside the houses in the villages visited i.e., Khokhar Pind and Bhamma. However, other areas have proper drainage facility.



4.13.4 Sources of Drinking Water

Groundwater is contaminated in these villages and cannot be used for drinking purposes. Water supply is the major source of drinking water in AOI.

4.13.5 Security Situation and Movement of the Foreigners

At present, security and safety situation in Lahore is satisfactory. During the social survey, locals informed that there has been no incident of any threat to lives or goods of foreigners visiting the area and there is no animosity towards foreigners. In the AOI, there is a reasonably liberal atmosphere for women. The local culture recommends modest dress for both men and women. Due to its historical and archaeological importance, many foreigners keep visiting Bara Dari and Jahangir Tomb.

4.14 GENDER ASPECTS

Conditions of the women of the Study Area were assessed by carrying out women sample survey and consultations. The women and girls of the study area were observed busy in doing laundry, looking after the children, preparing food etc. There is a lack of employment opportunities for women. However, few women doing jobs in different professions like teaching, medical and Government and Private Sector (medicine and textile industries) were reported.

The emancipation of women is a campaign to give women equal rights and status with men. The emancipation of women (i.e., their liberation from economic and sexual oppression, their access to higher education and their escape from narrow gender roles) is not easily achieved due to the traditional setup. In this rural society, males dominate. Cultural tradition, social practices and low female literacy ratio have left women in a vulnerable position. Women are restricted to performing household work and are excluded from decision-making both on the domestic front and at the community level. Women's access to education and health care is limited because such services are not available close to home in the AOI.

Women in the AOI are also vulnerable through economic, social and psychological poverty. Economic poverty is due to lack of assets and low endowment of human capital. Social poverty derives from the inability of the society to accept women's equality and their economic, political and cultural rights, while psychological poverty is a product of the subjugation of women, under the dictates of customs and traditions, which deprives them even of control over their own lives.

In the rural set-up women are kept under-educated or uneducated. They are mainly dependent on male members of the family for economic reasons and cannot take decisions regarding their own lives. Yet for the paucity of rights, women play a vital part in the society through performing essential, albeit menial, tasks and supporting their families (e.g., preparation of fodder for animals, nurturing children, and cooking and cleaning for the family).



However, for the development of women in the area the Provincial Government has started many programs including a small loan scheme through the Punjab Rural Support Program (PRSP).



5 PUBLIC CONSULTATION

5.1 GENERAL

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 EIA has a tendency to improve project design, environmental soundness and social acceptability.

Public involvement, undertaken in a positive manner and supported by a real desire to use the information gained to improve the project design, will lead to better outcomes and lay the basis for on-going positive relationships between the stakeholders. It gives the feeling of an ownership to the local population. Public involvement is necessary for smooth implementation of the project and especially the local community whose support is also required for the success of the project.

The project management and implementation authorities are committed for undertaking public consultation at provincial and local levels as a part of project planning/design for getting necessary environmental permissions.

This Chapter presents the objectives, process, and outcome of the consultations carried out with the key stakeholders of the project during the present EIA Study. A consultation framework, describing the consultations to be carried out during the subsequent phases of the project implementation ensuring ongoing and inclusive dialogues with key stakeholder is also provided in this chapter.

5.2 OBJECTIVES

The objectives of stakeholder consultation were to contribute to the openness, transparency and dialogue. Special efforts were made to ensure that the communication with the public should be efficient and well balanced. The concerned stakeholder groups were identified to participate in the assessment process. Specific tasks and purposes of consultations with stakeholders have been given in the Table 5.1.

Table 5.1: Tasks and Purposes of Consultations

Task	Purpose of Consultation with Stakeholders
Why consultation with the stakeholders?	<ul style="list-style-type: none">• To build trust to ensure sustained support for the Waste Water Treatment Plant (WWTP) project and build resilience for times of crisis.• To learn about public concerns that need to be addressed and taken into account in designing of the project concept and preparation mitigation measures and programs.• To learn about the strengths, skills and organizations that the stakeholders can bring to support project planning and implementation.
Modes and benefits of consultation	<ul style="list-style-type: none">• Listening and dialogue with stakeholders to keep the project at tuned to public concerns early, to pre-empt breakdowns in public confidence.• Engaging the public as advocates for the project construction and to support the implementation of social, resettlement, and environment and health programs.



Other objectives of public involvement include:

- Informing the stakeholders about the proposed project;
- Providing an opportunity to those who remained unable to present their views and values, therefore allowing more sensitive consideration of mitigation measures and trade-offs;
- Providing those involved with planning the proposal with an opportunity to ensure that the benefits of the proposal are maximized and that no major impacts have been overlooked;
- Providing an opportunity for the public to influence the project design in a positive manner;
- Increasing public confidence in front of proponent, reviewers and decision makers;
- Providing better transparency and accountability in decision making;
- Reducing conflict through the early identification of contentious issues, and working through these to find acceptable solutions;
- Creating a sense of ownership of the proposal in the minds of the stakeholders; and
- Developing the project which is truly sustainable.

5.3 IDENTIFICATION OF STAKEHOLDERS

Identification of stakeholder is an important step which ensures that all the concerned stakeholders are identified for the following:

- Sharing of information with stakeholders about the proposed project activities and potential impacts of proposed project on the physical, ecological and socio-economic conditions in the AOI; and
- To address the most relevant concerns of the stakeholders on project and its activities including the upfront negative impacts.

5.3.1 Primary Stakeholders

Primary stakeholders are those who are directly concerned with the project or directly affected both positively and negatively by the project interventions. The primary stakeholders of this project include project owner, the proposed Project Affected Persons (PAPs). Apart from this, the beneficiaries of the project and the implementing agency are also primary stakeholders for the proposed project.

5.3.2 Secondary Stakeholders

Secondary stakeholders are people or groups that are indirectly affected from the project activities or have their interest in the proposed project such as Punjab-EPA, Agriculture Department, Forest Department, Wildlife Department, Fisheries Department, Revenue Department and other various line agencies / departments of GoP.

Details regarding roles and responsibilities of the concerned agencies and departments are given below Table 5.2.



Table 5.2: Role of Concerned Agencies/Departments

Project Stakeholders	Roles and Responsibilities
Punjab-EPA	<ul style="list-style-type: none"><input type="checkbox"/> Punjab-EPA is the regulatory authority which is mainly responsible for the development and implementation of the environmental policies and strategies in order to integrate the environmental issues and sustainable development approaches into the legal and regulatory frameworks as per Punjab Environmental Protection Act, 1997 (amended in 2012 & 2017).<input type="checkbox"/> EPA is responsible for the issuance of NOC of the proposed Project.<input type="checkbox"/> Punjab-EPA is responsible for the compliance of EMP and NOC provision during the construction and operation stages of the Project.
Agriculture Department	<ul style="list-style-type: none"><input type="checkbox"/> Ensuring food security<input type="checkbox"/> Enhancing productivity through better varieties and improved management practices<input type="checkbox"/> Promoting high value crops, fruits and vegetables<input type="checkbox"/> Promoting export of high value agricultural products<input type="checkbox"/> Promoting efficient use of water and other inputs<input type="checkbox"/> Improving soil health<input type="checkbox"/> Development of culture able waste lands<input type="checkbox"/> Ensuring fair returns for the growers in marketing of their produce
Forest Department	<ul style="list-style-type: none"><input type="checkbox"/> Protection, improvement and maintenance of existing forests<input type="checkbox"/> Increase forests by planting new trees<input type="checkbox"/> Extension and advisory services to the general public about tree plantation
Wildlife Department	<ul style="list-style-type: none"><input type="checkbox"/> To save and protect wildlife
Fisheries Department	<ul style="list-style-type: none"><input type="checkbox"/> Conservation of fisheries reservoirs<input type="checkbox"/> Management and development of resources on scientific lines<input type="checkbox"/> Extension services to private sector
Revenue Department	<ul style="list-style-type: none"><input type="checkbox"/> Provide land ownership data of PAPs which include but not limited to the ownership record, land categorization and price details.<input type="checkbox"/> Responsible for implementation of all relevant Sections of LAA, 1894.

Considering the importance of the project, consultations were carried out at all possible levels i.e., departmental and local level. The process of consultation is an on-going process which continues during the project life cycle and even after the submission of this report and so on. Stakeholders were identified, categorized and consulted at departments and community's level.

During the field survey, significant efforts were made to identify the possible categories of stakeholders and their stakes. Key stakeholders of the proposed Project include government departments such as Environmental Protection Agency, Agriculture Department, Local



Government Department, Government of Punjab, Forest Department, Wildlife Department, Fisheries Department, Revenue Department, Irrigation Department and local communities including PAPs.

5.4 APPROACH FOR THE CONSULTATION AND INFORMATION DISSEMINATION

A series of public consultations were required to get the feedback/concerns of the different category of stakeholders including provincial departments, district level departments, potential PAPs, local community and other general public residing in the Project Area.

Consultation process included meetings with specific proposed project PAPs, community meetings/consultations and semi-structured interviews and one to one meeting/ interviews with the 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.

Consultations were conducted at two levels:

- Institutions/Departments Level
- Community level

5.4.1 Consultations with Stakeholders at Departments Level

The stakeholder consultations were held with officials of the relevant departments. Details of department officials contacted are given in Table 5.3.

Table 5.3: List of Government Officials Consulted

Sr. No.	Department/Venue	Name/Designation	Date
1.	Punjab-EPA	Mr. Noman Younis-AD	15-09-2021
2.	Forest Department	Mr.Faizan Shah -RFO	14-09-2021
3.	Wildlife Department	Mr. Abdul Shakoor Mang-DD	14-09-2021
4.	Agriculture Department	Mr. Muhammad Anwar-AD	14-09-2021
5.	Fisheries Department	MS. Maryam Hameed-AD	14-09-2021

The Table 5.4 indicates the detail of issues raised/discussed and suggestions given during the consultation:



Table 5.4: Detail of Issues/Points Raised/Discussed during Departmental Consultations

Sr. No.	Department/ Organization	Suggestions
1.	Punjab- EPA	<ul style="list-style-type: none"><input type="checkbox"/> The proposed project is a good initiative of the client.<input type="checkbox"/> It is an environmental friendly project and will be first ASP treatment plant in the Punjab.<input type="checkbox"/> Site for WWTP should be carefully selected to avoid any inconvenience and social issues.<input type="checkbox"/> Future needs should be taken into account during design of the proposed WWTP.<input type="checkbox"/> The treatment facility should be able to cater the fluctuations in the flows. The design life of the plant should be on high.<input type="checkbox"/> The provision in the design and budget for the relocation of the existing utility infrastructures wherever required.
2.	Revenue Department	<ul style="list-style-type: none"><input type="checkbox"/> The official explained about the status notification and implementation of section 4 of land acquisition act 1894. He also explained procedure about the physical displacement of the people due to construction of the proposed project. He suggested, the alignment in the residential area should be avoided with alteration in the design to the possible extent. He also explained that the DPs will be compensated. Clearing of Project Area from encroachers would be a challenge and it could be a main obstacle in the project completion in time.
3.	Agriculture Department	<p>The official was briefed by the NESPAK Ecologist and the proposed project details were presented for better understanding of the project.</p> <ul style="list-style-type: none">• Crops details of the area were shared along with other details by the official.• The tentative compensation rates for agricultural crops were shared and discussed among the experts.• The official added that detailed assessment for the agricultural crops is required to compensate the local communities as per acceptable /market rate.
4.	Forest Department	<p>The DFO office/RO was briefed by NESPAK Ecologist regarding the Project and other specifications. In result the officer responded the following</p> <ul style="list-style-type: none">• The flora and forest of the region was discussed among the Forest officer and NESPAK team and agreed to avoid trees cutting up to maximum level and plantation will be added.• The official emphasized on minimum damages to tree and green cover as these species are playing important role in soil formation, flood protection and clean environment over all.• Detailed discussions held on nearby reserve forest.• There will be no activities/impact in and nearby the forests.• No activities will be in the reserve forest.

5.	Wildlife Department	<ul style="list-style-type: none"> • The representatives of wildlife department were briefed about the proposed activities of the project. • Minimum/no damages to the habitats were discussed • Loss of trees will be managed by tree plantation will lead to eco balance and to protect habitat of wildlife of the region as mentioned in baseline. • The official shared that project area is not falling under any protected area of wildlife department. • Required details of the faunal species of the region were also provided.
6.	Fisheries Department	<ul style="list-style-type: none"> • The official was briefed by NESPAK Sr. Ecologist regarding the proposed project. • Among the experts, detailed discussions were held to support the aquatics of the project area. • The official highly appreciated the project as it will cause positive impacts on river ecology. • During the construction phase, if any sensitivity is observed, fisheries department should be informed regarding the issue. • Contractor will follow plans to avoid waste disposal in running waters and ponds as well. • Oil spills, polluting water and Waste management should be properly planned to avoid any negative impact on aquatics.

Pictorial View of the Departmental/Community Consultations



Consultation with Assistant Director Agriculture,
Lahore



Consultation with Assistant Director Fisheries
Department



Consultation with Deputy Director Wildlife Department



Consultation with RFO- Forest Department



A view of Consultation with Ex-Chairman Khokhar Pind



Community Consultation



A view of Project Briefing



A view of Project Briefing



A view of Socioeconomic Survey



A view of Socioeconomic Survey



A view of Socioeconomic Survey



A view of socioeconomic Survey

5.5 COMMUNITY CONSULTATION AND PARTICIPATION PROCESS

For ascertaining the perceptions of different stakeholders about the project, meetings were held with communities and PAPs within the project AOI. These meetings were held to record views of the participants and they expressed views in terms of fruitful discussions. Informal group discussions were also held as an additional tool for the assessment of the perceptions of the stakeholders about the project and potential impacts both positive and adverse, likely to occur due to its implementation.

5.5.1 Methods of Public Consultation

The following methods were used for public consultations with project stakeholders in order to ascertain their stakes regarding project implementation. The views of the beneficiaries were formally recorded. PAPs were also consulted along with general public (randomly selected) who were residing or working in the AOI of the proposed project.

- Community/Public Consultations
- Individual meetings with DPs

5.5.2 Locations of the Public Consultations

The public consultations were conducted with the community members of the following villages;

- Khokhar Pind
- Bhamma
- Jhuggian



5.5.3 Categories of Stakeholders Contacted

Different categories of stakeholders contacted, during consultation is shown in the Table 5.5.

Table 5.5: Stakeholders Contacted in the Project Area

Sr. No.	Stakeholder Category
1	Proposed Project PAPs
2	Local Residents
3	Local Farmers
4	Business/ shop owners
5	Government and private Servants

5.6 CONSULTATIONS WITH LOCAL COMMUNITIES AND PROJECT DISPLACED PERSONS

Extensive consultations were conducted with the local communities and project PAPs in the Project area to record their views and incorporating in the project planning. Consultations were held with the participants of three villages in the proposed project area. The major categories participated in these meetings were local population, community groups, landowners, and particularly PAPs. The details of the participants with villages is annexed as Annexure-III.

The participants were briefed about the proposed project site with the help of design maps. During the consultations, participants were informed/briefed about the project objectives and extensive question and answer sessions were conducted to clarify the project related works and activities to resolve the environmental, social and resettlement issues. They were briefed that the purpose of the consultations and discussions is to find out the possible solutions of the issues which may be faced before and during the construction of the proposed project. The concerns and their possible solutions presented by the participants regarding proposed project were recorded to make further possible recommendations. The summary findings of the consultations is presented in an annotated form given below in Table 5.6.

Table 5.6: Summary Findings of the Consultations

Sr. No.	Concerns Raised by Participants	Mitigation Proposed by Participants	Action to be taken by Project Executors
1	Government/DC rates will be applied by the government for our affected lands which will not be acceptable.	DC rates are very low, hence, market based rates should be applied for the affected lands. Community is already very poor and relies on cultivable lands for livelihood.	Rates will be determined based on DPAC as per law.
2	Participants showed their concerns regarding demolition of their residential structures and cattle sheds falling in the AOI.	Participants were of the view that market based rates and additional financial assistance should be given to the project DPs, so they can build proper residential structures and cattle sheds.	As per given law.



3	Participants were of the view that construction/ establishment of the WWTP is not good near the residential area as houseflies, as well as other pests such as cockroaches, can also pose a health hazard for those living near wastewater treatment facilities.	It was briefed to the participants that wastewater treatment plant cleans the water so it can be safely returned to the environment. It reduces organic material and pollutants by the controlled action from wastewater. However, participants were of the view that government should take every protective measure to combat these issues for betterment of the local people.	Provision of Design will fix the issue .
4	Septic systems of WWTP can easily become a source of nutrient pollution if not properly maintained. It can contaminate the underground water.	Participants were of the view that government should take every protective measure to avoid such issues.	Design provision will cover this issue.
5	Due to land acquisition, livelihood of the local farmers will be disturbed as farming community depends on livestock rearing and produce fodder from proposed affected land.	Proper market based compensation should be given for the affected land and standing crops. Moreover, an ample time should be given to harvest the standing crops before the execution of the project.	Will be treated as per law.
6	Human displacement may occur due to demolition of residential structures and loss of livelihood.	Fair and market based compensation for the lost assets can reduce the risk of human displacement. Due to fair market rates, PAPs will become able to settle themselves.	Will be treated as per given laws.
7	Graveyard, if any	It will not be disturbed	Arrangements will be made to avoid.
8	Irrigation structures and fixtures will be affected. It will be difficult to irrigate the cultivable lands due to impact on tube wells.	Fair and market based compensation should be given before acquisition/demolition of such structures so they can keep continue to irrigate their remaining cultivable lands.	Will be treated under given laws.
9	During the construction period, mobility of the local community will be disturbed.	Alternate route should be provided to the local communities for convenience in mobility.	Alternate route will be provided before the commencement of the civil work on the proposed project under Traffic Management Plan.



10	Disturbance of the social amenities.	Participants were of the view that due to construction of the proposed Project, several social amenities will be disturbed. These social amenities should be restored before commencement of the construction work to avoid any inconvenience for the local community.	Social amenities should be restored before execution of the civil work according to the plan.
11	Due to construction activities as well as influx of labor, movement of the citizens particularly of females, residing in the local area will be restricted.	In order to tackle this situation, construction should be carried out in scheduled hours. So that local community, particularly females can easily move in the area.	People should be aware about complete construction activity plans so that they can move in the area freely and safely. Social Framework Agreement can be drafted.
12	Dust and noise will disturb the nearby residential and commercial structures.	All protective measures should be taken to keep safe the local community from noise and dust.	Contractor will follow approved plan in this regard.
13	Job and labor opportunities for local people.	Skilled and unskilled work force should be hired from local community. It will enhance the acceptability of the proposed project among local people.	Contractor will give priority to hire the skilled if any, and unskilled work force from the local community.

5.7 PROPOSED CONSULTATIONS PROGRAM AND STAKEHOLDER WORKSHOP

The stakeholder consultation and engagement is an ongoing process and will continue throughout the project's construction as well as operation and maintenance phases. The ongoing consultation process could be scheduled on need basis with the stakeholders including but not limited to the concerned government departments, local administration, community representatives and PAPs from the proposed project area.

The overarching goal of consultations and community engagement is to support and facilitate the project's design and implementation, to reduce conflicts and project opposition, and to increase project's acceptability.

The community members will be compensated by the GoP and they will be encouraged to participate in project activities during construction and operation phases. The consultations will be made in future to facilitate the community at the local level.



Further consultations to be undertaken as part of the project EIA process include the project public hearing. The Punjab-EPA will require that public hearings to assess public opinion on the environmental impacts of the proposed project. The Punjab-EPA will advertise the public hearings in a newspaper. The legal requirement is advertisement in at least one English or Urdu national newspaper, but in practice, advertisements are usually placed in two national newspapers and also in local newspapers. The public hearings will be held at least 30 days after the public notice. Concerns raised during the public hearing will be addressed in the EIA report before approval.

The consultations will be carried out during the construction and operation phases of the project. Consultations will be undertaken in all the communities twice or more time in a year, depending on the number of concerns raised under each consultation. Ongoing stakeholders' engagement activities include:

- Ongoing reporting on progress on the implementation of environmental and social management measures identified during the EIA process and recording of comments on the effectiveness of these measures;
- Updating communities and other stakeholders about project developments and recording comments on these; and
- Ongoing action of the grievance mechanism.

The framework for the future consultations is elaborated in Table 5.7, but not limited to the following:

Table 5.7: Proposed Consultations Framework

Sr. No.	Stakeholders	Project Phase	Frequency of Consultation
1	Institutions/Departments	<ul style="list-style-type: none">• Pre-Implementation• During the Project• Implementation• At Closure period	<ul style="list-style-type: none">• One round of consultation before start of implementation of project.• Bi-annually during operation phase• Once before the closure of the project.
2	Local Communities/ Key Persons	<ul style="list-style-type: none">• Pre-Implementation• During the Project• Implementation• At Closure period	<input type="checkbox"/> Consultation at different stages, before implementation, periodic meetings during construction phase and at the time of project completion.
3	NGOs/CBOs	<ul style="list-style-type: none">• Pre-Implementation• During project• Implementation• At Closure period	<input type="checkbox"/> Periodic meetings will be conducted as per requirement of the Project.

During the operational phase of the project, consultation of stakeholders is important to assess the benefits of the project and impacts on the local communities. A comprehensive stakeholder consultation plan should be prepared by the contractor(s) to get feedback from the stakeholders and to resolve the issues during the operational phase of the project.



5.8 INFORMATION DISCLOSURE PLAN

After suggesting the possible solutions of the stakeholders' concerns, the solutions will be disclosed once again before the stakeholders and general public in the form of workshop. EIA report will be accessible to interested parties on request and the version of final report will be available in the project office and RUDA website and its summary will also be available in national language.



6 ANTICIPATED ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

6.1 GENERAL

This chapter identifies the beneficial as well as the potentially significant adverse environmental and social impacts during design/pre-construction, construction and operation phases of the proposed Project on the physical, ecological and socio-economic domains of the environment. The appropriate mitigation and remedial measures are proposed in this chapter. A project impact evaluation matrix has been developed to evaluate the potential impacts of the proposed Project. A brief qualitative description of each aspect and the affected environment in Study Area / AOI is presented below.

6.2 NOTION OF SIGNIFICANCE

The term “*Environmental Impact*” or simply “*Impact*” covers the negative, adverse or harmful as well as positive, desirable or beneficial impacts of the project on environmental settings. Prediction of impacts of the proposed activity is based on factual data; however, the significance of these impacts involves a value judgment technique. The nature of the impacts may be categorised in terms of:

Direction	-	Positive or Negative
Duration	-	Long or Short Term
Effect	-	Direct or Indirect
Extent	-	Wide or Local

Impact significance depends on both the nature of the impact and on the sensitivity of the receptor. The more sensitive the receptor the greater will be the significance of impact from that proposed activity. For this EIA, activities and nature of impact are combined with the sensitivity of the receptor to evaluate the significance of the impact. The significance of impact is characterized as very low, low, moderate, high and very high. Environmental issues having “moderate”, “high” and “very high” significance is provided with mitigation measures.

Following the assessment of magnitude, the quality and sensitivity of the receiving environment or potential receptor has been determined and the significance of each potential impact established using the impact significance criteria matrix as shown below. Most of the potential impacts can be mitigated by implementation of various types of mitigation measures; however, some residual environmental impacts may remain after mitigation.



Magnitude of Impact	Sensitivity of Receptors			
	High (4)	Medium (3)	Low (2)	Negligible (1)
Major (4)	16	12	8	4
Moderate (3)	12	9	6	3
Minor (2)	8	6	4	2
Negligible (1)	4	3	2	

Score	Impact Significance
1	Negligible
2	– 4 Low
5 – 8	Medium
9 – 12	High
> 12	Very High

6.3 METHODOLOGY FOR IMPACT EVALUATION

The methodology adopted for the evaluation of the impacts included the following assessment tools, (i) project impact evaluation matrix and (ii) overlays. These tools were used to identify the significance and magnitude of the impact as well as the nature, reversibility, extent, etc.

6.3.1 Project Impact Evaluation Matrix

The Impact Evaluation Matrix was developed by placing project activities along one axis (i.e. Y-axis), and on the other axis (i.e. X-axis) the different environmental parameters likely to be affected by the proposed Project actions grouped into categories i.e. physical, ecological and socio-economic environment. For the impact assessment, project impact evaluation matrix was used by dividing the project action into different phases (design/pre-construction, construction and operational phases). A Project Impact Evaluation Matrix is given as Table 6.1.

6.3.2 Overlays

In order to identify spatial based impacts, overlays were used. An overlay is based on a set of transparent maps, each of which represents the spatial distribution of an environmental characteristic (for example, land acquisition). Information for an array of variables such as land use, infrastructure, vegetation etc. was collected for the standard geographical units within the project's AOI, recorded on a series of maps, typically one for each variable. These maps were overlaid to produce a composite map. The resulting composite maps characterize the Project area's land use, physical, social, ecological and other relevant parameters related to proposed intervention. The overlays maps used in this EIA for the quantification of the landuse categories is given in Chapter 4: Description of Environment.

Table 6.1: Project Impact Evaluation Matrix

Environmental Component ↗ ↘ Project Component	Physical Environment							Ecological Environment					Socio Economic Environment														
	Soil (Erosion / Stability / Contamination)	Air Quality	Noise Level	Surface & Ground Water Quality	Solid Waste Generation	Emission of GHGs	Odour	Aquatic Ecosystem	Terrestrial Ecosystem	Endangered Species	Beneficial Plants	Loss of Trees	Loss of Crops/Orchards	Conflict over Resources	Public Infrastructure	Accessibility	Housing Infrastructure	Cultural Properties (Mosque, Shrine, Graveyard)	Community Stability	Gender Issues	Cultural & Social Issues	Health & Safety	Aesthetic	Security Situation	Living Standards	Employment Opportunities	
A. Planning & Design Phase																											
Topographic Survey of Project	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Geotechnical Investigation	0	0	2	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0
Land Acquisition	0	0	0	0	0	0	0	0	0	0	4	8	4	12	12	2	2	0	7	0	0	0	0	0	0	0	0
B. Construction Phase																											
Site Clearance	9	9	9	2	8	2	0	0	12	0	9	12	0	6	12	3	0	0	0	0	2	9	4	2	0	6	
Earthwork in Filling and Excavation	9	9	9	2	8	2	0	0	12	0	9	8	0	6	2	3	0	0	2	0	2	9	4	2	0	6	
Establishment of Construction Camps & Workshop	2	2	4	0	0	0	0	0	4	0	0	0	0	8	0	0	0	0	4	4	4	8	4	0	0	6	
Transportation & Storage of Construction Materials	4	6	6	2	4	2	0	0	2	0	0	0	0	0	0	0	0	4	0	4	6	4	0	0	4		
Use of Construction Material and Heavy Machinery	3	8	9	0	4	0	0	0	4	0	0	0	0	0	2	2	0	0	0	2	8	0	4	0	4		
Installation and operation of Batching and Asphalt Plants	4	8	8	2	4	2	0	0	2	0	0	0	0	2	0	0	0	0	0	0	6	4	0	4	4		
Spoil Disposal	3	3	0	2	6	0	0	0	6	0	0	4	0	0	0	0	0	0	2	0	4	4	6	0	0	2	
Structural & Civil Work	8	8	8	2	7	2	0	0	6	0	0	0	0	2	2	0	0	0	2	4	4	9	4	3	0	8	
Drainage Work	6	6	6	2	6	2	0	0	6	0	0	0	0	2	2	0	0	0	2	4	4	9	4	4	0	8	
Finishing and Commissioning of WWTP	0	2	4	0	4	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	4	
C. Operational Phase																											
Operation of WWTP	4	2	2	4	9	4	4	0	4	0	0	6	0	0	0	0	0	4	0	2	6	4	3	0	6		
Screening of Influent	6	2	4	2	0	0	9	0	0	0	0	0	0	0	0	0	0	0	0	2	6	4	0	0	0		
Biological Treatment of Wastewater	0	0	0	0	6	6	9	0	0	0	0	0	0	0	0	0	0	0	0	2	6	4	0	0	0		
Sedimentation	0	0	0	2	6	6	9	0	0	0	0	0	0	0	0	0	0	0	0	2	6	4	0	0	0		
Sludge Handling	0	0	0	0	6	0	9	0	0	0	0	0	0	0	0	0	0	0	0	2	6	4	0	0	0		
Inspection & Monitoring	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	6	4	0	0	0		
Maintenance and Miscellaneous Work	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	6	4	0	0	0		

Positive Impact Score	Impact Significance
0	Negligible
2 to 4	Low
5 to 8	Medium
9 to 12	High
> 12	Very High



6.4 DELINEATION OF STUDY AREA / AOI

For an EIA Study, a clear delineation of the Study Area / AOI is required. Study Area / AOI is the area within which the potentially significant impacts of the proposed Project activities (direct or indirect) are envisaged. In this report, the Study Area / AOI of the proposed project is considered as 50m from project boundary where the impacts on the environment due to the proposed Project activities are assessed. Based on the available Google Earth Imagery and ARC GIS software, Project footprints were overlaid on the existing Project Area Imagery. Utilizing the information collected through the detailed site visit, consultations with the locals and concerned departments and foreseen impacts of the proposed Project, a tentative AOI was delineated. Map of the Study Area / AOI is shown as Figure 4.1.

6.5 POTENTIAL ENVIRONMENTAL IMPACTS AND MINTIGATION MEASURES

There are some potential significant adverse environmental impacts on the local environment. The proposed Project is divided into three (03) phases i.e., Pre-construction / Planning and Design Phase, Construction Phase and Operation and Maintenance (O&M) Phase. The Pre-Construction Phase includes all stages before the Construction Phase (i.e., site investigation work i.e. topographical, seismic studies etc.); Construction Phase includes all stages from mobilization of Contractor to the completion of Project; and Operation Phase starts after the Construction Phase which includes the inspection and repair works.

Adverse impacts envisaged at these three (03) phases of the proposed Project along with their proposed remedial or mitigation measures are detailed below:

6.5.1 Potential Environmental Impacts during Pre-Construction / Design Phase

Following is the brief description of impacts envisaged and the recommended mitigation measures during Pre-construction / Design phase.

6.5.1.1 Land Acquisition and Resettlement

The land required for the construction of the proposed WWTP is about 280 Acres, out of which 201 Acres land is in process, whereas, 79 Acres additional land is also required for the proposed project. Private land acquisition is involved in the construction of proposed project, which is mostly agricultural/barren land with sparsely population. This impact will be permanent.

Mitigation Measures

Mitigation measures will involve careful site selection by the design team to minimize the impacts by avoiding the residences of affected families. The Land Acquisition Act (LAA) of 1894 is the main law regulating land acquisition for public purpose. This impact can be mitigated by ensuring compliance of Land Acquisition Act, 1894, addressing community grievances on priority basis and timely compensation to affectees.



The process of land acquisition and compensation should be followed in a transparent manner to minimize the impacts to provide judicious compensation to the affected persons by providing sufficient budget in the project cost. According to Land Acquisition Act 1894, the following points need to be considered while determining compensation for the project affectees:

- The damage sustained by the person interested, by reason of the taking of any standing crops, or trees which may be on the land at the time of the collector's taking possession thereof;
- The damage if any sustained by the person interested at the time of the collector's taking possession of the land by reason of acquisition injuriously affecting his other property, moveable, or immovable, in any other manner, or his earning; and
- As a consequence of the acquisition of the land by the collector, the person affected is compelled to change his residence or place of business, the reasonable expenses incidental to such change.

Therefore, compensation should be made to the affected people as per Land Acquisition Act, 1894 and for the loss of assets as per law. Adequate budget will be provided in the Project cost for this compensation.

6.5.1.2 Impact on Structures

I. Impact on Residential Structures

In the AOI (RoW) housing structures of different categories will be affected fully due to Project intervention. In addition to these structures, boundary walls and other related structures are also under the impact. These households are losing their residences permanently and will have to relocate and move their dwellings elsewhere.

II. Impact on Commercial Structures

Different types of commercial structures, will be impacted due to clearance of AOI for the Project activities. Respective structures include, cattle sheds and other structures where miscellaneous commercial activities are being carried out.

III. Impact on Community and Religious Structures

The community and religious structures are very sensitive to impact and need special care during execution of the Project; because people think that these structures might not be rebuilt if once demolished. A Graveyards fall in the AOI of the proposed Project. It will be protected by using measures.

Due to impact on the residential structures, human disturbance will occur which create social, gender, livelihood and cultural issues. This impact can be categorized as negative, local, high, permanent and irreversible.



Mitigation Measures

The Land Acquisition Act (LAA) of 1894 is the law regulating land acquisition for public purpose. This impact can be mitigated by ensuring compliance of Land Acquisition Act, 1894, addressing community grievances on priority basis and timely compensation to affectees.

The process of land acquisition and compensation should be followed in a transparent manner to minimize the impacts to provide judicious compensation to the displaced by providing sufficient budget in the Project cost. Religious structures will be protected and managed.

6.5.1.3 Environmentally Responsive Design Considerations

Designing of the project components without considering the prospective and futuristic needs can result in structures with low social acceptability and functionality. Improper designed conveyance system and treatment facility may lead to failure and financial loss. The alignment of wastewater lines and pumping station must be properly planned; else it may lead to both technical and social problems along with environmental issues of back flow creating foul smell and unhygienic conditions.

Adequate planning for treated wastewater and sludge disposal is required to ensure an environmentally benign treatment process. This impact is permanent and moderate negative in nature.

Mitigation Measures

- The proposed WWTP should be designed keeping in view the future population and projected flows based on current projections. The treatment facility should be able to cater the fluctuations in the flows. The design life of the plant should be on higher side since it incurs great capital investment.
- All structural, layout and engineering designing should be in strict accordance with the applicable by-laws and engineering parameters;



- Adequate planning for treated effluent disposal and sludge disposal should be done to ensure an environmentally benign treatment process;
- Develop an Emergency Response System for the wastewater system leaks, burst and overflows, etc.; and
- Proper storm water drainage system should be designed for the proposed WWTP according to the national/international engineering guidelines.

6.5.1.4 Topography

The topography of the project area is flat. There will be slight change in topography due to excavation and tree cutting. Visual changes to the topography will be of permanent but minor negative in nature.

Mitigation Measures

- The project design would consider aesthetic concerns such as the tree plantation which is already recommended in the EIA Report;
- Best engineering design measures should be adopted keeping in view the aesthetics of the project area; and
- Ground disturbances should be limited to only the areas necessary for project related construction activities.

6.5.1.5 Landuse/ Land value

There will be change of landuse due to construction of proposed WWTP. Currently, the predominant landuse in the project area is agriculture. Some katcha houses, small wastewater ponds and trees also exist in the project area. The project site will be converted into wastewater treatment site.

Mitigation Measures

WWTP site should be surrounded by thick tree plantation to minimize the impact and improve the aesthetics. Therefore, a tree plantation plan should be composed in coordination with the Forest Department with allocation of adequate budget.

6.5.1.6 Storm Water Drainage / Urban Flooding

The construction of proposed Project may be subjected to urban flooding especially during monsoon season, but chances are negligible. Inadequate drainage design or natural cloud burst may lead to ponding on impervious surfaces such as roofs of building, tanks and roads and consequently may cause damage to the infrastructure and surface runoff may cause the over flow/flooding. This impact will be medium negative and short term.

Mitigation Measures



Mitigation measures will include provision of proper drainage structures with appropriate design capacity to avoid flooding especially during the rains. Proper slopes shall be incorporated in design to avoid the stagnant water. Provision of parallel ponds may be considered in design to be used for controlling over flow, storm water management and maintenance.

6.5.1.7 Surface water Quality

The main surface water body identified in the project area is River Ravi. The quantity of water in River Ravi near Lahore has been greatly reduced due to the construction of Thein Dam in India. River Ravi receives huge amount of untreated wastewater from the City of Lahore and other industrial discharges from different sources especially; Cantonment Drain, AIT Drain, and Hudyara Drain, a natural drain which carries pollution loads from both Pakistan and India. These wastewater discharges, along with reduction in available water naturally in River Ravi for dilution, has greatly deteriorated the quality of river water. The proposed project will reduce the direct discharge of untreated waste water from project area, consequently help in improving the river water quality. The impact is major positive and permanent in nature. However, following contingencies may be expected during construction and operation phases of the project:

- Surface runoff in case of over flow/flooding;
- Direct discharge of untreated wastewater during maintenance of ponds; and
- Improper design of the outlet may result in decreased efficiency of WWTP leading to contamination of receiving water body.

Mitigation Measures

- The proposed WWTP capacity shall be designed to cater accidental increase in inflow of wastewater;
- Proper gated arrangements in the design are required to be provided at exit side of the treated effluent water before its discharge in the river to avoid entry of flood water in case of any flood;
- Provision of parallel ponds may be considered in design to be used for controlling over flow, storm water management and maintenance/ sludge removal; and
- The design may also consider option of trapping channel outlets e.g., using a submerged exit pipe baffle to prevent syphoning and transfer of surface crusts to subsequent ponds.

6.5.1.8 Flooding Patterns

Since the proposed site for WWTP is located in the flood plain area of River Ravi along the existing flood protection bund. Therefore, it is essential to provide flood protection bund to protect the treatment plant. However, any occasional obstruction in the floodplain increases the potential for flooding of adjacent and downstream area and interferes with natural hydrological processes. The construction in the flood plain may alter the volume of water it may hold, thus altering the extent of the area under flood. This will be a major negative and permanent impact.



Mitigation Measures

- The natural drainage on the site had to be modified in the design in order to minimize flooding and protect the treatment units;
- Flood protection dykes have been proposed around WWTP boundary owing to the fact that the WWTP site lies within the flood plain of river Ravi; and
- A spur exists on the upstream of the proposed project area, whereas the Motorway (M-2) runs along its eastern side. These existing structures also secure the proposed project area against detrimental effects of flood discharges.

6.5.1.9 Seismic Hazard

As per Building Code of Pakistan, Seismic Provisions, 2007, the project area is located in Seismic Zone 2A (low to moderate hazard), where 2A represents peak horizontal ground acceleration from 0.08g to 0.16g. In this Zone, designing of various types of structures should be done on the basis of PGA. A high intensity earthquake impacting the project site can adversely impact the development. This factor requires special consideration of the designers keeping in view of the recent earthquake of October 08, 2005. This will be a local and high adverse impact.

Mitigation Measures

- The proposed structures should be designed and constructed to withstand high intensity earthquakes. For seismic hazard analysis, updated structural, geotechnical and seismic studies should be conducted; and
- To mitigate the seismic hazard, Seismic Building Code of Pakistan 2007 (SBC-07) should be adopted. This code specifies minimum requirements for seismic safety of buildings and has to be applied and used by engineers in conjunction with the necessary understanding of the concepts of structural, geotechnical and earthquake engineering.

6.5.1.10 Emergency Management

Emergency management in case of natural and man-made disaster is a major concern. Increased incidents of disasters especially act of terror, fire, earthquakes etc. demand proper planning. The impact is considered to be negative, local, high, long-term and probable.

a Electrical Hazards

The workers of the proposed buildings in the WWTP may be exposed to electrical hazards including shocks, fires and burns caused by faulty electrical wiring, unsafe installations, frayed cords, substandard power trips, and defective equipment.

Mitigation Measures



- Appropriately grounded and double insulation of every single piece of equipment, machine, and device should be kept in the design;
- Proper installation check and periodic maintenance by a competent electrician should be planned; and
- All power strips should be planned in the design to place in well-ventilated areas for adequate heat dispersion.

b Fire Fighting System

Inefficient firefighting system and insufficient storage of fire water may pose a severe threat to human life and to the proposed Project.

Mitigation Measures

Following mitigation measures may be incorporated by the design team regarding safety of fire outbreaks in buildings.

- Separate water storage tank should be designed for firefighting;
- Fire Hose Cabinets connected to pressurized water line at different locations of the building may also be considered in the design;
- System should be pressurized by means of an automatic booster system consisting of two duty pumps and jockey pump;
- A separate fire alarm system should be designed for the Project building; and
- Assigning of special number to be dialed to inform about the fire to emergency response team.

c Lightning

Lightning is a constant hazard for buildings and equipment. One lightning strike can damage the buildings and may cause failures to the electronic devices inside the building and sometimes it may even result in fire leading to human and financial loss.

Mitigation Measures

- Design of an efficient Lightning Protection System (LPS) should be ensured to minimize the damage to the building(s) by creating a path (divert) for the lightning discharge to the ground.

6.5.1.11 Construction Camps

Improper location of construction camp(s) and mismanagement of construction camp activities can lead to various social and environmental impacts which include loss of vegetation due to setting up construction camps, indiscriminate generation of solid waste, and discharge of sanitary effluent, water pollution and health & safety issues in the surrounding settlements (Bhamma, Jhuggian, Khokhar Pind, etc.). Furthermore, behavior of construction workers, potential disregard for local cultural norms can lead to increase tension between local communities and workers residing in the construction camps. If the sites are left unclear after



completion of construction phase; it may cause disturbance for the proponent and local community. This impact is negative, local, low, short term and definite.

Mitigation Measures

- Construction camps should be designed to be self-contained to reduce demand on infrastructure and services of nearby communities and to minimize the removal of existing macro-plants; and
- Formulation of a comprehensive safety and security plan for the camps which should be comprised of a training manual, use of safety equipment, emergency preparedness and code of ethics.
- Site Specific Camp Management Plan with layout will be prepared along with sewerage system.

6.5.1.12 Flora

During the pre-construction phase, activities such as installation of construction camps, construction of temporary facilities & mobility of construction staff may damage the local vegetation/trees. As the heavy machinery and camps will be moved and installed, which require significant space due to which available vegetation is expected to be removed. This impact is site-specific, permanent, irreversible, possible, medium significant and needs to be encountered prior to the start of construction stage.

Mitigation Measures

- The camps, mobility of machinery and construction of temporary facilities should be properly planned and well designed to avoid any loss to local green cover;
- It is recommended to establish the construction camps where minimum or no vegetation exists.
- Similarly, the alternate routes for roads and points for camps are recommended where no loss of vegetation is expected; and
- The location of construction camp should be selected so, as to have limited environmental impact during construction phase and to reduce the cost and land requirement. It will be well away from the settlements i.e., 500 meter.

6.5.1.13 Fauna

As movement and installations of machinery and vehicles will take place, so noise and habitat loss is expected. The routes of the available wildlife and other habitats may be affected due to camps set-up and machinery movements and installations. Temporary road may also affect the habitat of locally available fauna. This impact is site-specific, temporary, irreversible and low significant.

Mitigation Measures



- The standard measures must be adopted to minimize noise due to machinery movements and installations;
- Wildlife movements and routes must be considered during activities and should be avoided to their maximum level;
- The alternate routes and points are recommended to avoid any damage to locally available fauna;
- The camps shall be properly fenced and gated to check the entry of animals in search of eatable goods; and
- Similarly, wastes of the camps shall be properly disposed of to prevent it being eaten by animals, as it may be hazardous to them. Waste Management plan will be established.

6.5.1.14 Renting/Leasing Land

The Contractors will require renting/leasing land for:

- The development of Contractor camps and facilities i.e., storage, workshops, equipment parking and washing areas;
- Aggregate quarries; and
- Access roads/tracks for haulage, transportation etc.

The approximate area required for the establishment of one Contractor's camp facilities will be 1500m² at the different locations. Land utilization for Project activities and subsequent operation of Project may induce temporary changes in the existing land use pattern. This impact can be categorized as direct, low, site-specific, short term, temporary, medium probability and reversible.

Mitigation Measures

It is the foremost option to establish the Contractor camps at the acquired land to eliminate the issues of land leased etc. However, if this option is not feasible then the land for above mentioned facilities should be selected and leased prior to the start of construction phase. Rental terms should be negotiated to the satisfaction of the concerned landowners and the agreement should be in local language to make the process clear.

In addition, these Project facilities should be located at a minimum distance of 500 m from the existing settlements, built-up areas, archaeological and cultural monuments as the case may be. Prior to the commencement of the construction activities, the Contractor should submit a construction camp development/management plan to the Engineer-in-charge for its scrutiny and approval. As far as possible, waste/barren land i.e., areas not under agricultural or residential use and natural areas located at high elevation should be used for setting up the contractor camps.



6.5.1.15 Loss of Agriculture Land

Due to the proposed Project, almost 280 acres of land will be affected. A major proportion of the affected land is comprised of residential and agriculture land, where vegetables and fodders are cultivated which will be disturbed. This impact is permanent and negative in nature.

Mitigation Measures

- Due consideration should be given to minimum land acquisition in design phase in and around the agricultural land by careful site selection for the construction of the proposed project; and

6.5.1.16 Public Utilities

Due to the proposed Project, public utilities will be affected creating disruption of public services and inconvenience to the local residents. Various utilities such as electrical poles and tube-wells situated within the AOI of the proposed Project will be disturbed. These utilities if not handled properly will cause difficulties to the people of Project Area. This impact can be categorized as direct, low, site-specific, short term, temporary, low to medium probability and reversible.

Mitigation Measures

Mitigation measures will include:

- Proper compensation and restoration mechanism of public utilities will be prepared;
- The provision in the design and budget for the relocation of the existing utility infrastructures wherever required shall be finalized in consultation with the concerned department;
- All public utilities likely to be affected by the proposed Project will be relocated well ahead of time before the actual commencement of the construction work.
- Strengthening of utilities, wherever required;
- Close coordination with the concerned departments to curtail inconvenience to the residents of the Project Area;
- Timely public notification of unexpected disruption of services; and
- The Contractor shall in no instance excavate around or over live buried electrical cable or pressurized gas lines during the construction, or allow such to be suspended across open excavations in a manner that, in the opinion of the Resident Engineer, threatens public or worker safety. Neither shall water lines be left suspended and unsupported across open excavations.

6.5.1.17 Physical, Religious and Cultural Resources

According to the field survey, only a graveyard is coming under AOI of the proposed project.



Mitigation Measures

Due consideration shall be given to minimize the impacts on graveyard. The graveyard will be protected.

6.5.2 Potential Environmental Impacts during Construction Phase

Following is the brief description of impacts envisaged and the recommended mitigation measures during construction phase.

6.5.2.1 Soil Erosion and Contamination

Impact on topsoil and soil stability is mainly expected during the preparatory and construction works, which will be caused by the arrangement of the construction camp, construction site, replacement of the equipment, earthworks, arrangement of temporary and permanent infrastructures, etc.

The soil would be exposed to erosion due to removal of vegetation, establishing construction camps / workshops and excavation etc. The most significant aspects in the construction phase of the proposed treatment plant concerning the soil impact are excavation works, road construction and tank construction works. These will temporarily expose soils in the affected project area leaving them vulnerable to erosion by surface run-off and wind. The monsoon season will require construction SOPs.

On the other hand, the construction of the wastewater treatment plant will involve building large embankment structures on land, which will result in a loss of the option for alternative land use and thus represents an irreversible commitment of land resources.

Besides, there is high possibility for soil pollution with substances due to leakages of fuels and oils from the heavy vehicles and machinery used for construction and due to applied chemicals during this phase.

Mitigation Measures

- In order to prevent the damage and contamination of soil at the project site, surface layer of the soil should be removed and stored temporarily in pre-selected locations. The soil should be stockpiled separately. Stockpiles should be protected from wind and atmospheric precipitation and should be at least 50 meters away from surface water body;
- Stored excavated material shall be covered and preferably reused, e.g., in construction of dykes etc.;
- Sprinkling of water may help in reducing the erosion soil;
- Use of heavy machinery should be restricted as far as possible to work sites only to avoid the destruction of soil structure;
- Vehicles and equipment should be checked regularly. In case of damage and fuel / oil leakage, it should be repaired immediately. Damaged Vehicles should not be allowed on the construction sites;



- In case of spillage of pollutants, spilled material should be localized and contaminated site should be immediately cleaned; Staff should be provided with appropriate means (adsorbents, shovels, etc.) and with personal protective equipment as well;
- All spoils should be disposed of at site designated by LWMC/Authority and the site should be restored back to its original conditions;
- Non-bituminous wastes from construction activities will be dumped in approved sites, in line with the guidelines for dump sites, and shall be covered;
- Washing yards shall be paved to avoid seepage of runoff from the yard;
- After completion of construction works, all kind of waste (including hazardous waste) will be collected and removed from the area. Hazardous waste should be removed for further management by the licensed contractor; and
- Perennial grasses and shrubs trees should be planted to control the runoff on the site.

6.5.2.2 Water Quality

The potential sources of water pollution associated with the construction of proposed project are runoff from the construction works area that may contain increased loads of sediments, suspended solids and other contaminants. Potential sources of pollution from the site include:

- Runoff and erosion from exposed soil surfaces, earth work areas and stockpiles e.g. grouting and cement material with the rain;
- Wash water from dust suppression sprays;
- Fuel and lubricants from maintenance of construction vehicles and mechanical equipment;
- Spillage of liquids stored on-site such as oil, diesel, and solvents etc. are likely to result in water pollution; and
- Uncontrolled discharge of debris and rubbish such as packaging, construction material and refuse.

The River Ravi may get further contaminated due to the aforementioned activities. Groundwater may also get contaminated from the wastewater generation from the construction camps, leachate from improper dumping of solid waste. The impact is medium adverse in nature.

Mitigation Measures

As a mandatory step, all the effluents will be disposed as per the requirements of PEQS. Moreover, to reduce the risk of surface and groundwater contamination, good management practices will be adopted to ensure that fuels, chemicals, raw sewage and wastewater effluent are disposed of in a controlled manner. These measures are described below:

- Construction camp will be established in area with adequate natural drainage channels in order to facilitate the flow of the treated effluents after ensuring that PEQS are met;



- The proponent will ensure that the construction work is confined within the project boundary and water bodies are prevented from pollution during construction;
- The solid waste will be disposed of in designated landfill sites to sustain the water quality for domestic requirements;
- Regular water quality monitoring according to determined sampling schedule;
- Water required for construction shall be obtained in such a way that the water availability and supply to nearby communities remain unaffected;
- The contractor will ensure that construction debris do not find their way into the drainage which may get clogged;
- To maintain the surface water flow/drainage, proper mitigation measures will be taken for the proposed project, like drainage structures;
- Wastes will be collected, stored and taken to approved disposal site;
- Wastewater effluent from the Contractors' workshops and equipment washing-yards will be passed through gravel/sand beds to remove oil/grease contaminants before discharging into the natural streams. According to the PEQS, the BOD concentration in sewage must be brought down to less or equal to 80 mg/l before being discharged into a natural stream having capacity to dilute the effluent. For wastewater, apart from BOD, COD of 150 mg/l will also be checked; and
- Similarly, if the sewage after treatment is to be discharged into the land it will meet the requirements of the PEQS for disposal of wastewater.

6.5.2.3 Deterioration of Ambient Air Quality

Air quality will be affected by fugitive dust emissions from construction machinery; dust from the unpaved surface and construction vehicles. Emissions may be carried over longer distances depending upon the wind speed, direction, temperature of surrounding air and atmospheric stability. Besides, multifarious construction activities and increased vehicular traffic (construction vehicles) would also contribute to the localized airborne dust. The larger sized particles, under influence of gravity, tend to settle down in the immediate vicinity of the source. The Suspended Particulate Matter (SPM) tends to remain suspended in the environment for much longer and persistent time and is an environmental hazard. The objectionable impacts of settling of the suspended dust would be its dry deposition on vegetation, motor vehicles, structures, and other exposed surfaces. Exhausts from fossil fuel burning in the construction machinery will also deteriorate local air quality. Similarly, exhausts from generators can also have impacts on air quality in the vicinity.

The overall impact on the quality of air during the construction phase will be monitored, however, it will be temporary and limited to the project's implementation phase only.

Mitigation Measures

The construction phase impacts of the proposed Project could be effectively mitigated by the implementation of simple procedures by the Contractor including but not limited to the following:



- All vehicles, machinery, equipment and generators used during construction activities should be kept in good working condition and be properly tuned and maintained in order to minimize the exhaust emissions;
- Open burning of solid waste from the Contractor's camps and at construction site should be strictly banned;
- Preventive measures against dust should be adopted for on-site mixing and unloading operations;
- Construction materials (sand, gravel, and rocks) and spoil materials will be transported through trucks covered with tarpaulins and all vehicles (e.g., trucks, equipment, and other vehicles that support construction works) will comply with the PEQS for carbon emissions and noise;
- Regular water sprinkling of the site should be carried out to suppress excessive dust emission(s);
- Emissions from power generators and construction machinery are important point sources at the construction sites. Proper maintenance and repair is needed to minimize the hazardous emissions;
- Emissions from batching / asphalt plants can be controlled efficiently by the installation of cyclone / scrubbers. Diesel operated equipment should be equipped with well-maintained fuel filter and may be replaced timely (if required). In addition to that, regular maintenance activities comprising changing of lubricating oil, changing the air and fuel filter, cleaning the fuel system, draining the water separators and proper tuning may also help in reducing the emissions from diesel generators;
- Construction equipment is generally left idling while the operators are on break or waiting for the completion of another task. Emissions from idling equipment tend to be high. Existing idling control technologies, which automatically shut the engine off after a preset time can reduce emissions, without intervention of the operators;
- PEQS applicable to gaseous emissions generated by construction vehicles, equipment and machinery should be enforced during construction works;
- Service roads (used for earthmoving equipment and general transport) should be regularly sprayed with water during dry weather;
- All excavation work should be sprinkled with water;
- Construction workers should be provided with masks for protection against the inhalation of dust;
- Vehicles used for construction should be tuned properly and regularly to control emission of exhaust gases;
- Ensure precautions to reduce the level of dust emissions from hot mix plants, crushers and batching plants should be taken up; e.g., providing them as applicable, with protection canvasses and dust extraction units. Mixing equipment should be well sealed and equipped as per existing standards; and
- Regular monitoring of air quality in accordance with the formulated environmental monitoring plan (given in EMP).

6.5.2.4 Noise and Vibration

The noise and vibration will be produced due to the operation of construction machinery equipment. Sources of noise and vibration during construction are heavy machinery such as bulldozers, excavators, stabilizers, concrete mixing plant, pneumatic drills, stone crushers,



asphalt plants and other equipment. Noise and vibration are perceived as one of the most undesirable consequences of construction activity. The above machinery is expected to generate noise levels that would be severe in the Project Area. The noise and vibration may cause health hazards to the residents of nearby villages including Bhamma, Jhuggian and Khokhar Pind, etc.

The likely impacts due to noise are:

- Localized in nature
- Machinery induced, temporary

This impact is medium negative, local and short term.

Mitigation Measures

There are a variety of ways by which construction equipment and worksite noise can be controlled. The following is a list of ways to control noise level at the worksite of the proposed Project:

- Well-tuned equipment
- Usage of new technology
- Green barrier or other available barrier protection
- Work schedule for day and night
- Traffic Management Plan will also address working schedule.

6.5.2.5 Borrow Areas/ Open Pits

Borrow / open pits and its excavation activities may result in land disputes, soil erosion, loss of potential cropland, loss of vegetation, landscape degradation, and may damage to road embankments.

Borrow/ open pits may also result in potential sources of mosquito breeding and may prove hazardous to human beings, livestock and wildlife. This will also degrade hygienic condition of the Project Area. This impact is permanent and high adverse in nature.

Mitigation Measures

- Necessary permits will be obtained for any borrow pits from the competent authorities;
- In borrow pits, the depth of the pit shall be restricted upto 5' and the sides of the excavation will have a slope not steeper than 1:4;
- Soil erosion along the borrow pit shall be regularly checked to prevent/mitigate impacts on adjacent lands; and
- Necessary agreements with the landowners will be made.
- In case borrow pits fill with water, measures have to be taken to prevent the creation of mosquito-breeding sites.



The Guideline Quarry Management Plan is attached as Annex-IV.

6.5.2.6 Construction Camps / Camp Sites

Improper construction camp location and mismanagement of construction camp activities can lead to various social and environmental impacts which include health and safety, traffic problems, soil degradation, loss of vegetation and assets on the selected land, solid waste and water pollution in the vicinity settlements. Furthermore, cultural differences, behavior of construction workers, potential disregard for local cultural norms can lead to increased tension between local communities and workers residing in the construction camps. This impact is temporary and moderate negative in nature.

Mitigation Measures

- The project will seek to avoid sitting camps where their presence might contribute to any conflicts with locals;
- Employment policies which aim to maximize job opportunities for local people will help to minimize tensions caused by different socio-cultural values;
- Camps will be designed to be self-contained to reduce demand on infrastructure and services of nearby communities;
- A comprehensive safety and security plan for the camp will be prepared which will comprise of a training manual, use of safety equipment and emergency preparedness;
- Training will be provided to all staff on camp management rules and overall discipline and cultural awareness;
- Waste Management Plan (refer Annex-V) will be implemented to ensure safe handling, storage, collection and disposal of construction wastes and the training of employees who handle waste;
- Site for construction camp will be selected to minimize the removal of existing macroplants at camp sites;
- Photographical and botanical inventory of vegetation before clearing the site;
- Compensatory plantation to be done when construction work near ends; and
- The contractor(s) shall ensure removal and rehabilitation of site upon completion.

6.5.2.7 Wastewater Generation at Construction Camps

Wastewater will be generated at the construction camps by the workers. If the generated wastewater is not properly treated or disposed of, this may contaminate the surface water sources such as nullahs, drains, water channels etc. apart from soil contamination. The wastewater generation is estimated to be 9,600 liters/day¹⁵ for 300 construction workers during construction phase of the proposed Project. This impact can be categorized as direct, moderate, site-specific, short term, temporary, high probability and reversible.

¹⁵ Design Criteria of Public Health Engineering for Water Supply, Sewerage and Storm Water Drain (Domestic sewage generation = 80% of water consumed/day)



Mitigation Measures

To dispose the liquid waste generated from the construction activities, the following steps will be taken by the Contractor:

- Domestic and chemical effluents from the construction camp will be disposed by the development of on-site sanitation systems i.e., septic tanks (as shown in Figure 6.1);
- Proper monitoring to check the compliance of PEQS will be carried out;
- Sewage from construction camps will be disposed of after proper pre-treatment and processes such as soakage pit; and
- The Contractor(s) will be responsible to submit details of Site-Specific Wastewater Management Plan along with details of wastewater collection, transportation and its disposal.

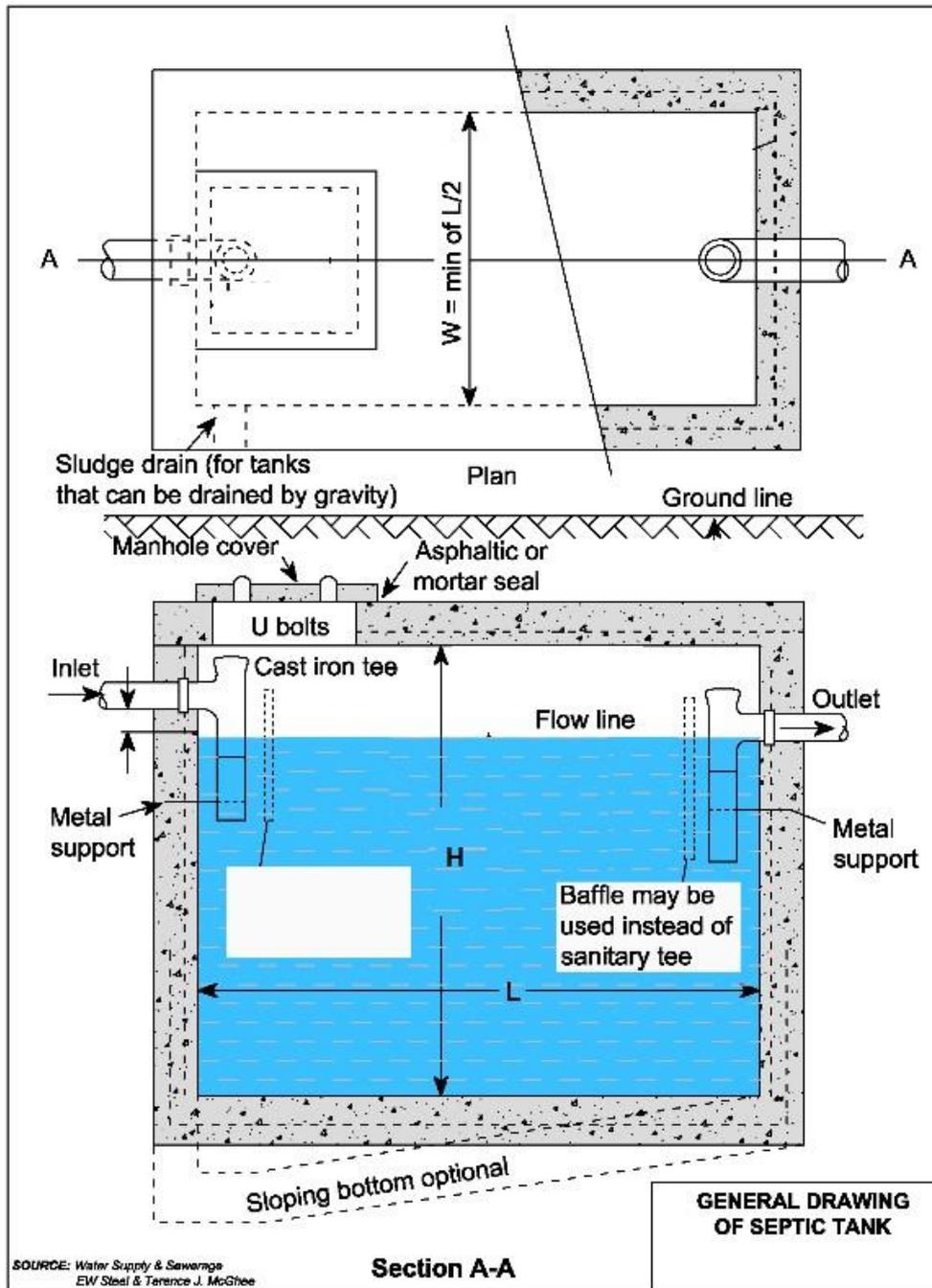


Figure 6.1: General Drawing of Septic Tank



6.5.2.8 Solid Waste Generation at Construction Camps

The solid waste generation is estimated to be 135 kg/day¹⁶ for 300 construction workers during construction phase of the proposed Project. Different type of waste is likely to be generated during the construction phase of the proposed Project. The municipal waste will be in the form of food, cans, paper and wastewater from construction camps toilets and washing yards.

Construction waste will include excavated soil, sand, gravel, rocks, asphalt, pieces of concrete, bricks, wood, metal pieces and electrical wires. Whereas, hazardous waste can be comprised of paints and construction chemicals. All these, if left unattended, can become a source of nuisance and environmental pollution in the Project Area.

Insecure and unhygienic disposal of the solid wastes particularly garbage and trash may cause degradation of soil and land. Insecurely disposed off heaps of wastes containing kitchen garbage and food waste can serve as breeding grounds for the disease spreading vectors and rodents. Throwing away of solid wastes into water channels and the wastewater network can result into choking of the latter. These impacts are temporary and minor negative in nature.

Mitigation Measures

- Solid Waste generated during construction and camp sites will be safely disposed in demarcated waste disposal sites and the contractor will provide a proper waste management plan;
- Training of work force in the storage and handling of hazardous materials and chemicals Construction workers and supervisory staff should be encouraged and educated to practice waste minimization, reuse and recycling to reduce quantity of the waste; proper labeling of containers, including the identification and quantity of the contents, hazard contact information, etc.;
- Waste disposal plan must be reviewed during the entire construction phase in the light of changing weather conditions;
- Emergency response plan shall be prepared to address the accidental spillage of fuels and hazardous goods;
- Immediate collection of spilled oils/fuels/lubricants by collection of contaminated soils and skipping oils from surface water by applying appropriate technologies;
- Reusing bitumen spillage; and disposing non-usable bitumen spills in a deep trench providing clay linings at bottom and filled with soil at the top (for at-least 0.5 m);
- Used oil shall be collected in separate containers stored on impervious platform with restricted access and shall be sold to licensed contractor and the burning of waste oil shall be strictly restricted;
- Segregating and stockpiling scarified/ milled bituminous material and reusing this material in sub grade/shoulders;
- Construction waste such as waste wood can be recovered and recycled into wood for new building projects, and cement, bricks, and plaster can be crushed and reused in other construction and building projects; and

¹⁶ Source: The World Bank Report 2012 – What a Waste: A global review of solid waste management. Based on UNEP estimates for waste generation in the Asia Pacific. Average is 0.45 kg/capita/day.



- The contractor should ensure implementation of proposed Construction Waste Management Plan and it must be reviewed during the entire construction phase in the light of changing weather conditions.

6.5.2.9 Traffic Issues

Due to the proposed project construction activities and movement of heavy project vehicles for construction material supply, traffic problems may arise for the commuters and transporters travelling especially through Bhamma Road, Ring Road and other Project Area access roads. The problems will include traffic jams and inconvenience to the public passing through the Project Area. It will also increase traffic load on the existing road network or access roads ultimately deteriorating the existing condition of the roads. The movement of vehicles along the haulage routes will cause soil erosion, debris flow, dust emissions, vibrational impacts, etc. Considering these consequences, this impact can be categorized as site-specific, medium negative, temporary and irreversible.

Mitigation Measures

To minimize traffic problems in the proposed Project Area, following measures will be considered:

- Movement of vehicles carrying construction materials and equipment/machinery will be restricted during the daytime to reduce traffic load and inconvenience to the local population;
- Construction vehicles, machinery and equipment will be parked at designated areas (at construction camps site) to avoid un-necessary congestions along the major roads;
- Damages of roads due to construction vehicles will be instantly repaired and/or compensated after the completion of work;
- Proper sign boards will be provided for smooth flow of traffic;
- Period of construction and area / location of construction site shall be informed to public in general and specifically to local residents;
- Any closure of the roads (especially main roads) and deviations / diversions proposed should be informed to the riders through standard signs and displays; and
- Traffic Management Plan (refer Annex-VI) will be prepared by the contractor and implemented to avoid traffic accidents, jams/public inconvenience.

6.5.2.10 Climate Change and Green House Gas Abatement

Potential Impacts

The main sources of Greenhouse Gases (CO₂, CH₄, NO_x etc.) during the construction activities of the proposed Project will include both mobile and stationary sources. The mobile sources will be the construction and transportation vehicles while the stationary source will be the batching and asphalt plants. Emission of greenhouse gases cause global warming and other climatic changes on regional and global scale. The climate change due to global warming, may result in following impacts over a period of time:



- Extended summer season;
- Higher temperatures may result in more precipitation falling as rain rather than snow, hence earlier and greater runoffs, increased runoff may pose greater challenges for water management;
- Increased natural hazards such as landslides and debris flows, extreme/unpredictable rainfall events, wind storms, droughts and wildfire.
- Due to shift in temperatures and precipitation patterns runoff, stream/lake temperatures, suitable habitats may move upland, thereby declining in size, ecosystems become fragmented, number and composition of species will change with particular threats to sensitive species; and
- Increased damages to transportation infrastructure from extreme events, causing difficulties for access and emergency evacuation, and involves higher maintenance costs.

Mitigation Measures

- Regular motioning of the vehicles for engine efficiency;
- All stakeholders (RUDA, consultants, contractors, concessionaires) need to become aware that their actions at all stages of a project can contribute to reducing the CO₂ burden;
- Elimination of unnecessary idling can save fuel, prolong engine life, and reduce emissions. It can also help reduce the noise levels associated with construction. Unnecessary idling occurs when trucks wait for extended periods of time to load or unload materials or supplies, or when equipment is left on when it is not being used. Construction workers may take breaks and leave equipment running unnecessarily or may idle equipment because it is an ingrained habit;
- Managing equipment operations and training workers to reduce unnecessary idling is a relatively easy way to lower operating costs and help reduce the environmental impact of construction;
- A preventive maintenance program by the contractor seeks to maintain engines at their original level of performance and eliminate the high cost of catastrophic engine failure. Preventive maintenance is the systematic inspection, detection, and correction of potential construction equipment failures. It significantly reduces fuel consumption and emissions; and
- Use of low sulfur and good quality fuel in the construction vehicles or operating equipments that will reduce maintenance costs and harmful emissions.
- Alternative energy resources shall be considered where possible; and
- PEQS applicable to gaseous emissions generated by construction vehicles, equipment and machinery shall be enforced during construction works.

6.5.2.11 Natural and Man-Made Disasters

Natural disasters (earthquakes) and accidents such as fire, falls, slips and trips may result in injuries, financial losses and may even lead to deaths. The workers shall be trained and facilitated to cope with such disasters.



Mitigation Measures

Mitigation measures include the following:

- An Emergency Response Plan (ERP) for earthquakes and manmade disasters should be developed by contractor in coordination with SC and RUDA should be implemented in close consultation with the RESCUE Services and other concerned departments;
- Training of the Contractor and RUDA staff and employees regarding the emergency procedures and plans should be regularly conducted;
- Emergency numbers should be clearly posted at active construction sites; and
- Minor incidents and near misses should be reported, and preventive measures should be formulated accordingly by the RUDA management.

6.5.2.12 Occupational Health and Safety

Occupational Health and Safety (OHS) related impacts will arise during construction phase activities including clearing of earth, levelling, compaction, carpeting, pavement finishing and testing & commissioning. Eye injury can be caused by stone or metal particles. Hazard of being hit by falling objects, major hand-arm and whole body vibration hazards, skin and respiratory tract irritation from exposure to cement dust, overexertion and awkward postures etc. will be another impact. Welding hazards include electric shock, fumes and gases, fire and explosions, falls from height, eye and head injuries etc.

Other impacts will be fall from height, contact with heavy electrical and mechanical equipment, equipment failure, uncontrolled movement, unguarded moving mechanical equipment parts, fatigue, unbalanced load, falling objects, hand injury, slip and trip hazards, wind / storm activity, injury from releasing load too soon etc. Operating mechanical and electrical equipment will trigger the OHS related issues e.g., struck by moving vehicles or other equipment, slips or trips, struck by flying objects, such as dirt or splashed fluids, caught in pinch points, shear points, crush points, falling from machine etc. The proposed project area is also sensitive from the law and order point of view and the security as well as the safety of the Contractor and Consultant staff will be a major issue. Considering these consequences, this impact can be categorized as direct, moderate, site-specific, medium term, temporary, medium probability and irreversible.

Mitigation Measures

Following mitigation is given to avoid the accidental risks:

- Providing basic medical training to specified work staff and basic medical service and supplies to workers;
- Complying with the safety precautions for the construction workers as per International Labour Organization (ILO) Convention No. 62, as far as applicable to the Project Contract;



- Training of workers in construction safety procedures, environmental awareness, equipping all construction workers with safety boots, helmets, gloves and protective masks, goggles, shields and monitoring their proper and sustained usage;
- Contractor will ensure the provision of medicines, first aid kits, ambulance etc. at the camp site;
- Work areas will be cordoned off where necessary;
- Contractors will instruct their staff to use Personal Protective Equipment (PPE) (e.g., wire containment, displaying warning signs along the work site, communicating advance warnings to mats) to enhance the safety; and
- Safety lookouts will be built to prevent people and vehicles from passing at the time of hot or cold work; and
- An emergency management plan must be devised by the contractor in close coordination with the provincial emergency services.

The Occupational Health and Safety Plan is attached as Annex-VII.

6.5.2.13 Community Health and Safety

The construction activities and vehicular movement at construction sites may result in roadside accidents particularly inflicting local communities who are not familiar with presence of heavy equipment. Quality of groundwater and surface water resources available in the nearby local communities may be affected due to the construction activities, oil spillage and leakage, roadside accidents, etc. The proposed Project will also have potential of air (dust pollution), noise and vibrational impacts on nearby community. The labour works with different transmittable diseases may cause spread out of those diseases in the local residents. The construction areas located near the residential, settlements, may cause accident for the people moving near to those areas. Conflicts may arise between the local community and the construction workers, which may be related to religious, cultural or ethnic differences, or based on competition for local resources. Tensions may also arise between different groups within the labor force, and pre-existing conflicts in the local community may be exacerbated. Ethnic and regional conflicts may also be aggravated if workers from one group are moving into the territory of the other. Considering these consequences, this impact can be categorized as sites specific, medium term, temporary and irreversible.

Mitigation Measures

- Providing basic medical training to specified work staff and basic medical service and supplies to workers;
- There will be proper control on construction activities and oil spillage leakage of vehicles;
- The labourers with different transmittable diseases will be restricted within the construction site;
- Ensure that the site is restricted for the entry of irrelevant people particularly children;
- Efforts will be made to create awareness about road safety among the drivers operating construction vehicles;
- Timely public notification on planned construction works;



- Close consultation with local communities to identify optimal solutions for diversions to maintain community integrity and social links;
- Provision of proper safety and diversion signage at sensitive/accident-prone spots;
- Setting up speed limits in close consultation with the local stakeholders;
- The mitigation measures provided in the following sub-sections for air and noise shall be adopted to reduce the air pollution, noise pollution and vibrational impacts on nearby community;
- The communicable disease of most concern during construction phase, like Sexually-Transmitted Disease (STDs) such as HIV/AIDS, will be prevented by successful initiative typically involving health awareness; education initiatives; training health workers in disease treatment; immunization program and providing health service;
- Reducing the impacts of vector borne diseases will be accomplished through implementation of diverse interventions aimed at eliminating the factors that lead to disease, which include prevention of larval and adult propagation of vectors through sanitary improvements and elimination of breeding habitat close to human settlements and by eliminating any unusable impounding of water;
- The Contractor will prepare the construction camp management plan which, in addition to other components, will include the labor influx management plan. This will be reviewed and approved by RUDA; and
- Contractor will take due care of the local community and observe sanctity of local customs and traditions by his staff. Contractor will warn the staff strictly not to involve in any unethical activities and to obey the local norms and cultural restrictions.

6.5.2.14 Communicable Diseases

The laborers in the Contractor Camp, truck drivers and like personnel who interact with each other have the potential for the spread of communicable diseases like COVID-19 and HIV/AIDS. 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 COVID-19 and HIV/AIDS, yet its occurrence in such a situation cannot be precluded. It is necessary that awareness and preventive campaigns are run from time to time in the labor camps and the field offices of the Project to prevent the communicable diseases.

There is a chance of spreading of an epidemic of Coronavirus disease (COVID-19) due to close interaction of the labor force during construction not only among the workers but also in the area. This impact can be categorized as direct, medium, site-specific, short term, temporary, medium to high probability and reversible.

Mitigation Measures

The Contractor shall:

- Arrange to run an active campaign, in the labor camp, to make people aware of the cause, mode of transmission and consequences of HIV/AIDS;



- SOPs related to the construction industry advised by National Action Plan for COVID19 Pakistan to control spreading of COVID-19, shall be implemented by the contractor and should be strictly monitored. Guideline for COVID-19 are attached as Annex-VIII;
- Strengthen the existing local health and medical services for the benefit of labor as well as the surrounding villages;
- Ensure cleanliness and hygienic conditions at the labor camp by ensuring proper drainage and suitable disposal of solid waste. Inoculation against Cholera will be arranged at intervals recommended by the Health Department;
- Locating a labor camp at least away from the villages (local settlement), and
- Keep all the camps, offices, material depots, machinery yards and work sites open for the inspection of health and safety measures and related documents.

6.5.2.15 Resource Conservation

The materials used in construction of proposed project would include coarse aggregates (crush), fine aggregates (sand), steel, water, asphalt, reinforcement and cement. Almost all the materials to be used in the construction of proposed Project are non-renewable and therefore their sustainable use is necessary for the future use.

Fuel will be used to operate construction machinery and asphalt and batching plants. Sustainable use of energy resources is very important not only to continue future use but also to help to reduce air emissions. For conservation of energy, efficiency of the engines and burning processes is very important. The impact is negative and long term in nature.

Mitigation Measures

Following practices shall be adopted to conserve these natural resources:

- Diesel and fuels with low sulphur content should be used to operate construction machinery and equipment's;
- The efficient and well maintained equipment's and machinery should be used;
- The equipment and machinery should be turned off when not in use;
- Regular maintenance of machinery to avoid fuel leakages;
- Reduction of wastage of water through training of workers involved in water use should be planned;
- Plan for reuse of construction waste materials may be formulated;
- A good camp design and an efficient worksite management plan should be prepared that may help the contractor to reduce the water demand, and wastewater and solid waste volumes to the lowest levels; and
- Use of solar panels at camp sites to conserve energy.

The Resources Conservation Plan is attached as **Annex-IX**.



6.5.2.16 Discovery of Heritage Sites/ Structures during Excavation

During excavation, there is a chance of finding artifacts. In case of finding any artifact, the contractor shall immediately report through Supervision Consultant to Directorate General (DG) of Archeology, Government of Punjab to take further suitable action to preserve those antiques or sensitive remains. Chance finds procedure attached as **(Annex-X)** shall be adopted in case of any accidental discovery of cultural heritage.

6.5.2.17 Flora

The project will involve destruction of vegetation cover on construction areas particularly along proposed project construction. It is initially examined that approximately 472 mature, submature, and pole crop and saplings of different tree/plants species may be disturbed (as per data from GIS, which needs ground trothing and physical verification through Forest department & PHA) during the construction phase of the project. Moreover, trees of small and medium sizes will be removed due the layout of the project for which compensation should be made to concerned parties (local community, forest and other relevant departments, if any).

Exhaust of noxious gases from movement of heavy machinery and dust will pollute air which will adversely affect health and vigor of plants. During construction activities the Contractor's workers may damage the vegetation and trees (for use as fire-wood to fulfill the camps requirements). Overall, it can be stated that the large number of trees may be damaged in the proposed project activities.

This impact is site-specific, medium negative and high significant.

Mitigation Measures

- Cutting of trees and disturbance of trees shall be avoided as far as possible and select the alternate site for the proposed project as the impact on local ecosystem (especially trees) is expected as high. So, that negative effects on the process of natural regeneration of species are minimized and if possible an alternate area may be considered for proposed project, in which minimum ecological and environmental losses are expected;
- Trees should be replanted or transplanted wherever possible, instead of cutting;
- Tree plantation plan should be implemented preferably in the project area or nearby blank spaces (along the roads, parks & green areas etc. where suitable) within 500m radius possibly;
- A tree plantation program shall be formulated with the recommendations and technical support of concerned PHA and Forest Department;
- NOC for tree cutting from PHA is mandatory as per PHA officials;
- As a principal, ten trees shall be planted in place of felling of one tree in consideration of mortality. Total 4,720 trees shall be planted in compensation of 472 trees;
- The proponent shall implement the program with the help of PHA, Forest Department and in consultation with concerned consultant ecologist;
- Open fires should be banned in the area to avoid hazards of fire in the area;



- Clearing of vegetation cannot be avoided at the areas specified for project structures, but damage to the natural vegetation may be minimized by establishing camp sites, workshops and batching plants on waste / barren land rather than on forested or green land;
- However, if such type of land is not available, it shall be ensured that minimum clearing of the vegetation is carried out and minimum damage is caused to trees and undergrowth;
- Construction vehicles, machinery and equipment will remain confined within their designated areas of movement;
- The Contractor's staff and labor shall be strictly directed not to damage any vegetation such as trees or bushes; and
- Contractor shall provide gas cylinders at the camps for cooking purposes and cutting of trees/bushes for fuel shall not be allowed.

6.5.2.18 Fauna

During construction phase the existing population of birds, mammals and reptiles of the construction areas will be affected due to disturbance arising from construction activities involving excavation, movement of machinery and vehicular traffic, movement of labor, camping, etc. The existing fauna will leave the directly affected areas due to construction activities and human intervention. Some animals particularly reptiles may get killed during the earthworks operations. Moreover, the movements of the mammals and reptiles will be restricted during the construction phase.

Birds as well will tend to move away from the construction areas and find shelter and food elsewhere due to the activities mentioned above for fear of being hunted / trapped.

Noise generated from machinery particularly during the night hours will even scare the wildlife residing in habitats located at some distance from the construction areas. Uncontrolled blasting may even disturb the fauna of the Project Areas. Food and refuse at the Contractor's camps may attract animals that might in turn be hunted by the workers. This impact is indirect, site-specific, temporary, reversible and medium significant.

Mitigation Measures

- Care shall be taken during construction activities for avoiding purposely or chance killing of animals;
- If any wild species and habitat is found during construction, it must be dealt carefully and local wildlife department officials should be informed;
- Hunting, poaching and harassing of animals shall be strictly prohibited, and Contractor shall be required to instruct and supervise its labor force accordingly and clear orders should be given in this regard;
- The Contractor must be held responsible for instructing his work force accordingly and for enforcing this restriction. In addition, this shall have to be controlled by the Wildlife Department;
- Special measures shall be adopted to minimize impacts on the wild birds, such as avoiding noise generating activities during the critical periods of breeding;



- Noise generating activities shall not be carried out during the night by the work force;
- Wastes of the camps shall be properly disposed of to prevent it being eaten by animals, as it may be hazardous to them; and
- Noise produced due to construction activities may be kept to acceptable level.

6.5.2.19 Social/ Cultural Conflicts

During the construction phase of the project, conflicts may arise between labor force and Local communities. i.e. Bhaama, Jhuggian and Khokhar exists near the Project Area. Use of local resources (existing infrastructure and utilities) by the construction workers can generate stress on the local residents. Furthermore, difference in cultural values may also cause discomfort to local residents. This impact is temporary and moderate adverse in nature.

Mitigation Measures

- Local labor should be preferably employed for the construction works;
- Careful planning and training of work force to minimize disturbance to the local people; and
- Public notification through print or electronic media during the entire construction phase to avoid any inconvenience in accessibility to the locals.

6.5.2.20 Agriculture and Trees

The AOI of the proposed Project is also falling in agricultural area and damages of crops and tree are expected during construction activities. The areas used for the construction camps will result only in temporary loss of cultivatable land, as the land can be again brought under cultivation following completion of the construction works. However, standing crops and trees in AOI of the proposed project will result in permanent loss of cultivatable land. The impact on agriculture in the Project Area is major adverse in the short term and permanent.

Mitigation Measures

- The payment of compensation to farmers for the loss of any standing crops, or crops already sowed should be properly assessed which will be applicable for all crops standing on land within the acquisition area at the time of dispossession;
- The compensation value shall be calculated based on market value of the crops and average yields in the Project Area;
- Removal of all contractors' facilities from the Project Area shall be a contractual requirement, and as such the land used for the sub-camps can be restored to facilitate agriculture and the land used for the construction camp shall become cultivatable.
- Compensation for the loss of crops to the land owners and cultivators as the case may be will be paid, in accordance with the prevailing market prices and uniformity in rates will be ensured within the local areas;
- As far as possible, land within the AOI (which will be acquired) or otherwise barren land without any crop outside the AOI will be selected for the camp sites and disturbance to the crops and natural vegetation will be avoided as much as possible.



6.5.2.21 Employment

Due to construction of the proposed Project, economic and commercial activities will be generated in the study area, as the laborers and semi-skilled staff from nearby communities will have an opportunity to work for the construction of the proposed Project. Similarly, the restaurants, hotels, and tea stalls present in and around the proposed Project Area will also get benefits in an income generation, as workers will visit them for food and nourishment. The impact is temporary and positive in nature.

6.5.2.22 Impacts on Livelihood

Potential Impact

The construction activity may disturb the business and livelihoods of the Cattle shed owners, shopkeepers and workers doing their work in the AOI due to the excavation activities. In this respect, the most critical area is Khokhar Pind. The main commercial activities in these areas include livestock sheds (Milk producing points), vegetables shops and grocery shops. At this stage the assessment of livelihood impacts has been carried out on the basis of the proposed AOI. During the construction phase, these locations will be finalized and on that basis the livelihood impacts will be determined more accurately.

Mitigation Measures

- Proper compensation should be provided to all the affectees losing their livelihoods along the AOI;
- Relevant stakeholders should be engaged to design livelihood restoration measures including affectees of the proposed Project Area;
- Livelihood restoration should be provided to mitigate the adverse impacts on livelihood and restoration of commercial activities which will be monitored;
- Initial assessment of compensation should be carried out for the income loss of the affectees based upon the current approximation of the AOI and construction camps.
This assessment should be reviewed and revised on the basis of final AOI and construction camp site determined during the construction phase;
- Project Construction should be completed on time; and
- Proper awareness and training should be conducted among the affectees regarding Project benefits, reasons for acquiring lands and compensations to be provided.

6.5.2.23 Influx of Labor

For the implementation of Project activities, skilled and unskilled labor is required by the contractor. Mostly, skilled and unskilled workers have been associated with the contractor since long which they utilize, where they are required for the projects, and while other workers are hired from the different areas that belong to different cultural backgrounds. Social problems and conflicts that are associated with Labor Influx are as follows:

- Risk of social conflict: Conflicts may arise between the local community and the construction workers, which may be related to religious, cultural or ethnic differences,



- or based on competition for local resources. Ethnic and regional conflicts may be aggravated if workers from one group are moving into the territory of the other;
- Increased risk of illegitimate behavior and crime: The influx of workers and service providers into communities may increase the rate of crimes and a perception of insecurity by the local community. Such illegitimate behavior and crimes can include theft, physical assaults, substance abuse, sexual assault and human trafficking;
 - Impacts on community dynamics: Depending on the number of incoming workers and their engagement with the host community, the composition of the local community, and with it the community dynamics, may change significantly. Preexisting social conflict may intensify as a result of such changes;
 - Increased burden on and competition for public service provision: The presence of construction workers and service providers (and in some cases family members of either or both) can generate additional demand for the provision of public services, such as water, electricity, medical services, transport, education and social services. This is particularly the case when the influx of workers is not accommodated by additional and separate supply systems;
 - Increased risk of communicable diseases and burden on local health services;
 - Local inflation of prices, accommodations and rents: A significant increase in demand for goods and services due to labor influx may lead to local price hikes and crowding out of community consumers. Depending on Project worker income and form of accommodation provided, there may be increased demand for accommodations, which again may lead to price hikes and crowding out of local residents; and
 - Increase in traffic and related accidents: Delivery of supplies for construction workers and the transportation of workers can lead to an increase in traffic, rise in accidents, as well as additional burden on the transportation infrastructure.

This impact is negative and temporary in nature.

Mitigation Measures

Suggested mitigation measures for smooth execution of construction activities include:

- Labor camp(s) should be established away from residential population;
- Preference should be given to the local people to work with contractor, and contractor should hire maximum labor force from the Project Area because this will reduce the labor influx;
- Awareness should be created among the work force to ensure respect for local customs;
- Construction work should be completed within the stipulated time to move workers to next location;
- Labor force should be shuffled with the time;
- An effective GRM should be established for the Project to resolve all issues related to the community. Thus, progress regarding resolving the issues should be monitored closely;
- Create awareness among workers on proper sanitation and hygiene practices to endorse proper health and maintain good housekeeping practices at all Project sites;



- Provide adequate personal hygiene facilities in good condition with adequate supply of clean water;
- Make arrangements to treat the affected workers on time to control the movement of vector borne diseases;
- Provide proper and free COVID-19, HIV/AIDS and STI health screening and counseling for site workers and community members;
- Develop and enforce a strict code of conduct for workers to regulate behavior in the local communities;
- Taking all sensible precautions to avert illicit, vicious conduct by or amongst the Contractor's personnel, and to preserve unity and harmony, and protection of people and property on and near the sites;
- Prohibiting drugs, alcohol, weapons, and ammunition on the worksite among personnel;
- Site security preparations must be contained within the Bills of Quantities (BOQs) to avoid any delays which might be caused due to insecurity;
- Appropriate fencing, security check points, gates and security guards should be provided at the construction sites to ensure the security of all plant, equipment, machinery and materials, as well as to secure the safety of site staff; and
- The Contractor must guarantee that good relations are maintained with local communities and their leaders to help reduce the risk of vandalism and theft.

6.5.2.24 Gender Based Violence (GBV)

In the society, female plays important role in managing household as well as in income earning activities, but they face various challenges to get access to educational institutions and employment opportunities due to cultural bindings, economic vulnerability and lack of facilities.

According to Pakistan Demographic and Health Survey (PDHS), 2017-18, 28 percent of women of Pakistan age 15 to 49 have experienced physical violence, six percent have experienced sexual violence, and seven percent experienced violence during pregnancy. Three in ten women who have ever experienced physical or sexual violence sought help to stop the violence, yet 56 percent never sought help nor told anyone.

Mitigation Measures

With the effective measures and monitoring, the risk of gender violence could be minimized by adopting the following mitigation measures:

- Awareness should be created among the females at individual and community levels about the constructions sites;
- During the timing of educational institutions workers should not be allowed to crowd in the surroundings;
- Alternative routes for pedestrian should be provided to avoid mixing of women with workers;
- Gender protection act should strictly be enforced during the construction activities in the Project Area, and monitor the implementation through field staff;



- Raise awareness among the communities of the potential risks of GBV, and establish response services in the communities that can respond to instances of GBV (particularly those related to issues of labor influx);
- The Contractor should make sure that no discrimination is made on the basis of gender while hiring of workers. Complete SOPs should be formed and implemented by the contractor regarding working women at site. Implementation on these SOPs should be monitored by the implementation Consultants.
- Provisions of gender disaggregate bathing, changing, and sanitation facilities; and
- Contractor should take proper measures to address and resolve issues relating to harassment, intimidation, and exploitation, especially in relation to women.

6.5.2.25 Child Labor

There are two basic conventions on child labor adopted by the ILO, and one adopted by the United Nations. The ILO Minimum Age Convention, 1973 (No. 138) and its accompanying Recommendation (No. 146) set the goal of elimination of child labor, and the basic minimum age for employment or work (in developing countries at 14 years of age or the end of compulsory schooling, whichever is higher; and 15 or the end of compulsory schooling for developed countries). The Convention sets a minimum age of 2 years younger for "light work," i.e., 12 and 13 years, respectively; and a higher minimum age for dangerous or hazardous work (basically 18 years of age, but 16 in certain circumstances). The Convention also has various other flexibility clauses.

Mitigation Measures

The chance of hiring of underage worker for the Project activities will be minimized by adopting the following mitigation measures:

- Awareness should be created among the local communities about the adverse impacts of child labor. For the public awareness, meetings should be held in the Project Area, and announcements should be made using the available local platforms with the involvement of all sectors of the society;
- Contractor through contractual agreement should be bound to follow the labor standards, rules and regulations during hiring the labor force and all activities should be monitored by the social and environmental staff of the implementing agency;
- Client and Supervision consultant should ensure that contractor shall have its employment policy in accordance with relevant act and labor policies in Punjab and Pakistan; and
- Contractor should ensure the presence of all persons at site are adults and have their proper identity cards with them.
- Reduce or eliminate the worst forms of child labor and rescue and rehabilitate the children in the worst forms of child labor.
- Penalize contractors/employees using the worst forms of child labor and penalize adults who violate children's rights and who force children to enter child labor, especially in its worst forms.
- Reduce the health hazards and dangers to young persons in the workplace.



6.5.3 Potential Environmental Impacts during Operational Phase

The anticipated environmental impacts related to the proposed Project have been studied for the operational phase of the project as discussed hereunder.

6.5.3.1 Odour

The operation of proposed WWTP will result in generation of odour from biological tanks, sludge holding areas and dewatering units. Moreover, scum is also another source of odour. Overloading of the ponds will also result in odour problems because the treatment capacity will have exceeded. Wind is an effective source of aeration through surface mixing, but too much wind action can disturb bottom sediments and also create an odour problem. In most instances, the odours are generated as a result of an anaerobic or "septic" condition, which causes nuisance to the residential community in the surroundings of the WWTP and the people passing by this area for routine activities (travelling to schools, mosque and shops). The magnitude of this impact will be moderate adverse.

Mitigation Measures

- Strictly follow standard operating procedures and operational manual for operation and maintenance of lifting and pump stations;
- At pond start up, if organic loading is highly variable, acid fermentation of the wastewater may generate foul odours. This may be corrected by controlled dosing with alkalis (e.g. slaked lime);
- Pond wastewater inlets should be submerged to minimize the odour release and surface crust disruption;
- Ensure that operating staff is properly trained, and have clear understanding of odor issues related with operational practices;
- Ensure proper maintenance of the machinery;
- Regular cleaning of aeration tank walls and floors, washing weirs, and removing scum regularly, also helps in odour reduction;
- Ensure adequate water flow in ponds and aeration to reduce the potential of odour formation;
- Regularly monitor spread of unpleasant odors around WWTP, and apply additional measures of odor control based on the monitoring outcomes;
- The proposed WWTP may install synthetic windbreakers (e.g., walls) around the existing facility may serve to minimize potential odour dispersions and will reduce the significance of the odour impact; and
 - A landscape should be properly designed with provision of new trees and ornamental plants around the boundary, roadside and stretches of open land.

6.5.3.2 Ambient Air Quality

The operation of WWTP will result in generation of fugitive emissions including H₂S and CH₄ (due to anaerobic conditions) and minor concentrations of N₂ and NH₃ from biological tanks and from sludge, if not handled properly or remain unattended. H₂S is a foul smelling



poisonous gas which might be harmful for the workers of sewer maintenance and could be fatal sometimes.

During operation phase, operation of stand-by generator and un-necessary idling of diesel run will also result in the emission of pollutants (CO, Smoke, NO₂, SO₂ CO₂ and PM₁₀) into the air, thus deteriorating air quality. These emissions may adversely affect the health of the nearby residents and working staff. This impact can be categorized as negative, local, medium negative and long-term.

Mitigation Measures

- To mitigate the pollutants emissions use of low sulfur fuel should be ensured;
- Location of generators should be carefully selected;
- Plantation of trees along the WWTP to create a buffer zone that will help in absorbing the emissions;
- Use of gas generators (if possible) should be preferred for low emissions;
- The height of the generator stacks should be high enough to disperse the emissions in the air;
- Provision of budget for regular monitoring of ambient air quality in accordance with PEQS, 2016;
- Improved monitoring, planning, and maintenance of the WWTP by RUDA;
- Workers for cleaning or maintenance of WWTP should cover their faces with mask;
- Use gas detector before inspection;
- Plan and execute appropriate tree plantation along the WWTP.

6.5.3.3 Noise

Due to the operation of proposed WWTP, noise and vibration may produce from the running of pumping machinery and standby generators which will be a constant source of nuisance to the local population. This impact is considered to be moderate adverse.

Mitigation Measures

- Regular maintenance of vibrating parts through a well-coordinated operation and maintenance procedure which consists of checking periodically all parts of the pumping machinery, its oiling to remove friction, replacement in case of malfunctioning and periodic noting of noise levels;
- All noisy equipment and machinery such as generators and blowers should be housed in closed rooms or buildings;
- Provision of budget for regular monitoring of noise in accordance with PEQS, 2016; and
- Tree Plantation Plan should be devised to reduce noise issues.

6.5.3.4 Soil Quality

Impact on the integrity and stability of soil or the loss and damage of the topsoil is not expected during the operational phase. However, the liner of the sludge storage ponds, while desludging



may get dried and cracks may lead to the seepage of wastewater and thus contaminate the soil. Improper disposal of sludge is another concern. Emergency situations (spillage of wastewater in case of damage of pipelines or other infrastructures) may also cause soil pollution. The impact is minor negative and temporary in nature.

Mitigation Measures

- While de-sludging, the ponds shall be sprinkled with water;
- Scum and sludge shall be removed regularly and disposed of safely in consultation with Lahore Waste Management Company (LWMC);
- In case of fuel/oil spill, cleaning of the territory and withdrawal of the contaminated soil and ground for further remediation; and
- Training of the personnel on environmental and safety issues regarding sludge disposal and soil contamination.

6.5.3.5 Wastewater Quality

The WWTP will have overall positive impact on the surface water by discharging treated wastewater into the River Ravi. However, accidental discharges of untreated wastewater due to the overflow, syphoning or disruption in operation during maintenance of the treatment plant may cause contamination of river water quality. Impact on water quality may occur during the maintenance works as well. The impact will depend on the type and volume of works.

There is probability of the seepage of wastewater from the ponds and channels that may contain high concentrations of organic matter and heavy metals. Improper functioning or choking of inlet or outlet of the treated wastewater may also cause the ground water contamination. The impact is moderate negative and permanent in nature.

Mitigation Measures

- Use the suitable lining material to control the seepage and ground water contamination;
- In case of maintenance/sludge removal, alternative ponds shall remain functional;
- Water should be retained constantly in ponds to prevent drying out of compacted clay liners. In dry liner Shrinkage cracks may occur, which may cause excessive leakage when ponds later refill;
- Inlet and outlet pipework access/maintenance pits should be inspected regularly for blockages. These pits should be covered at other times;
- Monthly treated effluent quality monitoring shall be done from an EPA certified laboratory for compliance with PEQS; and
- In case maximum permissible discharge of pollutants are exceeded, appropriate measures will be taken to remedy the situation promptly (appropriate repairs and maintenance works will be implemented). At the same time, a person in charge of environmental protection should immediately notify the Punjab EPA about the existing situation. Information should contain the causes and preventive measures that will be implemented in order to eliminate the problem.



6.5.3.6 Solid Waste Generation

The solid waste will be produced from the administration building, staff quarters and workshop during operation phase. If these wastes are not properly handled, they may cause nuisance to the workers and staff. Improper storage and dumping of waste may also pollute soil, sewerage pipes and groundwater. It may also cause the health problems to the staff and workers handling waste. This impact is moderately negative and temporary in nature.

Mitigations Measures

- Storage bins should be provided at the appropriate places with clear demarcation of type of wastes;
- Recyclable wastes such as newspaper, cardboard, plastics, glass and metals could be separated for individual collection. Single stream collections may be more cost effective as the recyclables can be cheaper to collect and will reduce the volume of a costlier co-mingled dry recyclable collection;
- Waste minimization should be encouraged and regular training be provided to solid waste management staff in correct identification and disposal of waste;
- Storage areas should be cleaned regularly to minimize odor, pests and nuisances and preserve visual amenity;
- Housekeeping procedures, (including spillage control) should be implemented to minimize the generation of waste;
- Special storage facility should be arranged for temporary disposal of hazardous waste during the operational phase, which should be in compliance with environmental requirements. The facility must include exhaust ventilation system and Shelves and racks for waste disposal;
- In case of waste disposal, an approved contractor shall dispose of the sludge at the landfill site in consultation with LWMC;
- A proper waste management plan should be prepared for onsite storage, collection and disposal of waste.

6.5.3.7 Handling and Disposal of Sludge

Sludge will be produced during the operational phase of WWTP and sludge handling is important part of biological wastewater treatment processes. The proposed WWTP shall generate huge quantities of sludge which require due consideration for its management. This impact will moderately negative and permanent in nature.

Mitigation Measures

At present, the composition of sludge after sewage treatment and its market aptitude is unknown. Moreover, no legislation concerning the reuse of sewage sludge exists in the country. Considering these aspects, further treatment is not proposed at this stage. Consequently, the dried sludge will be disposed of in to landfill. The sludge composition and other parameters will be monitored in the operational phase and different options for sludge treatment and its reuse may be adopted accordingly in the next phase.



For the case of Mahmood Booti/Shad Bagh WWTP, Mono Fills (sludge storage ponds) shall be proposed in which dried sludge from sludge drying beds will be disposed of up to 2 to 3 years within the WWTP Site.

After these years, Mahmood Booti landfill site may also be considered as an alternate disposal site. During these years, any advancement in sludge management and treatment may be introduced and adopted accordingly.

6.5.3.8 HSE Considerations

The operation of WWTP involves minimum man power. The HSE considerations in this regard shall be addressed. During operation phase, health and safety issues may arise. Operation and maintenance of the building may cause safety risks to staff (electrical and mechanical staff, solid waste management staff and maintenance staff), that may include injuries due to electric shocks, arc flash and arc blast, slipping and falling, poor handling and storage of hazardous substances and during handling of the solid waste. This impact is moderate negative in nature.

Mitigation Measures

- Operation and maintenance of machinery and equipment shall be controlled and handled by efficient management, staff training, and other preventive measures;
- Emergency Response Plan shall be formulated for the WWTP and strictly implemented by the management;
- Emergency numbers shall be clearly posted and communicated to the operation and maintenance (O&M) staff;
- Installation of safety sign boards at the plant site;
- Adequate PPEs shall be provided to the O&M staff and concerned safety staff must do regular inspections for its implementation;
- Strict implementation and practice of work safety permits during maintenance activities;
- Fire extinguishing equipment shall be installed at the treatment plant and the concerned staff shall be well trained to use the equipment during an emergency situation;
- Regular inspection and maintenance of the fire safety and extinguishing equipment by the designated staff;
- Regular fire drills at the plant in order to train the staff and get well aware of the steps to be taken during an emergency situation;
- Regular trainings of O&M staff by a recognized trainer;
- COVID-19 SOPs must be fully adopted by the hospital in accordance with the WHO and GoP guidelines; and
- Regular medical checkups of the O&M staff.



6.5.3.9 Climate Change/ emission of Greenhouse Gasses

The operation of wastewater stabilization ponds will generate greenhouse gases, such as CO₂, CH₄ and N₂O. Pakistan is signatory to the United Nations Framework Convention on Climate Change (UNFCCC) and adopted Kyoto protocol in 1997. Under the Kyoto Protocol, Pakistan is committed to reduce GHG emissions into the environment to prevent interference with climate change. The GHG emissions for the proposed project are a concern due to the large number of ponds being established in the area. In addition, air emissions may result from burning of the fossil fuels to fulfill the energy requirement for operation of WWTP.

Mitigation Measures

- Ensure complete burning of fuel in machinery;
- For large installations with a considerable throughput of organic matter, the pond may be covered (with a supported membrane dome) to capture the gas for fuel to heat the pond or for power generation. Ponds may be covered with a fixed or floating roof, but provision of stormwater drainage, pond gas venting, sludge removal and chemical conditioning would be required; and
- Regular monitoring of air quality should be conducted from an EPA certified laboratory to comply with PEQS 2016.

6.5.3.10 Carbon Sinks

Wastewater treatment plants are one of the sources of GHG emissions as mentioned above and they also have a significant carbon footprint. It is necessary to evaluate the emissions of wastewater treatment plants and seek ways to reduce them and convert them from carbon source to carbon sinks.

Carbon emissions of sewage treatment plants are divided into two parts:

Direct Emission of greenhouse gases such as CO₂, CH₄ and N₂O will be occurred during the process of wastewater treatment; and

Indirect Emission: During the operation of the sewage treatment plant, blowers, pumps, aeration equipment and other equipment consume a large amount of electricity, the carbon emissions of the purchased electricity during the production process are the indirect emissions of the sewage treatment plant.

Nitrous oxide and methane can constitute an important part of the carbon footprint in the wastewater treatment plants and efforts are needed to efficiently mitigate them.

Mitigation Measures

- For reducing direct GHG emissions, ecological treatment processes such as stabilizing ponds, constructed wetlands, building greenhouses, cultivating aquatic plants, and planting trees, use plants to absorb nutrients such as nitrogen and phosphorus in wastewater, absorb CO₂, and transform into plant bodies. Using the



- canopy area of the plant and the corresponding carbon fixation coefficient, the amount of GHG recovered by the ecological process can be determined;
- CH₄ gas produced during operation phase shall be recycled, it can reduce GHG emissions as CH₄ is a renewable energy source, which meets the energy requirements of the consumers and it can also reduce power consumption and reduce costs

Indirect emissions from power consumption, the working effects of blowers, water pumps, aerators and other equipment during operation are carefully designed to reduce inefficient energy consumption and save power consumption. At the same time, the WWTP should do a good job in saving water at the source and reuse the tail water to reduce GHG emissions.

6.5.3.11 Operational Sustainability

The most pressing need is the sustainability of wastewater collection and treatment system, and it can be assessed on many factors including capacity issues of proponent, efficiency of the system and its performance, life cycle analysis (aging and deterioration), natural hazards (earthquakes, floods and fire outbreaks), escalation in population growth and energy requirements.

The three major drivers considered worldwide for ensuring sustainability are: (i) economic considerations, (ii) social considerations and (iii) environmental protection. Therefore, the proponent (RUDA) must consider these aspects in achieving appropriate and optimize use of wastewater treatment system.

Mitigation Measures

The operational sustainability can be achieved by adopting following measures:

- Establishment of Monitoring and Maintenance System for wastewater treatment before its final disposal into surface water bodies;
- Regular operation and maintenance of the scheme;
- Capacity building and training of workers;
- Periodic environmental monitoring;
- WWTP should be efficiently operated in such ways that it withstand existing climate change issues e.g. intense rainfall events and increase and decrease in temperature;
- Cost for the operation and maintenance shall be kept in the annual budget of RUDA;
- Option of recovery of heat and CH₄ for energy use shall be considered during the operation phase.

6.5.3.12 Emergency Preparedness and Response

The operation of the WWTP may encounter emergencies like operation failure in addition to disasters such as earthquakes and floods. This impact is negative, temporary and moderate in nature.



Mitigation Measures

- An Emergency Response Plans for floods, earthquakes, and manmade disasters must be developed by the RUDA, in close consultation with Fire Fighting Department (FFD), Rescue 1122 Services and National Disaster Management Authority (NDMA),
- Training of staff and employees regarding the emergency procedures and plans should be regularly conducted;
- Responsible person to implement the Emergency Response Plan should be clearly designated;
- Emergency numbers should be clearly posted, so that a quick action is taken when an emergency arises;
- Fire Fighting Systems should be calibrated and maintained regularly; and
- Regular drills for fire emergencies should be carried out.

6.5.3.13 Improved Water Quality

The construction of the proposed WWTP will result in improving the water quality of River Ravi to a great extent and will decrease the pollution load.

6.5.3.14 Improvement in Public Health, Hygiene and Sanitation

Current ponding of untreated wastewater without any buffer zone will change into a planned WWTP having buffer zone which will decrease health issues in the adjacent areas. Further practice of irrigating agriculture with untreated wastewater will be restricted which will positively impact the public health during operation. It is also foreseen that public health risk will be reduced by covering the drainage channels so that untreated wastewater is not discharged adjacent to agricultural land.

6.5.3.15 Reuse of Treated Water

Treated water from the proposed WWTP may be reused for irrigation of surrounding agricultural fields instead of fresh water. The treated wastewater usually contains nutrients which are beneficial up to certain level for crop productivity and reduces fertilizer application which has additional environmental implications associated with its production and usage. Depending upon treated wastewater quality, reuse of wastewater will be a benefit of the project.

Mitigation Measures

Treated wastewater should be tested before its application on agricultural land. Treated wastewater quality should meet WHO guidelines and PEQS for inland application.

6.5.3.16 Flora

During operational stage of the Project, there will be minimal effect on flora is expected due to the operation and maintenance activities. This impact is temporary, irreversible and low significant



Mitigation Measures

- The implementation of plantation plan recommends compensation for cutting of trees and work should be started during operational phase to ensure the ecological balance and to avoid any impact on local environment;
Large scale planting with suitable indigenous trees, shrubs and ornamental plants in the form of tree groves, and linear plantation will be carried out in accordance with the Tree Plantation Plan to improve aesthetic value and offset the effect of removal of vegetation;
- Proper check and balance for above activities is highly recommended. Plantations so raised must be maintained according to the silvicultural practices which includes proper irrigation, cleaning, pruning, thinning at prescribed intensity, silt clearance and trench-opening, etc.;
- Maintenance and security of the plantation should be done for at-least four years (in consultation with the PHA and forest department). Measures such as fencing, watch guards and fire protection should be considered; and
- All activities must be done under the technical supervision of PHA and forest department.

6.5.3.17 Fauna

There is no protected area, game reserve in the project area so no major impact on wildlife and livestock in the area is expected through noise, vibration and any type of normal activity in the project area.

This impact is Insignificant.

Mitigation Measures

- The pathways of locally available wildlife (if any) for food, shelter and other normal activities must be compensated with proper alternatives in proper consultations with PHA, Forest and Wildlife departments.
- Strict control must be exercised for stoppage of killing/poaching of available wildlife species by enhancing protection practices; and
- The precautionary measures described for future shall also be applicable during operation phase as relevant for the conservation of wildlife species in the Study Area.

6.5.3.18 Socio-economic Impacts

Livelihood Opportunities

After completion of the proposed WWTP, few staff personnel will be required for the O&M as well as for the security and working as supporting staff. Security and supporting staff can be hire from the local community. It will provide livelihood opportunity to local community members.

7 ENVIRONMENTAL MANAGEMENT AND MONITORING PLAN

7.1 GENERAL

Environmental Management Plan (EMP) is a tool for the implementation of the all the suggested measures to make the project environmentally sustainable. It provides an overall approach for managing and monitoring the environmental, ecological and socio-economic issues of the proposed Project, and describes the institutional framework and reporting mechanism to implement EMP for the proposed Project.

This section provides brief description of environmental issues, mitigation measures to eliminate or reduce environmental and social impacts to an acceptable level, institutional framework for the implementation of the mitigation measures and environmental monitoring plan for air quality, water quality, and noise pollution parameters during construction and operational phase. A budgetary plan is also developed, indicating estimated costs to be incurred to mitigate potential adverse impacts of the proposed Project.

7.2 EMP COMPONENTS

The EMP comprises following main components:

- EMP Objectives;
- Scope of the EMP;
- Environmental Policy, Legislation and Framework;
- Institutional Requirements;
- Environmental Mitigation and Management Matrix;
- Environmental Monitoring Plan;
- Planning for EMP Implementation;
- Training and Capacity Building;
- Communication & Documentation;
- Management Plans;
- Chance Find Procedure;
- Public Disclosure;
- EMP Cost; and
- Summary of Environmental Cost.

7.3 OBJECTIVES OF EMP

The main objectives of the EMP are to:

- Provide the details of the Project impacts along with the proposed mitigation measures, and the corresponding implementation activities;
- To ensure that all necessary corrective actions are carried out and monitored in time to counter any adverse environmental impact under a systematic monitoring approach;

Provide a procedure for timely action in the face of unanticipated environmental situation;

- Define the role and responsibilities of the Project Proponent (RUDA), Contractor(s), Supervisory Consultant(s) and other key players in order to effectively communicate environmental and social issues among them;
- Define a monitoring mechanism, reporting frequency and identify monitoring parameters to ensure that all the mitigation measures are completely and effectively implemented;
- Design the training and capacity building plan for enhancing the capacities of the Project Proponent (RUDA), Contractor(s), Supervisory Consultant(s) on environmental and social management;
- Identify the resources required to implement the EMP and outline the corresponding financing arrangements; and
- Define the requirements necessary for documenting compliance with EMP and communicating it to all the concerned regulatory agencies.

7.4 INSTITUTIONAL REQUIREMENTS

The institutional requirements for the Construction and Operation & Maintenance (O&M) phases of the proposed Project are provided in below sections.

7.4.1 Institutional Setup for Implementation and Management of EMP

The key players involved during construction phase of the proposed Project are the RUDA as employer/proponent, PEPA, the Supervisory Consultant (SC) and the Contractor. The roles and responsibilities of these organizations are outlined below. The following staff will be involved in the implementation of EMP;

- RUDA/Proponent/Employer;
- SC's; and
- Contractor's Environmental Manager.

The employer/ proponent (RUDA) will make Contractor bond through contract documents to implement the EIA including EMP and other terms and conditions of the Environmental Permit. The whole EMP will be included as a clause of the contract documents. Construction camps will be established after necessary approvals and submission of Site-Specific EMPs to be developed in the light of the relevant agencies requirements, before commencement of construction works. The organizational setup for implementation of EMP during construction phase is provided in Figure 8.1.

7.4.2 Overall Oversight Arrangements

A Project Steering Committee comprising of Chairman RUDA, Project Director RUDA and Deputy Director, RUDA will provide overall guidance and oversight and will be responsible for ensuring effective implementation of the project.

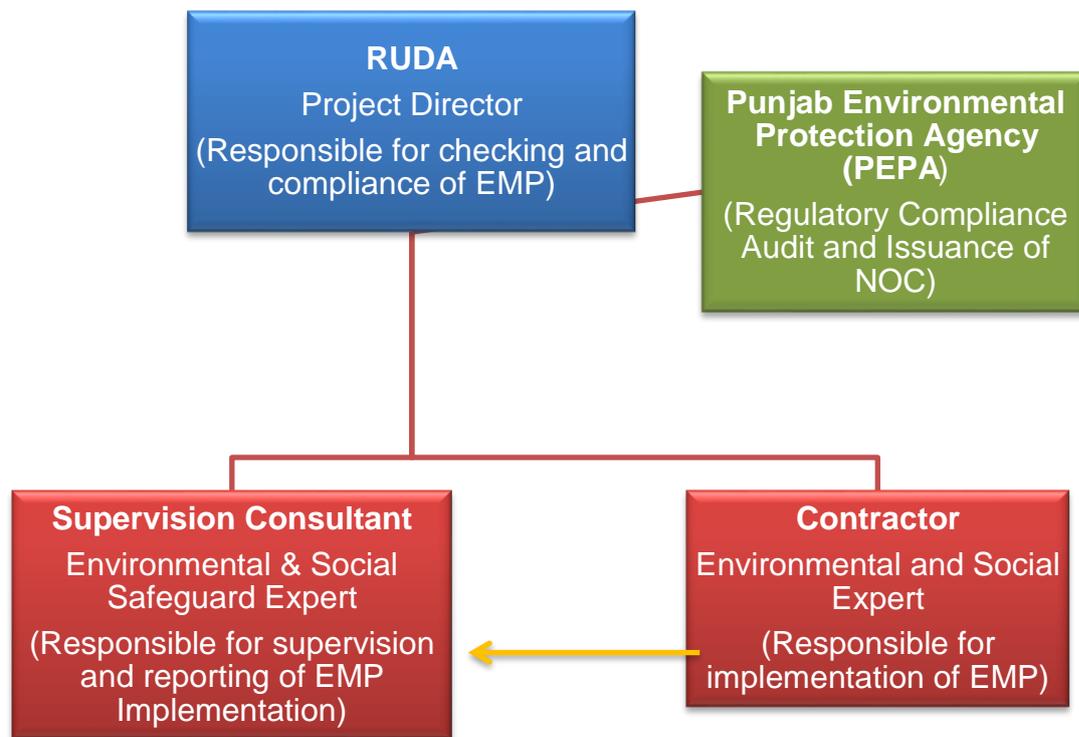


Figure 7.1: Organizational Setup for the Implementation of EMP at Construction Stage

7.4.3 Roles and Responsibilities for EMP Implementation during Construction Phase

a. RUDA/ Employer Concerned Staff

The specific responsibilities are as follows:

- Setting up systems for environmental management;
- Ensuring that the Contractor(s) develop and carry out environmental implementation plans that are consistent with the EMP;
- Liaising between the Project staff and the Supervisory Consultant's staff to monitor environmental and social compliance during construction phase;
- Ensuring that the required environmental and social training is provided to the concerned staff;
- Responsible for carrying out random site visits to the construction sites to review the environmental performance of the contractors;
- Monitoring the progress of environment and social related activities;
- Make sure that the contractor is implementing the additional measures, suggested by the Supervisory Consultant in monthly environmental monitoring reports;
- Assessment of the crops, orchards, valuation of property (if any), public utilities and negotiation with the affectees for fixation of compensation to be paid for temporary as well as permanent acquisition of the land;



- To estimate the crop compensation;
- Assist in checking genuine ownerships of the claimants, in consultation with the Revenue staff for prompt payment to the affectees;
To ensure that the tenants get their rightful compensation as per prevailing law especially in case of loss of crops;
- To assist Contractor for obtaining necessary approvals from the concerned departments;
- Maintaining interface with the other lined departments/stakeholders; and
- Reporting to the EPA-Punjab on status of EMP implementation.

b. Supervision Consultant (SC)

A professional consulting firm will be hired by RUDA and responsible for Contract Administration and Construction Supervision. The firm will be fully empowered as the 'Engineer'. The Consultant will administer the civil work's contracts, make engineering decisions, be responsible for quality assurance, provide general guidance and furnish timely responses to the Contractors in all matters relating to the civil works, and ensure that all clauses of the Contract Agreement including environmental and social clauses between the civil works Contractors' and RUDA are respected. The Project Engineer will have a full-time field based environmental and social specialist to ensure the implementation of EMP. Two separate experts, one for environment and one for social aspects, will be hired. The environmental and social specialist of SC will also develop training modules, conduct environmental and social trainings for the contractor's staff, and ensure social issues are properly addressed and mitigated during the project life.

Environmental and Social Experts (ESEs) of SC will oversee the performance of contractor to make sure that the contractor is carrying out the work in accordance with EMP as mentioned in the contract documents. He will provide guidance to the contractor's ESE for implementing each of the activity as given in EMP. ESEs will be responsible for record keeping, providing instruction through the Resident Engineer (RE) for corrective actions and will ensure the compliance of various statutory and legislative requirements.

However, overall responsibilities of ESEs are as follows:

- To oversee the performance of the Contractor to make sure that the Contractor is complying with EMP;
- Discussing various environmental and social issues and environmental mitigation, enhancement and monitoring actions with all concerned personnel's;
- Inspect, supervise and monitor all the construction and allied activities related to the EMP for the project and oversee the performance of the Contractor to make sure that the Contractor is complying with EMP;
- Visiting construction sites including incomplete construction work sites, where there is no contractor's activities, active construction work sites, completed areas of work sites as well as ancillary sites such as borrow areas, quarries, asphalt and crusher sites, hot mix plant sites, construction camps and work shop areas to ensure contractors compliance with EMP stipulations and conditions of statutory bodies;



- Assisting contractor in all matters related to public contacts including public consultation pertaining to environmental and community issues;
- To organize periodic environmental training programs and workshops for the consultant's and contractor's staff;
- Periodic reporting as mentioned in EMP; and
- Suggest any additional mitigation measures (if required).

c. Responsibilities of Contractor

Site Environmental and Social Expert of contractor will carry out the implementation of the mitigation measures at construction site. Contractor will be bound through contract documents to appoint the Site Environmental and Social Expert with relevant educational background and experience. The responsibilities of ESE of Contractor are as follows:

- ESE of contractor will be responsible for Implementation of the mitigation measures at construction site;
- ESE of contractor will prepare Site Specific Environmental and Management Plan (SSEMP) including Evacuation Plan, HSE Management Plan, Material Transportation Plan, Traffic Management Plan, Emergency Response Plan, Monitoring Plan, and asphalt and batching plant area plans, and will submit all the plans to the SC.
- ESE of contractor will be responsible for the implementation of EMP and to take effective measures against corrective actions plan;
- ESE will prepare the monthly compliance and monitoring reports as per schedule and will submit it to the SC;
- Provision of proper Personal Protective Equipment's (PPEs) to the workers and train them for their proper use;
- ESE will conduct the environmental, health and safety trainings for the staff and labors; and
- The Contractor shall submit the Code of Conduct that will apply to all of the contractor's staff. The contractor shall submit an outline of how the Code of Conduct will be implemented. The aspects to be addressed include:
 - Ensure compliance with applicable environment, health and safety standards and procedures associated with risks of Project activities;
 - Ensure compliance with all acquired approvals, applicable to the proposed Project;
 - Ensure protection of local community (including vulnerable and disable assemblies), and the Contractor's staff, sub-contractors and daily wage workers;
 - Ensure employment of fulltime security guards, and necessary security measures and instruments (CCTV) at site;
 - Ensure provision of adequately stocked first aid kit at site for dealing with accidental injuries, and natural hazards;
 - Prohibit use of illegal items such as weapons, alcohol and drugs at site;
 - Ensure that Project property is protected against vandalism, theft, and noxious activity;

- Ensure that positive attitude of respect and warmth is given to staff and community members;
- Ensure good housekeeping practices shall be adopted at site;
- Ensure that employment decisions are not made on the basis of personal characteristics unrelated to inherent job requirements, including race, gender, nationality, religion or belief, disability, age, sexual orientation, or ethnic, social and indigenous origin;
- Ensure establishment and strictly enforcement of “No Sexual Harassment Policy”;
- Ensure provision of necessary sanitation requirements for site workers (both for men and women);
- Ensure workers only use specified sanitary facilities provided by their employer and not in open areas;
- Restriction on burning solid waste;
- Restriction on dumping solid and liquid waste into nearby water bodies; ○ Prohibition for cutting trees, and clearing vegetative areas for construction camps, and for cooking purpose as a source of fuel; and
- Prohibition on illegal hunting of local fauna.

The Code of Conduct should be written in local and simple language (Urdu and English) and signed by each site staff to specify that they have received a copy of the code; code explained and clarified to them; acknowledged adherence to this Code of Conduct as a condition of employment; and understood that violations of the Code can result in serious consequences. A copy of the code shall be displayed at strategic location of the site, and mainly in the contractor’s site office.

d. Punjab Environmental Protection Department (PEPA)

PEPA is the regulatory authority for issuance of NOC for the proposed Project. As part of its mandate, protection of environment is their responsibility. Therefore, the agency will undertake an audit (as and when required) of the activities of the Project (both phases i.e., Construction and Operation) with respect to the protocols as defined in EMP and in NOC. The specific responsibilities are as follows:

- Liaison with the Environmental Committee of RUDA on the proposed Project to ensure compliance of measures as given in the EMP and in NOC issued by them for the construction activities of the proposed Project;
- Environmental Audit of the activities being undertaken by the Environmental Committee of RUDA and all other relevant stakeholders as provided in the EMP and NOC through random site visits and meetings.

7.4.4 Institutional Arrangement for Implementation of EMP during O&M Phase

The proposed Project will be administrated by RUDA during the O&M phase. RUDA has established District Support & Monitoring Department to monitor the development works of every district and for technical support for District Government. Therefore; it is suggested that



the Project Director of the proposed Project shall depute / hire Environment and Social Expert through District Support & Monitoring Department to monitor and implement EMP during operation phase.

The specific responsibilities of Environment and Social Expert are as follows:

- Coordinating with the operational staff working under the Regional General Manager and Project Director to monitor environmental compliance during operation phase;
- Advising on, and monitoring tree plantations along the road alignment as suggested in EMP;
- Reporting on the progress of environmental compliance to the Project Director and EPA-Punjab;
- Assess and propose mitigation measures for unforeseen long-term environmental and social impacts of operation; and
- Sustaining a working partnership among the RUDA, EPA-Punjab, Agriculture, Irrigation, Forest and Wildlife departments of Lahore District to ensure compliance of EMP during operation phase.

7.5 ENVIRONMENTAL MITIGATION AND MANAGEMENT MATRIX

Environmental Mitigation and Management Matrix (EMMM) is considered as one of the main elements of EMP. The EMMM provides the framework for the implementation of the mitigating measures against each identified potential adverse impacts, and management and monitoring of the same during the design, construction and operation phases of the proposed Project. Table 7.1 shows impacts, mitigations and the responsible authority and organization for the implementation of the same during design, construction and operation phase.

The Contractor(s) will be responsible for the preparation of Site Specific EMP (SSEMP) on the same format of this EMMP along with the site-specific plans based on the guidelines provided in this Section.

Table 7.1: Environmental Mitigation and Management Plan during Design Phase

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
Preconstruction / Design Phase					
1.	<p>Land Acquisition</p> <p>The land required for the construction of the proposed WWTP is about 280 Acres, Private land acquisition is involved in the construction of proposed project, which is mostly agricultural/barren land with sparsely population.</p>	<ul style="list-style-type: none"> Mitigation measures will involve careful site selection by the design team to minimize the impacts by avoiding the residences of affected families. The Land Acquisition Act (LAA) of 1894 is the main law regulating land acquisition for public purpose. The process of land acquisition and compensation should be followed in a transparent manner to minimize the impacts to provide compensation to the affected persons by providing sufficient budget in the project cost. 	Audits and Checks	Design Consultant	Proponent
2.	<p>Impact on Residential Structures</p> <p>In the AOI (ROW) housing structures of different categories will be affected fully due to Project intervention. In addition to these structures, boundary walls and other related structures are also under the impact.</p>	<ul style="list-style-type: none"> The Land Acquisition Act (LAA) of 1894 is the main law regulating land acquisition for public purpose. This impact can be mitigated by ensuring compliance of Land Acquisition Act, 1894, addressing community grievances on priority basis and timely compensation to affectees. 	Audits and Checks	Design Consultant	Proponent



Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
3.	<p>Impact on Commercial Structures</p> <p>Different types of commercial structures, will be impacted due to clearance of AOI for the Project activities. Respective structures include, cattle sheds and other structures where miscellaneous commercial activities are being carried out.</p>	<ul style="list-style-type: none"> The process of land acquisition and compensation should be followed in a transparent manner to minimize the impacts to provide judicious compensation to the displaced by providing sufficient budget in the Project cost. 			
4.	<p>Impact on Community and Religious Structures</p> <p>The community and religious structures are very sensitive to impact and need special care during execution of the Project. A Graveyards fall in the AOI of the proposed Project.</p>	<ul style="list-style-type: none"> The religious structures will not be disturbed but protected. 			



Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
5.	<p>Renting/Leasing Land</p> <p>The Contractors will require renting/leasing land for</p> <ul style="list-style-type: none"> • The development of Contractor camps and facilities i.e., storage, workshops, equipment parking and washing areas; • Aggregate quarries; and • Access roads/tracks for haulage, transportation etc. <p>The approximate area required for the establishment of one Contractor's camp facilities will be 1500m² at the different locations. Land utilization for Project activities and subsequent operation of Project may induce temporary changes in the existing landuse pattern.</p>	<p>It is the foremost option to establish the Contractor camps at the acquired land to eliminate the issues of land leased etc. However, if this option is not feasible then the land for above mentioned facilities should be selected and leased prior to the start of construction phase.</p> <p>Rental terms should be negotiated to the satisfaction of the concerned landowners and the agreement should be in local language to make the process clear.</p> <p>In addition, these Project facilities should be located at a minimum distance of 500 m from the existing settlements, built-up areas, archaeological and cultural monuments as the case may be. Prior to the commencement of the construction activities,</p> <p>The Contractor will submit site specific plan including layout, waste management, access to camp from no population, agreement with land owner, Social framework Agreement and as agreed with the Engineer. The contractor should submit a construction camp development/management plan to the</p>	<input type="checkbox"/> Audits and Checks	Design Consultant	Proponent



Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
		Engineer-in-charge for its scrutiny and approval. As far as possible, waste/barren land i.e., areas not under agricultural or residential use and natural areas located at high elevation should be used for setting up the contractor camps.			
6.	Loss of Agriculture Land Due to the proposed Project, almost 280 acres of land will be affected. A major proportion of the affected land is comprised of residential and agriculture land.	Due consideration should be given to minimum land acquisition in design phase in and around the agricultural land by careful site selection for the construction of the proposed project;	<input type="checkbox"/> Audits and Checks	Design Consultant	Proponent
7.	Technical Design and Layout Planning The alignment of wastewater lines and pumping station must be properly planned; else it may lead to both technical and social problems along with environmental issues of back flow creating foul smell and unhygienic conditions.	The proposed WWTP should be designed keeping in view the future population and projected flows based on current projections. The treatment facility should be able to cater the fluctuations in the flows. The design life of the plant should be on higher side since it incurs great capital investment. All structural, layout and engineering	<ul style="list-style-type: none"> • Confirmation of design incorporation. • Audits and Checks 	Design Consultant	Proponent

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
	Adequate planning for treated wastewater and sludge disposal is required to ensure an environmentally benign treatment process.	designing should be in strict accordance with the applicable bylaws and engineering parameters; Adequate planning for treated effluent disposal and sludge disposal should be done to ensure an environmentally benign treatment process; Develop an Emergency Response System for the wastewater system leaks, burst and overflows, etc.; and Proper storm water drainage system should be designed for the proposed WWTP according to the national/international engineering guidelines.			
8.	Topography The topography of the project area is flat. There will be slight change in topography due to excavation and tree cutting.	The project design would consider aesthetic concerns such as the tree plantation which is already recommended in the EIA Report; Best engineering design measures should be adopted keeping in view the aesthetics of the project area; and Ground disturbances should be limited to only the areas necessary for project related construction activities.	<ul style="list-style-type: none"> Confirmation of design incorporation. Audits and Checks 	Design Consultant	Proponent



<p>9.</p>	<p>Landuse/ Land value</p> <p>There will be change of landuse due to construction of proposed WWTP. Currently, the predominant landuse in the project area is agriculture. Some katcha houses, small wastewater ponds and trees also exist in the project area. The project site will be converted into wastewater treatment site.</p>	<p>WWTP site should be surrounded by thick tree plantation to minimize the impact and improve the aesthetics. Therefore, a tree plantation plan should be composed in coordination with the Forest Department/Authority with allocation of adequate budget. Those plants will also be promoted which can reduce odour, green protection, ornamental, indigenous etc</p>	<p>☐ Audits and Checks</p>	<p>Design Consultant</p>	<p>Proponent</p>
<p>10.</p>	<p>Storm Water Drainage / Urban Flooding</p> <p>The construction of proposed Project may be subjected to urban flooding especially during monsoon season.</p>	<p>Mitigation measures will include provision of proper drainage structures with appropriate design capacity to avoid flooding especially during the rains. Proper slopes shall be incorporated in design to avoid the stagnant water. Provision of parallel ponds may be considered in design to be used for controlling over flow, storm water management and maintenance.</p>	<ul style="list-style-type: none"> • Confirmation of design incorporation. • Audits and Checks 	<p>Design Consultant</p>	<p>Proponent</p>



<p>11.</p>	<p>Surface Water Quality</p> <p>River Ravi receives huge amount of untreated wastewater from the City of Lahore and other industrial discharges from different sources especially; Cantonment Drain, AIT Drain, and Hudyara Drain, a natural drain which carries pollution loads from both Pakistan and India.</p> <p>The proposed project will reduce the direct discharge of untreated waste water from project area, consequently help in improving the river water quality. The impact is major positive and permanent in nature. However, following contingencies may be expected during construction and operation phases of the project:</p> <ul style="list-style-type: none"> • Surface runoff in case of over flow/flooding; • Direct discharge of untreated wastewater during maintenance of ponds; and <p>Improper design of the outlet may result in decreased efficiency of WWTP leading to contamination of receiving water body.</p>	<p>The proposed WWTP capacity shall be designed to cater accidental increase in inflow of wastewater;</p> <p>Proper gated arrangements in the design are required to be provided at exit side of the treated effluent water before its discharge in the river to avoid entry of flood water in case of any flood;</p> <p>Provision of parallel ponds may be considered in design to be used for controlling over flow, storm water management and maintenance/ sludge removal; and</p> <p>The design may also consider option of trapping channel outlets e.g., using a submerged exit pipe baffle to prevent syphoning and transfer of surface crusts to subsequent ponds.</p>	<ul style="list-style-type: none"> • Confirmation of design incorporation. • Audits and Checks 	<p>Design Consultant</p>	<p>Proponent</p>
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Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
12.	<p>Flooding Patterns</p> <p>Since the proposed site for WWTP is located in the flood plain area of River Ravi along the existing flood protection bund. However, any temporary obstruction in the floodplain increases the potential for flooding of adjacent and downstream area and interferes with natural hydrological processes.</p>	<p>The natural drainage on the site had to be modified in the design in order to minimize flooding, if any, and protect the treatment units;</p> <p>Flood protection dykes have been proposed around WWTP boundary owing to the fact that the WWTP site lies within the flood plain of river Ravi; and a spur exists on the upstream of the proposed project area, whereas the Motorway (M-2) runs along its eastern side. These existing structures also secure the proposed project area against detrimental effects of flood discharges.</p>	<ul style="list-style-type: none"> • Confirmation of design incorporation. • Audits and Checks 	Design Consultant	Proponent

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
13.	<p>Seismic Hazard</p> <p>As per Building Code of Pakistan, Seismic Provisions, 2007, the project area is located in Seismic Zone 2A (low to moderate hazard), A high intensity earthquake impacting the project site can adversely impact the development.</p>	<p>The proposed structure should be designed and constructed to withstand high earthquakes. For seismic hazard analysis, updated structural, geotechnical and seismic studies should be conducted;</p> <p>To mitigate the seismic hazard, Seismic Building Code of Pakistan 2007 (SBC-07) should be adopted. This code specifies minimum requirements for seismic safety of buildings and has to be applied and used by engineers in conjunction with the necessary understanding of the concepts of structural, geotechnical and earthquake engineering.</p>	<ul style="list-style-type: none"> • Confirmation of design incorporation. • Audits and Checks 	Design Consultant	Proponent



Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
14.	<p>Lightning</p> <p>Lightning is a constant hazard for buildings and equipment. One lightning strike can damage the buildings and may cause failures to the electronic devices inside the building and sometimes it may even result in fire leading to human and financial loss.</p>	<p>Lightning</p> <ul style="list-style-type: none"> Design of an efficient Lightning Protection System (LPS) should be ensured to minimize the damage to the building(s) by creating a path (divert) for the lightning discharge to the ground. 			
15.	<p>Construction Camps</p> <p>Improper location of construction camp(s) and mismanagement of construction camp activities can lead to various social and environmental impacts which include loss of vegetation due to setting up construction camps, indiscriminate generation of solid waste, and discharge of sanitary effluent, water pollution and health & safety issues in the surrounding settlements (Bhamma, Jhuggian, Khokhar Pind, etc.).</p> <p>Furthermore, cultural differences, behavior of construction workers, potential disregard for local cultural norms can lead to increase tension between local communities and workers residing in the construction camps. If the sites are left unclear after completion of</p>	<ul style="list-style-type: none"> Camps should be designed to be self contained to reduce demand on infrastructure and services of nearby communities and to minimize the removal of existing macro-plants; and Formulation of a comprehensive safety and security plan for the camps which should be comprised of a training manual, use of safety equipment, emergency preparedness and code of ethics. 	<ul style="list-style-type: none"> Confirmation of design incorporation. Audits and Checks 	Design Consultant	Proponent



Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
	construction phase; it may cause disturbance for the proponent and local community.				
16.	Flora Installation of construction camps, construction of temporary facilities & mobility of construction staff may damage the local vegetation/trees. As the heavy machinery and camps will be moved and installed, which require significant space due to which available vegetation is expected to be removed.	The camps, mobility of machinery and construction of temporary road should be proper planned and well designed to avoid any loss to local green cover; It is recommended to establish the construction camps where minimum or no vegetation exists. Similarly, the alternate routes for roads and points for camps are recommended where no loss of vegetation is expected; and The location of construction camp will be selected so, as to have limited environmental effect during construction phase and to reduce the cost and land requirement.	<input type="checkbox"/> Audits and Checks	Design Consultant	Proponent
17.	Fauna Movement and installations of machinery and vehicles will take place so noise and habitat loss is expected. The routes of the available wildlife and other habitats may be affected due to camps set-up and machinery movements and installations	The standard measures must be adopted to minimize noise due to machinery movements and installations; Wildlife movements and routes must be considered during activities and should be avoided to their maximum level; The alternate routes and points are recommended to avoid any damage to locally available fauna; The camps shall be properly fenced and gated to check the entry of animals in search of eatable goods; and	<input type="checkbox"/> Audits and Checks	Design Consultant	Proponent

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
		Similarly, wastes of the camps shall be properly disposed of to prevent it being eaten by animals, as it may be hazardous to them.			
18.	<p>Public Utilities</p> <p>Due to the proposed Project, public utilities will be affected creating disruption of public services and inconvenience to the local residents. Various utilities such as electrical poles and tube-wells situated within the AOI of the proposed Project will be disturbed. These utilities if not handled properly will cause difficulties to the people of Project Area.</p>	<p>Proper compensation and restoration mechanism of public utilities should be prepared;</p> <p>The provision in the design and budget for the relocation of the existing utility infrastructures wherever required shall be finalized in consultation with the concerned department;</p> <p>All public utilities likely to be affected by the proposed Project will be relocated well ahead of time before the actual commencement of the construction work.</p> <p>Strengthening of utilities, wherever required;</p> <p>Close coordination with the concerned departments to curtail inconvenience to the residents of the Project Area;</p> <p>Timely public notification of unexpected disruption of services; and</p> <p>The Contractor shall in no instance excavate around or over live buried electrical cable or pressurized gas lines during the construction, or allow such to be suspended across open excavations in a manner that, in the</p>	Audits and Checks	Design Consultant	Proponent



		opinion of the Resident Engineer, threatens public or worker safety. Neither shall water lines be left suspended and unsupported across open excavations.			
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19.	<p>Physical, Religious and Cultural Resources</p> <p>According to the field survey, only a graveyard is coming under AOI of the proposed project.</p>	<p>Due consideration shall be given to minimize the impacts on graveyard. The graveyard will be protected.</p>	<input type="checkbox"/> Audits and Checks	<p>Design Consultant</p>	<p>Proponent</p>
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Construction Phase



<p>20.</p>	<p>Soil Erosion and Contamination</p> <p>Impact on topsoil and soil stability is mainly expected during the preparatory and construction works, which will be caused by the arrangement of the construction camp, construction site, replacement of the equipment, earthworks, arrangement of temporary and permanent infrastructures, etc.</p> <p>The soil would be exposed to erosion due to removal of vegetation, establishing construction camps / workshops and excavation etc. The most significant aspects in the construction phase of the proposed</p> <p>Treatment plant concerning the soil impact are excavation works, road construction and ponds construction works. These will expose soils in the affected project area leaving them vulnerable to erosion by surface run-off and wind. Better management of construction works in the monsoon season will give positive impacts.</p>	<p>In order to prevent the damage and contamination of soil at the project site, surface layer of the soil should be removed and stored temporarily in pre-selected locations. The soil should be stockpiled separately. Stockpiles should be protected from wind and atmospheric precipitation and should be at least 50 meters away from surface water body; Stored excavated material shall be covered and preferably reused, e.g., in construction of dykes etc.; Sprinkling of water may help in reducing the erosion soil; Use of heavy machinery should be restricted as far as possible to work sites only to avoid the destruction of soil structure; Vehicles and equipment should be checked regularly. In case of damage and fuel / oil leakage, it should be repaired immediately. Damaged Vehicles should not be allowed on the construction sites; In case of spillage of pollutants, spilled material should be localized and contaminated site should be immediately cleaned; Staff should be provided with appropriate means (adsorbents, shovels, etc.) and with personal protective equipment as well;</p>	<ul style="list-style-type: none"> • Visual observation and photographic record • Site restoration and rehabilitation plan implementation 	<p>Construction Contractor</p>	<p>Proponent</p>
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Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
	<p>On the other hand, the construction of the wastewater treatment plant will involve building large embankment structures on land, which will result in a loss of the option for alternative land use and thus represents an irreversible commitment of land resources</p> <p>Besides, there is chance for soil pollution with substances due to leakages of fuels and oils from the heavy vehicles and machinery used for construction and due to applied chemicals during this phase.</p>	<p>All spoils should be disposed of at site designated by LWMC/Authority and the site should be restored back to its original conditions;</p> <p>Non-bituminous wastes from construction activities will be dumped in approved sites, in line with the guidelines for dump sites, and shall be covered;</p> <p>Washing yards shall be paved to avoid seepage of runoff from the yard;</p> <p>After completion of construction works, all kind of waste (including hazardous waste) will be collected and removed from the area.</p> <p>Hazardous waste should be removed for further management by the licensed contractor; and</p>			



Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
21.	<p>Water Quality</p> <p>The potential sources of water pollution associated with the construction of proposed project are runoff from the construction works area that may contain increased loads of sediments, suspended solids and other contaminants. Potential sources of pollution from the site include:</p> <ul style="list-style-type: none"> • Runoff and erosion from exposed soil surfaces, earth work areas and stockpiles e.g., grouting and cement material with the rain; • Wash water from dust suppression sprays; • Fuel and lubricants from maintenance of construction vehicles and mechanical equipment; • Spillage of liquids stored on-site such as oil, diesel, and solvents etc. are likely to result in water pollution; and • Uncontrolled discharge of debris and rubbish such as packaging, construction material and refuse. 	<p>Construction camp will be established in area with adequate natural drainage channels in order to facilitate the flow of the treated effluents after ensuring that PEQS are met;</p> <p>The proponent will ensure that the construction work is confined within the project boundary and water bodies are prevented from pollution during construction;</p> <p>The solid waste will be disposed of in designated landfill sites to sustain the water quality for domestic requirements;</p> <p>Regular water quality monitoring according to determined sampling schedule;</p> <p>Water required for construction shall be obtained in such a way that the water availability and supply to nearby communities remain unaffected;</p> <p>The contractor will ensure that construction debris do not find their way into the drainage which may get clogged;</p> <p>To maintain the surface water flow/drainage, proper mitigation measures will be taken for the proposed project, like drainage structures;</p> <p>Wastes will be collected, stored and taken to approved disposal site; and similarly, if the sewage after treatment is to be discharged in to the land it will</p>	<ul style="list-style-type: none"> • Visual observation and photographic record • Regular environmental monitoring, sampling and testing reports 	Construction Contractor	Proponent



Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
		meet the requirements of the PEQS for disposal of wastewater.			
22.	<p>Deterioration of Ambient Air Quality</p> <p>Air quality will be affected by fugitive dust emissions from construction machinery; dust from the unpaved surface and construction vehicles. Emissions may be carried over longer distances depending upon the wind speed, direction, temperature of surrounding air and atmospheric stability. Besides, multifarious construction activities and increased vehicular traffic (construction vehicles) would also contribute to the localized airborne dust. The larger sized particles, under influence of gravity, tend to settle down in the immediate vicinity of the source. The Suspended Particulate Matter (SPM) tends to remain suspended in the environment for much longer and persistent time and is an environmental hazard. The objectionable impacts of settling of the suspended dust would be its dry</p>	<p>All vehicles, machinery, equipment and generators used during construction activities should be kept in good working condition and be properly tuned and maintained in order to minimize the exhaust emissions;</p> <p>Open burning of solid waste from the Contractor's camps and at construction site should be strictly banned;</p> <p>Preventive measures against dust should be adopted for on-site mixing and unloading operations;</p> <p>Construction materials (sand, gravel, and rocks) and spoil materials will be transported through trucks covered with tarpaulins and all vehicles (e.g., trucks, equipment, and other vehicles that support construction works) will comply with the PEQS for carbon emissions and noise;</p> <p>Regular water sprinkling of the site should be carried out to suppress excessive dust emission(s);</p> <p>Emissions from power generators and construction machinery are important</p>	<ul style="list-style-type: none"> • Visual observation • Regular environmental monitoring, sampling and testing reports • Vehicle maintenance records • Water sprinkling records. 	Construction Contractor	Proponent

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
	deposition on vegetation, motor vehicles, structures, and other exposed surfaces. Exhausts from fossil fuel burning in the construction machinery will also deteriorate local air quality. Similarly, exhausts from generators can also have impacts on air quality in the vicinity.	<p>point sources at the construction sites. Proper maintenance and repair are needed to minimize the hazardous emissions;</p> <p>Emissions from batching / asphalt plants can be controlled efficiently by the installation of cyclone / scrubbers. Diesel operated equipment should be equipped with well-maintained fuel filter and may be replaced timely (if required);</p> <p>Construction equipment is generally left idling while the operators are on break or waiting for the completion of another task. Emissions from idling equipment tend to be high. Existing idling control technologies, which automatically shut the engine off after a preset time can reduce emissions, without intervention of the operators;</p> <p>PEQS applicable to gaseous emissions generated by construction vehicles, equipment and machinery should be enforced during construction works;</p> <p>Regular monitoring of air quality in accordance with the formulated environmental monitoring plan.</p>			



<p>23.</p>	<p>Noise and Vibration</p> <p>The noise and vibration will be produced due to the operation of construction machinery equipment. Sources of noise and vibration during construction are heavy machinery such as bulldozers, excavators, stabilizers, concrete mixing plant, pneumatic drills, stone crushers, asphalt plants and other equipment's. Noise and vibration are perceived as one of the most undesirable consequences of construction activity. The above machinery is expected to generate noise levels. The noise and vibration may cause disturbance to the residents of nearby villages including Bhamma, Jhuggian and Khokhar Pind etc.</p>	<p>There are a variety of ways including Quieter Equipment; Modifying Existing Old Equipment; Barrier Protection; Work Activity Scheduling; Maintenance; Noise Perimeter Zones (NPZs) by which construction equipment and worksite noise can be controlled.</p>	<ul style="list-style-type: none"> • Physical observation • Regular environmental monitoring, sampling □ Vehicle maintenance records and testing reports 	<p>Construction Contractor</p>	<p>Proponent</p>
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<p>24.</p>	<p>Borrow Areas/ Open Pits</p> <p>Borrow / open pits and its excavation activities may result in land disputes, soil erosion, loss of potential cropland, loss of vegetation, landscape degradation, and damage to road embankments.</p> <p>Borrow/ open pits may also result in potential sources of mosquito breeding and may prove hazardous to human beings, livestock and wildlife. This will also degrade hygienic condition of the Project Area.</p>	<p>Necessary permits will be obtained for any borrow pits from the competent authorities;</p> <p>In borrow pits, the depth of the pit shall be restricted upto 5' and the sides of the excavation will have a slope not steeper than 1:4;</p> <p>Soil erosion along the borrow pit shall be regularly checked to prevent/mitigate impacts on adjacent lands; and</p> <p>In case borrow pits fill with water, measures have to be taken to prevent the creation of mosquito-breeding sites.</p>	<ul style="list-style-type: none"> • Visual observation and photographic record • NOC record of permits • Check and audits 	<p>Construction Contractor</p>	<p>Proponent</p>
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Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
25.	<p>Construction Camps/Camp Sites</p> <p>Improper construction camp location and mismanagement of construction camp activities can lead to various social and environmental impacts which include health and safety, traffic problems, soil degradation, loss of vegetation and assets on the selected land, solid waste and water pollution.</p>	<p>The project will seek to avoid sitting camps where their presence might contribute to any conflicts with locals; Employment policies which aim to maximize job opportunities for local people will help to minimize tensions caused by different socio-cultural values; and Waste Management Plan will be implemented to ensure safe handling, storage, collection and disposal of construction wastes and the training of employees who handle waste.</p>	<ul style="list-style-type: none"> • Visual observation and photographic record. • Waste Management plan implementation 	Construction Contractor	Proponent
26.	<p>Wastewater Generation at Construction Camps</p> <p>Wastewater will be generated at the construction camps by the workers. If the generated wastewater is not properly treated or disposed of, this may contaminate the surface water sources such as nullahs, drains, water channels etc. apart from soil contamination. The wastewater generation is estimated to be 9,600 liters/day¹⁷ for 300 construction workers during construction phase of the proposed Project.</p>	<p>Domestic and chemical effluents from the construction camp will be disposed by the development of onsite sanitation systems i.e., septic tanks; Proper monitoring to check the compliance of PEQS will be carried out; Sewage from construction camps will be disposed of after proper pre-treatment and processes such as soakage pit.</p>	<ul style="list-style-type: none"> • Visual observation and photographic record. • Waste Management plan implementation 	Construction Contractor	Proponent

¹⁷ Design Criteria of Public Health Engineering for Water Supply, Sewerage and Storm Water Drain (Domestic sewage generation = 80% of water consumed/day)



<p>27. Solid Waste Generation at Construction Camps</p> <p>The solid waste generation is estimated to be 135 kg/day¹⁸ for 300 construction workers during construction phase of the proposed Project. Different type of waste is likely to be generated during the construction phase of the proposed Project. The municipal waste will be in the form of food, cans, paper and wastewater from construction camps toilets and washing yards. Construction waste will include excavated soil, sand, gravel, rocks, asphalt, pieces of concrete, bricks, wood, metal pieces and electrical wires. Whereas, hazardous waste can be comprised of paints and construction chemicals.</p> <p>Insecure and unhygienic disposal of the solid wastes particularly garbage and trash may cause degradation of soil and land.</p> <p>Throwing away of solid wastes into water channels and the wastewater network can result into choking.</p>	<p>Solid Waste generated during construction and camp sites will be safely disposed in demarcated waste disposal sites and the contractor will provide a proper waste management plan;</p> <p>Training of work force in the storage and handling of hazardous materials and chemicals Construction workers and supervisory staff should be encouraged and educated to practice waste minimization, reuse and recycling to reduce quantity of the waste; proper labeling of containers, including the identification and quantity of the contents, hazard contact information, etc;</p> <p>Waste disposal plan must be reviewed during the entire construction phase in the light of changing weather conditions;</p> <p>Emergency response plan shall be prepared to address the accidental spillage of fuels and hazardous goods;</p> <p>Immediate collection of spilled oils/fuels/lubricants by collection of contaminated soils and skipping oils from surface water by applying appropriate technologies;</p> <p>Reusing bitumen spillage; and disposing non-usable bitumen spills in a deep trench providing clay linings at</p>	<p><input type="checkbox"/> Visual observation and photographic record. Waste Management plan implementation</p>	<p>Construction Contractor</p>	<p>Proponent</p>
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¹⁸ Source: The World Bank Report 2012 – What a Waste: A global review of solid waste management. Based on UNEP estimates for waste generation in the Asia Pacific. Average is 0.45 kg/capita/day.



Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
		<p>bottom and filled with soil at the top (for at-least 0.5 m);</p> <p>Used oil shall be collected in separate containers stored on impervious platform with restricted access and shall be sold to licensed contractor and the burning of waste oil shall be strictly restricted;</p> <p>Construction waste such as waste wood can be recovered and recycled into wood for new building projects, and cement, bricks, and plaster can be crushed and reused in other construction and building projects; and</p> <p>The contractor should ensure implementation of proposed Construction Waste Management Plan and it must be reviewed during the entire construction phase in the light of changing weather conditions.</p>			

<p>28.</p>	<p>Traffic Issues</p> <p>Due to the proposed project construction activities and movement of heavy project vehicles for construction material supply, traffic problems may arise for the commuters and transporters travelling especially through Bhamma Road, Ring Road and other Project Area access roads.</p> <p>It will also increase traffic load on the existing road network or access roads ultimately deteriorating the existing condition of the roads. The movement of vehicles along the haulage routes may cause soil erosion, debris flow, dust emissions, vibrational impacts, etc.</p>	<p>Movement of vehicles carrying construction materials and equipment/machinery will be restricted during the daytime to reduce traffic load and inconvenience to the local population; Construction vehicles, machinery and equipment will be parked at designated areas (at construction camps site) to avoid un-necessary congestions along the major roads; Damages of roads due to construction vehicles will be instantly repaired and /or compensated after the completion of work; Proper signs boards will be provided for smooth flow of traffic; Period of construction and area / location of construction site shall be informed to public in general and specifically to local residents;</p> <p>Any closure of the roads and deviations / diversions proposed should be informed to the riders through standard signs and displays; and</p> <p>Traffic Management Plan will be prepared by the contractor and implemented to avoid traffic accidents, and public inconvenience.</p>	<ul style="list-style-type: none"> • Vehicle maintenance record • Training record • Implementation of TMP • Regular visual observations 	<p>Construction Contractor</p>	<p>Proponent</p>
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Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
29.	<p>Green House Gas Abatement</p> <p>The main sources of greenhouse gases (CO₂, CH₄, NO_x etc.) during the construction activities of the proposed project will include both mobile and stationary sources. The mobile source will be the construction and transportation vehicles while the stationary source will be the batching and asphalt plants.</p>	<p>Regular motioning of the vehicles for engine efficiency;</p> <p>All stakeholders (RUDA, consultants, contractors, concessionaires) need to become aware that their actions at all stages of a project can contribute to reducing the CO₂ burden;</p> <p>Avoid idling of construction vehicles;</p> <p>Alternative energy resources shall be considered where possible;</p> <p>PEQS applicable to gaseous emissions generated by construction vehicles, equipment and machinery shall be enforced during construction works.</p>	<ul style="list-style-type: none"> Regular environmental monitoring, sampling and testing reports Vehicle inspection record Plantation record 	Construction Contractor	Proponent
30.	<p>Natural and Man-Made Disasters</p> <p>Natural disasters (earthquakes) and accidents such as fire, falls, slips and trips may result in injuries, financial losses and may even lead to deaths.</p>	<p>An Emergency Response Plan (ERP) for earthquakes and manmade disasters should be developed by contractor in coordination with SC and RUDA should be implemented in close consultation with the RESCUE Services and other concerned departments;</p> <p>Training of the Contractor and RUDA staff and employees regarding the emergency procedures and plans should be regularly conducted;</p> <p>Emergency numbers should be clearly posted at active construction sites; and</p>	<ul style="list-style-type: none"> Trainings, drills, record keeping ERP implementation Visual observation and photographic record. 	Construction Contractor	Proponent



Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
31.	<p>Occupational Health and Safety</p> <p>Occupational Health and Safety (OHS) related impacts will arise during construction phase activities including clearing of earth, levelling, compaction, carpeting, pavement finishing and testing & commissioning. Eye injury can be caused by stone or metal particles. Hazard of being hit by falling objects, major hand-arm and whole-body vibration hazards, skin and respiratory tract irritation from exposure to cement dust, overexertion and awkward postures etc, will be another impact. Welding hazards include electric shock, fumes and gases, fire and explosions, falls from height, eye and head injuries etc. Other impacts will be fall from height, contact with heavy electrical and mechanical equipment, equipment failure, uncontrolled movement, unguarded moving mechanical equipment parts, fatigue, unbalanced load, falling objects, hand injury, slip and trip hazards, wind / storm activity, injury from releasing load too soon etc. Operating mechanical and electrical equipment will trigger the OHS related issues e.g., struck by moving vehicles or</p>	<p>Providing basic medical training to specified work staff and basic medical service and supplies to workers.</p> <p>Complying with the safety precautions for the construction workers as per International Labour Organization (ILO) Convention No. 62, as far as applicable to the Project Contract.</p> <p>Training of workers in construction safety procedures, environmental awareness, equipping all construction workers with safety boots, helmets, gloves and protective masks, goggles, shields and monitoring their proper and sustained usage.</p> <p>Contractor will ensure the provision of medicines, first aid kits, ambulance etc. at the camp site.</p> <p>Work areas will be cordoned off where necessary.</p> <p>Contractors will instruct their staff to use Personnel Protective Equipment (PPE) (e.g., wire containment, displaying warning signs along the work site, communicating advance warnings to mats) to enhance the safety.</p> <p>Safety lookouts will be built to prevent people and vehicles from passing at the time of hot or cold work.</p>	<ul style="list-style-type: none"> <input type="checkbox"/> Implementation of HSE Plan <input type="checkbox"/> Use of PPEs <input type="checkbox"/> Training Records <input type="checkbox"/> Work permits <input type="checkbox"/> Implementation of Emergency response plan and disaster management plan in case of natural disaster occurrence 	Construction Contractor	Proponent



	<p>other equipment, slips or trips, struck by flying objects, such as dirt or splashed fluids, caught in pinch points, shear points, crush points, falling from machine etc.</p>	<p>An emergency management plan must be devised by the contractor in close coordination with the provincial emergency services.</p>			
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Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
32.	<p>Community Health and Safety</p> <p>The construction activities and vehicular movement at construction sites may result in roadside accidents particularly inflicting local communities who are not familiar with presence of heavy equipment. The proposed project will also have potential of air (dust pollution), noise and vibrational impacts on nearby community</p>	<p>Providing basic medical training to specified work staff and basic medical service and supplies to workers;</p> <p>There will be proper control on construction activities and oil spillage leakage of vehicles;</p> <p>Seeking cooperation with local educational facilities (school teachers) at each village along the route for road safety campaigns; and</p> <p>Provision of proper safety and diversion signage, particularly at urban areas and at sensitive/accident prone spots.</p>	<ul style="list-style-type: none"> • Implementation of HSE Plan • Use of PPEs • Community concerns record • Medical reports of worker 	Construction Contractor	Proponent



<p>33.</p>	<p>Communicable Diseases</p> <p>The laborers in the Contractor Camp, truck drivers and like personnel who interact with each other have the potential for the spread of communicable diseases like COVID-19 and HIV/AIDS. 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 COVID-19 and HIV/AIDS, yet its occurrence in such a situation cannot be precluded. It is necessary that awareness and preventive campaigns are run from time to time in the labor camps and the field offices of the Project to prevent the communicable diseases.</p> <p>There is a chance of spreading of an epidemic of Coronavirus disease (COVID-19) due to close interaction of the labor force during construction not only among the workers but also in the area. This impact can be categorized as direct, medium, site-specific, short term, temporary, medium to high probability and reversible.</p>	<p>Arrange to run an active campaign, in the labor camp, to make people aware of the cause, mode of transmission and consequences of HIV/AIDS;</p> <p>SOPs related to the construction industry advised by National Action Plan for COVID-19 Pakistan to control spreading of COVID-19, shall be implemented by the contractor and should be strictly monitored. Guideline for COVID-19 are attached as Annex-VIII;</p> <p>Strengthen the existing local health and medical services for the benefit of labor as well as the surrounding villages;</p> <p>Ensure cleanliness and hygienic conditions at the labor camp by ensuring proper drainage and suitable disposal of solid waste. Inoculation against Cholera will be arranged at intervals recommended by the Health Department/Authority;</p> <p>Locating a labor camp at least away from the villages (local settlement), and</p> <p>Keep all the camps, offices, material depots, machinery yards and work sites open for the inspection of health and safety measures and related documents.</p>	<ul style="list-style-type: none"> • Implementation of HSE Plan • Use of PPEs • Community concerns record • Medical reports of worker 	<p>Construction Contractor</p>	<p>Proponent</p>
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Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
34.	<p>Resource Conservation</p> <p>The materials used in construction of proposed project would include coarse aggregates (crush), fine aggregates (sand), steel, water, asphalt, reinforcement and cement.</p> <p>Fuel will be used to operate construction machinery and asphalt and batching plants. Sustainable use of energy resources is very important not only to continue future use but also to help to reduce air emissions.</p>	<p>Diesel and fuels with low sulphur content should be used to operate construction machinery and equipment's;</p> <p>The efficient and well maintained equipment's and machinery should be used;</p> <p>The equipment's and machinery should be turned off when not in use;</p> <p>Regular maintenance of machinery to avoid fuel leakages.</p>	<input type="checkbox"/> Audits and Checks	Construction Contractor	Proponent
35.	<p>Discovery of Heritage Sites/ Structures during Excavation</p> <p>During excavation, there is a chance of finding artifacts. In case of finding any artifact, the contractor shall immediately report through Supervision Consultant to Directorate General (DG) of Archaeology, Government of Punjab to take further suitable action to preserve those antiques or sensitive remains.</p>	<p>Chance finds procedure (given in Annex-X) shall be adopted in case of any accidental discover of cultural heritage.</p>	<input type="checkbox"/> Implementation of chance find procedure	Construction Contractor	Proponent



Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
36.	<p>Flora</p> <p>The project will involve destruction of vegetation cover on construction areas particularly along proposed project construction. It is initially examined that approximately 472 mature, sub-mature, and pole crop and saplings of different tree/plants species may be disturbed (as per data from GIS, which needs ground trothing and physical verification through Forest department & PHA) during the construction phase of the project. Moreover, trees of small and medium sizes will be removed due the layout of the project for which compensation should be made to concerned parties (Local community, forest and other relevant departments, if any).</p> <p>Exhaust of noxious gases from movement of heavy machinery and dust will pollute air which will adversely affect health and vigor of plants. During construction activities the Contractor's workers may damage the vegetation and trees (for use as fire-wood to fulfill the camps requirements).</p>	<p>Cutting of trees and disturbance of trees shall be avoided as far as possible and select the alternate site for the proposed project as the impact on local ecosystem (specially trees) is expected as high. So, that negative effects on the process of natural regeneration of species are minimized and if possible an alternate area may be considered for proposed project, in which minimum ecological and environmental losses are expected. Trees should be replanted or transplanted wherever possible, instead of cutting. Tree plantation plan should be implemented preferably in the project area or nearby blank spaces (along the roads, parks & green areas etc. where suitable) within 500m radius possibly. A tree plantation program shall be formulated with the recommendations and technical support of concerned PHA and Forest Department/Authority.</p> <p>As a principle, ten trees shall be planted in place of felling of one tree in consideration of mortality. Total 4,720 trees shall be planted in compensation of 472 trees</p>	<ul style="list-style-type: none"> Implementation of Tree Plantation Plan Visual Observations 	Construction Contractor in association with PHA or Forest Department	Proponent



Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
	Overall, it can be stated that the large number of trees may be damaged in the proposed project activities.	<p>The proponent shall implement the program with the help concerned consultant ecologist.</p> <p>Open fires should be banned in the area to avoid hazards of fire in the area.</p> <p>Clearing of vegetation cannot be avoided at the areas specified for project structures, but damage to the natural vegetation may be minimized by establishing camp sites, workshops and batching plants on waste/barren land rather than on forested or green land</p> <p>However, if such type of land is not available, it shall be ensured that minimum clearing of the vegetation is carried out and minimum damage is caused to trees and undergrowth.</p> <p>Construction vehicles, machinery and equipment will remain confined within their designated areas of movement.</p> <p>The Contractor's staff and labor shall be strictly directed not to damage any vegetation such as trees or bushes.</p> <p>Contractor shall provide gas cylinders at the camps for cooking purposes and cutting of tress/bushes for fuel shall not be allowed</p>			



Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
37.	<p>Fauna</p> <p>The existing population of birds, mammals and reptiles of the construction areas will be affected due to disturbance arising from construction activities involving excavation, movement of machinery and vehicular traffic, movement of labor, camping, etc.</p> <p>Noise generated from machinery particularly during the night hours will even scare the wildlife residing in habitats located at some distance from the construction areas. Uncontrolled blasting may even disturb the wildlife of the Project Areas.</p>	<p>Care shall be taken during construction activities for avoiding purposely or chance killing of animals; If any wild species and habitat is found during construction, it must be dealt carefully and local wildlife department officials should be informed;</p> <p>Hunting, poaching and harassing of wild animals shall be strictly prohibited, and Contractor shall be required to instruct and supervise its labor force accordingly and clear orders should be given in this regard; and</p> <p>The Contractor must be held responsible for instructing his work force accordingly and for enforcing this restriction. In addition, this shall have to be controlled by the Wildlife Department.</p>	<ul style="list-style-type: none"> ☐ Visual Observations 	Construction Contractor	Proponent
38.	<p>Social/ Cultural Conflicts</p> <p>During the construction phase of the project, conflicts may arise between labor force and Local communities. i.e. Bhaama, Jhuggian and Khokhar Pind exists near the Project Area. Use of local resources (existing infrastructure and utilities) by the construction workers can generate stress on the local residents. Furthermore, difference in cultural</p>	<p>Local labor should be preferably employed for the construction works; Careful planning and training of work force to minimize disturbance to the local people; and</p> <p>Public notification through print or electronic media during the entire construction phase to avoid any inconvenience in accessibility to the locals.</p>	<ul style="list-style-type: none"> • Visual observations • Regular monitoring, audit and checks 	Construction Contractor	Proponent



Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
	values may also cause discomfort to local residents.				
39.	<p>Agriculture and Trees</p> <p>The AOI of the proposed Project is also falling in agricultural area and damages of crops and tree are expected during construction activities. The areas used for the construction camps will result only in temporary loss of cultivatable land, as the land can be again brought under cultivation following completion of the construction works. However, standing crops and trees in AOI of the proposed project will result in permanent loss of cultivatable land. There is also encroached land.</p>	<p>The payment of compensation to farmers for the loss of any standing crops, or crops already sowed should be properly assessed which will be applicable for all crops standing on land within the acquisition area at the time of dispossession;</p> <p>The compensation value shall be calculated</p> <p>Removal of all contractors' facilities from the Project Area shall be a contractual requirement, and as such the land used for the sub-camps can be restored to facilitate agriculture and the land used for the construction camp shall become cultivatable.</p> <p>Compensation for the loss of crops to the land owners and cultivators as the case may be will be paid, As far as possible, land within the AOI (which will be acquired) or otherwise barren land without any crop outside the AOI will be selected for the camp sites and disturbance to the crops and natural vegetation will be avoided as much as possible.</p>	<ul style="list-style-type: none"> • Visual observations • Regular monitoring, audit and checks 	Construction Contractor	Proponent

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
40.	<p>Impacts on Livelihood</p> <p>The construction activity may disturb the business and livelihoods of the Cattle shed owners, shopkeepers and workers doing their work in the AOI due to the excavation activities. In this respect, the most critical area is Khokhar Pind The main commercial activities in these areas include livestock sheds (Milk producing points), vegetables shops and grocery shops. At this stage the assessment of livelihood impacts has been carried out on the basis of the proposed AOI. During the construction phase, these locations will be finalized and on that basis the livelihood impacts will be determined more accurately.</p>	<p>Proper compensation should be provided to all the affectees losing their livelihoods along the AOI; Relevant stakeholders should be engaged to design livelihood restoration measures including affectees of the proposed Project Area;</p> <p>Project Construction should be completed on time; and</p> <p>Proper awareness and training should be conducted among the affectees regarding Project benefits, reasons for acquiring lands and compensations to be provided.</p>	<p>☐ Regular monitoring, audit and checks</p>	<p>Construction Contractor</p>	<p>Proponent</p>



<p>41.</p>	<p>Influx of Labor</p> <p>For the implementation of Project activities, skilled and unskilled labor is required by the contractor. Mostly, skilled and unskilled workers have been associated with the contractor since long which they utilize, where they are required for the projects, and while other workers are hired from the different areas that belong to different cultural backgrounds. Social problems and conflicts that are associated with Labor Influx are as follows:</p> <ul style="list-style-type: none"> • Risk of social conflict; • Increased risk of illegitimate behavior and crime • Impacts on community dynamics • Increased burden on and competition for public service provision • Increased risk of communicable diseases and burden on local health services • Local inflation of prices, accommodations and rents <ul style="list-style-type: none"> • Increase in traffic and related accidents 	<p>Labor camp(s) should be established away from residential population; Preference should be given to the local people to work with contractor, and contractor should hire maximum labor force from the Project Area because this will reduce the labor influx;</p> <p>Awareness should be created among the work force to ensure respect for local customs;</p> <p>Construction work should be completed within the stipulated time to move workers to next location; Labor force should be shuffled with the time;</p> <p>An effective GRM should be established for the Project to resolve all issues related to the community. Thus, progress regarding resolving the issues should be monitored closely;</p> <p>Create awareness among workers on proper sanitation and hygiene practices to endorse proper health and maintain good housekeeping practices at all Project sites;</p> <p>Provide adequate personal hygiene facilities in good condition with adequate supply of clean water; Make arrangements to treat the affected workers on time to control the movement of vector borne diseases;</p> <p>Sensitize workers and surrounding communities on awareness and prevention of COVID-19, HIV/AIDS and sexually transmitted infections (STI) through training, awareness campaigns and workshops during community meetings;</p>	<p><input type="checkbox"/> Regular monitoring, audit and checks</p>	<p>Construction Contractor</p>	<p>Proponent</p>
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Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
		<p>Develop and enforce a strict code of conduct for workers to regulate behavior in the local communities;</p> <p>Taking all sensible precautions to avert illicit, vicious conduct by or amongst the Contractor's personnel, and to preserve unity and harmony, and protection of people and property on and near the sites;</p> <p>Prohibiting drugs, alcohol, weapons, and ammunition on the worksite among personnel;</p> <p>Site security preparations must be contained within the Bills of Quantities (BoQs) to avoid any delays which might be caused due to insecurity;</p> <p>Appropriate fencing, security check points, gates and security guards should be provided at the construction sites to ensure the security of all plant, equipment, machinery and materials, as well as to secure the safety of site staff; and</p> <p>The Contractor must guarantee that good relations are maintained with local communities and their leaders to help reduce the risk of vandalism and theft.</p>			

<p>42.</p>	<p>Gender Based Violence (GBV)</p> <p>In the society, female plays important role in managing household as well as in income earning activities, but they face various challenges to get access to educational institutions and employment opportunities due to cultural bindings, economic vulnerability and lack of facilities.</p> <p>According to Pakistan Demographic and Health Survey (PDHS), 2017-18, 28 percent of women of Pakistan age 15 to 49 have experienced physical violence, six percent have experienced sexual violence, and seven percent experienced violence during pregnancy. Three in ten women who have ever experienced physical or sexual violence sought help to stop the violence, yet 56 percent never sought help nor told anyone.</p>	<p>Awareness should be created among the females at individual and community levels about the constructions sites;</p> <p>According to government policy, zero tolerance over GBV.</p> <p>During the timing of educational institutions workers should not be allowed to crowd in the surroundings; Alternative routes for pedestrian should be provided to avoid mixing of women with workers;</p> <p>Gender protection act should strictly be enforced during the construction activities in the Project Area, and monitor the implementation through field staff;</p> <p>Raise awareness among the communities of the potential risks of GBV, and establish response services in the communities that can respond to instances of GBV (particularly those related to issues of labor influx);</p> <p>The Contractor should make sure that no discrimination is made on the basis of gender while hiring of workers. Complete SOPs should be formed and implemented by the contactor regarding working women at site. Implementation on these SOPs should be monitored by the implementation Consultants.</p>	<p>☐ Regular monitoring, audit and checks</p>	<p>Construction Contractor</p>	<p>Proponent</p>
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		<p>Provisions of gender disaggregate bathing, changing, and sanitation facilities; and</p> <p>Contractor should take proper measures to address and resolve issues relating to harassment, intimidation, and exploitation, especially in relation to women</p>			
<p>43.</p>	<p>Child Labor</p> <p>There are two basic conventions on child labor adopted by the ILO, and one adopted by the United Nations. The ILO Minimum Age Convention, 1973 (No. 138) and its accompanying Recommendation (No. 146) set the goal of elimination of child labor, and the basic minimum age for employment or work (in developing countries at 14 years of age or the end of compulsory schooling, whichever is higher; and 15 or the end of compulsory schooling for developed countries). The Convention sets a minimum age of 2 years younger for "light work," i.e., 12 and 13 years, respectively; and a higher minimum age for dangerous or hazardous work</p>	<p>Awareness should be created among the local communities about the adverse impacts of child labor. For the public awareness, meetings should be held in the Project Area, and announcements should be made using the available local platforms with the involvement of all sectors of the society;</p> <p>Contractor through contractual agreement should be bound to follow the labor standards, rules and regulations during hiring the labor force and all activities should be monitored by the social and environmental staff of the implementing agency;</p> <p>Client and Supervision consultant should ensure that contractor shall have its employment policy in accordance with relevant act and labor policies in Punjab and Pakistan; and</p>	<p><input type="checkbox"/> Regular monitoring, audit and checks</p>	<p>Construction Contractor</p>	<p>Proponent</p>



	<p>(basically 18 years of age, but 16 in certain circumstances). The Convention also has various other flexibility clauses.</p>	<p>Contractor should ensure the presence of all persons at site are adults and have their proper identity cards with them.</p> <p>Reduce or eliminate the worst forms of child labor and rescue and rehabilitate the children in the worst forms of child labor.</p> <p>Penalize contractors/employees using the worst forms of child labor and penalize adults who violate children's rights and who force children to enter child labor, especially in its worst forms.</p> <p>Reduce the health hazards and dangers to young persons in the workplace.</p>			
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Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
Operational & Management Phase					
44.	<p>Odour</p> <p>The operation of proposed WWTP will result in generation of odour from biological tanks, sludge holding areas and dewatering units. Moreover, scum is also another source of odour.</p> <p>Overloading of the ponds will also result in odour problems because the treatment capacity will have exceeded. Wind is an effective source of aeration through surface mixing, but too much wind action can disturb bottom sediments and also create an odour problem. In most instances, the odours are generated as a result of an anaerobic or "septic" condition, which causes nuisance to the residential community in the surroundings of the WWTP and the people passing by this area for routine activities (travelling to</p>	<p>Strictly follow standard operating procedures (SOPs) and operational manual for operation and maintenance of lifting and pump stations;</p> <p>At pond start up, if organic loading is highly variable, acid fermentation of the wastewater may generate foul odours. This may be corrected by controlled dosing with alkalis (e.g., slaked lime);</p> <p>Pond wastewater inlets should be submerged to minimize the odour release and surface crust disruption;</p> <p>Ensure that operating staff is properly trained, and have clear understanding of odor issues related with operational practices;</p> <p>Ensure proper maintenance of the machinery;</p> <p>Regular cleaning of aeration tank walls and floors, washing weirs, and removing scum regularly, also helps in odour reduction;</p>	<p>Monitoring of plant maintenance and activities records</p>	<p>Proponent</p>	



Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
	schools, mosque and shops).	Ensure adequate water flow in ponds and aeration to reduce the potential of odour formation; Regularly monitor spread of unpleasant odors around WWTP, and apply additional measures of odor control based on the monitoring outcomes; The proposed WWTP may install synthetic windbreakers (e.g. walls) around the existing facility may serve to minimize potential odour dispersions and will reduce the significance of the odour impact; and A landscape should be properly designed with provision of new trees and ornamental plants, flowering plants with enhancing smell around the boundary, roadside and stretches of open land.			



<p>45.</p>	<p>Ambient Air Quality</p> <p>The operation of WWTP will result in generation of fugitive emissions including H₂S and CH₄ (due to anaerobic conditions) and minor concentrations of N₂ and NH₃ from biological tanks and from sludge, if not handled properly or remain unattended. H₂S is a foul smelling poisonous gas which might be harmful for the workers of sewer maintenance and could be fatal sometimes.</p> <p>During operation phase, operation of stand-by generator and un-necessary idling of diesel run will also result in the emission of pollutants (CO, Smoke, NO₂, SO₂ CO₂ and PM₁₀) into the air, thus deteriorating air quality. These emissions may adversely affect the health of the nearby residents and working staff.</p>	<p>To mitigate the pollutants emissions use of low sulfur fuel should be ensured;</p> <p>Location of generators should be carefully selected;</p> <p>Plantation of trees along the WWTP to create a buffer zone that will help in absorbing the emissions;</p> <p>Use of gas generators (if possible) should be preferred for low emissions; The height of the generator stacks should be high enough to disperse the emissions in the air;</p> <p>Provision of budget for regular monitoring of ambient air quality in accordance with PEQS, 2016;</p> <p>Improved monitoring, planning, and maintenance of the WWTP by RUDA;</p> <p>Workers for cleaning or maintenance of WWTP should cover their faces with mask;</p> <p>Use gas detector before inspection;</p> <p>Plan and execute appropriate tree plantation along the WWTP</p>	<ul style="list-style-type: none"> • Visual observation • Regular environmental monitoring, sampling and testing reports □ □ maintenance records 	<p>Proponent</p>
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<p>46.</p>	<p>Noise</p> <p>Due to the operation of proposed WWTP, noise and vibration may produce from the running of pumping machinery and standby generators which will be a constant source of nuisance to the local population.</p>	<p>Regular maintenance of vibrating parts through a well-coordinated operation and maintenance procedure which consists of checking periodically all parts of the pumping machinery, its oiling to remove friction, replacement in case of malfunctioning and periodic noting of noise levels;</p> <p>All noisy equipment and machinery such as generators and blowers should be housed in closed rooms or buildings;</p> <p>Provision of budget for regular monitoring of noise in accordance with PEQS, 2016; and</p> <p>Tree Plantation Plan should be devised to reduce noise issues.</p>	<ul style="list-style-type: none"> • Physical observation • Regular environmental monitoring, sampling and testing reports • maintenance records 	<p>Proponent</p>
<p>47.</p>	<p>Soil Quality</p> <p>Impact on the integrity and stability of soil or the loss and damage of the topsoil is not expected during the operational phase. However, the liner of the sludge storage ponds, while de-sludging may get dried and cracks may lead to the seepage of wastewater and thus contaminate the soil. Improper disposal of sludge is another concern. Emergency situations (spillage of wastewater in case of damage of pipelines or other infrastructures) may also cause soil pollution.</p>	<p>While de-sludging, the ponds shall be sprinkled with water;</p> <p>Scum and sludge shall be removed regularly and disposed of safely in consultation with Lahore Waste Management Company (LWMC)/Authority;</p> <p>In case of fuel/oil spill, cleaning of the territory and withdrawal of the contaminated soil and ground for further remediation; and</p> <p>Training of the personnel on environmental and safety issues regarding sludge disposal and soil contamination.</p>	<ul style="list-style-type: none"> □ Physical observation Regular monitoring, audit and checks 	<p>Proponent</p>



<p>48.</p>	<p>Wastewater Quality</p> <p>The WWTP will have overall positive impact on the surface water by discharging treated wastewater into the River Ravi. However, accidental discharges of untreated wastewater due to the overflow, syphoning or disruption in operation during maintenance of the treatment plant may cause contamination of river water quality. Impact on water quality may occur during the maintenance works as well. The impact will depend on the type and volume of works.</p> <p>There is probability of the seepage of wastewater from the ponds and channels that may contain high concentrations of organic matter and heavy metals. Improper functioning or choking of inlet or outlet of the treated wastewater may also cause the ground water contamination.</p>	<p>Use the suitable lining material to control the seepage and ground water contamination;</p> <p>In case of maintenance/sludge removal, alternative ponds shall remain functional;</p> <p>Water should be retained constantly in ponds to prevent drying out of compacted clay liners. In dry liner Shrinkage cracks may occur, which may cause excessive leakage when ponds later refill;</p> <p>Inlet and outlet pipework access/maintenance pits should be inspected regularly for blockages. These pits should be covered at other times;</p> <p>Monthly treated effluent quality monitoring shall be done from an EPA certified laboratory for compliance with PEQS; and</p> <p>In case maximum permissible discharge of pollutants are exceeded, appropriate measures will be taken to remedy the situation promptly (appropriate repairs and maintenance works will be implemented). At the same time, a person in charge of environmental protection should immediately notify the Punjab EPA about the existing situation.</p> <p>Information should contain the causes and preventive measures that will be implemented in order to eliminate the problem.</p>	<ul style="list-style-type: none"> • Implementation of WWMP • Regular monitoring, sampling and testing • Regular monitoring, audit and checks 	<p>Proponent</p>
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49.	Solid Waste Generation The solid waste will be produced from the administration building, staff quarters and workshop during operation phase. If these wastes are not properly handled, they may cause nuisance to the workers and staff. Improper storage and dumping of waste may also pollute soil, sewerage pipes and groundwater	Storage bins should be provided at the appropriate places with clear demarcation of type of wastes; Recyclable wastes such as newspaper, cardboard, plastics, glass and metals could be separated for individual collection. Single stream collections may be more cost effective as the recyclables can be cheaper to collect and will reduce the volume of a costlier co-mingled dry recyclable collection; Waste minimization should be encouraged and regular training be provided to solid waste management staff in correct identification and disposal of waste; Storage areas should be cleaned regularly to minimize odor, pests and nuisances and preserve visual amenity; Housekeeping procedures, (including spillage control) should be implemented to minimize the generation of waste; Special storage facility should be arranged for temporary disposal of hazardous waste during the operational phase, which should be in compliance with environmental requirements. The facility must include exhaust ventilation system and Shelves and racks for waste disposal;	<ul style="list-style-type: none">• Implementation of WMP• Regular monitoring, sampling and testing• Regular monitoring, audit and checks	Proponent
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		<p>In case of waste disposal, an approved contractor shall dispose of the sludge at the landfill site in consultation with LWMC/Authority; A proper waste management plan should be prepared for onsite storage, collection and disposal of waste.</p>		
<p>50.</p>	<p>Handling and Disposal of Sludge</p> <p>Sludge will be produced during the operational phase of WWTP and sludge handling is important part of biological wastewater treatment processes. The proposed WWTP shall generate huge quantities of sludge which require due consideration for its management.</p>	<p>At present, the composition of sludge after sewage treatment and its market apatite is unknown. Moreover, no legislation concerning the reuse of sewage sludge exists in the country. Considering these aspects, further treatment is not proposed at this stage. Consequently, the dried sludge will be disposed of in to landfill. The sludge composition and other parameters will be monitored in the operational phase and different options for sludge treatment and its reuse may be adopted accordingly in the next phase.</p> <p>For the case of Mahmood Booti/Shad Bagh WWTP, Mono Fills (sludge storage ponds) shall be proposed in which dried sludge from sludge drying beds will be disposed of up to 2 to 3 years within the WWTP Site.</p> <p>Aftr these years, Mahmood Booti landfill site may also be considered as an alternate disposal site. During</p>	<ul style="list-style-type: none"> • Implementation of WMP • Regular monitoring, sampling and testing • Regular monitoring, audit and checks 	<p>Proponent</p>



Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
		these years, any advancement in sludge management and treatment may be introduced and adopted accordingly.			
51.	<p>HSE Considerations</p> <p>The operation of WWTP involves minimum man power. The HSE considerations in this regard shall be addressed. During operation phase, health and safety issues may arise. Operation and maintenance of the building may cause safety risks to staff (electrical and mechanical staff, solid waste management staff and maintenance staff), that may include injuries due to electric shocks, arc flash and arc blast, slipping and falling, poor handling and storage of hazardous substances and during handling of the solid waste</p>	<p>Operation and maintenance of machinery and equipment shall be controlled and handled by efficient management, staff training, and other preventive measures;</p> <p>Emergency Response Plan shall be formulated for the WWTP and strictly implemented by the management;</p> <p>Emergency numbers shall be clearly posted and communicated to the operation and maintenance (O&M) staff;</p> <p>Installation of safety sign boards at the plant site;</p> <p>Adequate PPEs shall be provided to the O&M staff and concerned safety staff must do regular inspections for its implementation;</p> <p>Strict implementation and practice of work safety permits during maintenance activities;</p> <p>Fire extinguishing equipment shall be installed at the treatment plant and the concerned staff shall be well trained to use the equipment during an emergency situation;</p>	<ul style="list-style-type: none"> • Implementation of HSE Plan • Use of PPEs • Training Records • Work permits • Implementation of Emergency response plan and disaster management plan in case of natural disaster occurrence 	Proponent	

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
		Regular inspection and maintenance of the fire safety and extinguishing equipment by the designated staff; COVID-19 SOPs must be fully adopted by the hospital in accordance with the WHO and GoP guidelines; and Regular medical checkups of the O&M staff.			
52.	<p>Climate Change/ emission of Greenhouse Gasses</p> <p>The operation of wastewater stabilization ponds will generate greenhouse gases, such as CO₂, CH₄ and N₂O. Pakistan is signatory to the United Nations Framework Convention on Climate Change (UNFCCC) and adopted Kyoto protocol in 1997. Under the Kyoto Protocol, Pakistan is committed to reduce GHG emissions into environment to prevent interference with climate change. The GHG emissions for the proposed project are a concern due to the large number of ponds being established in the area. In addition, air emissions may result from burning of fossil fuels to fulfill the energy requirement for operation of WWTP</p>	<p>Ensure complete burning of fuel in machinery;</p> <p>For large installations with a considerable throughput of organic matter, the pond may be covered (with a supported membrane dome) to capture the gas for fuel to heat the pond or for power generation. Ponds may be covered with a fixed or floating roof, but provision of stormwater drainage, pond gas venting, sludge removal and chemical conditioning would be required; and</p> <p>Regular monitoring of air quality should be conducted from an EPA certified laboratory to comply with PEQS 2016.</p>	<p>☐ Regular monitoring, audit and checks</p>	Proponent	



Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
53.	<p>Carbon Sinks</p> <p>Wastewater treatment plants are one of the sources of GHG emissions and they also have a significant carbon footprint.</p> <p>Carbon emissions of WWTP, such as CO₂, CH₄ and N₂O will be occurred during the process of wastewater treatment; and</p> <p>During the operation of the sewage treatment plant, blowers, pumps, aeration equipment and other equipment consume a large amount of electricity, the carbon emissions of the purchased electricity during the production process are the indirect emissions of the sewage treatment plant. Nitrous oxide and methane can constitute an important part of the carbon footprint in the wastewater treatment plants and efforts are needed to efficiently mitigate them.</p>	<p>For reducing direct GHG emissions, ecological treatment processes such as stabilizing ponds, constructed wetlands, building greenhouses, cultivating aquatic plants, and planting trees, use plants to absorb nutrients such as nitrogen and phosphorus in wastewater, absorb CO₂, and transform into plant bodies. Using the canopy area of the plant and the corresponding carbon fixation coefficient, the amount of GHG recovered by the ecological process can be determined;</p> <p>CH₄ gas produced during operation phase shall be recycled, it can reduce GHG emissions as CH₄ is a renewable energy source, which meets the energy requirements of the consumers and it can also reduce power consumption and reduce costs. Indirect emissions from power consumption, the working effects of blowers, water pumps, aerators and other equipment during operation are carefully designed to reduce inefficient energy consumption and save power consumption. At the same time, the WWTP should do a good job</p>	<p><input type="checkbox"/> Regular monitoring, audit and checks</p>	Proponent	



Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
		in saving water at the source and reuse the tail water to reduce GHG emissions.			
54.	<p>Operational Sustainability</p> <p>The most pressing need is the sustainability of wastewater collection and treatment system, and it can be assessed on many factors including capacity issues of proponent, efficiency of the system and its performance, life cycle analysis (aging and deterioration), natural hazards (earthquakes, floods and fire outbreaks), escalation in population growth and energy requirements.</p> <p>The three major drivers considered worldwide for ensuring sustainability are: (i) economic considerations, (ii) social considerations and (iii) environmental protection. Therefore, the proponent (RUDA) must consider these aspects in achieving appropriate and optimize use of wastewater treatment system.</p>	<p>Establishment of Monitoring and Maintenance System for wastewater treatment before its final disposal into surface water bodies;</p> <p>Regular operation and maintenance of the scheme;</p> <p>Capacity building and training of workers;</p> <p>Periodic environmental monitoring; WWTP should be efficiently operated in such ways that it withstand existing climate change issues e.g. intense rainfall events and increase and decrease in temperature;</p> <p>Cost for the operation and maintenance shall be kept in the annual budget of RUDA; and</p> <p>Option of recovery of heat and CH₄ for energy use shall be considered during the operation phase.</p>	<ul style="list-style-type: none"> Regular environmental monitoring, sampling and testing Regular audit and checks 	Proponent	

<p>55.</p>	<p>Flora</p> <p>During operational stage the Project, there will be minimal effect on flora or release of any significant pressure detrimental to flora. Low level impact is expected at operational phase on Flora due to the operation and maintenance activities</p>	<p>The implementation of plantation plan recommends in compensation for cutting of trees should start working during operational stage, to ensure the ecological balance and to avoid any impact on local environment; Large scale planting with suitable indigenous trees, shrubs and ornamental plants in the form of tree groves, and linear plantation will be carried out in accordance with the Tree Plantation Plan to improve aesthetic value and offset the effect of removal of vegetation; and Proper check and balance for above activities is highly recommended. Plantations so, raised must be maintained according to the silvicultural practices which include proper irrigation, cleaning, pruning, thinning at prescribed intensity, silt clearance and trench-opening, etc.</p>	<ul style="list-style-type: none"> • Tree plantation plan • Visual observations • Audit and Checks 	<p>Proponent in association with PHA or Forest Department</p>
<p>56.</p>	<p>Fauna</p> <p>There is no protected area, game reserve, game sanctuary or national park in the project area so no major impact on wildlife and livestock in the area is expected through noise, vibration and any type of normal activity in the project area.</p>	<p>Strict control must be exercised for stoppage of killing/poaching of available wildlife species by enhancing protection practices; and The precautionary measures described for future shall also be applicable during operation phase as relevant for the conservation of wildlife species in the Study Area.</p>	<ul style="list-style-type: none"> • Visual observations • Audit and Checks 	<p>Proponent in association with Wildlife Department</p>



KEY

DC	Design Consultant
CC	Construction Contractor
SC	Supervision Consultant
RUDA	Ravi Urban Development Authority



7.6 ENVIRONMENTAL MONITORING

Environmental Monitoring is undertaken during both the construction and operational phases, to ensure the effectiveness of the proposed mitigation measures against identified adverse environmental impacts in the EIA report.

The main objectives of the construction phase monitoring plan will be to:

- Monitor the actual impact of the works on the project site physical, biological and socio-economic receptors;
- Recommend mitigation measures for any unexpected impact or where the impact level exceeds the anticipated impact;
- Ensure compliance with legal obligations including safety on construction site; and
- Monitor the rehabilitation of borrow areas and the restoration of construction campsites as described in the EMMP; and
- Ensure the safe disposal of excess construction materials.

The main objectives of monitoring during the operational phase will be to:

- Appraise the adequacy of the EIA with respect to the Project's predicted long term impacts of operation on physical, biological and socio-economic environment;
- Evaluate the effectiveness of the mitigation measures proposed in the EMMP and recommend improvements, if and when necessary; and
- Compile periodic Environmental Monitoring reports on the basis of recommendations in EMMP.

7.6.1 Monitoring Strategy

Under the proposed monitoring strategy, it is recommended RUDA should be responsible for all the monitoring activities. All the findings and results in the form of monitoring report will be finally shared with Punjab-EPA. The monitoring program has been designed carefully considering the identified impacts mentioned in Chapter-6. Table 7.2 provides environmental monitoring schedule for construction and operations stages of the proposed Project.

7.6.2 Budget Estimate for Environmental Monitoring and Compliance

Budget Estimate for Environmental Monitoring and Compliance during the Construction and Operation Phase has been summarized in Table 7.3.

Table 7.2: Environmental Monitoring Schedule

Sr. No.	Receptors	Monitoring Parameters / Performance Indicator	Location	Monitoring Mechanism	Monitoring and Reporting Frequency	Responsibility	Duration
1.	Water Resources/ Water Quality	Monitoring of Physical, Chemical and Biological parameters and its compliance with PEQS, 2016 for surface water and drinking water.	<ul style="list-style-type: none"> Major receptors are Drains, distributaries and commercial / residential areas within the AOI of the proposed project. Other proposed effluent discharge points are: <ul style="list-style-type: none"> Contractors camps; Concrete preparation plants; Fuel (Petrol. Oil and Grease) products storages; and Vehicle and machines repairing and servicing yards. 	<ul style="list-style-type: none"> Visual checks of laboratory activities; and Discrete grab sampling and laboratory testing of water samples by EPAPunjab Certified Laboratory for monitoring. 	<ul style="list-style-type: none"> Once before the start of construction activities; On quarterly basis during the construction phase; Bi-annually for at least one year during O&M phase; and Visual inspection daily. 	<ul style="list-style-type: none"> RUDA Contractor RUDA 	□ As per PEQS, 2016.
2.	Soil Contamination	Soil contamination due to effluent / surface runoff and uncontrolled solid waste disposal activities at sites.	<ul style="list-style-type: none"> Along access Roads (proposed project); and Other proposed sampling sites are: <ul style="list-style-type: none"> Construction camps; Equipment washing yards; Spillage points of fuel, chemicals and lubricants. 	<ul style="list-style-type: none"> Visual observations and checking of laboratory activities; Sampling and laboratory testing for soil samples. 	<ul style="list-style-type: none"> Once before the start of construction activities; On quarterly basis during the construction phase; Bi-annually for at least one year during O&M phase; and Visual inspection daily. 	<ul style="list-style-type: none"> RUDA Contractor RUDA 	



Sr. No.	Receptors	Monitoring Parameters / Performance Indicator	Location	Monitoring Mechanism	Monitoring and Reporting Frequency	Responsibility	Duration
3.	Dust Emissions	Monitoring of PM ₁₀ and PM _{2.5} and its compliance with PEQS, 2016 for Ambient Air.	Sensitive receptors (residential area, educational and health institutions, religious places and construction camps) within the AOI of the proposed project.	<ul style="list-style-type: none"> • Visual checks of laboratory activities; • Onsite Ambient Air Monitoring Equipment; and • Daily visual monitoring of dust emissions at construction route. 	<ul style="list-style-type: none"> • Once before the start of construction activities; • On quarterly basis during the construction phase; and • Bi-annually for at least one year during O&M phase. 	<ul style="list-style-type: none"> • RUDA • Contractor • RUDA 	
4.	Noise Pollution	Monitoring of Noise Level and its compliance with PEQS 2016 for Noise.	Sensitive receptors (residential area, educational and health institutions, religious places and construction camps) within the AOI of the proposed project.	<ul style="list-style-type: none"> • Visual checks of laboratory activities; and • Onsite Noise Monitoring using Sound Meter. 	<ul style="list-style-type: none"> • Once before the start of construction activities; • On quarterly basis during the construction phase; and • Bi-annually for at least one year during O&M phase. 	<ul style="list-style-type: none"> • RUDA • Contractor • RUDA 	
5.	Fumes and gases	Monitoring of CO, CO ₂ , SO _x , NO _x , Lead and PM _{2.5} PM ₁₀ , Vehicular emissions and its compliance with PEQS 2016.	Sensitive receptors (concrete plants, construction camps and vehicular emissions) within the AOI of the proposed project.	<ul style="list-style-type: none"> • Visual checks of laboratory activities; • Onsite Ambient Air Monitoring Equipment; and • Daily visual monitoring of dust emissions at construction route. 	<ul style="list-style-type: none"> • Once before the start of construction activities; • On quarterly basis during the construction phase; and • Bi-annually for at least one year during O&M phase. 	<ul style="list-style-type: none"> • RUDA • Contractor • RUDA 	



Sr. No.	Receptors	Monitoring Parameters / Performance Indicator	Location	Monitoring Mechanism	Monitoring and Reporting Frequency	Responsibility	Duration
6.	Ecological Resources	Disturbance to natural habitat and uncontrolled floral cutting which can be avoidable.	Natural habitats within the AOI of the proposed project.	<ul style="list-style-type: none"> • Visual checks to ensure that only marked trees are cut within the Project corridor; and • Monitoring of Wildlife / birds hunting. 	<ul style="list-style-type: none"> • Once before the start of construction activities; and • Visual inspection daily / weekly during construction and O&M phase. 	<ul style="list-style-type: none"> • RUDA • Contractor • RUDA 	
7.	Safety of workers	Medical record of workers	Construction site.	<ul style="list-style-type: none"> • Checking of accident/ near miss records. • Medical surveillance of Construction workers 	<input type="checkbox"/> On quarterly basis during the construction phase.	<input type="checkbox"/> Contractor	
8.	Restoration of work sites	Site cleared and no solid and construction waste in the study area	Construction site and camp sites	<input type="checkbox"/> Visual inspection	<input type="checkbox"/> After completion of construction work	<input type="checkbox"/> Contractor	



7.6.3 Responsibilities for Environmental Testing and Reporting

The Construction Contractor (CC) will be responsible for environmental monitoring and reporting throughout the construction phase under the supervision of Environmental Engineer of Supervision Consultant (SC); in coordination with Project Director, RUDA. During construction phase, environmental testing reports will be prepared on quarterly basis and one comprehensive report will be prepared at the end of the construction phase and will be submitted to each of the following authorities and institutions: (i) RUDA and (ii) EPA- Punjab.

During the first year of the project operation, concessionaire will be responsible to conduct environmental testing and monitoring along with its cost through a third party contractor and EPA-Punjab certified lab. The reports will be prepared biannually and one comprehensive report will be prepared annually and submitted to the EPA-Punjab. Contents of the final report will include results of environmental monitoring in comparison to the standards for the various parameters, location and sampling time along with recommendations for the future environmental testing and monitoring.

7.6.4 Budget Estimate for Environmental Monitoring and Compliance

Budget Estimate for Environmental Monitoring and Compliance during the Construction and Operation Phase has been summarized in Table 7.3.



Table 7.3: Budget Estimate for Environmental Monitoring and Compliance during the Construction and Operation Phase

Components	Parameters	Quantity (No. of samples x No. of Locations x Frequency)	Frequency	Responsibility	Duration	Cost (Rs.)
A) Construction Phase (36 Months)						
Ambient Air Quality	CO, NO ₂ , SO ₂ , Lead, SPM, PM _{2.5} and PM ₁₀	1x2x12= 24	Quarterly @ Rs. 30,000 per sample	CC and SC	24 hours	720,000/-
Noise Level	Day and night time levels on dB (A) Scale (min-max)	1x2x12= 24	Quarterly @ Rs. 2,000 per point	CC and SC	24 hours	48,000/-
Drinking Water Quality	<p>Physical Parameters: Color, pH, Taste, Odour, Turbidity, Total Hardness as Calcium Carbonate and Total Dissolved Solids</p> <p>Biological Parameters: E. Coliform, Fecal Coliform and Total Coliform</p> <p>Chemical Parameters: Aluminum, Antimony, Arsenic, Barium, Cadmium, Chloride, Chromium, Copper, Cyanide, Fluoride, Lead, Manganese, Mercury, Nickel, Nitrate, Nitrite, Selenium, Residual Chlorine, Zinc and Phenolic Compounds</p>	1x2x12= 24	Quarterly @ Rs. 20,000 per sample	CC and SC	-	480,000/-



Surface Water Quality	Physical Parameters: Temperature, pH, Color, Total Dissolved Solids, and Total Suspended Solids	1x2x12= 24	Quarterly @ Rs. 20,000 per sample	CC and SC	-	480,000/-
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Components	Parameters	Quantity (No. of samples x No. of Locations x Frequency)	Frequency	Responsibility	Duration	Cost (Rs.)
	Biological Parameters: Biochemical Oxygen Demand, Chemical Oxygen Demand, and Fecal Coli Chemical Parameters: Grease and Oil, Lead, Phenolic compounds, Cyanide, Chloride, Fluoride, Anionic Detergents, Sulphate, Sulphide, Ammonia, Calcium, Cadmium, Chromium, Copper, Mercury, Selenium, Nickel, Silver, Zinc, Arsenic, Barium, Iron, Manganese, Boron and Total chloride					
TOTAL (A) =						1,728,000/-
B) Operation Phase (12 Months)						
Ambient Air Quality	CO, NO ₂ , SO ₂ , Lead, SPM, PM _{2.5} and PM ₁₀	1x2x2 = 4	Biannually @ Rs. 30,000 per sample	RUDA	24 hours	120,000/-



Noise Level	Day and night time levels on dB (A) Scale (min-max)	1x2x2 = 4	Biannually @ Rs. 2,000 per point	RUDA	24 hours	8,000/-
Drinking Water Quality	Physical Parameters: Color, pH, Taste, Odour, Turbidity, Total Hardness as Calcium Carbonate and Total Dissolved Solids	1x2x2 = 4	Biannually @ Rs. 20,000 per point	RUDA	-	80,000/-

Components	Parameters	Quantity (No. of samples x No. of Locations x Frequency)	Frequency	Responsibility	Duration	Cost (Rs.)
	Biological Parameters: E. Coliform, Fecal Coliform and Total Coliform Chemical Parameters: Aluminum, Antimony, Arsenic, Barium, Cadmium, Chloride, Chromium, Copper, Cyanide, Fluoride, Lead, Manganese, Mercury, Nickel, Nitrate, Nitrite, Selenium, Residual Chlorine, Zinc and Phenolic Compounds					



Surface Water Quality	<p>Physical Parameters: Temperature, pH, Color, Total Dissolved Solids, and Total Suspended Solids</p> <p>Biological Parameters: Biochemical Oxygen Demand, Chemical Oxygen Demand, and Fecal Coli</p> <p>Chemical Parameters: Grease and Oil, Lead, Phenolic compounds, Cyanide, Chloride, Fluoride, Anionic Detergents, Sulphate, Sulphide, Ammonia, Calcium, Cadmium, Chromium, Copper, Mercury, Selenium, Nickel, Silver, Zinc, Arsenic,</p>	1x2x2 = 4	Biannually @ Rs. 20,000 per point	RUDA	-	80,000/-
Components	Parameters	Quantity (No. of samples x No. of Locations x Frequency)	Frequency	Responsibility	Duration	Cost (Rs.)
	Barium, Iron, Manganese, Boron and Total chloride					
TOTAL (B) =						288,000/-
GRAND TOTAL (A+B) =						2,016,000/-



KEY

CC Construction Contractor

SC

Supervision Consultant

RUDA Communication & Works Department

Notes:

- Provision must be given in annual budget of operation phase for environmental monitoring. For this, the cost of operation phase (i.e. Rs. 288,000/-) must be considered with an annual increment of 10%.
- All the environmental parameters will be analyzed as per Punjab Environmental Quality Standards (PEQS), 2016.



7.7 Tree Plantation

To minimize the negative impacts arising due to tree cutting (472 No.), increased odor and noise of operation of WWTP and to enhance the landscape of the project area, plantation at available spaces may be carried out especially along the boundary of treatment plant.

Plantation Plan shall be carried out by the Client in coordination with Forest Department/PHA, which has the requisite expertise and experience for such tasks.

Trees recommended for planting are 4,720. The tentative cost for the plantation is about Rs. 9.69 Million. Detailed Tree Plantation Plan is attached as Annex-XI.

7.8 TRAINING AND CAPACITY BUILDING

An environmental and social training and technical assistance (TA) program is to be carried out before the implementation of the proposed project as it strengthens the institutional capacity required to manage the environmental and social issues. Contractor's environmental awareness and appropriate knowledge of environmental protection is critical to the successful implementation of the EMMP because without appropriate environmental awareness, knowledge, and skills required for the implementation of the mitigation measures, it would be difficult for the Contractor(s) workforce to implement effective environmental protection measures.

RUDA will be responsible to engage TA consultant to conduct environmental and social training programs. The objective of the TA will be as follows:

- To help in establishment of appropriate systems;
- To train senior RUDA staff, Contractor and Sub-Contractor workers and Supervision Consultant employees, responsible for managing environment and social tasks and planning during construction and post construction phase; and
- Training courses on specialized areas such as air, water and noise pollution monitoring.

Table 7.4 provides brief detail of the capacity building and training plan for the proposed project.

Table 7.4: Capacity Building Programs and Technical Assistance Services

Provided by	Contents	Trainees	Duration
TA Individuals, Consultants and Organizations specializing in Environmental Management and Monitoring	Short Seminars and Courses on: <ul style="list-style-type: none"> • Environmental laws and regulations; • Environmental Sustainability; and • Environmental Management and Monitoring Plan (EMMP) 	Members of Environmental Committee, RUDA Staff and Contractor Workers	3 Days
TA Individuals, Consultants and Organizations	Short Seminars and Courses on:	Members of Environmental	3 Days
Provided by	Contents	Trainees	Duration
specializing in Social Management and Monitoring, and Occupational Health and Safety	<ul style="list-style-type: none"> • Occupational Health and Safety Plan (OHS); • Basic First Aid; • Occupational and Community Health and Safety Management; • Labour Camp Management; • Traffic Management; • COVID-19 Protection and Control; • Use and Importance of Personal Protective Equipment's (PPEs); and • Fire Safety and Emergency Response Measures. 	Committee, RUDA Staff and Contractor Workers	
TA Individuals, Consultants and Organizations specializing in Environmental and Social Management and Monitoring	Short Seminars and Courses on: <ul style="list-style-type: none"> • Environmental Management Plan (EMP); • Environment Health and Safety Management; • Occupational Health and Safety; • Basic First Aid; • Waste Management; • Fire Safety and Emergency Response Measures; • Electrical Safety; and • Use and Importance of Personal Protective Equipment's (PPEs) 	Operation and Maintenance Staff of RUDA	3 Days

7.9 COMMUNICATION & DOCUMENTATION

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

7.9.1 Data Recording and Maintenance

All forms to be used for recording information during the environmental monitoring will follow a standard format which will correspond to the data base in to which all the gathered information will be placed. Check boxes will be used as much as possible to facilitate data entry. Tracking system will be developed for each form.



7.9.2 Database

The database may include the following information:

- Training programs;
- Staff deployment;
- Non-compliances;
- Corrective actions
- List of environmental data; and
- List of environmental data to be maintained:
 - Soil and land pollution;
 - Disposal of waste;
 - Water resources;
 - Fuel oil and chemical spills
 - Vegetation record;
 - Noise pollution;
 - Air and dust pollution;
 - Socio-economic data; and
 - Ecological sensitivities.

7.9.3 Meetings and Reporting

Monthly meetings will be held at site during the construction phase. The purpose of these meetings will be to discuss the routine activities, non-compliances and their remedial measures. Various reports will also be produced at periodic time intervals, as provided in **Table 7.5** along with information regarding persons responsible for report preparation and review process. Additionally, minutes of meeting will also be submitted as part of routine environmental reports.

Table 7.5: Periodic Reporting Mechanism

Sr. No.	Report Category	Prepared by	Reviewed by
1	Monthly	Contractors' environmental staff	RUDA / SC
2	Quarterly	Contractors' environmental staff	RUDA / SC
3	Semi-Annual Environmental Monitoring Report (SAEMR)	Construction Supervision Consultant (CSC)	RUDA / SC
4	Annual Report	Contractors' environmental staff	RUDA / SC
5	Completion Report	Contractors' environmental staff	RUDA / SC

7.9.4 Social Complaint Register

The Contractor will maintain a register of complaints record from local communities and measures taken to mitigate these concerns.

7.9.5 Photographic Records

Contractors will maintain photographic records during the implementation of the proposed Project. As a minimum, the photographic records will include the site photographs, all the roads, camp sites and monitoring activities, etc.

7.9.6 Non-Compliance of the EMP

The implementation of the proposed EMP involves inputs from various functionaries. The Contractor will be primarily responsible for ensuring implementation of the mitigation measures proposed in the EMP, which will be part of the contract documents. The provision of the environmental mitigation cost will be made in the total cost of Project, for which the Contractor will be paid on the basis of monthly compliance reports. However, if the Contractor fails to comply with the implementation of EMP and submission of the monthly compliance reports, deductions will be made from the payments to the Contractor claimed under the heads of environmental components.

7.9.7 Review of Recorded Data

All the data and communication recorded and maintained by the Contractor will be periodically reviewed and checked by SC and RUDA and necessary action will be recommended to Contractor to improve the recording and documentation.

7.10 MANAGEMENT PLANS

Various site-specific management plans will be prepared by Contractor as a part of EMP for the better management and implementation of EMP during all phases of the proposed Project. However, approval of these site-specific plans from RUDA should be sought before start of construction activities. These site-specific plans are listed below but not limited to these:

- Tree Plantation / Reforestation Plan;
- Health, Safety and Environment (HSE) Management Plan;
- Emergency Preparedness and Response Plan;
- Site Restoration and Rehabilitation Plan;
- Waste Management Plan;
- Disaster Management Plan;
- Drinking Water Supply and Sanitation Plan
- Traffic Management Plan;
- Change Management Plan
- Quarry Management Plan; and
- Resource Conservation Plan.

7.11 PUBLIC DISCLOSURE

RUDA will disclose this EIA to all the stakeholders prior to the start of the construction. This report will be made available to the stakeholders at places as designated by the PEPA. In addition, executive summary of the Report will be translated into Urdu language and made available to the affected communities and locals. The copies will also be kept at construction site for ease in accessibility of the locals. This will ensure the locals to be aware of the Project



impacts, its mitigation, responsible staff and mode of implementation. In addition, the executive summary will also be published on RUDA website.

7.12 EMP COST

The contractor will be responsible for implementation of mitigation measures and environmental Monitoring during construction phase, whereas RUDA will be responsible for implementation of mitigation measures and environmental Monitoring during operation phase. For an effective implementation of environmental mitigation measures during construction and operational phase, it is very important to provide sufficient funds for the implementation of environmental and social mitigation measures, monitoring and training. The estimated cost of environmental and social mitigation measures, monitoring and training is given in the Table 7.6.

The cost for EMP will be part of the contract document with the Contractor. The same may also be included in the total project cost for the implementation of EMP. It must be noted that environmental cost will not be a separate entity because all of its components will be addressed in the bidding document under various heads of account.

Table 7.6: Environmental and Social Testing, Mitigation and Training Cost

Sr. No.	Activity	Description	Cost (Rs.)	Rationale
1.	Medical screening for workers	Rs. 5,000 per person for 300 employees <i>Pre-Construction Phase:</i> 300 x 5,000 x 1 = 1,500,000 <i>Construction Phase:</i> 300 x 5,000 x 6 = 9,000,000	10,500,000/-	Medical screening of the workers before deployment on site and twice a year during whole construction period.
2.	Material Storage, handling and use	Four Number of tarpaulins of Rs. 20,000 each	80,000/-	Four tarpaulins are proposed during the whole construction phase for the protection of material and dust control.
3.	Water Sprinkling	Sprinkling of water to control dust at site on alternate day @ 30,000/Month	1,080,000/-	Sprinkling of water to control dust emissions at site during whole construction period.
4.	Handling of solid waste	Includes the cost of collection, segregation, transportation, disposal and management of domestic, commercial and construction wastes	1,800,000/-	Rs. 50,000 per month for 36 months to collect construction waste from all the active sites on daily basis.

5.	Health and Safety of Workers	For 300 employees for the provision of dust masks, safety shoes, gloves, first aid box, ear plugs, safety helmets and safety jackets (Hi Vis) and provision of dust bins, warning tap, safety cones and safety sign boards.	8,971,500/-	For detail, please refer to Annex–XII.
6.	HSE Expert	HSE Expert to monitor / conduct all HSE related activities e.g. TBTs, PPEs, housekeeping, safety signage, emergency preparedness, etc. during construction and operational phase <i>Construction Phase:</i>	7,200,000/-	Cost for hiring HSE Experts along with their monthly logistics during construction and operational phase.
Sr. No.	Activity	Description	Cost (Rs.)	Rationale
		1 x 36 x 150,000 = 5,400,000 <i>Operational Phase:</i> 1 x 12 x 150,000 = 1,800,000		
7.	Environmental Testing Cost	Ambient air, drinking water, surface water and noise	2,016,000/-	Refer to Table 8.3 for detailed schedule and cost of environmental testing during construction and operation phase.
8.	Cost of environmental and social training	Short Seminars, Courses, Trainings and Lectures on Environment, Social and Occupational, Health and Safety constituents and components (Rs. 75,000/- per session during construction phase). 3 x 75,000 = 225,000	225,000/-	Refer to Table 8.4 for details.
9.	Environmental Audit	Environmental Auditing through third party twice a year during construction and operational phase 6x 400,000 = 2,400,000 <i>Operational Phase:</i> 2 x 400,000 = 800,000	3,200,000/-	Cost for at least two auditors along with logistics, travels and accommodation charges.
10.	Tree Plantation	Plantation of different trees may be cut down during construction phase. Therefore, Compensatory planting of ten trees against each fallen tree of similar floral function should be planned which is 4,720 to enhance the landscape of the project area. Plantation at available spaces may be carried out especially at the median.	9,695,108/-	For detail, please refer to Annex–XII.
Total =			44,767,608/-	



The total estimated cost for the environmental management, monitoring and auditing during construction and O&M (annual cost will be updated for next upcoming years accordingly) comes to about **PKR 44.767 Million**.

8 CONCLUSION AND RECOMMENDATIONS

8.1 GENERAL

This section presents conclusion of the EIA study of the proposed project. The overall objective of this EIA is to carry out an environmental assessment to assess impacts caused by the different activities and to address measures to mitigate adverse environmental impacts that may arise from the execution of the proposed project.

8.2 CONCLUSION

This report has been prepared to comply with Punjab Environmental Protection Act, 1997 (Amended 2012 & 2017). The proposed Project involves construction of Waste Water Treatment Plant (WWTP) along with conveyance system and treatment facility at Mahmood Booti/Shadbagh, Lahore. The Activated Sludge Process (ASP) will be opted for proposed WWTP on the basis of criteria discussed in Analysis of Alternatives.

Apart from the positive impacts, the proposed project will also have some potential minor negative, temporary in nature environmental and social impacts during the construction and operational phases. Some significant impacts include land acquisition, soil contamination, health risks and work safety problems, traffic management during construction phase, sludge handling, odour issues and removal of approximately 472 mature, sub-mature, pole crop and saplings of different tree/plants species. Major efforts were made to identify the key physical, ecological, social, cultural and environmental issues related to the construction and operation of the proposed Project. Various stakeholders including government departments and agencies were also contacted for obtaining salient information in this regard along with that from area residents. Most of these adverse impacts during construction are of a temporary nature.

In order to minimize, avoid or reduce the potential adverse impacts appropriate mitigation and remedial measures have been suggested against each identified impact. Efforts are made to propose economical and sustainable mitigation and remedial measures which can be easily implemented. An EMP has also been developed to provide proper framework for the implementation of the suggested mitigation measures. A project will be executed under environmentally sustainable manner. An extensive Tree Plantation will add value to the project.

8.3 RECOMMENDATIONS

Following recommendations must be taken care prior to any of the decision about the proposed project:

- The plantation of 4,720 trees as part of tree plantation plan provided in the EMP must be implemented as Lahore is already facing the environmental issue of high Air Quality Index (AQI) causing severe smog episodes.
- Layout of WWTP and conveyance system should be design in such a way to avoid temporary loss of utilities and infrastructure;
- Sustainable use of resources in the construction of the proposed project must be ensured by incorporating renewable and recycled resources into construction;
- Odor from WWTP should be minimized by implementation of tree plantation plan;



-
- Blowing of dust and particulate matter from stockpiled loose materials (e.g. sand, soil), during excavation and loading and unloading of construction materials may be avoided either by sheeting them with tarpaulin or plastic sheets or by regular sprinkling with light shower of water;
 - Proper implementation of EMMP should be ensured during all three phases of the proposed project;
 - The construction process should be strictly monitored by enforcing all the environmental mitigations provided in the EMP as it can cause nuisance to the surrounding settlements in terms of noise, dust, traffic management, privacy and waste; and
 - The EMP, its mitigation and monitoring programs, contained in this report should be included within the Bidding documents for project works for all Project components. The Bidding documents state that the Contractor will be responsible for the implementation of the requirements of the EMP through his own site specific EMP which will adopt all of the conditions of the EMP. This ensures that all potential bidders are aware of the environmental requirements of the Project and its associated environmental costs.

The implementation of these steps will ensure that the project is executed in an environmentally sustainable manner.



ANNEXES

ANNEX-I: QUESTIONNAIRES AND CHECKLISTS



NATIONAL ENGINEERING SERVICES PAKISTAN (PVT) LIMITED

ENVIRONMENTAL IMPACT ASSESSMENT (EIA)

PROJECT: _____

SOCIOECONOMIC SURVEY

Interview Schedule

Name of Interviewer _____ Date _____

Location / Home Town _____ Tehsil & District _____

A- Demographic Characteristics.

1. Name of the Respondent _____ Cell # _____
2. Father Name _____
3. Gender
 1. Male
 2. Female
4. Age

15-25 _____	25-35 _____	
35-45 _____	45 & above _____	
5. What is your education level?

I. Illiterate _____	II. Primary _____	III. Middle _____
IV. Metric _____	V. Intermediate _____	VI. Graduate & above _____
6. Profession _____
7. Marital Status
 1. Married _____
 2. Un-married _____
8. Language Spoken _____
9. Caste / Ethnic Group _____
10. Religion _____
11. What Type of your family system?
 1. Joint _____
 2. Nuclear _____
12. Total number of family members living with you.

Male _____	Female _____	Total _____
------------	--------------	-------------

B- Socio-Economic Characteristics.

13. What are the major sources of your household income?
 1. Govt, job _____
 2. Private job/Labour _____
 3. Business _____
 4. Student _____
 5. Any other _____
14. What is your average monthly income?(Rs)
 1. Less than 10000 _____
 2. 10,000 – 17,500 _____
 3. 17,501 -- 30,000 _____

ANNEX-I

4. 30,000 - 40,000 _____
5. Above 40,000 _____
15. How much is your average monthly expenditure? (Rs).
1. Less than 10,000 _____
 2. 10,000 –20,000 _____
 3. 20,000 -30,000 _____
 4. 30,000 -40,000 _____
 5. above 40,000 _____
16. Status of ownership (In case of shop keeper/business owner/ resident)?
1. Owner 2. Renter
17. What type of construction of your house (In case of resident)?
1. Pacca _____ 2. Semi Pacca _____ 3. Katcha _____
18. Do you have any livestock? Yes _____ No _____
19. If yes, how much? _____ If yes, what type of livestock do you have?
- | | |
|-----------------|---------------------|
| i. Sheep _____ | ii. Goat _____ |
| iii. Cow _____ | iv. Poultry _____ |
| v. Donkey _____ | vi. Horse _____ |
| vii. Bull _____ | viii. Buffalo _____ |
20. Do you have any Land?
- i. Yes _____ ii. No _____
21. Major Crops:
- | | |
|--------------------|---------------------|
| i. Wheat _____ | ii. _____ |
| Maize _____ | iii. Cotton _____ |
| _____ | iv. Sugarcane _____ |
| _____ | |
| v. Any Other _____ | |
22. Since how long are you living/working in this area?
- Period _____
- a) From which locality do you come here for business/ job?
- Name of place _____ Distance _____
- b) Why do you prefer this locality for business, job? _____

C- Civic Amenities.

23. Which of the following facilities available in your area?
1. Electricity__ 2. Water supply__ 3. Gas__ 4. Sewerage system__ 5. Telephone
24. What are the sources of household water being used in the project area?
1. Govt supply _____ 2. Bore hole _____ 3. Hand pumps _____ 4. Any other _____
25. Are you satisfied with the water quality?
1. Yes _____ 2. No _____
- If no, then what are the reasons of dissatisfaction?
1. Odorous water _____ 2. Polluted water _____

ANNEX-I

3. Saline water _____ 4. No response _____
26. Is your house connected with sewerage system?
1. Yes 2. No
27. Are you satisfied with performance of current sewerage system in this area?
1. Yes 2. No
- If no, then reasons _____

28. What is the source of energy for cooking and lightening in this area?
1. _____ 2. _____ 3. _____
29. During last one year did you borrow any money?
1. Yes _____ 2. No _____
- a) If yes, than what were Sources of borrowing
I- Bank _____ II- Money Landers _____ III- Private _____
- b) If, yes than how much money & what purpose _____

D- Social Institutions (Education & Health).

30. Is there any educational institute in this area?
1. Yes 2. No
- If yes, then
- Name _____ Distance _____
31. Is there any health facility availability in this area?
1. Yes 2. No
- If yes, then
- Name _____ Distance _____
32. What are the major common diseases in the area?
1. _____ 2. _____ 3. _____ 4. _____
33. Currently what mode of transport being used by you?
1. _____ 2. _____ 3. _____

E- Cultural Characteristics.

34. Is there any shrine/mosque in this area?
1. Yes 2. No
- If yes, then
- Name _____ Place _____
35. Are there any Protected/ archaeological/historical site in this area?
1. Yes 2. No
- If yes, then

ANNEX-I

Name _____ Place _____
 Significance _____

36. Specify the existing Non -Government Organizations (NGOs) in your area and state of their area of work?

Name of Organization _____ Area of interest _____

37. Do you know that Construction of WWTP is going to be Implemented?

1. Yes _____ 2. No _____

(If no then tell him about the proposed Project)

F- Assessment of Environmental & Social Impacts.

38. In your opinion should this project be implemented here?

1. Yes _____ 2. No _____

If yes, then reasons _____ if no, then reasons _____

39. Perceptions of Respondents for Action Associated With the Project?

Sr. No.	Possible impacts/effects of the Project	1	Increase	2	Decrease
1	Employment opportunities				
2	Industrial Development Opportunities				
3	Living standard				
4	Unemployment				
5	Loss of Land				
6	Resettlement				
7	Income generating activities				
8	Electricity Supply Quality				
9	Mobility (Access to Resources)				
10	Other specify				

40. Will you feel any disturbance during construction/operation of the Project?

i. Yes _____ ii. No _____

i. If yes, then type of disturbance

ANNEX-I

Sr. No.	Project Impact	Yes	Remarks
1	Loss of Structures		
2	Loss of Commercial Structure		
3	Loss of Land		
4	Trees to be Cut (Nos)		
5	Dust Generation		
6	Any Other		

41. What protective measures do you suggest during construction to safeguard your interests?

Protective measures _____

42. In your opinion, what are some of the pressing needs of this area (other than proposed project)?

Pressing Needs _____

43. Any other observations by Interviewer during site visit?

Signature of Interviewer: _____

ANNEX-II: ENVIRONMENTAL MONITORING REPORT



GROUND WATER ANALYSIS REPORT

Sample Detail			
Reference No.	AES-06-RV/2021	Reporting Date	18-01-2021
Nature of Sample	Ground Water	Sampling Method Reference	AES/LMS/QSP-014
Grab/Composite	Grab	Sample Collected by/Sent By	AES
Sampling Date	10-01-2021	Sample Receiving Date	11-01-2021
Analysis Completion Date	15-01-2021	Lab Temp & Humidity	24.6°C & 52%
Ambient Temperature & Humidity at the Time of Sampling			21°C & 71%
Sample ID	AES-GW-08/2021	Sampling Location	Shahdra Town Lahore
Project Detail	Ravi Urban Development Project		



Ground Water Analysis Results					
Parameter	Analysis Method	PEQS	Result	MU (CL95%)	Remarks
Lab Analysis					
Color*	SMWW 2120 C	≤ 15 TCU	1.0	N.A.	Optimal
Taste*	SMWW 2160 C	Non- Objectionable	Non- Objectionable	N.A.	Optimal
Odor*	SMWW 2150 B	Non- Objectionable	Non- Objectionable	N.A.	Optimal
Turbidity*	SMWW 2130 B	< 5 NTU	1.0	N.A.	Optimal
Total Hardness (as CaCO ₃) **	SMWW 2340 C	< 500 mg/L	126	± 0.61	Optimal
Total Dissolved Solids (TDS)**	SMWW 2540 C	< 1000 mg/L	220	± 1.16	Optimal
Total Suspended Solids (TSS)*	SMWW 2540 D	NGVS	0.0	N.A.	Optimal
pH**	SMWW 4500 H* B	6.5- 8.5	7.76	± 0.60	Optimal
Aluminum (Al)	SMWW 3111 B	≤ 0.2 mg/L	<0.005	N.A.	Optimal
Antimony (Sb)	SMWW 3114 B	≤ 0.005 mg/L	<0.005	N.A.	Optimal
Arsenic (As)	SMWW 3114 B	≤ 0.05 mg/L	0.048	N.A.	Optimal
Barium (Ba)	SMWW 3113 B	0.7 mg/L	<0.0035	N.A.	Optimal
Boron (B)	SMWW 3113 B	0.3 mg/l	<0.02	N.A.	Optimal
Iron (Fe)	SMWW 3113 B	NGVS	0.20	N.A.	Optimal
Cadmium (Cd)	SMWW 3113 B	0.01 mg/L	<0.006	N.A.	Optimal
Chloride (Cl ⁻) **	SMWW 4500 Cl B	< 250 mg/L	7.99	± 0.61	Optimal
Chromium (Cr)	SMWW 3113 B	≤ 0.05 mg/L	<0.004	N.A.	Optimal
Copper (Cu)	SMWW 3111 B	2.0 mg/L	<0.164	N.A.	Optimal
Sulfate (SO ₄ ²⁻) *	SMWW 4500 SO ₄ ²⁻ C	NGVS	39.6	N.A.	Optimal
Calcium (Ca)	SMWW 3500-Ca B	NGVS	31.5	N.A.	Optimal
Cyanide (CN)*	SMWW 4500 CN F	≤ 0.05 mg/L	0.0	N.A.	Optimal
Fluoride (F)*	SMWW 4500 F C	≤ 1.5 mg/L	0.05	N.A.	Optimal
Ammonia (NH ₃) *	SMWW 4500-NH ₃ D	NGVS	0.0	N.A.	Optimal
Lead (Pb)	SMWW 3114 B	≤ 0.05 mg/l.	0.005	N.A.	Optimal
Manganese (Mn)	SMWW 3113 B	≤ 0.5 mg/l	0.054	N.A.	Optimal
Mercury (Hg)	SMWW 3114 B	≤ 0.001 mg/L	<0.001	N.A.	Optimal

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GROUND WATER ANALYSIS REPORT

Sample Detail			
Reference No.	AES-06-RV/2021	Reporting Date	18-01-2021
Nature of Sample	Ground Water	Sampling Method Reference	AES/LMS/QSP-014
Grab/Composite	Grab	Sample Collected by/Sent By	AES
Sampling Date	10-01-2021	Sample Receiving Date	11-01-2021
Analysis Completion Date	15-01-2021	Lab Temp & Humidity	24.6°C & 52%
Ambient Temperature & Humidity at the Time of Sampling		21°C & 71%	
Sample ID	AES-GW-08/2021	Sampling Location	Shahdra Town Lahore
Project Detail	Ravi Urban Development Project		



Ground Water Analysis Results					
Parameter	Analysis Method	PEQS	Result	MU (CL95%)	Remarks
Nickel (Ni)	SMWW 3113 B	≤0.02 mg/L	<0.02	N.A.	Optimal
Nitrate (NO ₃ ⁻) *	SMWW 4500 NO ₃ ⁻ B	≤ 50 mg/L	1.03	N.A.	Optimal
Nitrite (NO ₂ ⁻) *	SMWW 4500 NO ₂ ⁻ B	≤ 3.0 mg/L	0.0	N.A.	Optimal
Sodium as Na ⁺	SMWW 3500-Na B	NGVS	17.6	N.A.	Optimal
Selenium (Se)	SMWW 3114 B	0.01 mg/L	<0.01	N.A.	Optimal
Residual Chlorine (Cl ₂) *	SMWW 4500 Cl ₂ B	0.5 mg/L	0.0	N.A.	Optimal
Phenolic Compounds (as Phenols) *	SMWW 5530 D	NGVS	0.0	N.A.	Optimal
Zinc (Zn)	SMWW 3113 B	5.0 mg/L	0.028	N.A.	Optimal
Microbiological Analysis					
Total Coliforms*	SMWW 9222 B	0/ 100 mL CFU	0	N.A.	Optimal
E.Coli *	SMWW 9222 H	0/ 100 mL CFU	+ve	N.A.	High

*Parameters are approved from Punjab Environment Protection Agency.
 **Parameters are accredited from Pakistan National Accreditation Council.

Abbreviations:

PEQS = Punjab Environment Quality Standards
 TCU = True Color Unit
 NTU = Nephelometric Turbidity Unit
 SMWW = Standard Methods for the examination of Water and Wastewater
 N.A. = Not Available
 MU = Measurement Uncertainty
 CFU = Colony Forming Unit
 NGVS = No Guideline Value Set

Remarks:

Optimal = Compliance with Permissible Range
 Law = Less Than Permissible Range
 Marginal = Close to Extreme Edge
 High = Exceeds from Permissible Range

Report Disclaimer

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- This report shall not be reproduced in part/parties.
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Analyzed By

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-----End of Report-----



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WASTEWATER ANALYSIS REPORT

Sample Detail			
Reference No.	AES-06-RV/2021	Reporting Date	18-01-2021
Nature of Sample	Waste Water	Sampling Method Reference	AES/LMS/QSP-014
Grab/Composite	Grab	Sample Collected by/Sent By	AES
Sampling Date	11-01-2021	Sample Receiving Date	11-01-2021
Analysis Completion Date	15-01-2021	Lab Temp & Humidity	24.6°C & 52%
Ambient Temperature & Humidity at the Time of Sampling		15°C & 71%	
Sample ID	AES-WW-07/2021	Sampling Location	Mehmood Boti DS
Project Detail	Ravi Urban Development Project		



Wastewater Analysis Results					
Parameter	Analysis Method	PEQS	Result	MU (CL95%)	Remarks
Lab Analysis					
pH**	SMWW 4500 H* B	6 - 9	7.33	± 0.60	Optimal
Biochemical Oxygen Demand (BODs) *	SMWW 5210-B	80 mg/L	372	N.A.	High
Chemical Oxygen Demand (COD)*	SMWW 5220 B	150 mg/L	755	N.A.	High
Total Suspended Solids (TSS)*	SMWW 2540 D	200 mg/L	232	N.A.	High
Total Dissolved Solids (TDS)**	SMWW 2540 C	3500 mg/L	808	± 1.16	Optimal
Phenolic Compounds (as Phenols) *	SMWW 5530 D	0.1 mg/L	0.0	N.A.	Optimal
Grease and Oil*	USEPA 1664 B	10 mg/L	0.0	N.A.	Optimal
Chloride (Cl)**	SMWW 4500 Cl- B	1000 mg/L	55	± 0.61	Optimal
Fluoride (F)*	SMWW 4500 F- C	10 mg/L	0.0	N.A.	Optimal
Cyanide (CN)*	SMWW 4500 CN- F	1.0 mg/L	0.6	N.A.	Optimal
An-ionic Detergents (as MBAs) *	SMWW 5540-C	20.0 mg/L	2.8	N.A.	Optimal
Sulfate (SO ₄ ²⁻) *	SMWW 4500 SO ₄ ²⁻ C	600 mg/L	52	N.A.	Optimal
Sulfide (S ²⁻) *	SMWW 4500 S ²⁻ F	1.0 mg/L	4.52	N.A.	High
Ammonia (NH ₃) *	SMWW 4500-NH ₃ D	40 mg/L	8.4	N.A.	Optimal
Cadmium (Cd)	SMWW 3113 B	0.1 mg/L	0.006	N.A.	Optimal
Chromium (Cr)	SMWW 3113 B	1.0 mg/L	0.04	N.A.	Optimal
Copper (Cu)	SMWW 3113 B	1.0 mg/L	0.283	N.A.	Optimal
Lead (Pb)	SMWW 3113 B	0.5 mg/L	0.005	N.A.	Optimal
Mercury (Hg)	SMWW 3112 B	0.01 mg/L	0.001	N.A.	Optimal
Selenium (Se)	SMWW 3114 B	0.5 mg/L	0.078	N.A.	Optimal
Nickel (Ni)	SMWW 3113 B	1.0 mg/L	0.07	N.A.	Optimal
Silver (Ag)	SMWW 3113 B	1.0 mg/L	0.06	N.A.	Optimal
Total Toxic Metals	Calculated Value		2.0 mg/L	0.779	N.A.
Zinc (Zn)	SMWW 3111 B	5.0 mg/L	0.014	N.A.	Optimal
Arsenic (As)	SMWW 3114 B	1.0 mg/L	0.052	N.A.	Optimal
Barium (Ba)	SMWW 3113 B	1.5 mg/L	0.0038	N.A.	Optimal

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WASTEWATER ANALYSIS REPORT

Sample Detail			
Reference No.	AES-06-RV/2021	Reporting Date	18-01-2021
Nature of Sample	Waste Water	Sampling Method Reference	AES/LMS/QSP-014
Grab/Composite	Grab	Sample Collected by/Sent By	AES
Sampling Date	11-01-2021	Sample Receiving Date	11-01-2021
Analysis Completion Date	15-01-2021	Lab Temp & Humidity	24.6°C & 52%
Ambient Temperature & Humidity at the Time of Sampling		15°C & 71%	
Sample ID	AES-WW-07/2021	Sampling Location	Mehmood Boti DS
Project Detail	Ravi Urban Development Project		



Iron (Fe)	SMWW 3113 B	8.0 mg/L	0.94	N.A.	Optimal
Manganese (Mn)	SMWW 3111 B	1.5 mg/L	0.158	N.A.	Optimal
Boron (B)	SMWW 3113 B	6.0 mg/L	0.18	N.A.	Optimal
Residual Chlorine (Cl ₂)*	SMWW 4500 Cl- B	1.0 mg/L	0.0	N.A.	Optimal

*Parameters are approved from Punjab Environment Protection Agency.
 **Parameters are accredited from Pakistan National Accreditation Council.
Conclusion: All the parameters are in compliance with Punjab Environmental Quality Standards (PEQS)

Abbreviations:
 PEQS = Punjab Environment Quality Standards
 USEPA = United States Environment Protection Agency
 SMWW = Standard Methods for the examination of Water and Wastewater
 N.A. = Not Available
 MU = Measurement Uncertainty

Remarks:
 Optimal = Compliance with Permissible Range
 Low = Less Than Permissible Range
 Marginal = Close to Extreme Edge
 High = Exceeds from Permissible Range

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Analyzed By

Reviewed By
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Approved By
 (QM)



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WASTEWATER ANALYSIS REPORT

Sample Detail			
Reference No.	AES-06-RV/2021	Reporting Date	18-01-2021
Nature of Sample	Waste Water	Sampling Method Reference	AES/LMS/QSP-014
Grab/Composite	Grab	Sample Collected by/Sent By	AES
Sampling Date	11-01-2021	Sample Receiving Date	11-01-2021
Analysis Completion Date	15-01-2021	Lab Temp & Humidity	24.6°C & 52%
Ambient Temperature & Humidity at the Time of Sampling		15°C & 70%	
Sample ID	AES-WW-08/2021	Sampling Location	Shad Bagh DS
Project Detail	Ravi Urban Development Project		



Wastewater Analysis Results					
Parameter	Analysis Method	PFQS	Result	MU (CL95%)	Remarks
Lab Analysis					
pH**	SMWW 4500 H ¹ B	6 - 9	7.33	± 0.60	Optimal
Biochemical Oxygen Demand (BOD ₅)*	SMWW 5210-B	80 mg/L	658	N.A.	High
Chemical Oxygen Demand (COD)*	SMWW 5220 B	150 mg/L	1420	N.A.	High
Total Suspended Solids (TSS)*	SMWW 2540 D	200 mg/L	270	N.A.	Optimal
Total Dissolved Solids (TDS)**	SMWW 2540 C	3500 mg/L	738	± 1.16	Optimal
Phenolic Compounds (as Phenols)*	SMWW 5530 D	0.1 mg/L	0.0	N.A.	Optimal
Grease and Oil*	USEPA 1664 B	10 mg/L	0.8	N.A.	Optimal
Chloride (Cl ⁻)**	SMWW 4500 Cl- B	1000 mg/L	60.9	± 0.61	Optimal
Fluoride (F ⁻)*	SMWW 4500 F- C	10 mg/L	0.0	N.A.	Optimal
Cyanide (CN ⁻)*	SMWW 4500 CN- F	1.0 mg/L	0.6	N.A.	Optimal
An-ionic Detergents (as MBAs)*	SMWW 5540-C	20.0 mg/L	2.0	N.A.	Optimal
Sulfate (SO ₄ ²⁻)*	SMWW 4500 SO ₄ ²⁻ C	600 mg/L	58	N.A.	Optimal
Sulfide (S ²⁻)*	SMWW 4500 S ²⁻ F	1.0 mg/L	2.6	N.A.	High
Ammonia (NH ₃)*	SMWW 4500-NH ₃ D	40 mg/L	0.0	N.A.	Optimal
Cadmium (Cd)	SMWW 3113 B	0.1 mg/L	0.006	N.A.	Optimal
Chromium (Cr)	SMWW 3113 B	1.0 mg/L	0.26	N.A.	Optimal
Copper (Cu)	SMWW 3113 B	1.0 mg/L	0.164	N.A.	Optimal
Lead (Pb)	SMWW 3113 B	0.5 mg/L	<0.005	N.A.	Optimal
Mercury (Hg)	SMWW 3112 B	0.01 mg/L	0.001	N.A.	Optimal
Selenium (Se)	SMWW 3114 B	0.5 mg/L	0.019	N.A.	Optimal
Nickel (Ni)	SMWW 3113 B	1.0 mg/L	0.005	N.A.	Optimal
Silver (Ag)	SMWW 3113 B	1.0 mg/L	0.017	N.A.	Optimal
Total Toxic Metals	Calculated Value	2.0 mg/L	1.325	N.A.	Optimal
Zinc (Zn)	SMWW 3111 B	5.0 mg/L	0.063	N.A.	Optimal
Arsenic (As)	SMWW 3114 B	1.0 mg/L	0.032	N.A.	Optimal
Barium (Ba)	SMWW 3113 B	1.5 mg/L	0.11	N.A.	Optimal

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WASTEWATER ANALYSIS REPORT

Sample Detail			
Reference No.	AES-06-RV/2021	Reporting Date	18-01-2021
Nature of Sample	Waste Water	Sampling Method Reference	AES/LMS/QSP-014
Grab/Composite	Grab	Sample Collected by/Sent By	AES
Sampling Date	11-01-2021	Sample Receiving Date	11-01-2021
Analysis Completion Date	15-01-2021	Lab Temp & Humidity	24.6°C & 52%
Ambient Temperature & Humidity at the Time of Sampling		15°C & 70%	
Sample ID	AES-WW-08/2021	Sampling Location	Shad Bagh DS
Project Detail	Ravi Urban Development Project		



Iron (Fe)	SMWW 3113 B	8.0 mg/L	1.76	N.A.	Optimal
Manganese (Mn)	SMWW 3111 B	1.5 mg/L	0.141	N.A.	Optimal
Boron (B)	SMWW 3113 B	6.0 mg/L	0.71	N.A.	Optimal
Residual Chlorine (Cl ₂) *	SMWW 4500 Cl- B	1.0 mg/L	0.0	N.A.	Optimal

*Parameters are approved from Punjab Environment Protection Agency.
 **Parameters are accredited from Pakistan National Accreditation Council.
Conclusion: All the parameters are in compliance with Punjab Environmental Quality Standards (PEQS)

Abbreviations:
 PEQS = Punjab Environment Quality Standards
 USEPA = United States Environment Protection Agency
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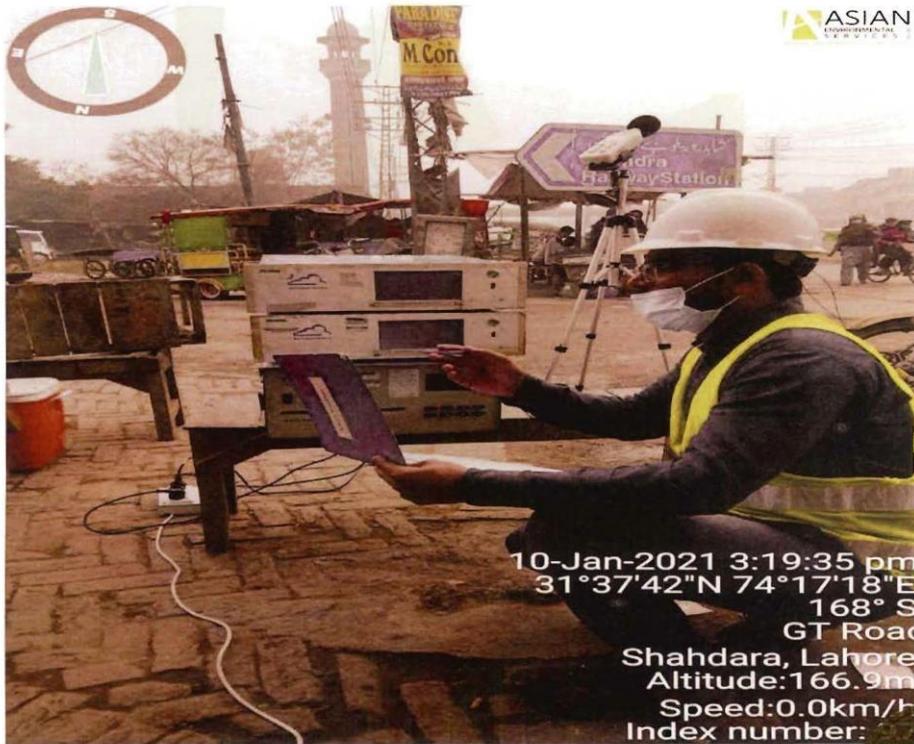




Ambient Air Monitoring Location

Railway Station, Shahdara

Lahore



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LAB 208
ISO 17025

Ambient Air Monitoring Report

Monitoring Details

Reference Number	AES-06-RU/2020
Sampling Point	Railway Station, Shahdara
Date of Monitoring	10-Jan-2021 to 11-Jan-2021
Sampling Coordinates	31°37'42" N 74°17'18" E

Sr. No.	Time	CO (mg/m ³)	NO (µg/m ³)	NO ₂ (µg/m ³)	NO _x (µg/m ³)	SO ₂ (µg/m ³)
1	09:00	2.71	11.39	12.71	24.1	20.6
2	10:00	1.53	13.08	15.0	28.08	22.79
3	11:00	1.59	12.39	18.69	31.08	19.9
4	12:00	2.1	15.18	20.58	35.76	18.4
5	13:00	1.93	13.71	21.06	34.77	16.51
6	14:00	1.83	16.9	26.91	43.81	21.7
7	15:00	1.68	10.69	24.34	35.03	16.58
8	16:00	1.51	12.52	26.94	39.46	22.13
9	17:00	1.53	16.85	28.44	45.29	21.9
10	18:00	1.54	13.98	21.64	35.62	21.9
11	19:00	1.63	14.89	24.94	39.83	23.63
12	20:00	1.52	13.18	22.44	35.62	21.52
13	21:00	1.34	13.25	22.74	35.99	14.61
14	22:00	1.43	15.28	21.61	36.89	12.16
15	23:00	1.72	14.68	16.23	30.91	13.8
16	00:00	1.70	11.45	19.51	30.96	14.91
17	01:00	1.65	14.78	16.47	31.25	17.63
18	02:00	1.63	11.18	18.37	29.55	20.08
19	03:00	1.64	16.72	22.37	39.09	21.37
20	04:00	1.62	10.97	15.26	26.23	20.14
21	05:00	1.63	12.94	14.46	27.4	17.29
22	06:00	1.67	14.23	20.75	34.98	19.49
23	07:00	1.63	12.57	26.75	39.32	21.38
24	08:00	1.63	11.3	22.03	33.33	20.62
Average Concentration		1.68	13.50	20.84	34.35	19.21

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Ambient Air Monitoring Report

Monitoring Details

Reference Number	AES-06-RU/2020
Sampling Point	Railway Station, Shahdara
Date of Monitoring	10-Jan-2021 to 11-Jan-2021
Sampling Coordinates	31°37'42" N 74°17'18" E

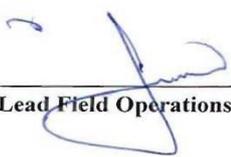
Parameters	Units	Monitoring Duration	LDL	Average Obtained Concentration	PEQS
Nitrogen Dioxide (NO ₂)	µg/m ³	24Hours	1.00	20.84	80.0
Nitrogen Oxide (NO)	µg/m ³	24Hours	1.00	13.50	40.0
NO _x	µg/m ³	24Hours	1.00	34.35	120.0
Sulphar Dioxide (SO ₂)	µg/m ³	24Hours	1.00	19.21	120.0
Carbon Monoxide (CO)	mg/m ³	24Hours	0.01	1.68	05.0
Particulate Matter (PM ₁₀)	µg/m ³	24Hours	1.00	164.8	150
Particulate Matter (PM _{2.5})	µg/m ³	24Hours	1.00	59.3	35
Total Suspended Particulate Matter (TSP)	µg/m ³	24Hours	1.00	325.8	500

LDL= Lower Detection Limit

PEQS= Punjab Environmental Quality Standard

µg/m³ = Micro Gram per Meter Cube

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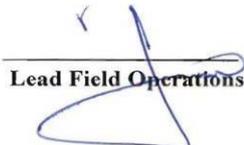
Ambient Air Monitoring Report

Monitoring Details

Reference Number	AES-06-RU/2020
Sampling Point	Railway Station, Shahdara
Date of Monitoring	10-Jan-2021 to 11-Jan-2021
Sampling Coordinates	31°37'42" N 74°17'18" E

Sr. No.	Time	Ambient Temperature °C	Wind Direction	Wind Velocity m/s	Humidity %	Pressure (mm of Hg)
1	09:00	12	SW	1.8	71	1012.3
2	10:00	13	SW	1.4	71	1012.4
3	11:00	13	SW	1.3	74	1012.5
4	12:00	13	S	1.6	64	1012.4
5	13:00	11	S	1.4	66	1012.3
6	14:00	12	S	1.6	62	1012.8
7	15:00	10	SW	0.9	64	1012.4
8	16:00	10	S	0.8	60	1012.1
9	17:00	09	S	1.3	63	1012.3
10	18:00	08	N	1.5	69	1012.2
11	19:00	08	SW	1.7	74	1012.6
12	20:00	08	SW	1.6	71	1012.4
13	21:00	07	N	1.5	76	1012.2
14	22:00	07	SW	1.8	78	1012.8
15	23:00	07	S	1.3	79	1011.3
16	00:00	08	SW	1.4	77	1011.4
17	01:00	07	SW	1.9	74	1011.5
18	02:00	06	N	1.3	73	1011.2
19	03:00	05	SW	1.7	70	1011.1
20	04:00	05	SW	1.2	72	1011.5
21	05:00	05	SW	1.5	70	1011.8
22	06:00	07	N	1.6	73	1011.4
23	07:00	08	SW	1.3	67	1011.3
24	08:00	10	SW	1.2	65	1011.6

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Noise Level Monitoring Report

Monitoring Details

Reference Number	AES-06-RU/2020
Sampling Point	Railway Station, Shahdara
Date of Monitoring	10-Jan-2021 to 11-Jan-2021
Sampling Coordinates	31°37'42" N 74°17'18" E

Sr. No.	Time	Noise dB(A)		PEQS
1	09:00	64.2		
2	10:00	63.2		
3	11:00	62.7		
4	12:00	61.5	Day Time	65
5	13:00	63.5		
6	14:00	64		
7	15:00	54		
8	16:00	50		
9	17:00	52		
10	18:00	49		
11	19:00	46		
12	20:00	44		
13	21:00	47	Night Time	55
14	22:00	48		
15	23:00	45		
16	00:00	44		
17	01:00	48		
18	02:00	62.3		
19	03:00	64		
20	04:00	59.5		
21	05:00	62.5	Day Time	65
22	06:00	60		
23	07:00	60		
24	08:00	64.1		

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ANNEX-III: DETAILS OF THE PARTICIPANTS IN VILLAGES

LIST OF PARTICIPANTS OF PUBLIC CONSULTATIONS

Sr. No.	Date	Village	Occupation	Name
1	09-09-21	Khokhar Pind	Farmer/Business	Malik Lateef
			Farmer	Malik Nawaz
			Farmer	Malik Arshad
			Labor	Malik Murshid Ali
			Private Job	M. Azam Khokhar
			Private Job	Ashiq Ali Khokhar
			Govt. Servant	Mohsin Ali Khokhar
			Govt. Servant	Dildar Ali
			Private Job	Hafiz Maqsood
			Shopkeeper	Shabir Ahmad
			Farmer	M. Qasim
2	10-09-21	Bhamma	Private Job	Fiaz Ismail
			Farmer	Haji Sarwar
			Farmer	Noor Elahi
			Farmer	Khursheed Ahmad
			Private Job	Muhammad Munir
			Private Job	Muhammad Bilal
			Labor	Kareem Nawaz
			Farmer	Rehmat Ali
3	10-09-21	Jhuggian	Farmer	Abdul Khaliq
			Farmer/Business	Ch. Mehmood
			Private Job	Hassan Ali
			Private Job	Javed Hussain
			Shopkeeper	Riaz Ahmad
			Labor	Jameel Ahmad
			Labor	Khair Muhammad
			Labor	Nasir Mehmood

ANNEX IV: QUARRY MANAGEMENT PLAN

Quarry Management Plan

1.0 Introduction

After the completion of construction phase of the proposed project, it is the responsibility of the contractor to restore the site that has been disturbed due to construction activities. RUDA has a stewardship responsibility to ensure that the environmental value of the project area is maintained for future generations to appreciate.

2.0 General Quarry Planning and Progressive Rehabilitation

A well-considered quarry development plan prior to starting work, or when opening up new areas will greatly reduce the effort required to achieve appropriate leading practice environmental and safety outcomes for quarry rehabilitation and closure.

The selection of a site, sequencing of quarrying and rehabilitation and final land-use should all be carefully planned prior to commencement of work at a quarry or borrow pit.

2.1 Progressive Rehabilitation

Progressive rehabilitation refers to the rehabilitation of completed parts of a quarry while extractive operations continue in other parts of the quarry. As new quarry sections are opened, worked out areas should be progressively rehabilitated to avoid increasing the total disturbed area of a quarry. Overburden and topsoil can be stripped from areas being opened up and placed directly onto worked out areas which are being rehabilitated. This will avoid double handling of materials and prevent degradation of the topsoil.

Progressive rehabilitation helps to minimize the visual impact of a quarry, control dust and erosion. It also assists in fostering good landowner and community relations.

Recommended progressive rehabilitation practices are:

- Agree on the final land form and use of a site with the relevant landowner.
- Rehabilitate in accordance with the intended final use of the land.
- Plan and develop the quarry in stages towards terminal areas so that progressive rehabilitation works can commence as soon as possible).
- Once the final landform is established, re-vegetate areas to stabilize the landform and to give the vegetation maximum time to establish while the quarry is still in operation.

2.2 Re-vegetation

Establishing a self-sustaining cover of vegetation is the best way to stabilize disturbed sites in the long term. Re-vegetation also minimizes the visual impact of quarries. Generally, the vegetation type which existed before the disturbance, or a similar vegetation type will regenerate most successfully.

Prior to the commencement of a quarrying activity the type of re-vegetation should be agreed with the landowner, and should be consistent with the proposed final land-use.

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Some indigenous plant species may not thrive in areas where soil conditions are substantially different after quarrying. If this is the case, and the objective is to re-establish vegetation, which fulfils the function of the original native vegetation, then some species from outside the quarry area, may have to be introduced. Care must be taken to avoid introducing a species, which could become an unacceptable fire hazard, invade surrounding areas of native vegetation or become agricultural weeds.

Where agriculture is the planned land-use then the species planted should be those commonly used for pasture or crops known to be successful on soils of similar texture, drainage status, pH and fertility. Suitable legumes should always be considered for their ability to improve soil fertility.

3.0 Rehabilitation of Borrow Pits

Borrow pits are areas either in a road reserve or adjacent land holdings that have been used to extract materials such as gravels and soils. They can vary considerably in size, depending on the quantity of material taken and the borrow pits' reserve body of remaining material. The variable size, shape and nature of borrow pits preclude very specific recommendations; however, the following general conditions apply:

- Before extraction commences, licenses and permits should be checked and limits of disturbance and/or clearing must be clearly marked out on the site before any ground disturbing activity takes place; and
- Agreement will be framed
- At the completion of extraction, the former borrow pit must be made stable and safe. This usually requires the sides of the pit to be reshaped with gentle safe grades. All disturbed areas associated with borrow pits must be retopsoiled, seeded, fertilized and mulched (if appropriate) as part of the restoration plan. Main Roads has been discouraging the conversion of borrow pits to stock watering points.

ANNEX V: WASTE MANAGEMENT PLAN

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CONSTRUCTION WASTE MANAGEMENT PLAN

1. GENERAL INTRODUCTION

Construction work refers to a wide range of materials depending on their origin; they are categorized as excavation material, demolition materials and worksite waste material. Construction waste material of the proposed project consists mainly of concrete, bentonite, masonry, limestone, sandstone, metal, and wood. In addition to this, significant amount of municipal waste will also generate from the construction camps. The solid waste generation estimated to be 650 kilogram per day for 1,000 construction workers during construction phase of the proposed project.

2. CONSTRUCTION WASTE MANAGEMENT PLAN

a) Waste Management Goals

The contractor established goal that this project will generate at least 50 percent less waste into landfills and the processes shall be employed to ensure that this goal is met. These shall include prevention of damage to materials to be incorporated into the work due to mishandling, improper storage, contamination, inadequate protection, minimizing poor quantity estimation, and through design.

b) Responsibility

- The Contractor shall be responsible for the implementation of the administrative portions of this program, including the notification of subcontractor management, the training of the site supervisor and the onsite posting of this plan.
- The site supervisor shall be responsible for the implementation of the onsite portions of this program including the training of subcontractor personnel.

c) Waste Prevention Planning

- In addition to other requirements specified herein it is a requirement for the work of this project that the contractor comply with the applicable city waste disposal requirements.
- Of the inevitable waste that is generated, the waste materials designated in this specification shall be salvaged for reuse and or recycling where practical and possible. Waste disposal in landfills shall be minimized as much as possible.
- Project Construction Documents: The Contractor will contractually require all subcontractors to comply with the Construction Waste Management Plan (WMP)". A copy of the WMP will accompany all subcontractor agreements and require subcontractor participation.
- The "Construction Waste Management Plan" shall be implemented and executed as follows and as on the chart:
 - i) Salvageable materials will be diverted from disposal where feasible;
 - ii) There will be a designated area on the construction site reserved for materials that can be recycled;
 - iii) Areas shall be marked to designate what recycle materials are to be stored there; and iv) Hazardous waste shall be managed by a licensed hazardous waste vendor.

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d) Communication and Education Plan

- This Waste Management Plan will be posted onsite;
- Each subcontractor will be made aware of the intent of this project with respect to reduction of waste and recycling. Onsite recycling containers and/or areas will be plainly marked;
- The subcontractor will be expected to make sure all their crews comply with the Waste Management Plan;
- All recycling containers and areas will be clearly marked;
- Lists of acceptable and unacceptable materials will be posted at the site; and
- All subcontractors will be informed in writing of the importance of non-contamination with other materials or trash.
- Hospital/first aid waste will be dealt according to SOPs.

e) Motivation Plan

The Contractor will conduct a pre-award meeting for subcontractors. Subcontractors under consideration will be required to attend the meeting to review project goals and requirements with the project team. Attendance will be a prerequisite for award of subcontracts. This document will be an attachment to every subcontract. Copies of the attachment will be posted prominently at the job site.

f) Expected Project Waste, Disposal, and Handling

The following chart identifies waste materials expected on the proposed project, their expected disposal methods and handling procedures. New items may be added as needed

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Material	Disposal Method	Handling Procedure
Land Clearing Debris	Keep separate for reuse and or wood sale. Suitable materials may be delivered to a composting site. Separate topsoil and rock for future landscaping use.	Keep separated in designated areas onsite.
Clean Dimensional Wood and Palette Wood	Keep separate for reuse by on-site construction or by site employees for either heating stoves or reuse in home projects. May be offered to public.	Keep separated in designated areas onsite.
Painted or Treated Wood	Reuse, off site recycle, and landfill.	Keep separated in designated areas onsite. Place in "Trash" container.
Concrete	Recycle when possible.	Keep separated in designated areas onsite.
Concrete Masonry Units	Keep separate for re-use by on-site construction or by site employees	Keep separated in designated areas onsite
Metals	Recycle off site when possible. Separate copper wire when possible.	Keep separated in designated areas onsite. Place in "Metals" container.
Gypsum drywall (unpainted)	Recycle with supplier when possible.	Keep scraps separate for recycling – stack on pallets in provided onsite. All scrap drywall should be taken back by contractor to drywall supplier
Paint	Reuse onsite; donate to Habitat for Humanity Restore.	Keep separated in designated areas onsite
Insulation	Reuse and landfill.	Keep separated in designated areas onsite.
Glass	Recycle locally.	Keep separated in designated areas onsite.
Plastics	Plastic Bottles: recycle locally; be aware of plastics that are acceptable to recycle facility.	Keep separated in designated areas onsite.

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g) Waste Disposal Company:

- Lahore Waste Management Company (LWMC)
- OZPAK
- Authority Arrangements

h) Recycle Hauler

- To be determined;
- Contact Address; and
- Some or all recycle may be hauled by the authorized representative.

i) Possible Recycle Locations and Acceptable Materials

- Coordinate with companies in Lahore or which are registered with LWMC that accept materials for recycle; and
- Using the above as a resource, a list will be kept indicating local opportunities for recycle of expected materials. New locations should be added as needed.

ANNEX VI: TRAFFIC MANAGEMENT PLAN

TRAFFIC MANAGEMENT PLAN

1 Need for Plan

During the construction period of the project, considerable vehicular movement carrying large amounts of material and machinery is expected. This will definitely interrupt the local traffic and is therefore important to manage the traffic to avoid the nuisance to local residents in terms of noise, dust, congestion and inconvenience.

2 The plan

The objective of Traffic Management Plan (TMP) is to define the requirements that should be implemented to mitigate any potential negative risks to the environment, workers or the community resulting from construction traffic.

The TMP will advise and inform site Contractors and external suppliers of equipment and materials of access and entry points along with other key information such as tipping areas and wash-out areas. It is intended to compliment and work alongside relevant EMP. The TMP will be classed as “live” and therefore be subjected to updates as required.

The Contractor, at the time of the execution of the project, will prepare a comprehensive TMP in coordination with local traffic police department, RUDA, emergency services and local administrative department. RUDA and CSC will review and approve the Contractor’s TMP. The Contractor’s TMP shall include following mitigation measures during its preparation:

- Undertake a road conditions assessment prior to and following the peak construction period, to assess any damage to road infrastructure that can be attributed to Project development.
- Repair damage as appropriate or enter into a voluntary agreement with the relevant roads authority to reimburse the cost of any repairs required to the public road network as a result of the Project.
- Spoil dumpsites located close to project site to minimize journey distance and limit movements to site access roads.
- Construction of worker accommodation on site to reduce light vehicle movements relating to travel to/ from the site.
- Provision of bus/minibus services for personnel living in nearby settlements.
- Movements of construction workers will be planned to avoid the busiest roads and times of day when traffic is at its greatest.
- Schedule deliveries and road movements to avoid peak periods.
- Driver training for HGV drivers and refresher course every six months for project drivers.
- Speed restrictions for project traffic travelling through communities (to be agreed among stakeholders).
- Run a safety campaign to improve the people’s knowledge of the traffic hazard on their roads, public information and other activities to address the issues.

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- Run a pedestrian awareness programme.
- Temporary signage

The traffic management plan for the project corridor is provided below.

3 Other Recommendations

It is important to manage public access routes during construction because it can cause delay to local traffic and create a safety hazard both on and offsite. People working and living near the tower sites would be annoyed by the emissions, noise and visual intrusion of queuing vehicles. Some important factors involved in access routes and site traffic are as follows:

3.1 Public Access Routes

The use of public road for site access may be restricted in terms of:

- Vehicle size, width and type of load
- Time limits
- Parking
- Pedestrian conflicts

Contractor should have consultation with the local police or local authority to address these issues and to effectively manage them before the beginning of the construction.

3.2 Site Workers Traffic

Site personnel should not be permitted to park vehicles right on the road; this will lead to disruption in material deliveries. Designated parking areas with appropriate parking space will be needed for this purpose; any plain area near construction site can be used for this purpose.

3.3 Site Rules

- Access to and from the site must be only via the specified entrance.
- On leaving the site, vehicles must be directed to follow the directions given.
- Drivers must adhere to the site speed limits.
- All material deliveries to site must keep allocated time limits.
- No material or rubbish should be left in the loading-unloading area.
- Develop a map for alternate routes showing material delivery services.
- Assign designated personnel on site to receive deliveries and to direct the vehicles.
- Monitor vehicle movement to reduce the likelihood of queuing or causing congestion in and around the area.
- Project vehicles should have a unanimous badge or logo on windscreen displaying that they belong to the project.

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3.4 Contractor's Obligation

The Traffic Management Plan of the Contractor should be safe enough and widening of any access roads and construction of the detours (as applicable and practical) must be completed prior to start of project construction activities so that heavy vehicular transportation for construction activities do not hinder the normal course of traffic lanes. Contractor must ensure that road closures are carried out by a competent person. The Contractor obligation must include the display of traffic signs according to the need to divert the traffic volume and to guide the road users in advance. The traffic sign, traffic light should be placed from any diverting route or road marking.

The Contractor should consider the environmental and social impacts of the traffic during construction. It will be sole responsibility of the Contractor to implement a plan which produces minimum nuisance to the local people and to the environment. Safety of the people should be given due importance. It will be under Contractor obligation to notify the traffic management plan and its later changes to CSC, Lahore RUDA, emergency services and Traffic Police, and also publish weekly programme in the local newspaper.

**ANNEX-VII: OCCUPATIONAL
HEALTH AND SAFETY (OHS) PLAN**

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OCCUPATIONAL HEALTH AND SAFETY PLAN

Occupational Health and Safety covers all personnel working under the project and will be in line with the Authority approved EHS guidelines on health and safety.

The Occupational Health and Safety (OHS) program will aim to ensure that the workplace is safe and healthy by: addressing the hazards and risks at the workplace; outlining the procedures and responsibilities for preventing, eliminating and minimizing the effects of those hazards and risks; identifying the emergency management plans for the workplace or workplaces; and, specifying how consultation, training and information are to be provided to employees at various workplaces.

Some of the risks/hazards associated with workplaces are due to working close to or at sites associated with the various project construction activities. Other risks associated with the project construction phase include risk of increase of vector borne and other different diseases.

The following sections will be implemented during the construction phase to address and ensure workers' health and safety.

1. SCREENING AND REGULAR UNANNOUNCED CHECKING OF WORKERS

As per the procedure for hiring workers, all contractors and labor agencies are required to make all prospective workers undergo medical tests to screen for diseases and sicknesses, prior to selection and employment of any worker. The contractor is also responsible for ensuring that no worker who has a criminal record is employed at the project site. It will be ensured that all workers undergo medical tests to screen diseases at source and at sites in consultation with the designated Health Officer.

In addition to this, the Project Management will also undertake sudden, unannounced checks on workers to look for diseases such as COVID-19, HIV, STDs, and hepatitis and take necessary steps as mandated by the Contractual agreement between the Contractor and the Worker(s).

2. MINIMIZING HAZARDS AND RISKS AT THE WORKPLACE

To ensure safety at all work sites, the following will be carried out:

- i. Installation of signboards and symbols in risky and hazardous areas, to inform workers to be careful.
- ii. Construction of barricades around construction sites and deep excavated pits, to cordon off and deter entry of unauthorized personnel and workers into these areas.
- iii. Providing a safe storage site/area for large equipment such as power tools and chains, to prevent misuse and loss.
- iv. Proper Housekeeping: Ensuring that materials are all stacked, racked, blocked, interlocked, or otherwise secured to prevent sliding, falling, or collapse. Brick stacks will not be more than 7 feet in height and for concrete blocks they will not be more than 6 feet high.

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- v. Removing all scrap timber, waste material and rubbish from the immediate work area as the work progresses.
- vi. Where scaffolds are required, ensuring that each scaffold or its components shall be capable of supporting its own weight and at least 4 times the maximum intended load applied or transmitted to it. The platform/scaffold plank shall be at least 15 inches wide and 1.5 inches thick. The rope should be capable of supporting at least 6 times the maximum intended load applied or transmitted to that rope. Pole scaffolds over 60 feet in height shall be designed by a registered professional engineer and shall be constructed and loaded in accordance with that design. Where scaffolds are not provided, safety belts/safety nets shall be provided;
- vii. Ensure that all ramps or walkways are at least 6 feet wide, having slip resistance threads and not inclined at more than a slope of 1 vertical and 3 horizontal.
- viii. Stacking away all excavated earth at least 2 feet from the pit to avoid material such as loose rocks from falling back into the excavated area and injuring those working inside excavated sites.
- ix. Constructing support systems, such as bracing to adjoining structures that may be endangered by excavation works nearby.
- x. Only a trained electrician to construct, install and repair all electrical equipment to prevent risks of electrical shocks and electrocution.
- xi. Install fire extinguishers and/or other fire-fighting equipment at every work site to prepare for any accidental fire hazards.

3. PROVISION OF PERSONAL PROTECTIVE EQUIPMENT

Risks to the health and safety of workers can be prevented by provision of Personal Protective Equipment (PPEs) to all workers. This will be included in the construction cost for each Contractor. Depending on the nature of work and the risks involved, contractors must provide without any cost to the workers, the following protective equipment:

- i. High visibility clothing for all personnel during road works must be mandatory. ii. Helmet shall be provided to all workers, or visitors visiting the site, for protection of the head against impact or penetration of falling or flying objects.
- iii. Safety belt shall be provided to workers working at heights (more than 20 ft) such as roofing, painting, and plastering. iv. Safety boots shall be provided to all workers for protection of feet from impact or penetration of falling objects on feet.
- v. Ear protecting devices shall be provided to all workers and will be used during the occurrence of extensive noise.
- vi. Eye and face protection equipment shall be provided to all welders to protect against sparks.
- vii. Respiratory protection devices shall be provided to all workers during occurrence of fumes, dusts, or toxic gas/vapor.
- viii. Safety nets shall be provided when workplaces are more than 25 feet (7.5 m) above the ground or other surfaces where the use of ladders, scaffolds, catch platforms, temporary floors or safety belts is impractical.

The specific PPE requirements for each type of work are summarized below.

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Table 1: PPE Requirement List

Type of Work	PPE
Elevated work	Safety helmet, safety belt (height greater than 20 ft), footwear for elevated work.
Handling work safety	Helmet, leather safety shoes, work gloves.
Welding and cutting work	Eye protectors, shield and helmet, protective gloves.
Type of Work	PPE
Grinding work	Dust respirator, earplugs, eye protectors.
Work involving handling of chemical substances	Dust respirator, gas mask, chemical-proof gloves. Chemical proof clothing, air-lined mask, eye protectors.
Wood working	Hard hat, eye protectors, hearing protection, safety footwear, leather gloves and dust respirator.
Blasting	Hard hat, eye and hearing protection.
Concrete and masonry work	Hard hat, eye protectors, hearing protection, safety footwear, leather gloves and dust respirator.
Excavation, heavy equipment, motor graders, and bulldozer operation	Hard hat, safety boots, gloves, hearing protection.
Quarries	Hard hat, eye protectors, hearing protection, safety footwear, leather gloves and dust respirator.

4. PROCEDURES TO DEAL WITH EMERGENCIES SUCH AS ACCIDENTS, SUDDEN ILLNESS AND DEATH OF WORKERS

First aid kits will be made available at all times throughout the entire construction period by the respective contractors. This is very important, because most work sites will be at some distance from the nearest hospital. In addition to the first aid kits, the following measures should be in place:

- i. Provision of dispensaries by the individual EPC contractor.
- ii. A vehicle shall be on standby from the Project Office so that emergency transportation can be arranged to take severely injured/sick workers to the nearest hospital for immediate medical attention.
- iii. A designated Health Officer/worker for the Project will be identified as a focal person to attend to all health and safety related issues. This employee's contact number will be posted at all work sites for speedy delivery of emergency services. The focal person shall be well versed with the medical system and facilities available at the hospital.
- iv. Communication arrangements, such as provision of radios or mobile communication for all work sites, for efficient handling of emergencies, will be made.

5. RECORD MAINTENANCE AND REMEDIAL ACTION

The Project Management will maintain a record of all accidents and injuries that occur at the work site. This work will be delegated by the contractor to the site supervisor and regularly reviewed every quarter by project management. Reports prepared by the contractor shall

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include information on the place, date and time of the incident, name of persons involved, cause of incident, witnesses present and their statements. Based on such reports, the management can jointly identify any unsafe conditions, acts or procedures and recommend for the contractor to undertake certain mitigative actions to change any unsafe or harmful conditions.

6. COMPENSATION FOR INJURIES AND DEATH

Any casualty or injury resulting from occupational activities should be compensated as per the local labor laws of Pakistan. Where compensation is sought by the injured party, proper procedures for documentation of the case will be followed, including a detailed report on the accident, written reports from witnesses, report of the examining doctor and his/her recommendation for treatment. Each individual contractor will be responsible for ensuring compensation for the respective workers.

7. AWARENESS PROGRAMS

The Project management will undertake awareness programs through posters, talks, and meetings with the contractors to undertake the following activities:

- i. Dissemination sessions will clarify the rights and responsibilities of the workers regarding interactions with local people (including communicable disease risks, such as HIV/AIDS, COVID-19), work site health and safety, waste management (waste separation, recycling, and composting), and the illegality of poaching.
- ii. Make workers aware of procedures to be followed in case of emergencies such as informing the focal health person who in turn will arrange the necessary emergency transportation or treatment.

8. NOMINATION OF A HEALTH AND SAFETY FOCAL PERSON

Within each site (especially if different sites are being implemented by different contractors), a Health and Safety Focal Person will be appointed. The Terms of Reference for the focal person will mainly be as follows:

- i. Function as the focal person/representative for all health and safety matters at the workplace;
- ii. Responsible for maintaining records of all accidents and all health and safety issues at each site, the number of accidents and its cause, actions taken and remedial measures undertaken in case of safety issues;
- iii. Be the link between the contractor and all workers and submit grievances of the workers to the contractor and instructions/directives on proper health care and safety from the contractors back to the workers;
- iv. Ensure that all workers are adequately informed on the requirement to use Personal Protective Equipment and its correct use;
- v. Also responsible for the first aid kit and making sure that the basic immediate medicines are readily available.

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9. SUGGESTED CONTENTS OF OCCUPATIONAL HEALTH AND SAFETY PLAN

The suggested contents of Occupational Health and Safety Plan to be developed by the Contractor(s) are described below:

- a) Purpose
- b) Scope of Application
- c) Complying Basis
- d) Occupational Health and Safety Objectives
- e) Organization and Responsibility
- f) Contractor's Project Manager
- g) HSE Management Department of the Contractor(s)
- h) Medical Treatment Room of the Contractor(s)
- i) Subcontractor's Project Manager
- j) Subcontractor's HSE Managers
- k) Occupational Health and Safety
- l) Community Health and Safety and Health Plan
- m) Labour Protection
- n) Sanitary Epidemic Prevention
- o) Safety Plan
- p) Summary
- q) Qualification Review
- r) Safety Training
- s) Construction Plans and Documents
- t) Control Measures
- u) Monitoring Measures
- v) Management of the Key Safety Accidents
- w) Public Security Plan
- x) Local Community Health and Safety

**ANNEX-VIII: GUIDELINE FOR
COVID-19**

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Precautionary Action Against the Potential Risk of Novel Coronavirus

INTRODUCTION

On February 11, 2020 the World Health Organization (WHO) announced an official name for the disease that is causing the 2019 novel coronavirus outbreak, first identified in Wuhan, China. The new name of this is coronavirus disease 2019, abbreviated as COVID-19. In COVID-19, 'CO' stands for 'corona,' 'VI' for 'virus,' and 'D' for disease. Formerly, this disease was referred to as "2019 novel coronavirus" or "2019-nCoV".

Coronaviruses are a large family of viruses. Some cause illness in people, and others, such as canine and feline coronaviruses, only infect animals. Rarely, animal coronaviruses that infect animals have emerged to infect people and can spread between people. This is suspected to have occurred for the virus that causes Coronavirus Disease 2019 (COVID-19). Middle East Respiratory Syndrome (MERS) and Severe Acute Respiratory Syndrome (SARS) are two other examples of coronaviruses that originated from animals and then spread to people.

The risk of exposure to COVID-19 is equal for employees of Employer, Engineer, Contractor, and suppliers than for the general population. Contractor, therefore, must consider the physical well-being and safety of all the persons entitled to be on the Site and follow reasonable guidelines and recommendations of Government authorities and healthcare professionals. As experience has shown in other countries, confirmed cases of COVID-19 expand exponentially if health and safety controls are left unheeded.

Contractor should enforce all health and safety procedures at Site including sanitary protocols, proper hygiene, social distancing, use of Personal Protective Equipment (PPE), Toolbox Talks (TBTs) on special COVID-19 requirements, and prompt reporting of health issues related to COVID-19. Contractors must put safeguards in place to keep workers exposed to COVID-19 away from Site for at least 14 days after the last potential exposure.

WHO declared the COVID-19 as a Public Health Emergency of International Concern (PHEIC) in January 2020 and afterwards announced the COVID-19 outbreak as pandemic on 11th March 2020 due to the widespread of the disease in 114 countries during that period. WHO Director General urged the countries to take action to stop the disease.

The rapid spread of COVID-19 hits all the provinces of Pakistan Sindh, Balochistan, Punjab & Khyber Pakhtunkhwa including the Gilgit Baltistan and Azad Jammu & Kashmir. The prevailing virus creates the menacing and distressing situation when it arrived around the closed proximities of the Project Area.

Government of Pakistan has launched the National Action Plan for COVID-19 Pakistan to combat the challenge of prevailing virus, also available at <https://www.nih.org.pk/wpcontent/uploads/2020/03/COVID-19-NAP-V2-13-March-2020.pdf>. The Government of Pakistan has launched the real-time data portal for COVID-19 <http://covid.gov.pk/>. These measures are mostly relating to the containment and awareness and capacity building. Besides this COVID-19 daily situation report is also available at <https://www.nih.org.pk/wpcontent/uploads/2020/04/COVID-19-Daily-Updated-SitRep-03-April-2020.pdf>.

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All the stakeholders are on board to jointly prevent/ limit/ control the spread of COVID-19. All of the staff is required to take precautionary measures as well as maintain social distances. The use of thermal guns for checking every single person body temperature, placement of relevant flyers and disinfection spray inside of all the containers are few of the measures to combat COVID-19.

OBJECTIVE

Following are the objectives of this report to jointly prevent / limit/ control the spread of COVID19 at Site that can hamper the progress of proposed Project:

1. To control potential patients of COVID-19
2. To enhance understanding of the evolving COVID-19;
3. To share knowledge on COVID-19 and preparedness measures being implemented at Site;
4. To generate recommendations for adjusting COVID-19 containment and response measures; and
5. Outline the measures taken at Site. The advised measures will help all the stakeholders to plan their work continuity in response to the COVID-19.

Due to the evolving situation of the COVID-19, this document should be read in conjunction with the latest relevant advisories issued by WHO (especially "[Getting your workplace ready for COVID-19, 3 March 2020](#)") and Government of Pakistan.

WHAT IS CORONA VIRUS (COVID-19)

The COVID-19 belongs to a family of viruses known as the Coronaviruses, which can cause illnesses ranging from the common cold to more severe diseases, such as the Severe Acute Respiratory Syndrome (SARS) and Middle East Respiratory Syndrome (MERS)¹⁹. There have been four Covid-19 variants, i.e. Alpha, Beta, Gamma and Delta. The Delta variants possibly twice as transmissible as the original strain and the current vaccines were designed to target the original strain, the shots may not be as effective against Delta (as for original strain), which has a number of mutations on the virus's spike protein.

SYMPTOMS

The symptoms of the COVID-19 are similar to that of regular pneumonia. Typical symptoms include;

- Fever;
- Cough;
- Difficulty in breathing;
- Pneumonia;
- Running nose;
- Sore throat; and
- Feeling of being unwell.

MODE OF SPREAD

¹⁹ Source: World Health Organization

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Infected person – person transmission; Infected people can spread COVID-19 through their respiratory secretions via droplets produced when an infected person coughs or sneezes, similar to how influenza and other respiratory pathogens spread. The spread from person-to-person is most likely among close contacts (about 6 feet);

- Infected animals' dead or Alive;
- Air by coughing and sneezing;
- Close personal contact, such as touching or shaking hands;
- Touching an object or surface with a virus on it; and
- Touching your mouth nose or eyes before washing your hands.

GENERAL STANDARDIZED PRECAUTIONARY MEASURES

Following measures/recommendations are suggested as a general guidance to be followed for the protection of potential impacts of COVID-19:

Since, there is no vaccine available to protect against human Coronavirus infections. Therefore, transmission can be prevented through following measures:

- Cover your mouth while cough or sneeze;
- Avoid close contact with people who are sick;
- Avoid the use of hard soap;
- Wash your hands often with liquid soap and water for at least 20 seconds;
- All the employees should ensure sanitization of hands at appropriate time;
- Avoid touching your eyes, nose, and mouth with unwashed hands;
- If you are concerned about your symptoms you should see your health care provider at site or in office;
- Use of Personal Protective Equipment (PPE) according to risk (a surgical or N95 mask);
- Do not spit, wrap your oral and nasal secretion with tissue and throw it in a covered dustbin;
- Balance your nutrition and exercise moderately;
- Sterilization / disinfection of medical devices at Site dispensaries; and
- Do not touch, buy or eat wild animals (gamey). Try to avoid visiting markets that sell such animals.

PROJECT SITE SPECIFIC PRECAUTIONARY MEASURES

Measures for protecting staff and labour from exposure to, and infection with, the COVID-19 depend on the type of work being performed and exposure risk, including potential for interaction with infectious people and contamination of the work environment. Regardless of specific exposure risks, following are the main actions that have been jointly taken at Site to combat the COVID-19:

Employer's Side

Employer should issue the notification containing the precautionary measures in the light of GoPb guidelines to be implemented at Site. Upon receiving the Employer notification all the mentioned precautionary measures will be communicated to Engineer staff for compliance.

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Employer technical staff is also complying with the GoPb guidelines and Contractor suggestion to control the spread of COVID-19 at Site in the best interest of the Project and country.

Consultant's Side

Consultant's top management will issue the orders in the light of GoPb guidelines containing the precautionary measures to control the spread of COVID-19 for the staff working at Site.

Consultant staff at Site will fully complying with the orders including photographic evidence. Considering the severity of the prevailing virus Engineer devised the Standard Operating Procedure (SOP) containing precautionary action against the potential risk of novel corona virus.

Besides, above Consultant will ensure the following precautionary measures at Site.

- Adequate signage and information at all entrances and exits showing what is Corona Virus, how it spreads, what are the symptoms, standard precautions;
- The awareness session for the Contractor staff is equally important as of Consultant staff to combat the COVID-19 at Site. The Consultant will ensuring that Contractor is arranging such session at Site from time to time to reduce the potential risk of COVID19. Further, all the newly inducted and existing staff have been given HSE training by the Consultant & Contractor.

Contractor's Side

Contractor will communicate various precautionary measures to Employer and Engineer through letters to control the spread of COVID-19 at Site. Following are the major steps to be taken by the Contractor:

- Contractor will convey the instructions and requirements of its superior unit for the prevention and control of COVID-19 epidemic at Site.
- Contractor will establish a special organization for epidemic prevention and control on the Project Site that is responsible for arranging, implementing, publicizing and supervising the epidemic prevention and control measures.
- Launch the plan for epidemic prevention and control on the project Site that includes:
 - All personnel in temporary camp are required to wear masks; ○ Contractor personnel incharge of Site to wear masks;
 - Arranged special personnel to measure and record the temperature of all personnel when entering or leaving the temporary camp;
 - If any person with fever, cold and other symptoms are found, they will be admonished to go home for isolation and asked about the development of the disease every day; and
 - Propagate and implement the epidemic prevention measures for the staffs and labours and warn them not to go outside and home as much as possible.
- All these meetings should carried out through video conference.
Contractor is not limited to the above precautionary measures but practicing and implementing the following;

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- Contractor will prepare a pamphlet for the awareness of Site staff to combat the COVID-19. It will also place/posted at strategic points at Site.
- Launch awareness campaign to inform all the staff and labour about the coronavirus, to use facemask, hand hygiene, cough etiquette, and avoidance of close contact with animals and consumption of their raw products.
- Everyday awareness speech in English and Urdu in the temporary camp.
- All the employees are not allowed to go outside of the Project Area or on vacation to their homes and on daily basis visit to sites;
- Contractor will provide medical masks and antibacterial liquid hand wash to all personnel.
- Contractor will prepare the isolation facility at Site and provided three isolated rooms for such patients inside the temporary camp. Each room have three beds, oxygen cylinder, sanitizers, isolation kit, hand wash.
- Thermal scanning will be carried out continuously in the morning for everybody at the main gate of temporary camp.
- Record will be maintained for everyone that includes the temperature value of each person with their names, every morning and afternoon go to each department for scanning separately and noted down their name with temperature values.
- Contractor carry out disinfectant spray on daily basis morning and afternoon in each office and rooms and all the area of the camp.
- SSWMB and Consultant staff will also requested by Contractor to do not interact physically rather through electronically by emails or video conferencing.

RECOMMENDATIONS FOR THE CONTROL OF COVID-19 AT SITE

To Avoid Transmission

For all personnel at Site, it is always a good to practice the following precautionary measures:

- Workers to remain at least two meters apart from each other at all times (social distancing) – i.e. spread out and reduce the number of people working together in one area of the site;
- Avoid eating lunch in the form of group in available mess/canteens at Site;
- Close site canteens/ food preparation and eating areas (avoid gatherings) – workers to bring their own prepared lunch to site and eat alone e.g. in their van, car, or in an open space;
- Avoid in-person meetings if possible. In the case that an in-person meeting is unavoidable, make sure to have it in a well-ventilated area with sufficient space for attendees to distance themselves from one another. For meetings such as toolbox talks, consider breaking them up into smaller group meetings versus one large meeting;
- Introduce enhanced cleaning procedures across the Site and touch points e.g. office equipment, plant and machinery controls, taps/toilet/washing facilities, handrails;
- Stagger start times on site to avoid congestion in entrance areas;
- Reduce the number of people on site inductions at any one time and hold them outdoors if possible;
- Stop workers moving across various sites (potential for cross contamination);
- No outsiders should be at the Project Site;
- Contractor, Consultant and Employer personnel are advised to avoid travelling and in case traveling is unavoidable, prior approval from the management should be

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essential. In case of travelling, the above mentioned measures need to be strictly followed by the traveller;

- Prompt identification and isolation of potentially infectious individuals is a critical first step in protecting workers and other Site staff. An isolated area should be available at Site to immediately isolate suspected person, as it is most important to stop its spread at Site.
- Rapid Response Team should be formed and be informed immediately in case of suspect and confirmed case of COVID-19.
- Medical team at Site should separate the suspected person displaying fever, cough or difficulty breathing from other personnel; and
- If a person has had close contact with an individual that has confirmed COVID-19, that person will not be allowed to return to the Site until he/she has been symptom free for 14 days.
- Clean and fumigate all the workplaces at Site on daily basis;
- Ask people to stay at home if they have fever, cough, difficulty in breathing, runny nose, sore throat as per organizational rules;
- An immediate replacement of solid soap with liquid anti-bacterial soap bottles may be appropriate.
- Provision of alcohol-based hand sanitizer need to available for all staff;
- Clean the religious places carpets and rugs. Have them washed in place over the weekend and then do regular cleaning;
- Have the cleaners/ maintenance crews regularly clean surfaces that are touched frequently by personnel with disinfectants such as in and out doors;
- Fresh medical tests of staff working should be carried out at Site;
- Dispose of all contaminated waste (gloves, paper, swab handles, etc.) into biohazard waste bags for disposal;
- Ensure that panic is not created. In fact the posters should start with statements such as do not panic and fear the virus but know and prevent; and
- Ensure proper ventilation system and vaccination for all the personnel at Site.

Use of Personal Protective Equipment (PPEs)

- Necessary PPE should be available at Site all the times and are being issued to each personnel at Site;
- Practice of using masks is also being ensured by all parties at Site (a surgical or N95 masks);
- Re-usable PPE should be thoroughly cleaned after use and not shared between workers. Single use PPE should be disposed of so that it cannot be reused;

Outside Visitors

- Visitors should enter with strictly wearing visitors card;
- Ensure sanitization of hands;
- All parties should ensure that the sick persons should be wearing a surgical or N95 masks;
- Note down the complete information of outsiders before entrance;
- Proper screening should be carried out before entering the Site;
- Refrain from handshakes. Rather than shaking hands, visitors may explain why handshakes can contribute to the risk of spread;

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- Attempt to maintain a general six (6) feet distance between themselves. This will be challenging to follow at all times but it is Engineer recommendation to follow;
- Refrain from and/or limit touching of workplace surfaces; and
- In addition to these on-site procedures, it is advised to follow their respective organizational instructions related to Site visits.

ANNEX IX: RESOURCE CONSERVATION PLAN

RESOURCE CONSERVATION PLAN

1. INTRODUCTION

The most of the resources in this world are finite and non-renewable in nature. We are completely dependent on these resources to fulfill all our daily requirements. Therefore, sustainable development calls for the need to conserve resources in a way that meet our needs of present generation as well as future generation, especially the non-renewable resources.

2. OBJECTIVE OF THE PLAN

The Resource Conservation Plan is intended to make an effort towards achieving sustainable development. The objective of the resource conservation plan is to:

- Minimize the use of natural resources; and
- Mitigate and prevent pollution contaminating the natural resources.

3. PLANNING

Careful estimations of quantities of material, fuel, water and energy required directly or indirectly shall be done to avoid excessive or unnecessary wastage of these materials. In addition to this, pollution prevention strategies shall also be devised to prevent contamination of resources. The estimations include the following:

- Estimation of construction material required for the project;
- Estimation of fuel consumption for construction machinery, construction vehicles and generators;
- Estimations of the energy requirements during all the stages of the project; and
- Estimations of water consumption for construction activities and construction camp sites.
- Strategies shall be planned to reduce loads on the identified resources to be consumed;
- Best management practices shall be devised to control or reduce pollution resulting from the activities during different stages of the project; and
- An inspector shall be assigned responsibility to oversee the ongoing activities to check the compliance of the planned strategies.

4. EXECUTION OF THE PLAN

The planned strategies shall be implemented to conserve the natural resources including but not limited to the following:

Material

- Material supplied shall be in conformance with the estimated quantities and excess material shall be returned to the supplier;
- Material wastage shall be avoided by using best management practices;

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- Waste produced during the project execution shall be disposed off safely to the designated disposal sites through approved contractors; and
- Reuse of the materials shall be appreciated.

Energy

- Reduce trips and optimize routes to and from the construction site for all kinds of activities;
- Regular maintenance of equipment and vehicles to avoid leaks and sustain efficient fuel consumption;
- Switch off idle equipment and vehicles to avoid wastage of fuel;
- Minimize warm up time, unnecessary acceleration and deceleration of the construction equipment and vehicles;
- Avoid unnecessary burning of fuel for cooking in construction camps;
- Avoid unnecessary use of heating and cooling systems during extreme weathers events;
- Construction shall start in early hours of the day to avoid heat in summers and utilization of day light; and
- Alternate energy sources shall be considered for electricity generations during construction and operation to conserve fossil fuel as it is non-renewable resource.

Water

- Avoid using potable water for sprinkling, curing and washing of equipment and vehicles. Surface water or treated effluent can be used instead;
- Wastage of water should be controlled through providing proper valves and through controlling pressure of the water;
- Unnecessary equipment washings should be avoided;
- Awareness amongst workers shall be raised to conserve water and immediately report for any leaks detected; and
- Ensure protection of canal water from contamination resulting from construction activities.

Pollution

- Emissions shall be reduced and controlled as far as possible and direct discharges to air shall be avoided by strictly adhering to the mitigation measures outlined in EIA report;
- Waste water shall not be discharged directly into nearby water body and must be managed as per the recommendations presented in EIA; and
- Construction and demolition waste, and municipal solid waste shall not be dumped and burnt openly, and shall be handled according to the preventative measure given in EIA report.

5. CHECKING AND CORRECTIVE ACTIONS

The Authority shall bind the construction contractor through contract agreement to comply with the strategies outlined in the Resource Conservation Plan. The Environmental Committee shall also appoint an Inspector who shall monitor the daily onsite activities and shall report any issues and concerns raised in relation to Resource Conservation Plan. The inspector shall recommend adequate corrective actions to mitigate the issues raised.

ANNEX X: CHANCE FIND

PROCEDURE

ARCHAEOLOGICAL 'CHANCE FIND' PROCEDURE

1. BACKGROUND

The purpose of this document is to address the possibility of archaeological deposits becoming exposed during ground altering activities within the project area and to provide protocols to follow in the case of a chance archaeological find to ensure that archaeological sites are documented and protected as required.

The Antiquities Act, 1975, protects archaeological sites, whether on Provincial Government owned or private land. They are non-renewable, very susceptible to disturbance and are finite in number. Archaeological sites are an important resource that is protected for their historical, cultural, scientific and educational value to the general public and local communities. Impacts to archaeological sites must be avoided or managed by development proponents. The objectives of this 'Archaeological Chance Find Procedure' are to promote preservation of archaeological data while minimizing disruption of construction scheduling. It is recommended that due to the moderate to high archaeological potential of some areas within the project area, all on site personnel and contractors be informed of the Archaeological Chance Find Procedure and have access to a copy while on site.

2. POTENTIAL IMPACTS TO ARCHAEOLOGICAL SITES

Developments that involve excavation, movement, or disturbance of soils have the potential to impact archaeological materials, if present. Activities such as road construction, land clearing, and excavation are all examples of activities that may adversely affect archaeological deposits.

3. RELEVANT LEGISLATION

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

4. REMEDIES AND PENALTIES

The Antiquities Act, 1975 provides for heritage inspection or investigation orders, temporary protection orders, civil remedies and penalties to limit contraventions. These powers provide: "A contravention of any provision of this Act or the rules shall, where no punishment has been specifically provided be punishable with rigorous imprisonment for a term which may extend to two years, or with fine up to rupees ten hundred thousand, or with both. "

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5. ARCHAEOLOGICAL 'CHANCE FIND' PROCEDURE

If you believe that you may have encountered any archaeological materials, stop work in the area and follow the procedure below:

The following 'chance-find' principles will be implemented by the contractor throughout the construction works to account for any undiscovered items identified during construction works after approval from Authority:

- i. Workers will be trained in the location of heritage zones within the construction area and in the identification of potential items of heritage significance.
- ii. Should any potential items be located, the site supervisor will be immediately contacted and work will be temporarily stopped in that area.
- iii. If the site supervisor determines that the item is of potential significance, an officer from the Department of Archaeology (DoA) will be invited to inspect the site and work will be stopped until DoA has responded to this invitation.
- iv. Work will not re-commence in this location until agreement has been reached between DoA and Authority as to any required mitigation measures, which may include excavation and recovery of the item.
- v. A precautionary approach will be adopted in the application of these procedures.

6. DETAILED PROCEDURAL STEPS

- If the Director, department of Archaeology receives any information or otherwise has the knowledge of the discovery or existence of an antiquity of which there is no owner, he shall, after satisfying himself as to the correctness of the information or knowledge, take such steps with the approval of the Government, as he may consider necessary for the custody, preservation and protection of the antiquity.
- Whoever discovers, or finds accidentally, any movable antiquity shall inform forth with the Directorate within seven days of its being discovered or found.
- If, within seven days of his being informed, the Director decides to take over the antiquity for purposes of custody, preservation and protection, the person discovering or finding it shall hand it over to the Director or a person authorized by him in writing.
- Where the Director decides to take over an antiquity, he may pay to the person by whom it is handed over to him such cash reward as may be decided in consultation with the Advisory Committee.
- If any person, who discovers or finds any movable antiquity contravenes the provisions of the Act, he shall be punishable with imprisonment for a term which may extend to five (05) years, or with fine not less than fifteen hundred thousand rupees or with both and the Court convicting such person shall direct that the antiquity in respect of which such contravention has taken place shall stand forfeited to Government.
- The Director or any officer authorized by him with police assistance may, after giving reasonable notice, enter into, inspect and examine any premises, place or area which or the sub-soil of which he may have reason to believe to be, or to contain an antiquity and may cause any site, building, object or any antiquity or the remains of any antiquity in such premises, place or area to be photographed, copied or reproduced by any process suitable for the purpose.
- The owner or occupier of the premises, place or area shall afford all reasonable opportunity and assistance to the Director.

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- No photograph, copy of reproduction taken or made shall be sold or offered for sale except by or with the consent of the owner of the object of which the photograph, copy or the reproduction has been taken or made.
- Where substantial damage is caused to any property as a result of the inspection, the Director shall pay to the owner thereof reasonable compensation for the damage in consultation with the Advisory Committee.
- If the Director after conducting an inquiry, has reasonable grounds to believe that any land contains any antiquity, he may approach the Government to direct the Revenue Department to acquire such land or any part thereof and the Revenue Department shall thereupon acquire such land or part under the Land Acquisition Act, 1894 (I of 1894), as for a public purpose. Authority will act under its Act and formal procedure regarding the issue.

ANNEX-XI: TREE PLANTATION PLAN

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Tree Plantation/Afforestation Plan

The basic purpose of afforestation/plantation of suitable species in the project area is to reduce the risk been made due to cutting of trees for the proposed Project and to enhance green cover and improve the overall environment of the area. Afforestation will not only reduce the risk been made but will also increase the carrying capacity of the area regarding many positive aspects.

Plantation will be done after the removal of trees during the construction work immediately. Plantation of indigenous tree species is highly important to maintain the biodiversity and ecological balance. It is also important to prevent global warming, soil erosion and pollution. Afforestation purifies the environmental sustainability and helps in reducing the carbon dioxide level.

Importance of tree plantation

- Trees contribute to their environment by providing oxygen, improving air quality, climate amelioration, conserving water, preserving soil, and supporting wildlife;
- Trees control climate by moderating the effects of the sun, rain and wind. Leaves absorb and filter the sun's radiant energy, keeping things cool in summer;
- They preserve warmth by providing a screen from harsh wind;
- Lowers the air temperature and reduce the heat intensity of the greenhouse effect by maintaining low levels of carbon dioxide;
- Both above and below ground, trees are essential to the eco-systems in which they reside.
- Absorb and store rainwater which reduce runoff and sediment deposit after storms. This helps the ground water supply recharge, prevents the transport of chemicals into streams and prevents flooding; and
- Trees, shrubs and turf also filter air by removing dust and absorbing other pollutants like carbon monoxide, sulfur dioxide and nitrogen dioxide.

Objectives

- To Restore native species;
- To improve the quality of air and reduce its pollution;
- To add color to the landscape and enhances the beauty of the environment;
- To uplift the quality of our living environment through active planting, proper maintenance and preservation of trees together with other vegetation;
- To Protect and conserve flora and fauna of the project area;
- To cause rain which is a positive impact on the project area at all; and
- To reduce sedimentation by plantation in the project area which will act as protection wall against wind born dust particles.

Study Area Enhancement/Rehabilitation Plan

Due to the construction activities, about 472 trees will be affected in RoW based on GIS and field trothing for species identification. The reforestation ratio of **1:10** has been considered, which is approximately **4,720** for reforestation and rehabilitation of the area. Total number of plants to be planted is approximately 4,720 with standard spacing of approximately 10 feet.

Note: *The compensation for fruit trees and orchards may be notified by the Forest and Agriculture or competent authority with Ecologists consultant team after proper field survey/assessment and consultation with local communities, for this purpose special team to be constituted under the approval of competent authority, to assess the losses and propose compensations.*

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The total area required for this particular plantation is approximately **4.52 hectares**. (If spaces for the plantation is available on both sides of the road, then the plantation will be done on both sides acquiring linearly on one side and approximately the same at the other side of the road, then same will be considered as liner plantation). Total cost on this particular plantation including purchasing of plants in the project area is approximately **Rs. 9,695,108/- PKR**

The project area can be afforested and vegetation cover can be improved by adopting standard afforestation techniques.

Note: *The above calculations are approximate and provided on the basis of available data.*

Present Status of the Site

A detailed site survey was conducted of the project area and the trees identification process was done according to the proposed design which was later verified by the design team,

The present area supports a large variety of indigenous trees species having low water requirements/behaviour. It is favored as an erosion-control plant, with its easy spreading and resilience, some varieties of acacia, are potentially an invasive species. One of the most globally significant invasive Acacias is Black Wattle, which is taking over grasslands and abandoned agricultural areas worldwide, especially in moderate coastal and island regions where mild climate promotes its spread. In many areas Weed Risk Assessment gives it a "high risk, score of 15" rating and it is considered one of the world's 100 most invasive species. Extensive ecological studies should be performed before further introduction of acacia varieties as this fast-growing Genus, once introduced, spreads fast and is extremely difficult to eradicate.

PLANTATION TECHNIQUE

Plantation of suitable broad leaved species is to be carried out in the immediate vicinity of the project area. The project area can be afforested and vegetation cover can be improved by adopting standard afforestation technique of digging pits. The project area is suitable for plantation activities and can be managed thoroughly with care.

PITS

Pits should be dug in the project area at a spacing of 10' linearly. The pits should be of 1.5 feet diameter at the top and 1 feet diameter at the bottom with a depth of 1-3/4" ft. The earth taken out of the pits will be deposited below each pit in a crescent shape, so as to form a ridge with a clear berm of 9 inches in front. The consecutive crescents will be joined to catch the maximum quantity of moisture. Moreover, planting should be carried out in the pits and sowing on the berms, before or immediately after the first shower of rain. The choice of species (Authority change as per actual requirement and suitability *standards & Species as well) for the project area is given in the following table:

Table: Proposed Species for Plantation of the Project Area (Ornamental + Local)

Sr. No.	Common Name	Scientific Name
1	Alstonia	<i>Alstonia scholaris</i>
2	Phulai	<i>Acacia modesta</i>
3	Ber	<i>Ziziphus mauritiana</i>
4	Sumbal	<i>Bombax ceiba</i>
5	Dhrek	<i>Melia azedarach</i>

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When to Plant

Planting should be completed early in the rains in as short a time as possible. The trees must be given time to become well established prior to the dry season. A good rule of thumb is to start planting when the soil is moist to a depth of 15-25 cm or to the bottom of the planting hole. Plantation will be expedited in monsoon and spring. Failures because planting is too late are more common than failures because of planting too early. To obtain good results and avoid labour shortage in these areas considerable preparatory planning is needed. The size of the plantation might have to be adapted to the availability of labour. If dry sites cannot be planted in time, planting should be postponed until the next season.

Cost

The cost and maintenance of about 4,720 plant species for afforestation in the project area has been estimated including cost of layout, digging, planting, carriage and watch and ward and its maintenance for five years. Below **Table** shows the approximate cost of plantation including five years' maintenance (Standard).

Note: These all activates of plantation plan should be implemented and they may change the standards as per rule and approved rates.

Table: Estimated structure for Plantation of One (01) Hectare (10x10)

Sr. No.	ITEM OF WORK
A.	Works
1.	Layout of pits
2.	Digging of pits
3.	Planting
	Sub Total
B.	Watch and ward
4.	Internal carriage of plants
5.	Carriage of plants from nursery to plantation site
	Sub Total
C.	Watch and ward
6.	Watch and ward for the initial year
	Sub Total
	Total (Initial planting cost)
D.	Maintenance and Restocking after 1st year of planting
Sr. No.	ITEM OF WORK
7.	Watch and ward @ 1 chowkidar per 40 ha for 12 months
8.	Restocking 1 st year after planting
	Sub Total
E.	Maintenance 2nd year after plantation
9.	Watch and ward @ 1 chowkidar per 40 ha for 12 months
10.	Restocking 2 nd year after planting
	Sub Total
F.	Maintenance 3rd year after plantation
10.	Watch and ward @ 1 chowkidar per 40 ha for 12 months

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11	Restocking 3 rd year after planting
	Sub Total
G.	Maintenance 4th year after plantation
12.	Watch and ward @ 1 chowkidar per 40 ha for 12 months
13.	Restocking 4 th year after planting
	Sub Total
H.	Maintenance 5th year after plantation
14.	Watch and ward @ 1 chowkidar per 40 ha for 12 months
	Sub Total
	Total (5 years maintenance)
	Grand Total

Cost of raising proposed **4,720** plants has been estimated as Rs **9,695,108/-PKR** - earthwork, procurement of manures, supply of water to young plants throughout the year and maintenance of plantation for four years.

Number of Plants to be Planted = **4,720 PKR**

Est. Total Cost of Purchasing Plant= **4720x2000= 9,440,000/- PKR (A)**

Est. Cost of Plantation+ Maintenance= 255,108/- PKR (B)

Est.Total Cost: Plantation+ Purchasing of Plants **A+B =9,695,108/- PKR**

Note: The above rates and calculations are approximate and tentative which will be updated according to the standard rates of concerned Forest Department/Implementing Agency, during implantation stage.

ANNEX XII: HEALTH AND SAFETY OF WORKERS

ANNEX XII**BREAKUP OF HEALTH AND SAFETY COST**

Items	Quantity	Rationale
Dust masks		One dust mask to be used in a week by each labourer for 36 months and for 144 weeks the quantity will be calculated.
Safety Shoes		Four safety shoes are supposed to be used for 36 months by each labourer and for 300 labourers for 36 months construction period it is estimated
Gloves		Twenty Four (24) pairs of gloves is to be used by each labourer for 12 months.
First Aid Box	12	One First Aid Box is proposed for 25 labourers and for 150 labourers 12 aid boxes are estimated.
Ear Plugs		One set of ear plug to be used for a week by each labourer and for 144 weeks (36 months) it is estimated for 300 labourers.

ANNEX XII

BREAKUP OF HEALTH AND SAFETY COST

Items	Quantity	Rationale
Safety Helmets		Four safety helmets are to be used by each labourer for 36 months and for 300 labourers 1,200 safety helmets are estimated.
Safety Jackets (Hi Vis)		Four safety Jacket (Hi Vis) to be used by each labourer for 36 months and 1,200 safety safety Jacket are estimated to be used by 300 labourers.
(B) Others		
Provision of Dust Bins		dust bins are proposed to be placed at construction site for the whole construction period.
Warning Tape		---
Safety Cones		safety cones are estimated to be placed at active construction sites.

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BREAKUP OF HEALTH AND SAFETY COST

Items	Quantity	Rationale
Safety Sign Boards		safety sign boards are proposed to be placed at active construction sites.

Time required for Construction = 36 Months
during construction = 300

No. of labour required

