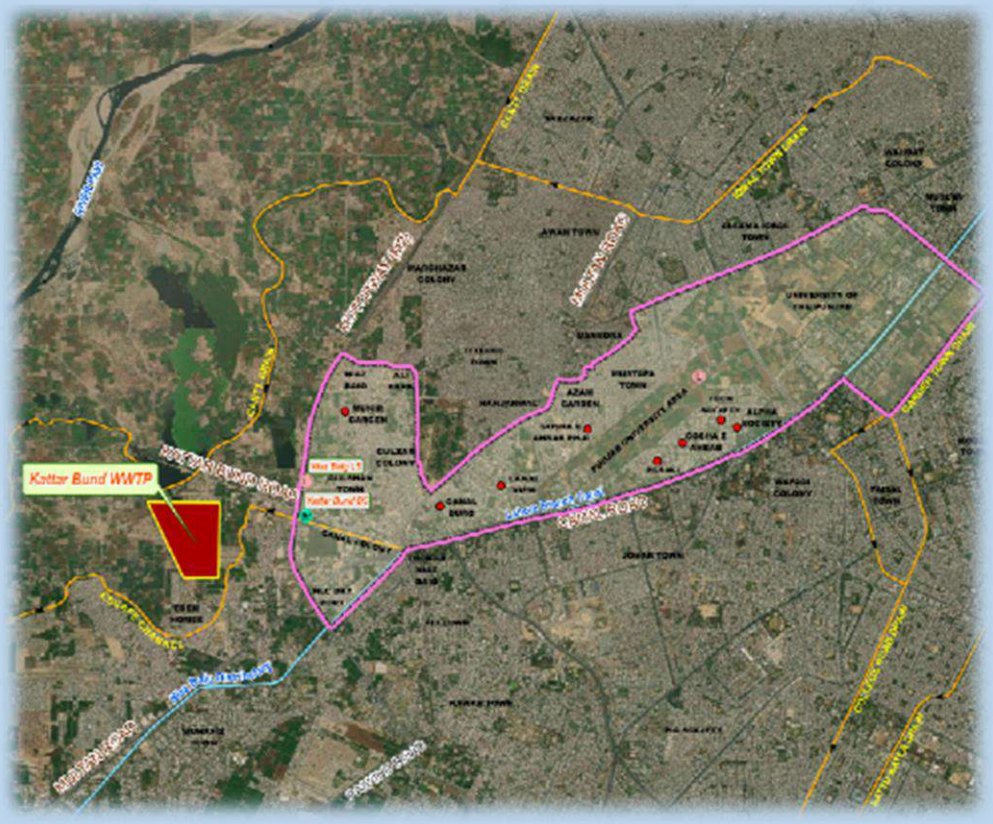
DANIDA SUSTAINABLE INFRASTRUCTURE FINANCE

WASA LAHORE

Environmental Impact Assessment (EIA) Report

"Construction of a Wastewater Treatment Plant at Kattar Bund (South) Lahore", Pakistan"









August, 2023

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GUIDLINES FOR PREPARATION AND REVIEW OF ENVIRONMENTAL REPORTS

CHECKLIST

Clause No.	Requirements for Preparation and Review of Environmental Reports	Page No./ Section of IEE/EIA Report
2	**Commencing Environmental Assessment**	
2.3	**Format of Report: Report should contain**:	
2.3 (A)	**Executive Summary, which should contain:**	
	1. Title and location of the project	Page 1
	2. Name of the proponent	Page 1
	3. Name of the organization preparing the report	Page 1
	4. A brief outline of the proposal	Page 1
	5. The major impacts	Page 7
	6. Recommendations for mitigation measures	Page 8
	7. Proposed monitoring	Page 10
2.3 (B)	**Introduction** should include:	
	1. Purpose of the report	Heading 1.2
	2. Identification of the project and proponent	Heading 1.7
	3. Details of the consultant	Heading 1.8
	4. Brief description of nature, size and location of project	Heading 1.6
2.3 (C)	**Description of project should include:**	
	1. Type and category of project	Heading 3.2
	2. Objectives of project	Heading 3.3
	3. Alternatives considered realistically (in detailed) and reasons for their rejection	Section 4
	4. Location and the site layout of the project (may be annexed at the end of report)	3.5,Annexure 3
	5. Land use on the site	3.6,Annexure 3
	6. Road access	Heading 3.6
	7. Vegetation features of the site	Heading 3.6
	8. Cost and magnitude of operation	Heading 3.15
	9. Schedule of implementation	Heading 3.16
	10. Description of the project (Process Flow Chart/ Steps)	Figure 3-8
	11. Restoration and rehabilitation plans	Heading 3.17
	12. Government approvals	Heading 3.18
2.3 (D)	**Description of Environment** should include:	
	1. Clear cut picture of existing environmental resources:	Section 5

Clause No.	Requirements for Preparation and Review of Environmental Reports	Page No./ Section of IEE/EIA Report
	• Physical • Ecological • Socioeconomic	Heading 5.3 Heading 5.5 Heading 5.6
	2. Quality of life values	Heading 5.6
	3. Lab reports of environmental analyses	Annexure 4
2.3 (E)	**Screening of potential Environmental Impacts and mitigation measures** should include Environmental parameters regarding:	
	1. Project location	Heading 7.1
	2. Design	Heading 7.5.1
	3. During construction Phase	Heading 7.5.2
	4. During operational phase	Heading 7.5.3
	5. Potential Environmental Enhancement Measures	Heading 7.6.2
2.3 (F)	**Environmental management and monitoring program** should include	
	1. Institutional capacity	Heading 8.7
	2. Training schedule	Table 8-3
	3. Summary of impacts and their mitigation measures	Table 8-1
	4. Equipment maintenance details	Heading 8.9
	5. Environment budget	Heading 8.10
2.5	**Involvement of stakeholder/public consultation: <u>(For EIA only)</u>** Communicate the possible impacts and concerns to assist further analysis and decision making	
	1. Proponent	Details Are Present in Chapter 6 of The Report i.e. "Stakeholder Consultation".
	2. The responsible authority	
	3. Other department and agencies	
	4. Environmental practitioners and experts	
	5. Affected and wider community	
2.7	**Site Selection should include:** sustainability of the site (will not be prohibited, environmentally sensitive, incompatible to surroundings and unsuitable)	Included
3	**Assessing Impacts <u>(For EIA only)</u>**	
3.2	Identification of all impacts	Matrices and Checklist provided in Chapter 7 of Impact Assessment
3.2 Table 2	Methodologies for impact identifications (one/more)	
	1. Checklist	
	2. Matrices	

Clause No.	Requirements for Preparation and Review of Environmental Reports	Page No./ Section of IEE/EIA Report
	3. Networks	Meetings, Consultations conducted and reported in Section 6
	4. Overlays	
	5. GIS and computer expert system	
3.3 and 3.6	Impact analysis and prediction (one/more)	
	1. Meetings	
	2. Workshops	
	3. Consultations/ case studies	
3.5	Characteristics of impacts (nature, magnitude, extent and location, timing, duration, reversibility, risk)	Section 7
3.10	Impact Significance: acceptable, require mitigation or are unacceptable to the community	Section 7 & 8
	1. Ecological importance	
	2. Social Importance	
	3. Environmental standards	
4	**Mitigation and Impact Assessment**	
4.1	Purpose of mitigation measures should include:	
	1. What is the problem	Heading 7.2.1
	2. When will problem will occur and when it should be addressed	Heading 7.2.2
	3. Where problem should be addressed	Heading 7.2.3
	4. How the problem should be addressed	Heading 7.2.4
4.2	Ways of achieving mitigation measures	Heading 7.2.5
	1. Changing in planning and design	Heading 7.2.5.1
	2. Improved monitoring and management practices	Heading 7.2.5.4
	3. Compensation in money terms	Heading 7.2.5.2
	4. Replacement, relocation and rehabilitation	Heading 7.2.5.3
4.3	Prepare an environmental management plan	Heading 8.4
5	**Reporting**	
5.1	Clear reporting style supported by maps or other descriptive details	✓
5.2	Specific terms of references should be present in report	✓
5.2	Appendices	
	1. Glossary	✓
	2. List of abbreviations	✓
	3. List of individuals and organizations consulted along with their written feedback	✓
	4. Sources of data and a full list of all reference material used	✓

Clause No.	Requirements for Preparation and Review of Environmental Reports	Page No./ Section of IEE/EIA Report
	5. List of names, qualifications and roles of team members carrying out the IEE /EIA study	✓

EXECUTIVE SUMMARY

ES-1 Introduction and Project Background

The Kattar Bund catchment includes a combination of various housing colonies with water supply, sewerage and stormwater drainage services provided by these private sector colonies, and public housing with water supply and sewerage services provided by the Water and Sanitation Agency of Lahore (WASA-L). Wastewater is collected via a primary sewerage system managed by WASA-L which discharges the combined wastewater to the Kattar Bund Disposal Station which pumps the wastewater untreated to the escape channel of the Lahore Branch Irrigation Canal (LBC) which is owned by the Irrigation Department; the escape channel drains the untreated wastewater to the Ravi River. Currently, there are no wastewater treatment facilities in the city of Lahore, however feasibility studies are currently being undertaken for all sewerage catchments.

The Provincial Government of Punjab has requested Danida Sustainable Infrastructure Finance (DSIF) of Denmark to finance for the construction of the Kattar Bund WWTP which eventually agreed to finance the project. WASA- Lahore is the proponent of the project.

WASA has engaged M/s Jers consultancy Pvt. Ltd. to provide Consultancy Services for the preparation of EIA of WWTP.

Project Title and Location	Construction of WWTP at Kattar Bund Road, Lahore
Consultant:	Jers Consultancy (Pvt) Ltd.
Proponent:	Water and Sanitation Agency (WASA), Lahore

ES-2 Legal and Administrative Framework

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, amended 2017; IEE/EIA Regulations, 2022; 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 Water and Sanitation Agency (WASA) Lahore. The management of WASA 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

The project is construction of Wastewater treatment plant (WWTP) at Kattar Bund area and is located on the Western side of motorway and Gopi Rai village and Eden Value Homes Society and Shahpur Kanjra exists in Southern side of WWTP site. The site is located in the West of Thokar Niaz Baig about 2.75 km:

The proposed project has following main components:

1. Conveyance system for raw wastewater
2. Conveyance system for storm water
3. WWTP based on Trickling Filters technology
4. Sludge Treatment
5. Conveyance System for Treated Effluent
6. Power supply at WWTP
7. Control System
8. Rehabilitation of LBC Escape Channel (which will avoid downstream flooding)

The proposed WWTP consists of following main components:

1. Inlet Works consisting of Coarse Screens, Inlet Pumping Station, Fine Screens and Grit Chamber
2. Primary Sedimentation Tanks
3. First Stage Trickling Filters for BOD Removal
4. Secondary Sedimentation Tanks
5. Second Stage Trickling Filters for Nitrification
6. Disinfection with UV radiation
7. Sludge treatment (gravity thickener, anaerobic digesters, thermal hydrolysis, dewatering, composting)
8. Energy recovery (gas collection system, CHP engine, gas storage dome)
9. Effluent pumping station

The land required is 150 acres and the estimated project cost is 66.706 million euros or Rs.19,344.7million.

ES-4 Analysis of Alternatives

The following seven alternatives were considered for the proposed Project:

- No project option
- Waste Stabilization Ponds
- Aerated Lagoons
- Trickling Filter
- Rotating Biological Contractor
- Conventional Activated Sludge Process
- Oxidation Ditch
- Extended Aeration

The following are noted:

- The Trickling Filter process and Waste Stabilization Ponds process rank very high on a qualitative basis. The trickling filter process is slightly higher, *esp.* due to the lower land area and the neutral power consumption and hence reduced climate change impacts.

- Waste stabilization ponds ranks as next best process. However, their use at the Kattar Bund site is not suitable because of the high land requirements (over 50ha for the first phase of investments).
- Aerated lagoons suffer from high power costs and high land requirements (25-30ha) and hence are not suitable. This process provides no flexibility for the site to be expanded in the future.
- Oxidation ditches and extended aeration suffer from extensive power and O&M costs.
- Activated Sludge suffers from high demands for maintenance due to the sophisticated treatment process. Although the power consumption is high, typically half of the power consumed is recovered by anaerobic digestion and biogas production.

According to the qualitative assessment, Trickling Filters are considered the most adequate wastewater treatment process in Kattar Bund. The proposed project also includes the flood protection works and the 50m vegetated buffer zone.

ES-5 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 lies at an elevation of *approx.* 217m above sea level; it is generally flat and slopes towards the south and south-west. Wind direction is predominantly north-west, however during the monsoon season it is south-east. The Lahore metropolitan area comprises Early Pleistocene to Recent silty loess and silty clay deposits of the Ravi River. Foundation conditions are generally good. The area consists of young flood plain deposits comprising a few meters thick cover of very fine sand, Silt and Silty Clay. The area shows older features of Channel, meanders, scars and levees.

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.

Lahore has a semi-arid climate not receiving enough rainfall to feature the humid subtropical climate. The hottest month is July where temperatures routinely exceed 42°C (107F). 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.

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.

Scattered trees are growing in the farm lands in scattered form consisting of Kikar (Acacia nilotica), Shisham (Dalbergia sissoo), Ber (Zizyphus sp), Sufeda (Eucalyptus camaldulensis), Mulberry (Morus alba), Neem (Azadirachta indica) , Sirris (Albizia lebbek), Dherek (Melia azedarach) , Date Palm (Phoenix dactylifera) Jaman (Syzygium cumini) , Bakain (Melia azadirachta) Guava (Psidium guajava), Sumbal (Bombac Cieba).

The Study Area, being agricultural land and is not very rich in wildlife mammals. However, common mammals are Jackal (Canis aureus), Squirrel (Funambulus), Fox (Vulpes vulpes), Rats (Mus musculus) and Mangoose (Herpestes auropunctatus). Porcupine (Hystrix indica) is common and causes lot of damage to young plants and crops. Domestic animals include goats, sheep, camels, cows and buffaloes

Important bird species found in the tract are Mynah (Acridotheres tristis), House Crow (Corvus splendens), House sparrow (Passer domesticus), Koel (Eudynamys scolopacea), Parrot (Psittacula krameria), Pigeon (Columba livia), Patridge Grey (Francolinus pondicerianus), Patridge Black (Francolinus francolinus), Quil (Coturnix coturnix), Little Egret (Egretta garzetta), Mallard (Anas platyrhynchos), Jal Kookri (Fulica atra),and Bulbul (Pycnontus cafer).

Socio-Economic Condition

The population census data for Lahore District has been collected from past census reports. The project area (*i.e.* catchment area of Kattar Bund WWTP) lies mostly within the City Tehsil and partially within the Model Town Tehsil.

Study area includes following area. 60 people are interviewed to assess socio economic condition of area of influence of the project.

1. Canal Veiw
2. Niaz Baig
3. Munir Garden
4. Kattar Band Road
5. Thokar Niaz Baig
6. Shahpur Kanjra
7. Eden Value Homes
8. Francis Town
9. Gopi Rai Village
10. Near Disposal station

Endogamy is the prevalent style of marriage. Most of the people are monogamous. As per social survey, the majority of respondents (i.e., 81.37%) were married and 18.33% were unmarried.

The educational distribution of the respondents shows that Fifteen (31.66%) of the respondents were illiterate. 13.33% were educated up to primary level. However, 15% and 23.33% were educated up to middle and matric level respectively. Moreover, 11.66% respondents were educated up to intermediate and 5% respondents described their education level up to graduation and above. Based on the field survey and discussion with the locals, it is noted that female literacy rate was even lower compared to males. 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 is available.

ES-6 Public and Stakeholder Consultation

Public Consultation refers to the process by which the concerns of the various stakeholders and local community who have a plausible stake in the environmental management and associated impacts of the project or activity are ascertained with a view to taking into account all the design and construction concerns in the project activity as appropriate

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 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 nearby 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-7 Impacts and Mitigation Measures

The time duration of construction of the proposed project is expected to be of two years and the associated activities will have both positive and negative impacts during both 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:

Major Impacts:

- The total land required for the construction of the proposed WWTP is about 150 Acres,
- 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.;
- some 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 i.e. for every single tree to be cut, ten new trees would be planted as its replacement.
- 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 siting 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;
- 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 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-8 Environmental Management and Monitoring Plan

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

The key players involved during construction phase of the proposed Project are the WASA as employer/proponent, Punjab Environmental Protection Agency, 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;

- WASA/Proponent/Employer;
- SC's; and
- Contractor's Environmental Manager/ HSE Expert.

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

The employer/ proponent (WASA) 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.

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 (WASA) and the Supervisory Consultants (SC).

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 16.918 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.

Monitoring Plan:

An environmental management and monitoring plan provide a delivery mechanism to address the potential environmental impacts of a Project during its construction and operational phases, to enhance project benefits, and to introduce health and safety standards of good practice to be adopted for project.

This process requires proper monitoring to report any performance or any mitigation measurement during the construction and operational phases. Environmental monitoring will be carried out to ensure that all the construction activities comply and adhere to the environmental provisions and standard specifications, so that all mitigation measures are implemented. The proponent will ensure the proper implementation of mitigation measures for the concerned operation and maintenance phase through adequate monitoring. The detailed monitoring plan for proposed project is given in Section-8 in Table 8-2.

ES-9 Conclusions and Recommendations

It is anticipated that the project will reduce the organic pollution discharged to the Ravi River by approx. 10,000 kg/day. This will improve conditions for aquatic life. The treated effluent will be returned to the Lahore Branch Canal for agricultural re-use. The remaining nutrients will support crop growth on the farms. Moreover, the return of treated effluent supports the nexus between the Department of Irrigation (which will release raw water to WASA for the production of potable water for drinking purposes) and WASA (which will discharge treated water back to the irrigation

system to service downstream farms). The treated sludge (a useful byproduct of the proposed WWTP) will be used as soil cover and fertilizer for PHA and nearby agricultural farms. The project will be energy neutral via biogas production, combustion and electricity production and via solar power.

The study concludes that the project does not involve any long term irreversible negative impacts. The negative impacts identified in the study are manageable through adopting the Environmental Management Plan, by providing monitoring arrangements and resources during design, construction and operation stages of the project.

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List of Abbreviations

AOI	Area of Influence
BAP	Biodiversity Action Plan
BDL	Below detection level
BMPs	Best Management Practices
BOD	Bio-chemical Oxygen Demand
CO	Carbon Monoxide
COD	Chemical Oxygen Demand
CC	Construction Contractor
dB	Decibel
DCR	District Census Report
DC	Design Consultant
Dia	Diameter
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
EMMP	Environmental Management and Monitoring Plan
Ft	Feet
Fig	Figure
GOP	Government of Pakistan
HSE	Health & Safety Engineer
IEE	Initial Environmental Examination
Km	kilometer
Km/h	kilometer per hour
LGO	Local Government Ordinance
RE	Resident Engineer
RCC	Reinforced Cement Concrete
ST	Sludge Thickener
PEQS	Punjab Environmental Quality Standards
PC-1	Planning Commission – 1
PEPA	Punjab Environment Protection Act
MD	Managing Director
NO_x	Nitrogen Oxides
NSL	Natural Surface Level
NEAP	National Environmental Action Plan

NOC	No Objection Certificate
^{O}C	Degree Centigrade
OSHA	Occupational Safety and Health Administration
PD	Project Director
P & D	Planning and Development Department
PM	Particulate Matter
PNCS	Pakistan National Conservation Strategy
SC	Supervision Consultant
SO_x	Sulfur Oxides
TSS	Total Suspended Solids
TMA	Town Municipal Administration
TOR	Terms of references
UC`s	Union Councils
WASA	Water and Sanitation Agency
WWTP	Waste Water Treatment Plant
RUDA	Ravi Urban Development Authority

Glossary

EIA (Environmental Impact Assessment): It is the process of identifying, predicting, evaluating and mitigating of effects of biophysical, social and other relevant proposed projects and physical activities prior to major decisions and commitments being made.

EMP (Environmental Management Plan): An EMP is a site-specific plan developed to ensure that all necessary measures are identified and implemented in order to protect the environment and comply with environmental legislation.

ESIA (Environmental Social Impact Assessment): It is to identify the impacts of the project on social and environmental conditions.

FAUNA: Word used for combination of all the species of animals.

FLORA: Word used for combination of all the species of plants.

IEE (Initial Environment Examination): Initial examination of projects for identification of hazards of project.

ISO (International Organization for Standardization): The International Organization for Standardization is an international standard-setting body composed of representatives from various national standards organizations.

NCS (National Conservation Strategy): Three objectives of the National Conservation Strategy (NCS) are: (i) conservation of natural resources; (ii) sustainable development; and (iii) improved efficiency in the use and management of resources.

NOC (No Objection Certificate): It is a kind of clearance issued by EPA necessary for any project to be constructed.

OHSAS (Occupational Health and Safety Assessment Series): It is an international standard for occupational health and safety management systems.

PEPA (Pakistan Environmental Protection Act 1997): An act to provide the protection, conservation, rehabilitation and improvement of environment, for the prevention and control of pollution and promotion of sustainable development.

TOPOGRAPHY: Physical features of any area including soil, water and air are called topography.

BOD: BOD is measurement of oxygen required by bacteria to stabilize organic matter in the wastewater

Sludge: any muddy or slimy matter or deposit; a thick suspension of fine particles or gel in a liquid, esp. one formed as a waste in any of various industrial and Mechanical process

Soil Erosion: physical removal of soil, either by wind or by running water

Stabilization Ponds: shallow ponds or lagoons constructed to treat wastewater

Sedimentation: deposition of the material in the form of sediment, as a geological process, or in a liquid in a tank, centrifuges, etc.

1 INTRODUCTION

1.1 PROJECT BACKGROUND

Lahore is the second largest city in Pakistan and is the capital of the Punjab Province, with a population of over 11 million people (2017 census). The city is located adjacent to the Ravi River, which is one of five rivers in the region flowing transboundary from India, being tributaries of the Indus River.

According to the Lahore Sewerage Master Plan (2019), the city is divided into 6 sewerage catchments, with each catchment to be served by a central wastewater treatment plant (WWTP). The focus of the current Study is the Kattar Bund sewerage catchment, located immediately south of Babu Sabu and to the north of the southern catchments.

The Kattar Bund catchment includes a combination of various housing colonies with water supply, sewerage and stormwater drainage services provided by these private sector colonies, and public housing with water supply and sewerage services provided by the Water and Sanitation Agency of Lahore (WASA-L). Wastewater is collected via a primary sewerage system managed by WASA-L which discharges the combined wastewater to the Kattar Bund Disposal Station which pumps the wastewater untreated to the escape channel of the Lahore Branch Irrigation Canal (LBC) which is owned by the Irrigation Department; the escape channel drains the untreated wastewater to the Ravi River. Currently, there are no wastewater treatment facilities in the city of Lahore, however feasibility studies are currently being undertaken for all sewerage catchments.

The Provincial Government of Punjab has requested Danida Sustainable Infrastructure Finance (DSIF) of Denmark to finance for the construction of the Kattar Bund WWTP which eventually agreed to finance the project.

1.2 PURPOSE OF THE REPORT

This report is an environmental impact assessment study of Construction of WWTP at Kattar Bund Road, Lahore. The Proposed Project is located in Lahore, Punjab Province, therefore, the Punjab Environmental Protection Act, 1997 (Amended 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".

The proponent feels its social, moral and legal obligation to protect environment. It is in this context that the company initiated the process of gaining Environmental Approval from the EPA, Government of Punjab. According to the direction of the EPA, this EIA is being submitted for issuance of the said Environmental Approval in compliance with the Punjab Environmental Protection Act -1997 (Amended 2012) Section 12.

The EIA report takes into account socio economic, physical, and environmental, land use, forestry, crops, water bodies, bio-diversity (flora and fauna), heritage, and other relevant aspects associated with the project itself and the area around the project. The report also describes mitigation measures those will be adopted to undo environmental impacts on any segment of the environment i.e. human health and environmental health around the project site both during construction and normal operation of the project. The report provides relevant information, as required under the officially approved format, to help the decision makers (EPA Punjab in the Present case) before issuing the desired environmental approval.

1.3 SCREENING

According to the Pakistan Environmental Protection Agency (Review of EIA and EIA) Regulations 2022, 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.

1.4 SCOPING

The scope of the Project for the purposes of the EIA includes all phases (construction, operation, and reclamation and closure) of the Wastewater Treatment Plant and the associated facilities and infrastructure required to carry out the activities involved in treatment. Specifically, the scope of the Project includes:

- Reconstruction at the Kattar Bund Disposal Station discharge/overflow chamber.
- Supply and installation of the gravity main 1000 mm *dia*. from the Kattar Bund DS overflow chamber to the Kattar Bund WWTP inlet lift station.

- Re-construction of Niaz Baig Lift Station and associated force main 250mm *dia*.to Kattar Bund Road.
- Construction of the Inlet Lift Station at Kattar Bund WWTP site to the elevation of the WWTP preliminary treatment system.
- Construction of the Kattar Bund WWTP, including fencing, and vegetated buffer zone.
- Construction of the Effluent Pump Station at the WWTP site and associated effluent force main to the Lahore Branch Canal at Thokar Niaz Baig. This shall include an overflow to the Escape Channel.
- Construction of the protection bund surrounding the WASA-L site. This will integrate with the existing bund on the western border of the site.
- Installation of solar power at the Kattar Bund Disposal Station.
- Rehabilitation and extension of the capacity of the Escape Channel.

1.4.1 Valued Environmental Components

The spatial boundaries for the EIA encompass the Principal Development Area (PDA) i.e. Wastewater treatment Plant and other local and regional areas, determined by the characteristics of each valued Environmental Component (VEC), where an effect from the Project can reasonably be expected. The PDA includes lands subject to direct disturbance from the Project and associated infrastructure, including access and utility corridors. The PDA for the Project is the proposed treatment plant development footprint (approximately 150 acres). However, spatial boundaries are established based on the zone of the Project influence, beyond which the potential environmental, cultural and socio-economic effects of the Project are expected to be non-detectable. As scope of the project is not limited to the wastewater treatment plant rather it involves other development, rehabilitation or re-construction of infrastructure; therefore, impacts are to identified at all sub-project components sites.

Temporal boundaries for the effects assessment are established in consideration of the construction period for the Project, operational life of the Project and anticipated period for reclamation and closure of the site. The proposed schedule for the construction spans over a period of 2 years while operation and closure of the Project is expected to be 50 years with 15-20 years for mechanical and electrical equipment.

1.4.2 Key issues identified

A major activity of scoping is to identify key interest groups, both governmental and non-governmental, and to establish good lines of communication. People who are or tend to be affected by the project need to hear about it as soon as possible. Their knowledge and perspectives may have a major bearing on the focus of the EIA. As a result of public consultation and information disclosure among the proposed project PAPs, Local Residents, Local Farmers, Business/ shop owners, Government and private Servants in the project area. After key issues were identified, a full-scale EIA has been prepared in which detailed prediction work is carried out for important issues identified or highlighted at scoping stage for further studies. The key impacts identified are:

- **Physical Environment**
  Impact to air and noise quality,
  Generation of Solid (C&D) waste,
  Cutting/removal of vegetation
  Impact on Water Bodies
  Odour and Nuisance

- **Biological Environment**
  Impact on Local Flora and Fauna as a result of excavation and development works.

- **Socio-Economic**

  Restriction in Movement
  Disruption to traffic flow
  Impediments in business activities due to limitation in access
  Influx of labour
  Health and Safety issues

1.5 PURPOSE OF EIA

The main objective of EIA is to foresee all the expected Environmental and social impacts of the proposed projects and try to mitigate or minimize these impacts. Furthermore, by EIA, stakeholders are informed and consulted about the project scope and its benefits. EIA is statutory requirement which helps the proponent to ensure the principle of sustainability in the project. The proponent feels its social, moral and legal obligation to protect environment. It is in this context that the company initiated the process of gaining Environmental Approval from the EPA, Government of Punjab. Accordingly, it on its own approached EPA for guidance in

this regard. According to the direction of the EPA, as detailed in the preceding para under "Introduction" this EIA is being submitted for issuance of the said Environmental Approval in compliance with the Punjab Environmental Protection Act -1997 (Amended 2017) Section 12.

- Determine pre-project environment conditions to assess post-project conditions if they have changed for better or worse;
- Document all the environmental impacts likely to occur due to the implementation of the proposed project;
- Determine the social impacts of the proposed project including impacts on individuals, assets, infrastructure, livelihood, public utilities and cultural and religious properties;
- Provide maximum information to the proponent and other stakeholders about the existing environmental conditions and the implications of the proposed project;
- Allow planners to alleviate potential impacts of the proposed project on different environmental conditions such as physical environment, biological environment and socio-economic environment.
- To provide opportunity to the public for understanding the project and its impacts on the community and their environment in the context of sustainable development.
- Aid decision makers to take informed decisions.

1.6 NATURE, SIZE AND LOCATION OF THE PROJECT

The proposed project involves the construction of Wastewater treatment plant (WWTP) at Kattar Bund Road Lahore. The capacity/ size of the proposed project is 10 MGD, average flow. Location and project scope are described in the maps below.

The WWTP site is located near Kattar Bund Road. The WWTP site is about 2.75 km distant from Thokar Niaz Baig in the west direction. The area is between the Cantonment Drain (to the north) and the Escape Channel of Lahore Branch Canal (to the south), both of which flow towards Ravi River. The WWTP site is adjacent to the existing protection bund named as Kattar Bund, which was built in the early 1990s as a protection from Ravi River flooding. The brief description of WWTP site is as follows:

The WWTP site is located at:

- Latitude: 31°28'47.05"N To 31°27'18.66"N
- Longitude: 74°12'26.77"E To 74°14'30.10"E

The Main approach road is Kattar Bund Road which is in the North of the site.

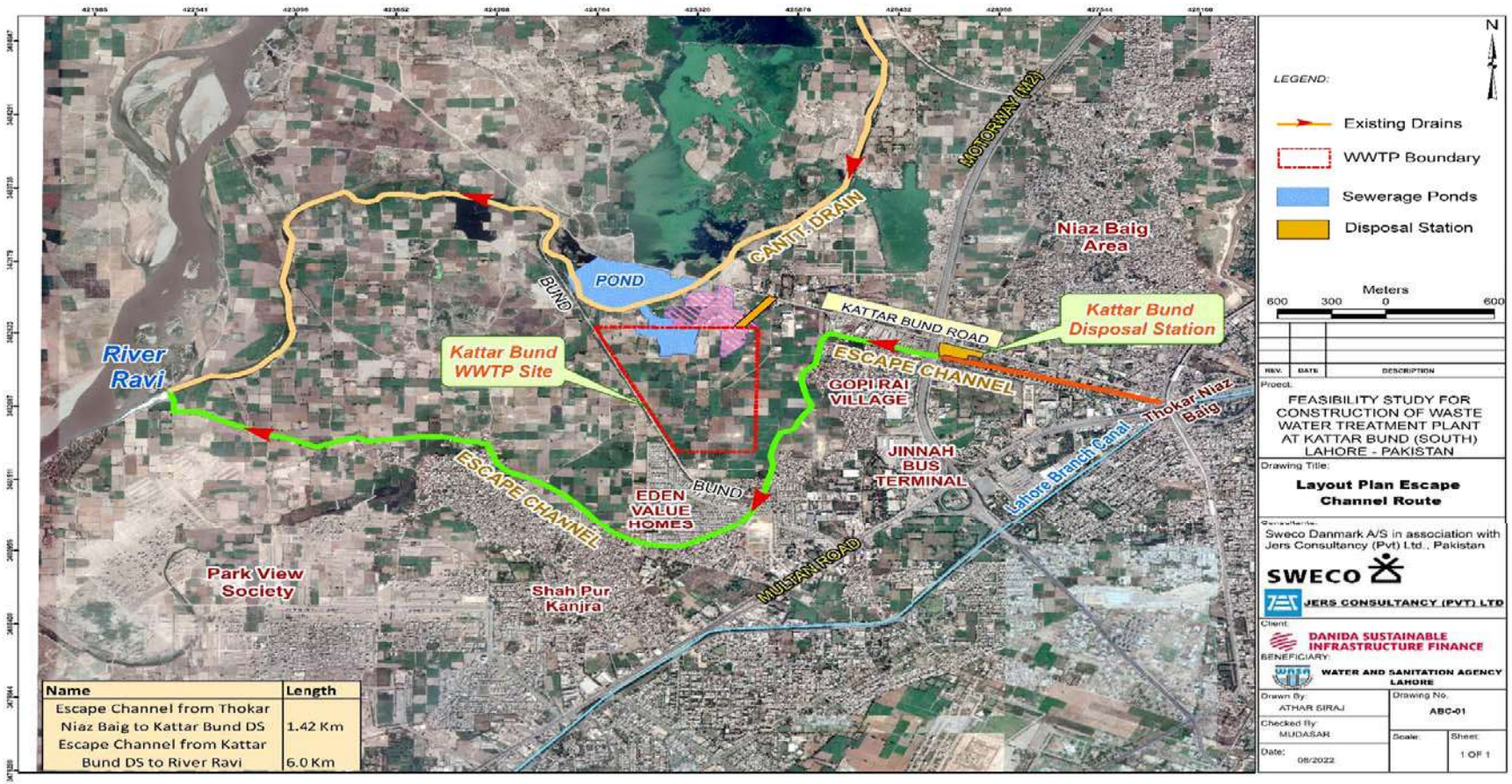


Figure 1-1 Location of the project

1.7 THE PROPONENT

Water and sanitation agency Lahore (WASA Lahore) is the proponent of the project. Details of the proponent is given below.

Table 1-1 Details of Proponent

Sr.No	Proponent Details	
1	Designation	Managing Director (MD)- WASA Lahore
2	Contact No.	(042) – 99332100
3	Address	31-B Zahoor Elahi Rd, Block B Gulberg 2, Lahore, Punjab 54660
4	Department	WASA, Lahore

1.8 CONSULTANT'S DETAIL

The proponent has engaged M/s Jers Consultancy (Pvt) Ltd to conduct the EIA Study for the establishment and enhancement of aforesaid project in accordance with Punjab-EPA guidelines. For this purpose, Jers Consultancy (Pvt) Ltd has engaged the group of professionals which comprises of environmental specialists and environmental engineers. The details of the consultants are given below:

Table 1-2 Consultant's Detail

Sr#	Consultant Details	
1	Consultant	Jers Consultancy (Pvt) Limited
2	Address	24 Civic Center St, Township Commercial Area Lahore
3	Contact No.	042-35113125

1.9 EIA TEAM

To prepare report of the respective project, the team list of experts is presented as follows:

Table 1-3 Team list of Experts

Sr. No.	Name	Position	Qualification	Tasks Assignment
1	Mudasar Arbi	Sr. Environmental Specialist	-M.Sc. in Environmental Engineering -B.Sc. in Civil Engineering	Conduct literature review/desk studies regarding the environmental impact of the project. Study environmental impacts of the project and suggest mitigation measures to reduce the negative impact. Participated in formation of EIA report in the light of relevant guidelines. Heads public consultation.
2	Tashfeen Abbas	Environmental Engineer	-B.Sc. in Environmental Engineering	Conduct field visits to collect base line data related to environment. Participated in formation of EIA report
3	Ghulam Murtaza	Sociologist	Masters in social Sciences	Conduct field visits to collect base line data related to socio-economic survey. Participated in formation of EIA report
4	Zeeshan Ali	GIS Expert	-MS Remote Sensing and GIS	Collect satellite images and maps where required for the study. Help the team in finding the location of project components.

1.10 STUDY APPROACH

The study is conducted in accordance with Punjab Environmental Protection Act (PEPA), the study is based on both primary and secondary data and information. The primary data includes data collected from field observations and secondary data includes review of the District Census Reports (DCRs) and relevant information from Government Departments. Discussions were held with stakeholders including government officials, community representatives and a wide range of road users and roadside dwellers near road. The main purpose of this approach was to know the people's perceptions of the project and its environmental impacts.

1.11 METHODOLOGY

The following methodology was adopted for carrying out the EIA Study of the proposed project.

1.11.1 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.

1.11.2 Data Collection and Planning

After the concept clarification and understanding obtained in the preceding step, a detailed data acquisition plan was developed for the internal use of the EIA Consulting Team. The plan included identification of specific data requirements and their sources; determined time schedules and responsibilities for their collection; and indicated the logistics and other supporting needs for the execution of the data acquisition plan.

1.11.3 Data Collection

In this step, primary and secondary data were collected through field observations, environmental monitoring in the field, concerned departments and published materials to establish baseline profile for physical, biological and socio-economic environmental conditions. Following activities were performed for data collection:

- Site Reconnaissance
- Analysis of Maps and Plans
- Literature Review
- Desk Research
- Public Consultation
- Field Observations & Studies

1.12 COMPONENTS OF THE REPORT

This EIA Report has been prepared following the Pakistan Environmental Protection Agency (PEPA) Guidelines for Environmental Assessment. The format of the report consists of the following chapters:

- **Chapter 1: Introduction**

This chapter represents an introduction of the EIA Report. It contains the scope of study and overview of the project. The chapter also includes the project categorization as per PEPA guidelines.

- **Chapter 2: Policy, Legal and Administrative Framework**

This chapter comprises policy, guidelines, statutory obligations and roles of institutions concerning EIA study of the proposed project.

- **Chapter 3: Description of the Project**

In this chapter, salient features of the project are presented. It furnishes information about the location, cost and size of the project, its major components including Geometric Design Standards and its benefits to the public.

- **Chapter 4: Analysis of Alternatives**

This chapter provides the analysis and discussion of different possible alternates to the proposed project while considering other practicable strategies that will promote the elimination of negative environmental impacts identified.

- **Chapter 5: Description of the Environment**

It provides an overview of the present environmental baseline of the project area. It discusses physical, biological, socio-Economic and cultural environment. This chapter also consists of the information based on public consultation and information disclosure to them about the project. It comprises of the identification of the main stakeholders, details of scoping sessions and stakeholders' concerns.

- **Chapter 6: Public Consultation**

This chapter provides the important tools for evaluating the social aspects of proposed project as well as the environmental and social assessment process.

- **Chapter 7: Anticipated Environmental Impacts and Mitigation Measures**

This chapter provides the information on the environmental impacts and proposed mitigation measures at pre-construction/design phase, construction phase and operation phase.

- **Chapter 8: Environmental Management & Monitoring Plan**

This chapter describes the measures suggested for executing the environmental management plan (EMP) at the project site. It elaborates the objectives of EMP, role of functionaries and specific implementation responsibilities; environmental management plan (in matrix), environmental monitoring and training plan and its costs.

- **Chapter 9: Conclusions & Recommendations**

This chapter presents the outcomes of the whole study. It explains the identification of the main issues and concerns; proposed mitigation measures, benefits of the project.

2 POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK

2.1 GENERAL

This section deals with the relevant policy, legal and administrative framework instituted by the Government of Pakistan for the protection of environment. All the relevant provisions of these policy and legal frameworks have been duly considered in this EIA study. In addition to this, the roles and responsibilities of the proponent as well as the Environmental Protection Agency (EPA), Punjab have been mentioned in this section.

2.2 POLICY FRAMEWORK

The Ministry of Climate Change is the responsible authority for policy making on environmental protection in Pakistan. The proposed project will be financed by WASA Lahore, which requires compliance to the National Policy and Guidelines, so it is obligatory on the part of the Proponent to follow these for environmental assessment.

2.2.1 National Environmental Policy, 2005

The National Environmental Policy (2005) provides an overarching framework for addressing the environmental issues (particularly pollution of fresh water bodies and coastal waters, air pollution, lack of proper waste management, deforestation, loss of biodiversity, desertification etc.) confronting Pakistan. It recognizes the goals and objectives of the Pakistan National Conservation Strategy (PNCS, 1992), National Environmental Action Plans, and other existing environment related national policies, strategies, and action plans. 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 effective management of their environmental resources.

2.2.2 National Conservative Strategy

Before the approval of NEP, the National Conservation Strategy (NCS) was considered as the Government's primary policy document on national environmental issues. At the moment this strategy just exists as a national conservation program. The NCS identifies 14 core areas including conservation of biodiversity; pollution prevention and abatement; soil and water conservation; and preservation of cultural heritage, and recommends immediate attention to these core areas in order to preserve the country's environment.

2.2.3 The Biodiversity Action Plan

The Biodiversity Action Plan (BAP), which has been designed to complement the NCS and the proposed provincial conservation strategies, identifies the causes of biodiversity loss in Pakistan and suggests a series of proposals for action to conserve biodiversity in the country. The BAP recognizes that an EIA is used as a tool at a project level to identify environmental effects of a proposed project and to plan for reducing adverse effects. The BAP further stipulates that an EIA needs to be initiated at an early stage of project development and that public participation in the review of potential effects is important.

2.3 LEGAL FRAMEWORK

The Government of Pakistan (GOP) has promulgated laws/acts, regulations and standards for the protection, conservation, rehabilitation and improvement of the environment. In addition to this, they have also developed environmental assessment procedures governing developmental projects. Following are the excerpts of these laws and procedures relevant to the proposed project.

2.3.1 Pakistan Environmental Protection Act, 1997 (PEPA-97) Amended 2017

The Act was enacted on December 06, 1997 by repealing the Pakistan Environmental Protection Ordinance (1983). It provides the framework for implementation of the PNCS-1992, establishment of provincial sustainable development funds, protection and conservation of species, conservation of renewable resources, and establishment of Environmental Tribunals, appointment of Environmental Magistrates, Initial Environmental Examination (IEE), and Environmental Impact Assessment (EIA). A copy of PEPA-97 (Amended 2017) is attached as **(Annex-I)**.

Section 12 of the Act stresses the need to carry out environmental assessment study prior to construction or operation of a project.

2.3.2 EPA (Review of IEE and EIA) Regulations, 2022

These regulations provide list of the projects requiring IEE and EIA **(Annex-II)**. They also briefly describe the preparation and review of environmental reports.

2.3.3 Pakistan Environmental Assessment Procedure, 1997

Pakistan Environmental Assessment Procedures (1997) is, in fact, a package which contains the following sets of information relevant to the proposed Project:

a) **Policy and Procedures for Filling, Review and Approval of Environmental Assessment Reports**

It describes environmental policy and administrative procedures to be followed for filing of environmental assessment reports by the proponents and its review and approval by the concerned environmental protection agency/department.

b) **Guidelines for the Preparation and Review of Environmental Reports**

These guidelines are developed to facilitate both the proponents and decision makers to prepare reports (inclusive of all the information contained therein) and carry out their review so as to take informed decisions.

c) **National Environmental Quality Standards, 2000**

The Pakistan Environmental Protection Council first approved these standards in 1993. They were later revised in 1995 and 2000. They furnish information on the permissible limits for discharges of municipal and industrial effluent parameters and industrial gaseous emissions in order to control environmental pollution.

d) **Other Relevant Laws**

- **Land Acquisition Act (1894):** Projects may require government procurement of privately owned land and the displacement of land users. Land may be acquired through:
    1. Expropriation (Compulsory Acquisition)
    2. Voluntary negotiation with the owners for sale of land
    3. Donation from the land owners

  The Land Acquisition Act (1894) deals with the government acquisition of private properties for public purposes including large development projects. There are 55 sections in this Act mainly dealing with area notifications, surveys, acquisition, compensation, apportionment awards, disputes resolution, penalties and exemptions.
- **Canal Drainage Act, 1873:** This Act entails provisions for the prevention of pollution of natural or man-made water bodies.
- **Cutting of trees (Prohibition) Act, 1975:** This Act prohibits cutting or chopping of trees without permission of the Forest Department.
- **Punjab Local Government Ordinance, 2001:** Environmental protection is devolving subject under Punjab Local Government Ordinance (LGO), 2001. Notwithstanding any specific provisions, every local government may perform functions conferred by or under the Punjab Local Government Ordinance,

2001 and in performance of such functions may exercise such powers, which are necessary and appropriate. Until different provisions, rules, regulations or byelaws are made, the local governments may exercise such powers as are specified in the Sixth Schedule of Punjab LGO, 2001. Environmental protection is at serial 48 of the Sixth Schedule.

- **The Punjab Plantation and Maintenance of Trees Act, 1974:** This Act defines rules and regulations for plantation and maintenance of trees in the Province of the Punjab.
- **Punjab Wildlife Act, 1974:** This Act defines rules and regulations for the protection, preservation, conservation and management of wildlife in the Province of the Punjab.
- **The Punjab Soil Reclamation Act, 1952:** This Act defines rules and regulations for the speedy reclamation and improvement of the areas damaged by salinity and water logging (for preventing further damage and for maximizing agricultural production).
- **The West Pakistan Fisheries Ordinance, 1961:** This Ordinance defines rules and regulations for the catching of fishes in Punjab. It provides information about their types and the period (in each year) when taking of the fishes is prohibited.
- **Pakistan Penal Code, 1860:** This Act defines the penalties for violations concerning pollution of air, water bodies and land.
- **The Antiquities Act, 1975:** Archaeological sites and monuments are specifically protected by this Act.

2.4 INSTITUTIONAL AND ADMINISTRATIVE FRAMEWORK

Government of Punjab has financed the proposed project through WASA. The proposed project falls under the following Institutional and Administrative Framework.

a) Water and Sanitation Agency (WASA) Lahore

Water and Sanitation Agency (WASA) is an agency of Lahore Development Authority (LDA) and is responsible for planning, designing, construction, operation and maintenance of water supply, sewerage and drainage facilities in the city.

b) Environmental Protection Agency, Punjab

The Pakistan Environmental Protection Agency (Pak-EPA) is meant for the enforcement of environmental laws in Pakistan. They have delegated powers to

provincial environmental protection departments/agencies for review, approval and monitoring of environmental assessment projects. As regards the proposed project, the EPA Punjab will be responsible for reviewing the report, issuing Environmental Approval and overall/broad based monitoring of the proposed project activities to ensure compliance with the Environmental Management Plan. Under the Punjab Local Government Ordinance, 2001, District Officers (Environment) are responsible to deal with environmental issues at the district level. National Reconstruction Bureau has formulated the following rules of business for district environment offices:

- To regulate motor vehicles subject to the provisions of the Pakistan Environmental Protection Act, 1997 and the rules and regulations made there-under;
- To ensure, guide and assist the proponents of new projects in submission of Initial Environmental Examination (IEE) / Environmental Impact Assessment (EIA) to the D.G, EPA for approval;
- To ensure implementation of environmental protection and preservation measures in all development projects at the district level and to sensitize government agencies on environmental issues;
- To identify the needs for legislation in various sectors of the environmental matters;
- To provide information and guidance to the public on environment;
- To encourage the formation and working of non-governmental organizations, to prevent and combat pollution and promote sustainable development; and
- To undertake regular monitoring of projects and to submit progress reports to the DG, EPA for publication in the annual Report.

2.5 MUNICIPAL AND LIQUID INDUSTRIAL EFFLUENTS QUALITY STANDARDS

Punjab Environmental Quality Standards for Municipal and Liquid Industrial effluents are given as follows:

Table 2-1 Punjab Environmental Quality Standards for Municipal and Liquid Industrial effluents

No	Parameter	Into Inland Waters	Into Sewerage Treatment
1	Temperature or Temperature Increase *	≤ 3˚C	≤ 3˚C
2	pH value (H^+)	6-9	6-9
3	Biochemical Oxygen Demand (BOD_3) at 20^0C	80	250
4	Chemical Oxygen Demand (COD)	150	400
5	Total suspended solids (TSS)	200	400
6	Total dissolved solids (TDS)	3500	3500
7	Grease and Oil	10	10
8	Phenolic compounds (as phenol)	0.1	0.3
9	Chloride (as Cl^-)	1000	1000
10	Fluoride (as F^-)	10	10
11	Cyanide (as CN^-) total	1.0	1.0
12	An-iconic detergents (as MBAs)	20	20
13	Sulfate (SO_4^{2-})	600	1000
14	Sulfide (S^{2-})	1.0	1.0
15	Ammonia (NH_3)	40	40
16	Pesticides	0.15	0.15
17	Cadmium (Cd)	0.1	0.1

No	Parameter	Into Inland Waters	Into Sewerage Treatment
18	Chromium (trivalent and hexavalent)	1.0	1.0
19	Copper (Cu)	1.0	1.0
20	Lead (Pb)	0.5	0.5
21	Mercury (Hg)	0.01	0.01
22	Selenium (Se)	0.5	0.5
23	Nickel (Ni)	1.0	1.0
24	Silver (Ag)	1.0	1.0
25	Total Toxic metals	2.0	2.0
26	Zinc (Zn)	5.0	5.0
27	Arsenic (As)	1.0	1.0
28	Barium (Ba)	1.5	1.5
29	Iron (Fe)	8.0	8.0
30	Manganese (Mn)	1.5	1.5
31	Boron (B)	6.0	6.0
32	Chlorine (Cl_2)	1.0	1.0

2.6 ENVIRONMENTAL MANAGEMENT FRAMEWORK IN PAKISTAN

The approach taken for the protection of the environment in Pakistan is laid down in the Environmental Conservation Strategy of 1992 and its review in 2000. For specific rules and regulations, “The Environmental Protection Act” was enacted in 1997 and it provides the backbone and framework for environmental legislation in Pakistan. This act establishes the Pakistan Environmental Protection Council, the highest

decision-making body in environmental issues, the Pakistan Environmental protection Agency (Pak EPA) and Environmental Tribunals.

The Pakistan Environmental Protection Council (PEPC) shall, among other duties, co-ordinate and approve comprehensive national environmental policies and approve National Environmental Quality Standards.

The act further defines the functions of institutions, providing a broad mandate to for enacting rules, procedures and technical standards in different areas of environmental protection. The Act requires Pak EPA to co-ordinate environmental policies and programs nationally and internationally, initiates legislation, establish surveys, manage monitoring and auditing schemes and promote research as well as education and awareness in the field of the environment.

The Environmental Protection Act does further require the provincial authorities to establish Provincial Environmental Protection Agencies for carrying out functions delegated to the provinces.

The Government of Pakistan has recently elaborated its further action in-line with the finding of the review of the National Conservation Strategy in the form of the National Environmental Action Plan, NEAP (as approved by PEPC in 2001).

3 PROJECT DESCRIPTION

This section of the study includes the details about the project, its components and all the associated works and construction materials intended for utilization during its execution phase. Also, it contains information regarding implementation procedures, construction time and estimated cost of the project. All the details furnished in this section are established based on preliminary design report and Feasibility Study.

3.1 GENERAL

This section covers the project comprehensively. It holds salient features including; location, project site layout, objectives, process employed, site alternatives, cost and magnitude of operation and various phases.

This chapter majorly describes in detail the proposed project of wastewater treatment plant for Lahore City at site of Kattar Bund Road.

3.2 TYPE AND CATEGORY OF THE PROJECT

According to the Pakistan Environmental Protection Agency (Review of EIA and EIA) Regulations 2022, 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.

3.3 OBJECTIVES OF THE PROJECT

The Project will take the first step to transform the present situation of untreated wastewater from the Kattar Bund catchment (which is currently being discharged untreated to the drainage system which flows to the Ravi River) to a new situation where the wastewater is treated and discharged to the Irrigation System for agricultural re-use. The feasibility study will propose the most suitable wastewater treatment technology for Kattar Bund WWTP. The other benefits of the projects are following.

- Reduction of waterborne and communicable diseases by provision of treatment plants to the nearby community of the project area.
- Improvement in the quality of living of urban residents and reduction of poverty in the low income and slum areas.
- Improvement of urban environmental conditions

- The quality of effluent will meet the PEQS and EU standards for effluent to be discharged into land waters and there will be a ten times dilution in LBC.
- Use of sludge produced as a low-grade fertilizer for agricultural re-use or for parks and gardens.
- Provision of expanded and upgraded urban environmental infrastructure with respect to sewerage treatment systems.
- Development of appropriate cost-recovery mechanisms to ensure sustainability of urban sewerage, drainage and sanitation services.
- Improvement of the working efficiency of individuals and ultimately the organizations.
- Improve the institutional capacity of WASA to run present and future wastewater management systems effectively.
- The proposed project is itself a value addition project.
- Socio-economic uplift of the project vicinity.
- Creation of new job opportunities and promoting income prospects for those engaged in the allied activities associated with operation of project is considered as indirect objectives of the project.

3.4 PROJECT ADMINISTRATIVE JURISDICTION

The proposed Project falls under administrative jurisdiction of District Lahore.

3.5 PROJECT LOCATION

WASA Lahore has selected around 150 acres of land at the western side of the Lahore Islamabad Motorway. The site is located on the Western side of motorway and Gopi Rai village and Eden Value Homes Society and Shahpur Kanjra exist in Southern side of WWTP site.

The WWTP site is located near Kattar Bund Road. The WWTP site is about 2.75 km distant from Thokar Niaz Baig in the west direction. The area is between the Cantonment Drain (to the north) and the Escape Channel of Lahore Branch Canal (to the south), both of which flow towards Ravi River. The WWTP site is adjacent to the existing protection bund named as Kattar Bund, which was built in the early 1990s as a protection from Ravi River flooding. The brief description of WWTP site is as follows:

The WWTP site is located at:

- Latitude: 31°28'47.05"N To 31°27'18.66"N

- Longitude: 74°12'26.77"E To 74°14'30.10"E

The Main approach road is Kattar Bund Road which is in the North of the site. The detailed location and layout plans have been attached as Annex-III of this report.

3.6 Site Description

3.6.1 Land Ownership

Land is under private ownership and WASA is acquiring the land according to land acquisition act 1894, and by providing relevant compensation to owners of the land. WASA is acquiring nearly 150 Acre of land for present and future aspects of the project.

3.6.2 Land Use on Site

Most of the land is agricultural land. Agricultural crops, bushes and wild grasses are present in the nearby surroundings of project area. During operation phase, green belts and flood protection bunds all around will be developed, and it will serve as a useful buffer to contain the menace of pollution from different sources and to limit the visual impact . Various local plants will be grown at the project site in the open areas, and along the boundary. During the said proposed activity, no major loss of vegetation will be observed, and more trees and plants of required species will be grown to enhance the aesthetics of the project vicinity.

3.6.2.1 Vegetation features of the site

Most of the land is agricultural land. Agricultural crops, bushes and wild grasses are present in the nearby surroundings of project area. Vegetation features are shown below in photos.



Figure 3-1 Pictorial evidence of vegetative features

3.6.3 Road Access

Kattar Bund road will be used to reach near the site. The land will be acquired and approach road up to the Kattar Bund Road will be built to reach the site.



Figure 3-2 location of Access Road and approach road

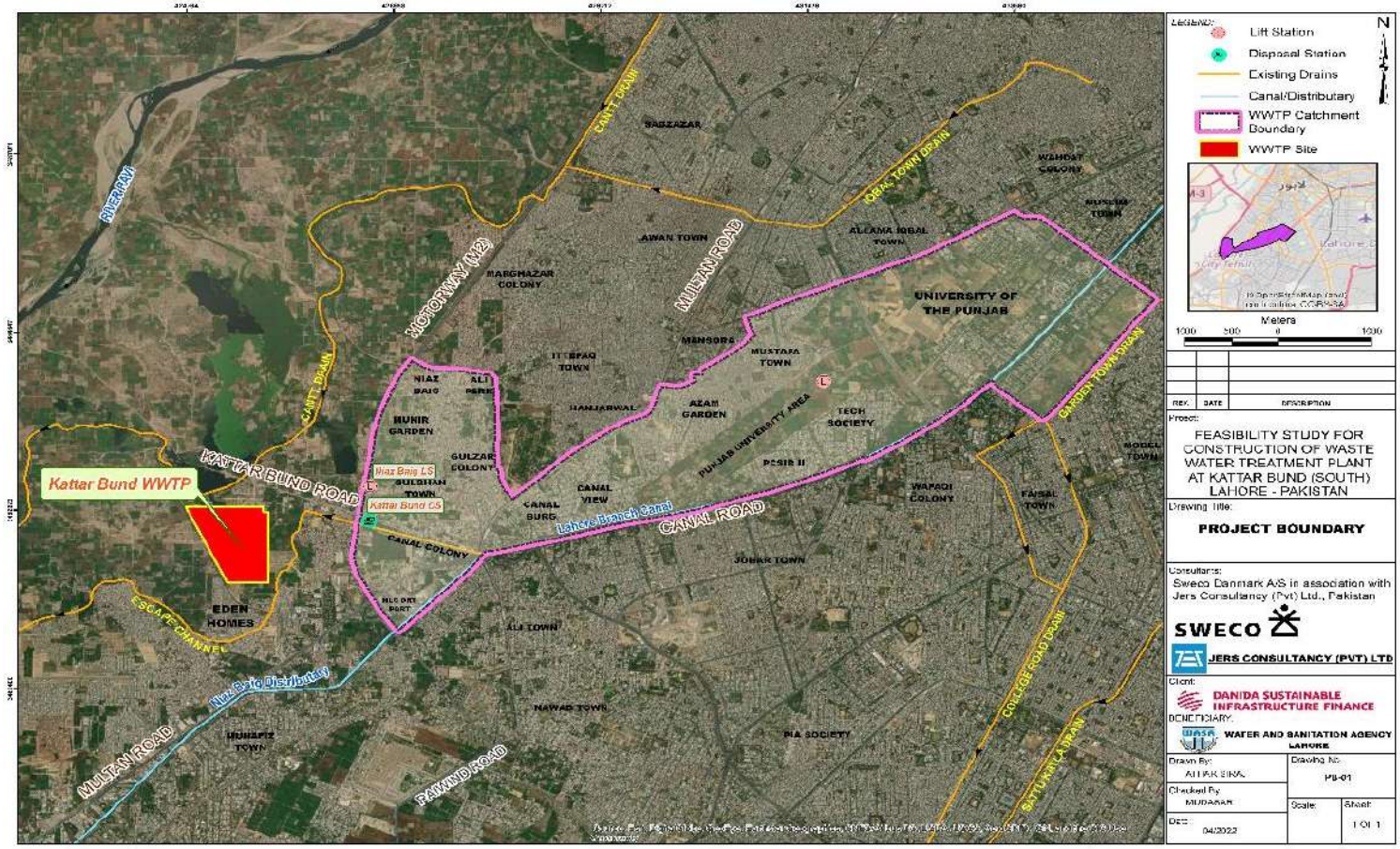


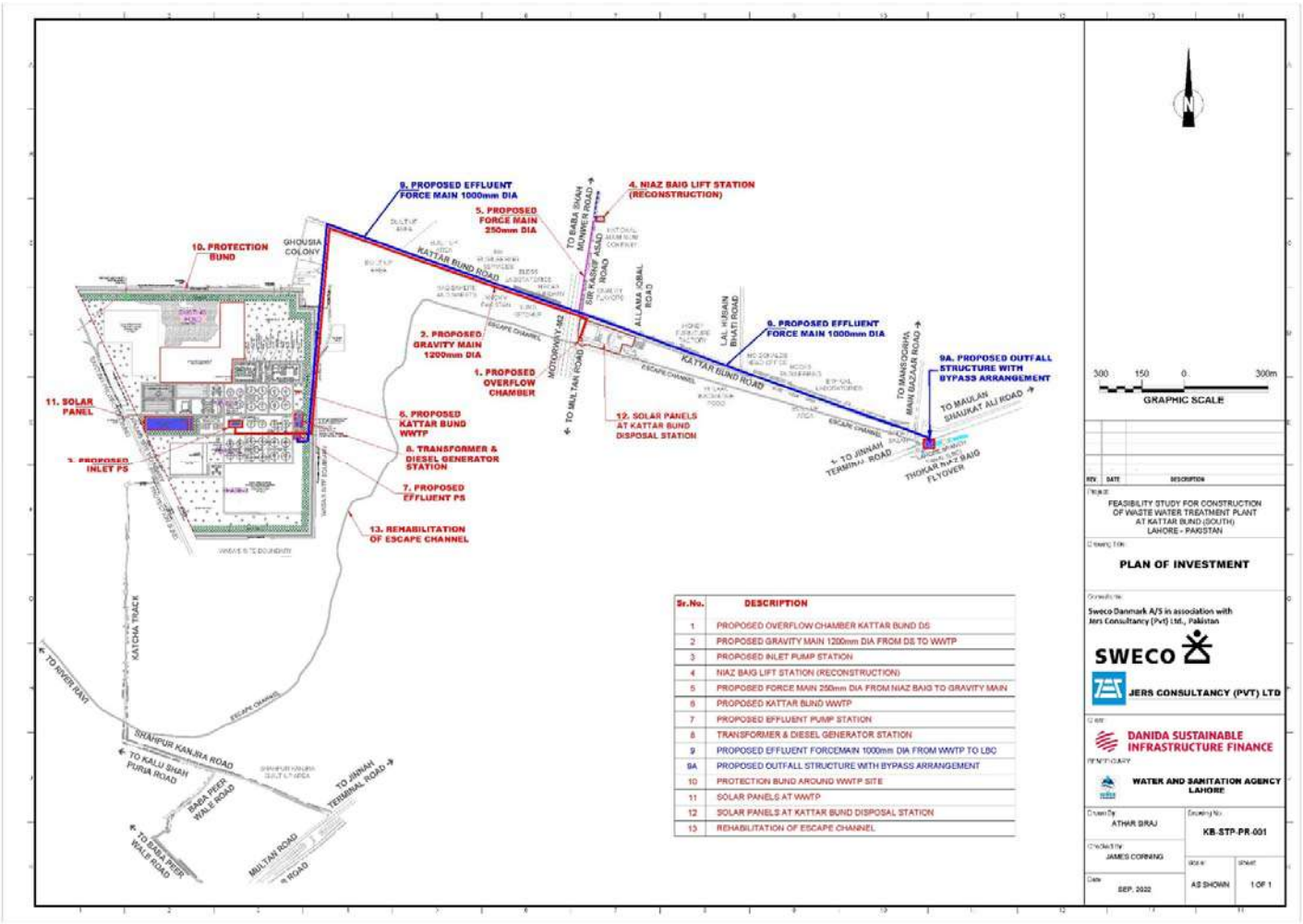
Figure 3-3 Location map of the project area

3.7 PROJECT COMPONENTS

The proposed project has following main components:

1. Conveyance system for raw wastewater
2. Conveyance system for storm water
3. WWTP based on Trickling Filters
4. Sludge Treatment
5. Conveyance System for Treated Effluent
6. Power supply at WWTP
7. Control System
8. Rehabilitation of LBC Escape Channel

The following figure shows the location plan of proposed plan of investment for subject project.



Sr.No.	DESCRIPTION
1	PROPOSED OVERFLOW CHAMBER KATTAR BUND DS
2	PROPOSED GRAVITY MAIN 1200mm DIA FROM DS TO WWTP
3	PROPOSED INLET PUMP STATION
4	NIAZ BAIG LIFT STATION (RECONSTRUCTION)
5	PROPOSED FORCE MAIN 250mm DIA FROM NIAZ BAIG TO GRAVITY MAIN
6	PROPOSED KATTAR BUND WWTP
7	PROPOSED EFFLUENT PUMP STATION
8	TRANSFORMER & DIESEL GENERATOR STATION
9	PROPOSED EFFLUENT FORCEMAIN 1000mm DIA FROM WWTP TO LBC
9A	PROPOSED OUTFALL STRUCTURE WITH BYPASS ARRANGEMENT
10	PROTECTION BUND AROUND WWTP SITE
11	SOLAR PANELS AT WWTP
12	SOLAR PANELS AT KATTAR BUND DISPOSAL STATION
13	REHABILITATION OF ESCAPE CHANNEL

Figure 3-4: Proposed Plan of Investment

3.8 CONVEYANCE SYSTEM FOR RAW WASTEWATER

Raw wastewater is currently collected from the vast majority of the Kattar Bund catchment to the Kattar Bund Disposal Station. Wastewater from the smaller sub-catchment of Niaz Baig Lift Station is collected separately at that Lift Station. Both Kattar Bund DS and Niaz Baig LS will be discharging their flows into the proposed gravity trunk sewer which will run along Kattar Bund Road and into the inlet works of the Kattar Bund WWTP.

3.8.1 Works at Kattar Bund DS

The current configuration in Kattar Bund DS will be maintained. The works included for Kattar Bund DS under the subject project include:

I. Upgradation of existing discharge chamber / overflow chamber will be carried out. It will be connected with the incoming pump delivery header of 1500mm dia at upstream side and DN1000mm gravity main at the other. An adjustable overflow weir will be provided in the chamber that will allow surplus stormwater to be discharged to nearby Escape Channel at the same location and structure to which it is discharging currently.



Figure 3-5: Existing discharge chamber

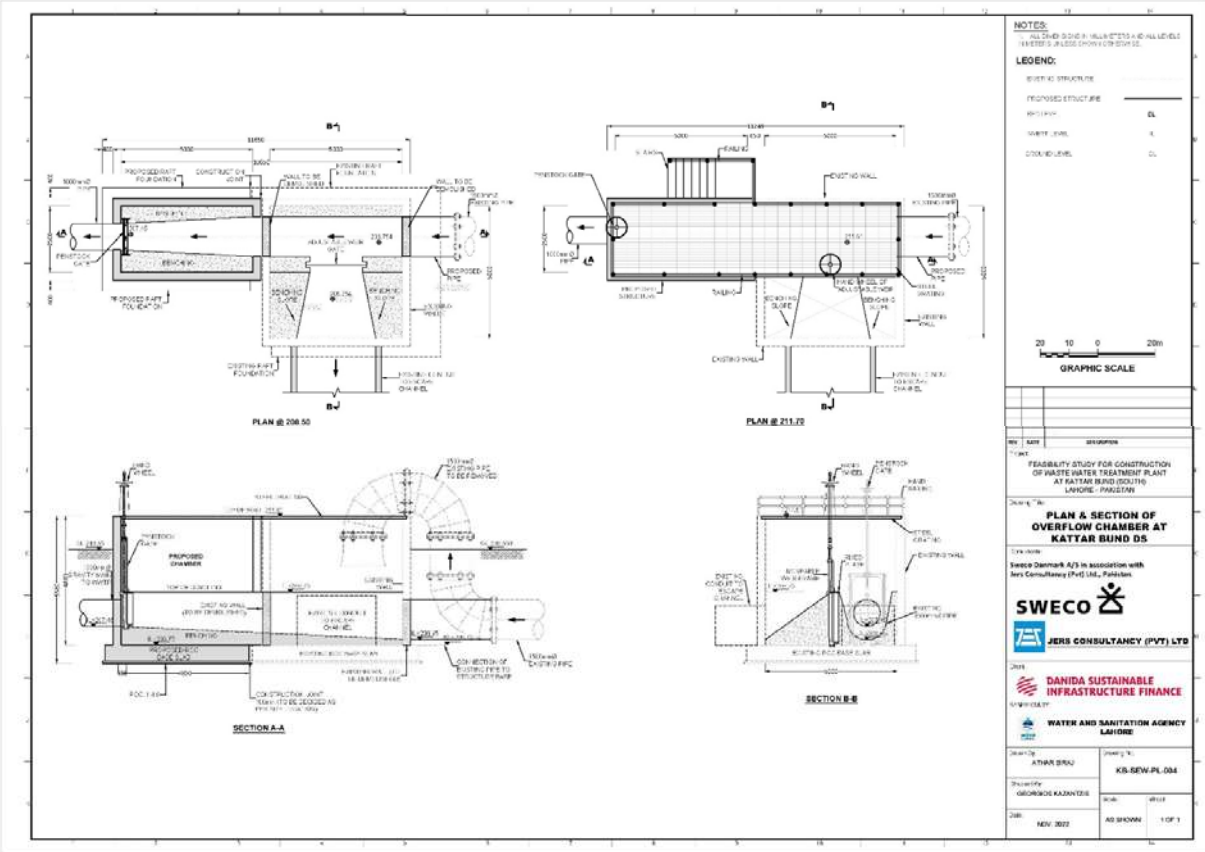


Figure 3-6: Detail of new Discharge/Overflow Chamber at Kattar Bund DS

II. The five (5) existing pumps at Kattar Bund DS will have reached their useful lifetime at the expected commissioning of the Kattar Bund WWTP in 2028. Therefore, it is recommended to replace these existing pumps with new pumps of equal capacity and head, but equipped with Variable Frequency Drives. The VFD drives will allow better control of the flow pumped towards the WWTP, and more efficient operation of the Kattar Bund DS in general. The Pumps will be operated automatically via the SCADA system installed at the WWTP

3.8.2 Gravity Main

Gravity main of DN1200mm dia for a length of about 2000 meter will carry raw wastewater to the proposed WWTP. This gravity main will have the capacity to cater peak dry weather flow i.e. 4,167 m^3/h.

3.8.3 Works at Niaz Baig LS

Reconstruction / Rehabilitation of Niaz Baig Lift Station will be carried out. The existing wet well and pumping station structure is not in a good shape. In order to operate the existing lift station for design horizon of 25 years, it is imperative to rehabilitate / reconstruct the wet well and pumping station.

3.8.4 Force main from Niaz Baig LS to Gravity Main

Force main of DN250mm from Niaz Baig LS to Gravity Main will be laid from Niaz Baig LS up to the proposed Gravity main at Kattar Bund Road.

Following figure shows the location of Kattar Bund DS, Niaz Baig LS, WWTP, route layout plan of proposed Gravity Main and force main from Niaz Baig LS:

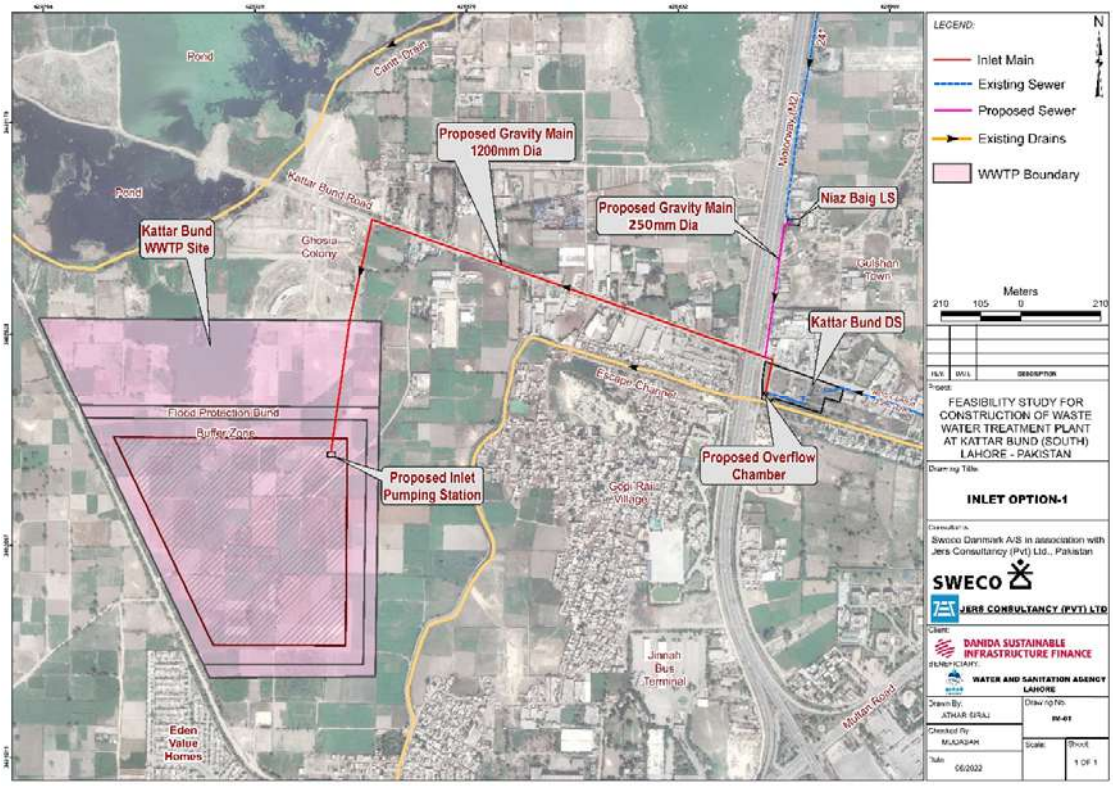


Figure 3-7: Layout Plan of Proposed Conveyance System for Inlet Raw Wastewater

3.9 CONVEYANCE SYSTEM FOR STORM WATER

Stormwater is currently being disposed to the LBC Escape Channel adjacent to the Kattar Bund Disposal Station. The Escape Channel has insufficient capacity to cater for large stormwater flows in addition to the emergency irrigation water discharge of 261 cusec from LBC. The settled sludge from stormwater has also caused reduction

in the carrying capacity of the channel. As a result, a significant social problem exists in the area and local people complain about overflow of the Escape Channel.

It is proposed to rehabilitate/upgrade the existing Escape Channel cross section. The Escape Channel runs a length of approx. 6.0 km before it ends up at the River Ravi.

3.10 WWTP BASED ON TRICKLING FILTERS

As the collected sewage is largely generated by domestic sources, a standard primary and secondary treatment plant is recommended. The proposed WWTP is based on trickling filters as the secondary / biological treatment. The WWTP is to be constructed as a first stage of 50,000m^3/day average capacity (100,000m^3/day peak capacity), with space allocated to allow for the expansion of a second stage of an additional 50,000m^3/day (average flowrate), should this be required in the future. The components of the proposed WWTP are as follows:

1. Inlet Works consisting of Coarse Screens, Inlet Pumping Station, Fine Screens and Grit Chamber
2. Primary Sedimentation Tanks
3. First Stage Trickling Filters for BOD Removal
4. Secondary Sedimentation Tanks
5. Second Stage Trickling Filters for Nitrification
6. Disinfection with UV radiation

Following table shows the detail of proposed WWTP components:

Table 3-1: Wastewater treatment plant units and their application and design basis

Operation	Application	Design basis
Wastewater treatment		
Coarse screening	Removal of coarse solids, *e.g.* sticks, rags and other debris to protect the inlet pumps.	Hourly peak flow
Inlet Pumps	Pump the influent up to the WWTP inlet elevation.	Hourly peak flow
Fine screening	Removal of small particles, *e.g.* rags.	Hourly peak flow
Grit removal	Removal of sand and grit.	Hourly peak flow
Primary Sedimentation Tanks	Removal of settleable solids (primary sludge + recirculated secondary humus sludge), limited removal of BOD.	Average Dry Weather Flow (ADWF) and secondary sludge flow; and peak DWF
First Stage Trickling Filter	Biological treatment for BOD reduction.	Mass BOD load (peak)

Operation	Application	Design basis
Secondary Sedimentation Tanks	Removal of settable biological (humus) sludge, recycling of collected secondary sludge to primary sedimentation or directly to gravity thickening.	ADWF and Peak DWF
Second Stage Trickling Filter	Biological treatment for nitrification (ammonia removal)	Mass TKN load (peak)
Disinfection with UV radiation	Removing pathogenic microorganisms to prevent spread of waterborne diseases.	Peak flowrate

The treated effluent will meet the both Pakistani and European standards and will be safe for reuse for irrigation purposes.

The following figure shows the process flow diagram of proposed WWTP:

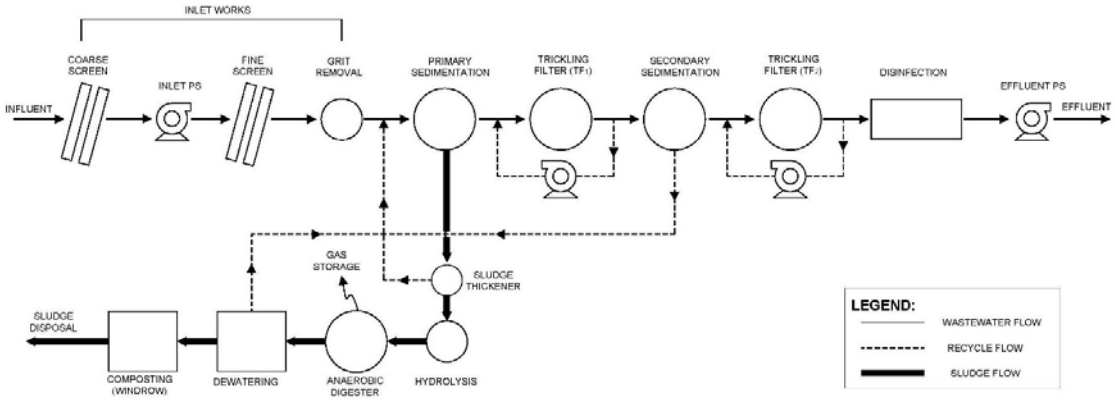


Figure 3-8: Process Flow Diagram of Proposed WWTP

The following figure shows the layout plan of proposed WWTP.

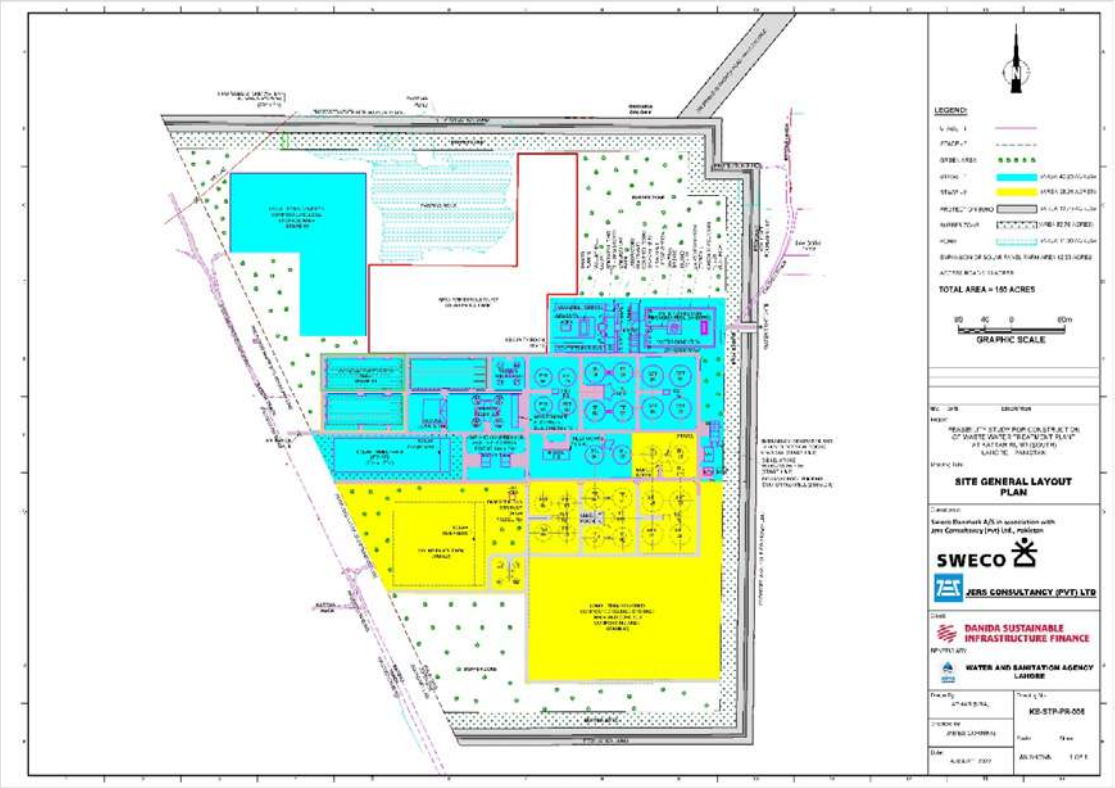


Figure 3-9: Layout Plan of Proposed WWTP

3.11 SLUDGE TREATMENT

The proposed WWTP consists of sludge treatment facility that is comprised of following main processes:

I. Gravity Thickening
II. Anaerobic Digestion with Thermal Hydrolysis
III. Dewatering using decanter centrifuge
IV. Composting

The final product of treated sludge will be stored in the long term sludge storage area proposed at the WWTP site. The treated sludge will be a useful byproduct of the proposed WWTP, which will be used as soil cover and fertilizer for PHA and nearby agricultural farms.

Following table shows the detail of proposed sludge treatment processes:

Table 3-2: Sludge Treatment Process and their application and design bases

Operation	Application	Design basis
Sludge processing		
Gravity Thickening	Thickening of collected primary and secondary sludge, reducing water content and making the anaerobic digestion process more efficient and effective.	Daily sludge load
Hydrolysis	Biodegrades the sludge, increasing the volatile solids content, making it more digestible and improving biogas production. Sterilizes the sludge.	Daily sludge load
Anaerobic digestion	Sludge stabilization, volatile solids reduction, biogas production.	Daily sludge load
Dewatering	Sludge volume reduction by increasing dry solids content, making it suitable for subsequent sludge composting treatment.	Daily sludge load
Composting	Further stabilization and sterilization of the dewatered sludge, reducing water content and facilitating transport from site. Improved appearance and reduced odour of composted sludge, making it more suitable for re-use options such as agricultural re-use or soil amendment or landfill top cover.	Daily sludge load
Composted Sludge Storage	Covered storage provided for up to 5 years long-term storage of composted sludge.	Daily sludge load

3.12 CONVEYANCE SYSTEM FOR TREATED EFFLUENT

The treated effluent will be pumped through an Effluent Pumping Station (EPS) proposed at the WWTP site. A 3 km long 1000mm dia force main will be laid from WWTP site up to Lahore Branch Canal (LBC). This will discharge the treated effluent to LBC for reuse in agricultural farms.

An outfall structure will be constructed near LBC. This structure has two main objectives; i) to safely discharge treated effluent flow to LBC without damaging to existing structures / embankments and ii) To bypass the flow to escape channel during canal closure or emergency period.

3.13 POWER SUPPLY AT WWTP

Power supply for the Kattar Bund WWTP will be provided from four different sources. All four sources are connected in parallel to the power distribution system on the site. Based on demand, the control system will determine which source is to be used at any point of time. Listed in order of operation priority, these power supply sources are:

1. Combined Heat and Power Plant (CHP)
2. Solar Panels (SP)
3. LESCO grid system
4. Emergency Generator.

3.13.1 Combined Heat and Power Engine

The proposed WWTP includes the cogeneration of power using biogas produced in the anaerobic digesters. The biogas produced in the Anaerobic Digesters is sent to gas storage dome from where it will be fed to Combined Heat and Power (CHP) engine for generation of power.

A Combined Heat and Power (CHP) plant is typically a gas engine that uses the energy in the gas to drive a crank shaft. The crank shaft turns a generator to produce electricity. Heat is released during the gas combustion process. This heat can be recovered during cogeneration to maximize the heating value of the system.

3.13.2 Solar Panels

An on-grid solar power system is a grid (Government electricity supply) connected system. This solar system will partly run the WWTP connected loads by using the solar power. The solar panels will generate the DC electricity by absorbing sunlight and the solar inverters will convert the same DC electricity into AC electricity which can then be used directly for the WWTP equipment or export to the main grid.

If the connected load exceeds the capacity of the CHP plant and the solar power plant, the system will automatically use the power from the main grid. In case the connected load is less than the generating capacity, it will supply surplus power to the grid.

3.13.3 LESCO Grid System

LESCO recommends the Shahpur Grid Station which is located approx. 7.6km from the WWTP site. The power supply will be overhead. It is noted that LESCO has mandatory requirements for on-site grid stations if the power demand exceeds 5MW, however the Kattar Bund WWTP will be less than this. Considering that the WWTP will produce power via biogas combustion and solar panels, and has a standby generator, it is not considered essential to have a dual feed, even though the WWTP may be considered as emergency services. LESCO can provide a dual feed if required, but at higher cost.

3.13.4 Emergency Generator

Electrical emergency power supply from one generator 0.4 kV with a capacity sufficient to power Inlet Pumping Station including fine screens and grit removal and all necessary electrical equipment for treatment of Stage 1 and outlet Effluent Pumping Station. The Emergency generator shall be designed to operate in “Island mode” for minimum 96 hours without any synchronization to the national grid and equipped with complete automatic control board. No export of power from the standby generator is allowed to the National Grid. The electrical output of diesel generator will be 1000 kVA.

3.13.5 Priority Power Source

The electricity produced on-site (CHP and SP) will have first priority and will cover all needs for operating the WWTP and the main pumps (inlet and effluent pumps) during daytime. LESCO grid connection will have the capacity to cover the total needs of WWTP and main pumps and will only be tapped in case the CHP and SP are not able to meet the demand. This may happen during night-time and in case of maintenance or break down and at daytimes with low SP production. The emergency generator will operate if the three first sources are not working. The emergency generator will be able to cover 50% of the total WWTP demand and will only operate critical items of equipment.

3.13.6 Power Demand and Production

The total power consumption at proposed WWTP is 11,300 kWh/day which requires a production capacity of 470 kW.

Based on the gas production from the digesters, the CHP will have a capacity of 400 kWe; but capacity losses for service/maintenance and repair are usually 8-10%, hence total CHP production capacity is therefore 8,800 kWh/day (367 kW). The Solar Power plant will cover the gap between total demand (470 kW) and supply from the CHP (367 kW), *i.e.* a gap of 103 kW. In order to compensate for night-time, the SP shall produce 100% more during daytime and use the grid as "storage". The SP will have a peak capacity of 450 kWp and an average capacity of 210 kW. The normal demand-supply situation is shown in figure below:



Figure 3-10: Typical power demand and supply

3.14 CONTROL SYSTEM

3.14.1 Programmable Logic Controllers (PLCs)

The Programmable Logic Controller (PLC) shall be based on a control system and designed with 1:1 hot redundant configuration for Controllers, power supply & communication modules. All functional controllers for sequence control, functional controllers for closed loop control and functional controller for processes & monitoring shall be provided with 100% hot standby controllers.

3.14.2 SCADA System

The SCADA system shall be designed to operate 24 hours a day in high automation degree, with few manual actions for the operation staff. A system error or communication failure shall automatically be detected and alarmed at the SCADA control room. At a power cut, the status of the I/Os shall be in a predefined position.

Restart after a power drop/after restoration of power supply shall be fully automatic with individually delayed starts of every motor (with adjustable time setting during commissioning).

The Programmable Logic Controller (PLCs) as Primary PLC and Secondary hot standby PLC as well vendor/subcontractor PLCs shall be installed with all necessary components, e.g. power supply module, central processing unit, communication processors, interface modules, signal modules for digital and analogue input and output functions.

3.14.3 Uninterruptible Power Supply System (UPS)

To ensure continuous processing and archiving the devices of the process control system and the PLCs and SCADA systems shall be supplied by Uninterruptible Power Supply system (UPS) each with a minimum capacity of 1-hour operation. The UPS and SCADA system shall be redundant, powered from two different switchboards. At least the following consumers must be supplied by UPS:

- Central Control equipment in the SCADA room
- All PLC-units and PLC bus-systems
- Remote I/O modules
- Field instrumentation with analogue and digital signals
- Computers and printers of office rooms
- Further critical consumers as required

3.15 COST

3.15.1 Capital Cost

The estimated project cost is 66.706 million euros or Rs.19,344.7million (*1 €=Rs.290).* The estimated construction costs including civil works, mechanical and electrical works, construction supervision, PMU costs, VAT and Punjab Sales Tax amount to 61.3 million EUR, including technical and price contingencies. In addition, 5 years of O&M costs are included as capital cost estimate, amounting to 5.4 million EUR.

Following table shows the summary of estimated project cost:

Table 3-3: Summary of Estimated Project Cost

Sr. No.	Description	Amount (Rs.)	
		(million Rs.)	(million €)
1.	Civil Works	5,432.028	18.731
2.	Mechanical & Electrical Works	6,812.540	23.491
	Total base cost excluding contingencies and construction supervision	12,244.568	42.222
3.	Technical contingencies (10%)	1,224.456	4.222
4.	Price contingencies (10%)	1,224.456	4.222
5.	Construction Supervision (7% of construction costs) excl. Design (covered by DSIF grant) & excl. PMU	857.119	2.955
6.	PMU Costs	400.593	1.381
7.	VAT (18%) on mechanical and electrical equipment, and services	1,226.257	4.228
8.	Punjab Sales Tax (5%) on all construction costs	612.228	2.111
9.	Operations for 5 years (2% p.a.*5=10%)	1,555.060	5.362
10.	Total Project construction cost	19,344.741	66.706

3.15.2 Annual O&M Cost

Annual Operating and Maintenance Costs (O&M) after Completion of the Project will include staff manpower, mechanical and electrical (and civil) maintenance, power consumption, chemical reagents and vehicle maintenance. The summary table for O&M cost is given below:

Table 3-4: Annual Operating costs for Kattar Bund WWTP Project

Component	Kattar Bund WWTP Annual Costs (EUR/year)	Kattar Bund WWTP Annual Costs (PKR/year)
Staff	174,600	50,634,000
Electricity	20,000	5,800,000
Consumables	36,000	10,440,000
Annual Maintenance	570,000	165,300,000

Component	Kattar Bund WWTP Annual Costs (EUR/year)	Kattar Bund WWTP Annual Costs (PKR/year)
Vehicle maintenance	42,900	12,441,000
Pump Stations maintenance, *excl.* manpower	79,614	23,088,000
Pump Stations maintenance manpower	36,828	10,680,000
Cleaning out the Escape Channel	12,070	3,500,300
Total annual O&M costs *excl.* VAT	**959,941**	**278,383,000**
VAT: 18%	134,700	39,072,400
Total Annual O&M Costs	**1,094,641**	**317,455,400**

3.16 SCHEDULE OF IMPLEMENTATION

The implementation schedule is shown below in Table 3-5 in which details of whole project is given.

3.17 RESTORATION AND REHABILITATION PLANS

The land used for temporary purpose like construction camps, material yard, or any other temporary activity will be restored after the completion of the project. This will make obligatory to contractor, sub-contractor. For this purpose, an initial report with pictorial evidence of land will be made and later it will be used for restoration and rehabilitation plans.

Table 3-5: Implementation Schedule – Kattar Band WWTP

IMPLEMENTATION PLAN - KATTAR BUND WWTP PROJECT

Project Component	Activity	Responsible	2023									2024	2025	2026	2027	2028	2029	2030	2031	2032	2033-2045
			APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC										
PC-I	Submission of PC-I	WASA-L																			
	Clearance of PC-I from PDWP	PDWP																			
	Clearance of PC-I from CDWP	CDWP																			
	Approval of PC-I from ECNEC	ECNEC																			
	Issuance of Administrative Approval																				
Loan	Loan Signing with DSIF	DSIF																			
TA	Select TA Consultant	DSIF																			
WWTP Kattar Bund	Tendering/contracting	WASA-L																			
	Design	DBO Contractor																			
	Construction	DBO Contractor																			
	DLP	DBO Contractor																			
	Operation (5 years)	DBO Contractor																			
	Operation (Long-term)	WASA-L																			

3.18 GOVERNMENT APPROVALS

To counter the increasing urbanization and its effects on environment, Water and Sanitation Agency (WASA) has planned to construct waste water treatment plant at Kattar Band, Lahore. With reference to "section 12 of Pakistan Environmental Protection Act 1997 (Amended 2012)", Environmental Approval from EPA is required. The No Objection Certificate (NOCs) from other relevant departments will also be acquired and shared with EPA. WASA has also already acquired NOC from Punjab Irrigation Department in respect of discharge of treated effluent from proposed Kattar Bund WWTP. Ravi Urban Development Authority (RUDA) has also issued NOC upon the continuance and culmination of proceedings for land acquisition by WASA upon land notified by WASA. Both NOCs are attached as Annexure-IX.

4 ANAYLSIS OF ALTERNATIVES

The discussion and analysis of alternatives in Environmental Impact Assessment (EIA) should consider other practicable strategies that will promote the elimination of negative environmental impacts identified. This section is helpful in consideration of ideal development with minimal environmental disturbance. This report has identified the major environmental impacts noted by scientific experts. The findings of these impacts were utilized to analyze possible options for the final development. The following alternatives have been identified and are discussed in further detail below:

4.1 NO PROJECT OPTION

The “no action” alternative is required to ensure the consideration of the original environment without any development. This is necessary for the decision-makers in considering all possibilities. The development will have a minimal effect on the physical environment instead it will improve the condition in downstream areas of Kattar Bund disposal station which are often flooded due to the disposal station running. This project is a welcomed initiative by the Government and locals as it aims to focus on economic uplift with guaranteed impact, therefore it will lead to an overall improvement in proper treatment facilities of sewerage in Lahore district along with improved aesthetics of the city. Installation of WWTP facilities in Lahore District will also lead to improvement in socioeconomic conditions of the town and country as well. Therefore, a “no project” alternative will be a major loss for country.

Table 4-1 Comparison “without project” and “With Project” during Operation

Components		Project Alternatives	
		Without Project	With Project
Physical Environment	Air	I	B
	Noise	N	I
	Soil	II	BB
	Open water areas and wetlands	III	BBB
	Groundwater	II	BB
	Surface water quality	III	BBB
	Groundwater quality	II	BB
	Flooding	I	B
Biological Environment	Terrestrial flora	N	N
	Terrestrial fauna	N	N
	Aquatic flora	I	B
	Aquatic fauna	II	B

Components		Project Alternatives	
		Without Project	With Project
	Insect vectors (disease transmitters)	I	B
Human and Economic Development	Fisheries	II	BB
	Agriculture	I	B
	Land use	N	N
	Water Supply	II	BB
	Sanitation	III	BBB
Quality of life values	Health	III	BBB
	Employment & economic activities	N	B
	Poverty	N	B
	Migration	N	N
	Status of women	N	N
	Equity	II	BB
N = Not significant	B = Small benefit	BB = Medium benefit	BBB = Large benefit
	I = Small negative impact	II = Medium negative impact	III= Large negative impact

4.2 SITE ALTERNATIVE

The subject project area boundary zone wise is ideal from the point of view of compatibility with other land uses within the area. The total project area is also spacious enough to accommodate the proposed facilities and their infrastructures. Due to existing infra-structure and its strategic location, it is our considered view that the subject project area is ideal and suitable for development. Moreover, the proponent is very concerned and conscious about the quality and equally about the environmental protection and resource conservation.

Various sites were assessed by WASA before the final project site for the installation of the Wastewater Treatment Plants (WWTPs).

The proposed site is selected as it is ideal due to land availability and in vicinity to the Kattar Bund Disposal station which is source of wastewater for which project is proposed. Further the disturbance to environment and people will be minimum in the proposed site.

4.3 ENERGY ALTERNATIVES

The following three energy sources have been considered for the project during construction and operational phases:

4.3.1 Solar Energy

Solar Energy facility if installed separately for the treatment plant site at Kattar Bund Lahore: Installation of solar facility will not only reduce the overall electric load on the National Grid, but it will also lessen the burden of the operational cost due to operation of the allied facilities. Solar energy is considered as secondary source of power for WWTPs with *approx.* 8 hours battery backup.

4.3.2 Power From WAPDA / Grid

For treatment plants, power from the grid is considered as the primary source of energy. Operation of the treatment plant and control room unit will require electricity. However, biogas production will reduce this total power imported from the grid.

4.3.3 Standby Generators

Power Supply from generator is an easily and readily available source. In case of grid failure generators, will be standby source of energy.

4.3.4 Combined Heat and Power Engine

The proposed WWTP includes the cogeneration of power using biogas produced in the anaerobic digesters. The biogas produced in the Anaerobic Digesters is sent to gas storage dome from where it will be fed to Combined Heat and Power (CHP) engine for generation of power.

A Combined Heat and Power (CHP) plant is typically a gas engine that uses the energy in the gas to drive a crank shaft. The crank shaft turns a generator to produce electricity. Heat is released during the gas combustion process. This heat can be recovered during cogeneration to maximize the heating value of the system.

4.3.5 Priority Power Source

The electricity produced on-site (CHP and Solar power (SP)) will have first priority and will cover all needs for operating the WWTP and the main pumps (inlet and effluent pumps) during daytime. LESCO grid connection will have the capacity to cover the total needs of WWTP and main pumps and will only be tapped in case the

CHP and SP are not able to meet the demand. This may happen during night-time and in case of maintenance or break down and at daytimes with low SP production. The emergency generator will operate if the three first sources are not working. The emergency generator will be able to cover 50% of the total WWTP demand and will only operate critical items of equipment.

4.4 TECHNOLOGY ALTERNATIVES IN TERMS OF WASTEWATER TREATMENT PLANT

4.4.1 Waste stabilization ponds

Three types of waste stabilization ponds (WSPs) exist, each of them characterized by different treatment and design: i) Anaerobic Pond; ii) Facultative Pond; iii) Maturation Pond. Anaerobic and facultative ponds are designed for BOD removal, while maturation ponds are designed for pathogen removal. They can be allocated individually or combined for improved treatment. In a typical series of WSPs, the effluent from the anaerobic pond is transferred to the facultative pond and finally to the maturation pond. Depending on the requirements for the final effluent in terms of pathogen reduction, only anaerobic and facultative ponds are necessary in some instances. Pre-treatment (including screening and grit removal) before any WSP series is necessary to prevent scum formation and to hinder excess solids and garbage from entering the WSPs. The pond buffer capacity evens out diurnal peaks and thus the design is based on average daily flows and organic loads.

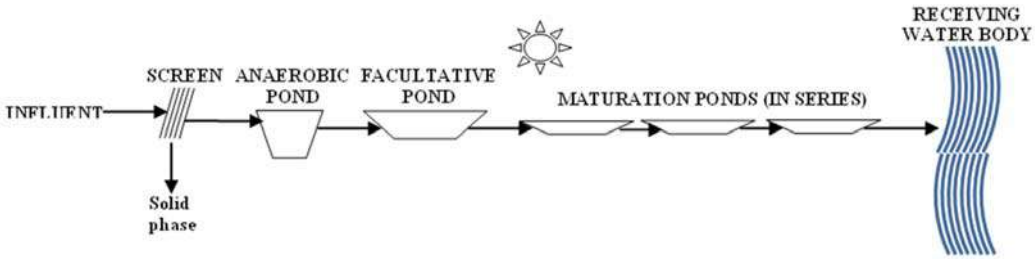


Figure 4-1Flow scheme of waste stabilization pond

Anaerobic ponds receive wastewater with high organic loads (greater than 100 gBOD/m^3.day). BOD_5 removal is achieved by sedimentation of solids to the base of the ponds, and subsequent anaerobic digestion of the resulting sludge. Anaerobic bacteria are usually sensitive to pH<6.2, thus acidic wastewater must be neutralized prior to its treatment in anaerobic ponds. A properly designed anaerobic pond will achieve about 40% BOD_5 removal at 10°C and more than 60% at 20°C. In anaerobic

conditions, the organic nitrogen is hydrolyzed to ammonia, therefore the effluent from the anaerobic pond has a higher ammonia concentration than the raw sewage. A short retention time (1.0-1.5 days) is commonly used. Anaerobic ponds require de-sludging when they are a third full of the sludge by volume (*approx.* once in 1-5 years). Methane gas is a by-product (which is a Greenhouse Gas), and although the methane is not normally collected, the ponds may be covered.

Two types of facultative ponds exist: primary facultative pond which receives raw wastewater, and secondary ponds which receive particle-free wastewater (usually from anaerobic ponds, septic tanks, primary facultative ponds, and shallow sewerage systems). The peculiarity of facultative ponds is the co-existence of an anaerobic zone, which is established in the bottom layer of the pond, and an aero-bic zone, which is established in the upper layer. The oxygen supply in the aerobic zone is provided by micro-algae photosynthesis. At peak algae activity, the pH of water can rise to above 9, leading to Faecal Coliform (FC) inactivation and promoting ammonia volatilization. A properly designed facultative pond will achieve about 70% BOD removal at 10°C and around 80% at 20°C. The FC removal at 20°C is around 97%. The retention time is commonly between 5 and 30 days.

Maturation ponds commonly receive the effluent from facultative ponds, with the main objective to remove FC. The key factors that promote FC removal are long retention time, high temperature, high pH, and high light intensity combined with high dissolved oxygen concentration. According to this, the maturation pond is the shallowest of the three ponds in order to allow the sunlight to penetrate the full pond depth. The retention time is between 15 to 20 days.

The BOD removal efficiency when the three ponds are linked is up to 92% at 20°C, with FC removal of 99.975%. Even though WSPs are designed with respect to BOD_5 removal and pathogen inactivation, nutrient removal also takes place in the facultative and maturation pond. In particular, the ammonia removal can reach 95% and is associated with ammonia volatilization and incorporation into algae biomass. Long retention times are required in a WSP system because oxygen supply in the (facultative and maturation) ponds relies on natural processes (*e.g.* photosynthesis).

The use of WSPs has the following advantages:

- The process requires minimum supervision for daily operation (*e.g.* inlet and outlet cleaning, removing floating scum from the surface water);

- The process does not require electrical energy;
- The process is resistant to organic and hydraulic shock loads;
- The process has low construction and operating costs;
- The ponds can be built and repaired with locally available materials;
- The process does not need any mechanical equipment;
- Sludge removal is infrequent (once per 3-5 years for anaerobic ponds, but only once per 10-20 years for facultative ponds), but is a large-scale project due to the pond size.

The use of WSPs has the following disadvantages:

- The process needs large land availability and thus it is not normally suitable for large-scale, densely populated areas like Lahore;
- The process requires mosquito control;
- Odour nuisance can develop from overloaded facultative and anaerobic ponds or during algal bloom. Algae control is important with respect to odour nuisance and to achieve stable treatment efficiency;
- To prevent leaching, the pond should have a liner which dramatically increases the capital costs;
- Performance is dependent on climate conditions (temperature and radiation). The process is not appropriate for cold climates (mean temperature below 12°C during several months of the year) – not a concern in Pakistan;
- Effluent from a WSP system is not suitable for discharge to waters sensitive to eutrophication.
- No possibility for biogas and energy production from digestion of sludge.

Note 1: A large-scale waste stabilization project is in operation in the neighboring city of Faisalabad, however is not well-maintained; the ponds have never been de-sludged.

Note 2: The Kattar Bund WWTP site is 150 ha (which would need to include a buffer zone). Because of developments, the available site might be substantially lower. It is unrealistic to construct a waste stabilization project at the proposed site; *e.g.,* a 50 MLD WWTP requires 50 ha (11 MGD requires 125 acres).

4.4.2 Aerated Lagoons

The aerated lagoon process comprises pre-treatment, aerated lagoon and sedimentation pond. The aerated lagoon is similar to a facultative pond with the main

difference that oxygenation does not rely on sun-algae photosynthesis but on mechanical aerators on floats or fixed platforms. Besides providing the oxygen required for organic matter degradation, the aerators keep the biomass suspended and mixed in the reactor. Consequently, separation of solids from suspended biomass is necessary and can be achieved by either several short hydraulic retention time (HRT) ponds (*i.e.,* 2 days), requiring frequent de-sludging, or by a single 10-day facultative pond with sufficient depth to allow long-term sludge storage.

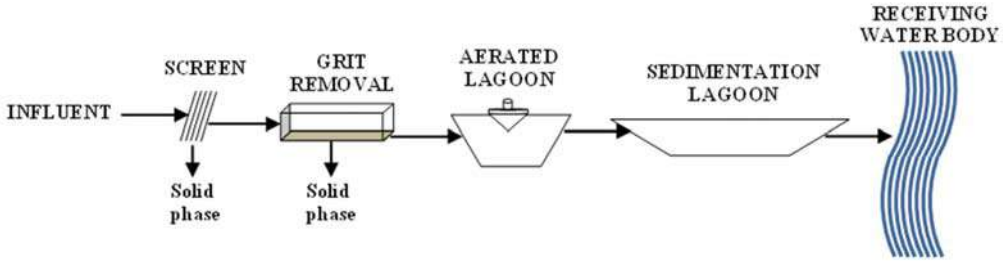


Figure 4-2 Flow scheme of aerated lagoons treatment plant

The main benefit of enhanced aeration is the shorter hydraulic retention time, (in this case equal to sludge retention time because there is not sludge recirculation) compared to WSPs. The aerated la-goon is designed based on SRT, typical values are between 3 and 6 days. The BOD_5 and pathogen removal efficiencies are comparable to the ones of WSPs.

The use of the aerated lagoon process has the following advantages:

- Aerated lagoons are more compact than WSPs. In fact, enhanced aeration allows ponds to be deeper and thus less surface area is required. This process can be used in urban areas;
- Aerated lagoons are less dependent on temperature and can be adopted in colder climate;
- High reliability regarding treatment efficiency and shock loadings;
- Higher ammonia and nutrient removal than WSPs;
- Low possibility of odour generation;
- Sludge removal is infrequent (once per 10-20 years) but is a major undertaking.

The use of aerated lagoons has the following disadvantages:

- Substantial energy consumption (energy for aerators);

- Even though aerated lagoons are more compact than WSPs, the land requirement is still high;
- Inefficient desludging and inadequate or missing system can lead to treatment failure;
- Desludging is infrequent but is a major task;
- No possibility of energy production from sludge.

4.4.3 Trickling Filter

The trickling filter process typically comprises preliminary treatment (*incl.* screening and grit removal); primary clarification and sludge removed for anaerobic digestion and biogas pro-duction; trickling filter ; secondary clarification; and disinfection unit process (optional). In addition: “humus” sludge is re-circulated from the secondary clarifier to the inlet works or the primary clarifier. The sludge from the primary clarifier is pumped to anaerobic digesters before disposal to sludge dewatering.

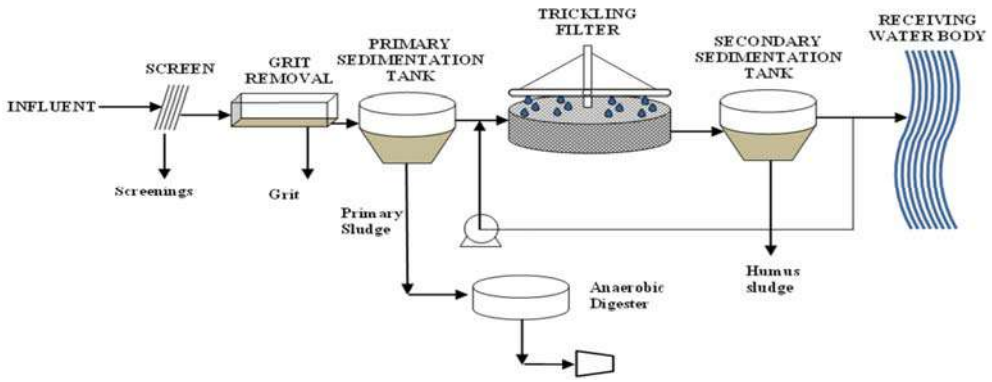


Figure 4-3 Flow scheme of high-rate trickling filter

Similar to the Conventional Activated Sludge system, primary sludge is collected in the primary tanks and digested in anaerobic digesters for biogas production which is combusted in a Combined Heat and Power Plant (CHP) to produce electricity. Consequently, the Trickling Filter process tends to produce sufficient power via biogas combustion to operate the mechanical works, however the Conventional Activated Sludge consumes greater amounts of power and is not normally energy neutral.

The principal features of a trickling filter are the filter media (traditionally 60-75mm rock material but more commonly plastic packing which is more efficient), the wastewater distribution system and the underdrain system, which collects the wastewater that has passed through the filter and provide an open area for the

movement of air. The influent wastewater is distributed over the filter and then trickles down the packing material, where the biofilm grows. Part of the trickling filter effluent is recirculated to ensure suitable filter wetting and to control the thickness of the biofilm. The biofilm is subjected to periodic "sloughing" events during which a substantial fraction of the total biomass can be lost. However, this loss of active biomass generally has only a minor impact on the performance of the trickling filter. The ventilation in trickling filters is typically due to natural convection but, in some cases, can be enhanced by forced ventilation. The plastic packing in the Trickling Filters is not manufactured in Pakistan however is sourced in the region, *e.g.* Malaysia at a preliminary cost estimate of €200/m^3, or *approx.* €3M for a WWTP of 50,000m^3/day.

Trickling filters can be used for: BOD removal only (70-90% BOD_5 removal efficiency); combined BOD removal and nitrification (85-90% BOD_5 removal efficiency); and for full nitrification. Trickling filters have demonstrated the ability to produce effluent BOD_5 concentrations of ≤30 mg/L when de-signed for BOD removal, and effluent BOD and ammonia-N concentration of ≤20 mg/L and ≤3 mg/L, respectively, when designed for combined BOD and ammonia removal. Tertiary nitrification systems have been designed to achieve effluent ammonia-N concentrations less than 1.0 mg/L.

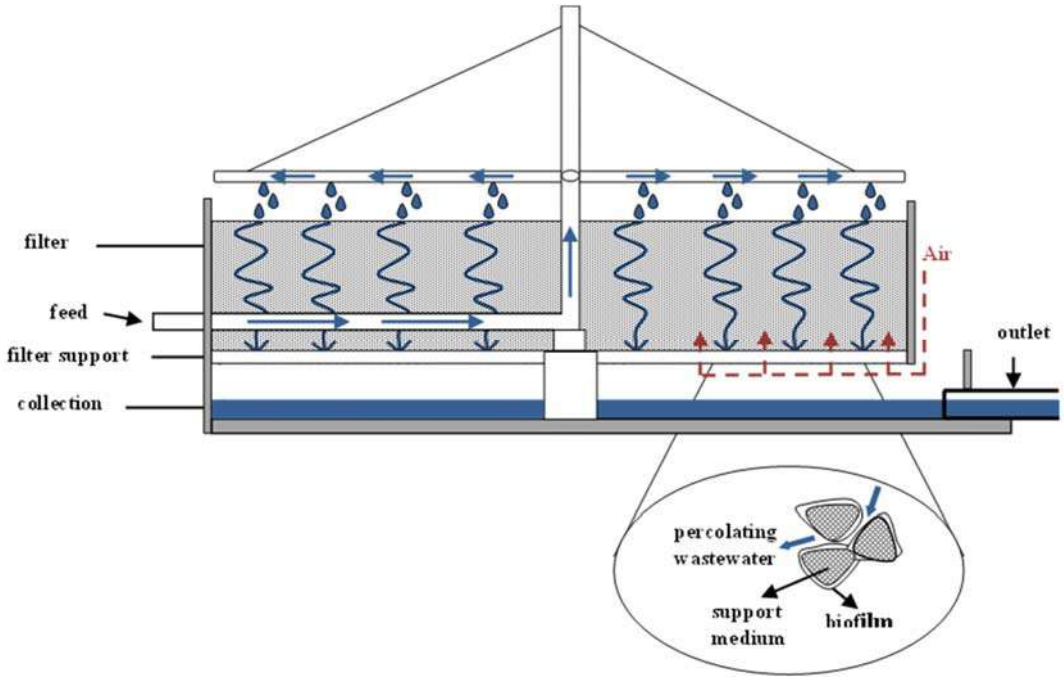


Figure 4-4 Schematic cross section of trickling filter

The use of the trickling filter process has the following advantages:

- Lower capital costs (since the filters are filled with plastic material rather than a sophisticated grid of fine bubble diffused aerators) and O&M costs (aeration is normally by natural ventilation) compared to Conventional Activated Sludge;
- Less energy required compared to CAS due to natural ventilation;
- Simpler and more stable operation compared to CAS, with no issues of mixed liquor inventory control and sludge wasting;
- No problems of bulking sludge in secondary clarifiers;
- Less equipment maintenance needs compared to CAS (typically limited to pumps);
- The process is very stable, with good recovery from shock toxic loads;
- The process requires modest operator skills;
- The costs of replacing the support material are modest;
- Low land requirements, similar to CAS;
- Possible energy production from the digestion of sludge, assuming primary tanks installed.

The use of trickling filter process has the following disadvantages:

- Difficulty in accomplishing biological nitrogen and phosphorus removal compared to single-sludge biological nutrient removal suspended growth design, and the production of an effluent with a higher suspended solids concentration than Activated Sludge treatment;
- Flies, worms and snails in trickling filters can be a nuisance but can be controlled through periodic high intensity hydraulic flushing, periodic flooding of the filter, or chemical treatment;
- The filters can be subjected to clogging if overloaded and not operated efficiently. In order to minimize the risk of filter clogging, a primary settler is needed before the trickling filter, which however increases the process sophistication;
- Relative dependence on ambient temperature (not relevant to Pakistan);
- Need of complete sludge treatment and disposal (but not as extensive as CAS);
- High head losses to lift the wastewater up to the level of the Trickling Filter.

Problems of the filter's flies

If the trickling filters are operated at flowrates substantially lower than design, there may be insufficient wetting of the filter support material, hence gaps occur in which filter

flies may breed and be-come a nuisance, *esp.* in the hot weather season experienced in Lahore – this is particularly a problem when the WWTP is located adjacent to residential areas. Although this was a problem when the filter media was crushed rock (and hence difficult to control the density of the packing), the problem is significantly reduced with the modern use of plastic material. The problem of filter flies may be dealt with via a range of operational methods, *e.g.:*

1. Utilize the new technology of plastic media rather than the old technology of crushed rock (the use of plastic material would be proposed in Lahore);
2. Maintain flowrate to each filter according to design to avoid gaps where filter flies may breed (this may require taking trickling filter units out of service when the WWTP operates at low capacity);
3. Periodic flooding of the filter at a standard time schedule which flushes out any filter fly eggs;
4. High pressure spraying of the filter media in areas which have become clogged;
5. Chemical sprays.

Note 1: The Trickling Filter process, including anaerobic digestion of sludge for biogas and electricity production, and the use of plastic media for improved wastewater treatment, was proposed for the Faisalabad WWTP project.

Note 2: A large-scale WWTP project is currently under construction in Karachi under "Greater Karachi Sewer-age Plan (S-III)" project. The project consists of multiple components, *incl.*: two trunk sewer lines; upgrade and capacity enhancement of 2 WWTPs and construction of a new WWTP. The revised PC-I of the project has been approved by ECNEC for an overall cost of Rs. 36,117.459 million (€180 million) on February 7, 2018. The funding of the project is on a 50:50 sharing basis between the Federal Government and Provincial Government. The existing trickling filter-based WWTP is located near the area of Haroon Abad in Karachi. The project is aimed at upgrade and capacity enhancement of the WWTP from 51 to 100 MGD (231 to 454 MLD). Rather than using modern plastic media, the conventional trickling filters utilize traditional gravel media. The WWTP covers *approx.* 40 ha of land. Main components of this WWTP include: Raw Wastewater Pumping Station; Gravity conduit from pumping station to WWTP; Preliminary treatment works, *incl.* screens and grit removal; Primary sedimentation tanks; Trickling Filters based on rock media; Secondary sedimentation tanks; Anaerobic digesters; and Sludge drying beds. Site photographs of the WWTP under execution are shown below:



Figure 4-5 Trickling filter unit with laid gravel at Haroonabad STP Karachi



Figure 4-6 Trickling filter unit under execution



Figure 4-7 viewof existing anaerobic digester

4.4.4 Rotating biological contractor

The Rotating Biological Contactor (RBC) process is a fixed film process similar to Trickling Filters, but not commonly used. It typically comprises pre-treatment (*incl.* screening and grit removal), primary clarification, RBC, which consists of a shaft surrounded by circular disks of polystyrene or polyvinyl chloride partially submerged in wastewater (typically 40%) upon which the biomass grows, secondary clarification and disinfection. The “humus” sludge from the secondary settling tanks is recirculated to the primary settling tanks and then removed by pumping it to primary and storage digesters. The primary settler tank effluent flows to the RBC where the shaft is rotated

by mechanical drivers and aeration is accomplished while the RBC disks rotate out of the wastewater. As for the trickling filters, sloughing episodes often occur in RBC.

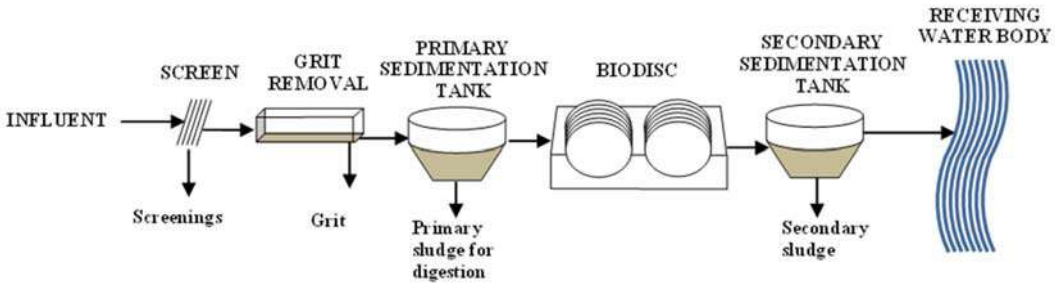


Figure 4-8 Flow scheme of biological contactor process (excluding sludge process)

RBCs provide combined treatment for BOD and ammonia. In particular, when the system is designed with multiple stages (typically two for BOD removal and six for nitrification) the effluent BOD_5 characteristics are comparable to well-operated activated sludge processes. Typically, the RBC process produces an effluent with a higher SS concentration than activated sludge treatment.

The use of the RBC process has the following advantages:

- Operationally very economical and efficient at low power consumption values (20-30% less energy consumption compared to Conventional Activated Sludge, CAS);
- Excellent sludge quality and low sludge volume index;
- The lack of recirculation makes the process less sophisticated;
- Low head loss;
- Some energy production possible from primary sludge.

The use of the RBC process has the following disadvantages:

- Not a common process compared to CAS, ponds or trickling filters;
- Operation and maintenance costs are relatively high, because operation requires a continuous power supply for the aeration process;
- Not all material might be locally available; motor and special material for rotation is required;
- Recirculation is normally not adopted; thus, the process lacks flexibility.

4.4.5 Conventional activated sludge

The conventional activated sludge (CAS) process comprises: pre-treatment (*incl.* screening and grit removal); primary treatment to remove settleable solids; aeration tank, in which the biomass responsible for organic matter degradation mixes with the wastewater (the mix is generally referred to as Mixed Liquor Suspended Solids, MLSS) and is kept in suspension and aerated by a blower and diffuser system (or surface aeration system); secondary clarifier, where the activated sludge settles; and optional disinfection of the secondary settler effluent. Return Activated Sludge (RAS) pumping station re-circulates most of the activated sludge from the secondary tank to the aerobic reactor. The Waste Activated Sludge (WAS) pumping station daily removes a small part of the biomass in order to keep the biomass in the system at a constant level. A complete sludge treatment system is needed for primary sludge and WAS. This includes thickening (*e.g.* centrifuge or picket fence thickening) of the WAS, stabilization (*e.g.* anaerobic digestion of primary sludge and possibly the thickened secondary sludge) and dewatering (*e.g.* belt filter press, centrifuge or drying beds).

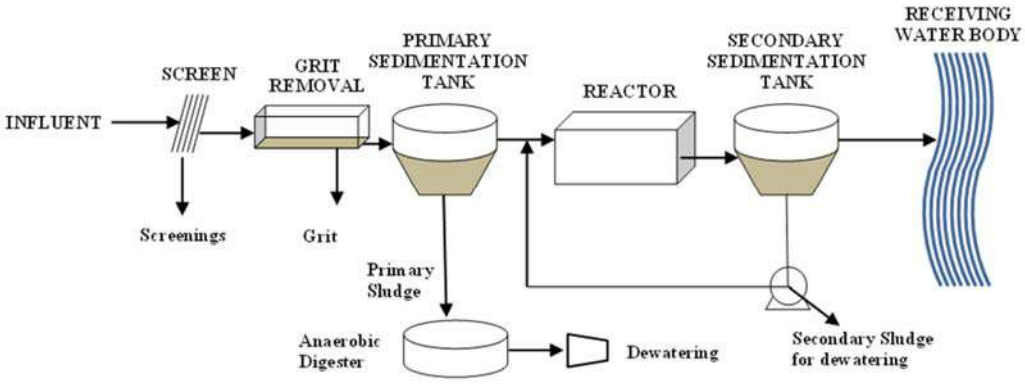


Figure 4-9 Flow scheme of conventional Activated sludge process

The aeration tank is designed based on short “sludge ages” and peak daily flowrates. The MLSS concentration in the aeration tank is typically between 2000 to 3000 mg/L. The BOD removal efficiency is superior (90-95%), and the clarity of treated effluent is high. Primary sludge is normally pumped to anaerobic digesters where biogas is produced and combusted in a Combined Heat and Power Plant (CHP) for production of electricity.

The use of CAS process has the following advantages:

- Low land requirements compared to extensive natural systems (e.g., Waste Stabilization Ponds or Aerated Lagoons);
- High operational flexibility: changes in the system can be achieved with a number of parameters (e.g., dissolved oxygen and aeration flowrates, RAS flowrate, WAS flowrate);
- The effluent quality is superior, high standard of BOD5 and ammonia removal are achieved, however nitrogen and phosphorus removal are modest – the process can be expanded to include nitrogen and phosphorus removal;
- The process is reliable if the maintenance program is followed, however greater attention is required compared to Trickling Filters;
- Low possibility of odours, insects and worms;
- Possible energy production from the digestion of sludge, assuming primary tanks installed;
- Plant expansion can be accomplished by adding fixed support material to increase biomass in the aeration tanks.

The use of CAS process has the following disadvantages:

- High construction and operation costs;
- High energy consumption, due to aeration requirements;
- High mechanization level;
- Relatively sensitive to toxic loads;
- Need for complete sludge treatment and disposal;
- Requires operation and maintenance by skilled operators;
- The process is susceptible to “filamentous sludge bulking”;
- The process requires primary sludge treatment, which adds to treatment process sophistication. In addition, the effectiveness of primary sludge treatment depends on the amount of influent settleable solids.
- Large sludge treatment facility is needed.

4.4.6 Oxidation ditch

The Oxidation Ditch process is a variation of the activated sludge procedure (but normally without primary treatment and no anaerobic digestion and biogas production) and comprises: pre-treatment (*incl.* screening and grit removal); aeration tanks which consists of a ring or racetrack-shaped channel equipped with mechanical

aeration and mixing devices that keep the activated sludge in suspension and promote unidirectional channel flow; and secondary clarifier. Return activated pumping station re-circulates the activated sludge from the secondary tank to the aeration tanks. When the wastewater passes through the aerators, the dissolved oxygen concentration increases, and is gradually depleted while the wastewater travels around the circuit. Accordingly, nitrification (high oxygen conditions) and denitrification (low oxygen conditions) are promoted in the basin. An anaerobic tank can be added prior to the ditch to enhance phosphorus removal; however, this is not a requirement for Lahore. The aeration tank is designed based on long sludge retention time (between 15 and 30 days) hence not requiring a primary treatment process.

The use of oxidation ditch has the following advantages:

- High reliable process; simpler operation than Activated Sludge;
- The BOD removal efficiency is better than the conventional method (up to 99%);
- Capable of treating shock/toxic loading loads without affecting the effluent quality;
- Use less energy than Extended Aeration;
- Adaptable to nutrient removal, although this requirement is not relevant in Lahore;
- High-quality effluent possible;
- Well-stabilized sludge and low biosolids production;
- Plant expansion can be accomplished by adding fixed support material to increase biomass in the aeration tanks.

The use of Oxidation Ditch has the following disadvantages:

- Requires more aeration energy than Conventional Activated Sludge process (which typically has anaerobic digestion and biogas production);
- Requires larger land area compared to other activated sludge treatment options due to the longer sludge age (and larger aeration tanks);
- Large sludge treatment facility is needed;
- Normally no primary tanks hence no biogas nor energy production from the sludge, however, the Oxidation Ditch process can be modified by installing primary tanks and digesting sludge for biogas production, however this loses the advantage of simplicity compared to Conventional Activated Sludge. The process aerobically digests the biomass, hence anaerobic sludge digestion and energy production is inefficient and not normally practiced.

4.4.7 Extended Aeration

The extended aeration process is a variation of the activated sludge procedure. The only difference between the flow scheme of Conventional Activated Sludge (CAS) and Extended Aeration, is that the latter normally omits the primary treatment), similar to Oxidation Ditch except with greater flexibility in the shape of the aeration tank). Whilst the Extended Aeration process does not include anaerobic digestion of sludge, it includes aerobic digestion of sludge (no biogas production).

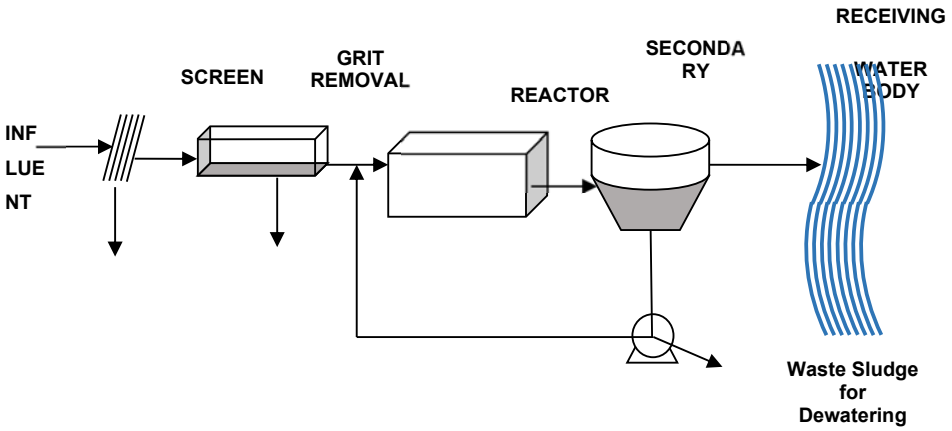


Figure 4-10 Flow Scheme of Extended Aeration

The process is operated at low organic BOD loading, long Sludge Retention Times (SRT of 20 to 30 days), and excess oxygen concentration in order to aerobically stabilize the sludge. In these conditions, nitrification is expected, the excess sludge production is lower and already well-stabilized. According to this process, the sludge treatment only requires thickening/dewatering (*e.g.* beltfilter press, centrifuge or drying beds). The MLSS concentration in the aerobic tank is typically between 3000 to 5000 mg/L which is higher than the CAS process. The aeration basins are designed based on long sludge ages and hence average daily loads.

The use of extended aeration has the following advantages:

- High operational flexibility: changes in the system can be achieved with a number of parameters (e.g. dissolved oxygen and aeration flowrates, Return Sludge (RAS) flowrate, Waste Activated Sludge (WAS) flowrate);
- The effluent quality is higher than the CAS process. High standard of BOD5, ammonia and nitrogen removal are achieved, and the process can be modified to

achieve phosphorus removal. The higher effluent standard contributes to lower disinfection costs (if applied);

- The process does not require primary treatment and this simplifies the treatment process;
- The process produces well-stabilized sludge and in a lower amount compared to CAS;
- The sludge treatment does not need further stabilization; High resistance to variations in load and to toxic loads; Plant expansion can be accomplished by adding fixed support material to increase biomass in the aeration tanks.

The use of extended aeration has the following disadvantages:

- High construction and operation cost;
- Energy consumption higher than CAS;
- High mechanization level (although lower than CAS);
- Need of sludge treatment (although stabilization is not necessary);
- The process requires high operator skills (similar but lower than activated sludge);
- Normally no primary tanks hence no biogas nor energy production from the sludge, however, the Extended Aeration process can be modified by installing primary tanks and digesting sludge for biogas and electricity production, however this loses the advantage of simplicity compared to Conventional Activated Sludge. The process aerobically digests the biomass; hence energy production is inefficient and not normally practiced.

Note: Due to the very high standard of treated effluent to meet strict nutrient discharge standards, the Oxidation Ditch process is very popular on an international basis, although is now coming under scrutiny due to the high-power consumption and lack of opportunity for biogas and electricity production.

4.5 SLUDGE TREATMENT PROCESS ALTERNATIVE

Sludge management typically consists of sludge thickening (typically to 3-5% solids), following by sludge dewatering (typically to 15-25% solids), and subsequent drying (to 40% solids).

- Sludge Thickening

Option 1: Dissolved Air Flotation

DAF is effective in thickening of sludge by introduction of microscopic air bubbles which adheres to in-coming solids and from a buoyant blanket. This blanket rises to the surface of the DAF tank and is removed by mechanical means.

Option 2: Gravity Thickener

This conventional means of thickening utilizes the natural tendency of higher density solids to settle down in the liquid to concentrate the solids. Gravity thickeners consist of circular tank with conical bottom fitted with centrally driven scrapers.

Option 3: Gravity Belt

It works on the principle of separating liquids from solids by gravity drainage through a porous filter cloths and belts through a system of rollers.

The following table compares the options for sludge thickening:

Table 4-2 Comparison of sludge Thickening process

Sludge Thickening Equipment	**Gravity Thickener**	**Dissolved Air Flotation (DAF)**	**Gravity Belt**
Performance	Moderate	Efficient	Efficient
Solids Recovery Rate	80 – 90 %	95%	95%
Capital Expense	High	Moderate	Moderate
Footprint	Large	Moderate	Moderate
Civil / Building	Moderate	High	High
Operational Expense	Very High	Moderate	Moderate
Chemicals	None	None	High
Electrical	Low	High	Moderate
Power	Low	Moderate	Moderate
Easiness of O&M	Convenient	Convenient	Convenient

Recommendation:

The gravity thickener is commonly used for sludge thickening and utilizes limited power. It is recommended to apply gravity sludge thickening.

- Sludge Dewatering

Dewatering of sludge is required to reduce the sludge volume so as to reduce the footprint for sludge disposal yard at the WWTP and the number of trucks for final sludge disposal.

Option 1: Belt Press

The belt filter press works on the principle of separating liquids from solids by press through porous filter cloths and belts through a system of rollers.

Option 2: Centrifuge

The centrifuge utilizes the centrifugal force for the separation of solids from liquid due to the different densities. Usually solid-bowl centrifuges with differential scroll drives are used for sludge dewatering.

Option 3: Screw Press

Screw press is a mechanical system in which dewatering is accomplished by gravity drainage at the inlet end of the screw and then by reducing the volume as the sludge being dewatered is being conveyed from the inlet to the discharge end of the screw press.

Option 4: Volute Dewatering Press

Solids are separated directly from liquid by a filter element that consists of two types of rings. Fixed rings, moving rings and a screw thrust, squeeze, transfer and press the filter element and the sludge.

Table 4-3 Comparison of Dewatering Equipment

Dewatering Equipment	**Centrifuge**	**Belt Press**	**Screw Press**	**Volute Dewatering Press**
Performance	Moderately Efficient	Moderately Efficient	Moderately Efficient	Moderately Efficient
Dewatered Cake Solid	18 – 20 %	18 – 20 %	18 – 20 %	18 – 20 %
Solids Recovery Rate	95%	95%	95%	95%
Capital Expense	Very High	High	Moderate	Moderate
Footprint	Moderate	Large	Moderate	Moderate
Civil/Building	Moderate	High	Moderate	Moderate
M&E	Moderate	Moderate	Moderate	High
Operational Expense	High	High	Very High	Very High
Chemicals	Moderate	Moderate	Moderate	Moderate
Electrical	High	Moderate	Low	Low
Wash Water	Moderate	High	Moderate	Low
Ease of Maintenance	Convenient	Moderately Convenient	Convenient	Highly Convenient

Recommendation:

The table above shows the comparison of dewatering equipment. The belt filter press or centrifuge are the most common sludge dewatering processes and have a compact footprint. It is proposed to utilize centrifuge for the sludge dewatering.

- Sludge Digestion

Sludge stabilization is a treatment technique applied to biological sludge to reduce its odour causing or toxic properties. This treatment often reduces the amount of solids

as a side effect. Anaerobic and aerobic digestion, lime treatment, chlorine oxidation, heat treatment and composting fall into this category.

Option 1: Anaerobic Digestion

Anaerobic digestion takes place in an enclosed tank. Sludge solids are decreased due to the conversion of biomass to methane and carbon dioxide. The resulting biogas (typically 65-70% methane) can be recovered for its heating value.

Option 2: Aerobic Digestion

Aerobic digestion is the separate aeration of sludge in an open tank. Oxidation of biodegradable matter, including cell mass, occurs under these conditions. As compared to anaerobic digestion, there is a decrease in sludge solids, and the sludge is well stabilized with respect to odour formation. Capital costs are lower than those for anaerobic digestion, but operating costs are higher, and there is no biogas by-product production.

Option 3: Lime Treatment

Stabilization by lime treatment does not result in a reduction of organic matter. Addition of sufficient lime to maintain the pH of the sludge above 11.0 for 1-14 days is considered sufficient to destroy bacteria. It requires extensive amounts of chemical addition and results in a product which cannot be used for agricultural re-use.

Option 4: Sludge Conditioning

The purpose of sludge conditioning is to provide a rigid sludge structure of a porosity and pore size sufficient to allow drainage. Biological sludges are conditioned with iron chloride, lime, and synthetic cationic polymers, either separately or in combination. Heat conditioning and low-pressure oxidation are also used for biological sludges. Inorganic sludges are conditioned with iron chloride, lime, and either cationic or anionic polymers. Conditioning is necessary due to the nature of the sludge particles. Both inorganic and organic sludge consist of very small (colloidal), intermediate and large particles. The large particles, or flocs are usually compressible. Under an energy gradient, these large flocs compress and prevent water from escaping. The pressure drops through the sludge cake, due to the decrease in porosity and pore sizing, exceeds available energy and dewatering ceases.

Recommendation:

Anaerobic digestion is typically used for stabilization of the sludge, and produces biogas for combustion and electricity production. It is recommended to utilize anaerobic sludge digestion for sludge stabilization.

- Sludge Disposal

Disposal of the sludge generated by WWTPs is dependent on government regulations, geographical location, and sludge characteristics, among other things. Final wastewater sludge disposal methods include reclamation, incineration, land application, landfill, *etc*.

Option 1: Reclamation of Sludge

Biological sludge can be disposed of by incineration; the carbon, nitrogen and sulphur are removed as gaseous by-products, and the inorganic portion is removed as ash. Old landfill sites are filling up and new ones are becoming increasingly difficult to obtain. Therefore, waste reduction through incineration is becoming a favoured disposal practice for large-scale WWTPs. Sludge incineration is a two-step process involving drying and combustion. Incineration of waste sludge usually requires auxiliary fuel to maintain temperature and evaporate the water contained in the sludge. It is critically important to maintain a low and relatively constant sludge moisture.

Option 2: Land Application

Sludge produced from biological oxidation of wastes can be used for land application as a fertilizer or soil conditioner. A detailed analysis of the sludge from industrial waste is important in order to evaluate toxic compound and heavy metal content, leachate quality, and nitrogen concentration. Soil geology, and climate characteristics are all important considerations in determining the suitability of land application, along with the type of crops to be grown on the sludge-amended soil. Sludge application rates vary according to all of these factors.

Option 3: Landfill Site

Landfill is a common method of WWTP sludge disposal, however it does contribute to early filling of the landfill. Care must be taken to avoid pollution of groundwater. The movement and consequent recharge of ground water is a slow process, so

contamination that would be very small for a stream or river can result in irreversible long-term pollution of the ground water. In addition to impermeable liners, leachate collection and treatment system are typically required for new and remediated landfills.

Recommendation:

Direct use of the sludge for agriculture is the least cost option and the most common method on an international basis. There is considerable agricultural land available adjacent to Kattar Bund WWTP site. Sludge re-use in municipal top-soil application is also suitable. A long-term sludge storage facility is also recommended to store sludge on-site.

4.6 QUALITATIVE ANALYSIS

The EU discharge standards are quite strict, however the Pakistani NEQS/PEQS effluent standards are not so strict. Since all the wastewater treatment options would be able to comply with both the EU and NEQS BOD and SS effluent standards, in this situation the weight of economic factors is considered more influential than the plant performance. Another critical parameter in Lahore is the treatment simplicity. It is crucial to recommend a wastewater treatment option appropriate to the technical experience likely to be available within WASA-L. Suggesting a wastewater treatment process which is too sophisticated might compromise the successful treatment implementation. Further, the land requirement is a crucial parameter because it is a key constraint within the WASA's service area in Kattar Bund. Note: there are risks that the adjacent areas immediately to the north and south of the Kattar Bund catchment may be re-directed to Kattar Bund in the future. The Punjab University also has substantial agricultural land which may be re-zoned in the future. There are also lands adjacent to the Kattar Bund WWTP which may be urbanized in the future, and wastewater directed to the Kattar Bund WWTP site, consequently the site should be designed with flexibility to allow future stages of the WWTP to be constructed.

Table 4-4 Qualitative Comparison of Different WWTP

	Criteria	Stabilization Ponds	Aerated lagoons	Trickling Filter	Activated Sludge	Oxidation Ditch
Plant Performance	BOD and SS Removal	1 Fair	2 Good	3 Good	4 Good	5 Good

Economic factors	Simple & cheap construction	5 Good	4 Fair	3 Poor	1 Poor	2 Poor
	Simple operation	5 Good	4 Fair	3 Fair	1 Poor	2 Fair
	Land requirement	1 Poor	2 Poor	3 Good	4 Good	5 Good
	Maintenance costs	5 Good	3 Poor	4 Fair	1 Poor	2 Poor
	Energy demand	5 Good	3 Poor	4 Fair	2 Poor	1 Poor
	Sludge removal costs	5 Good	4 Fair	3 Fair	1 Fair	2 Fair
Environment factors	Future land availability	1 Poor	2 Poor	3 Good	4 Good	5 Good
	Net GHG production	1 Poor	3 Poor	5 Good	4 Fair	2 Poor
	Energy recovery	5 Good	2 Poor	4 Good	3 Fair	1 Poor
Summary of ranks (Highest ranking is best)		**34**	**29**	**35**	**25**	**27**

Green = Good: Orange = Fair; Red = Poor.

The following are noted:

- The Trickling Filter process and Waste Stabilization Ponds process rank very high on a qualitative basis. Trickling filter process is slightly higher, *esp.* due to the lower land area and the neutral power consumption and hence reduced climate change impacts.
- Waste stabilization ponds ranks as next best process. However, their use at the Kattar Bund site is not suitable because of the high land requirements (over 50ha for the first phase of investments).
- Aerated lagoons suffer from high power costs and high land requirements and hence are not suitable (25-30ha). This process provides no flexibility for the site to be expanded in the future.
- Oxidation ditches and extended aeration suffer from extensive power and O&M costs.
- Activated Sludge suffers from high demands for maintenance due to the sophisticated treatment process. Although the power consumption is high,

typically half of the power consumed is recovered by anaerobic digestion and biogas production.

4.7 QUANTITATIVE ANALYSIS

The publication "A critical analysis of economic factors for diverse wastewater treatment processes: case studies in Thailand" (Singhirunnusorn & Stenstrom, 2010) is the most recent assessment comparing land requirements, capital costs and O&M costs (*incl.* equipment replacement and power recovery for sludge digestion) for a range of treatment processes commonly utilised in the region. This includes "Waste Stabilisation Ponds", "Aerated Lagoons", "Conventional Activated Sludge" and "Oxidation ditches". To estimate the Trickling Filter land requirements, similar values to activated sludge are suitable, whereas for capital costs, the expected values for trickling filters lie in the cost range between aerated lagoons and oxidation ditches. Similar assessment in Saudi Arabia comparing Trickling Filters with Activated Sludge and Oxidation Ditch has been used to confirm the cost estimates. Further, the Batumi WWTP (Georgia) uses a Trickling Filter process and has a similar size to the Kattar Bund WWTP project; the project cost was used to confirm the cost estimate. For O&M costs, trickling filters are similar to aerated lagoon. The following table may be used to compare the options.

Table 4-5 Basis for Comparison of Alternatives

Process	Land Requirements	Capital Costs	O&M Costs
	(m^2)	(US$ million)	(US$ million/year)
Activated Sludge	$L = 1.467 \times Q^{0.985}$	$C_c = 0.0031 \times Q^{0.881}$	$C_{O\&M} = 0.0529 + 1.31\times10^{-5} F$
Oxidation Ditches	$L = 183.398 \times Q^{0.513}$	$C_c = 0.0017 \times Q^{0.910}$	$C_{O\&M} = 0.0963 + 1.02\times10^{-5} F$
Aerated Lagoons	$L = 9.876 \times Q^{0.940}$	$C_c = 0.0143 \times Q^{0.681}$	$C_{O\&M} = 0.0607 + 3.31\times10^{-6} F$
Waste Stabilization Ponds	$L = 127.736 \times Q^{0.762}$	$C_c = 0.0004 \times Q^{1.060}$	$C_{O\&M} = 0.018 + 4.03\times10^{-6} F$

Note: Q is the design flowrate (m^3/day); F is the actual flowrate (m^3/day).
Source: Singhirunnusorn & Stenstrom, 2010

To compare all options on the same basis, the land costs are also to be included[1]. Further, a flood protection bund is required for the site, consequently the extra cost for the Aerated Lagoons (and Waste Stabilization Ponds) is to be included. Applying the above formulae and adjusting for inflation to 2022 figures, and including the cost for land and protection bund, a summary of the WWTP characteristics is presented in the table below, based on a range of treatment plant capacities.

Table 4-6 Cost with Land requirement.

Process	Land Requirement			Capital Costs			O&M Costs		
	(ha)			(EUR million)			(EUR million/year)		
	50MLD	75MLD	100MLD	50MLD	75MLD	100MLD	50MLD	75MLD	100MLD
Activated Sludge	6.2	9.3	12.3	48.36	69.16	89.14	0.79	1.16	1.52
Oxidation Ditches	4.7	5.8	6.7	36.3	52.4	68.01	0.68	0.96	1.25
Aerated Lagoons	25.8	**37.8**	**49.5**	30.85	44.1	56.5	0.25	0.35	0.44
Trickling filter	6.2	9.3	12.3	31.16	43.47	55.12	0.25	0.35	0.44
Waste Stabilization Ponds	**48.6**	**66.2**	**82.5**	48.96	73.51	98.43	0.25	0.36	0.47

The following conclusions are made:

- CAPEX: Activated Sludge and Waste Stabilisation Ponds are the most expensive wastewater treatment process with regard to capital costs, followed by Oxidation Ditch, Trickling Filter and Aerated Lagoons. The lowest CAPEX options of Aerated Lagoons and Trickling Filters are very similar.
- OPEX: Activated Sludge is the most expensive treatment with respect to O&M costs, followed by Oxidation Ditch, and then Waste Stabilisation Ponds, Trickling Filters and Aerated Lagoon;
- LCC: The treatment processes ranking according to Life-cycle Costs (Total Capitalised Costs) is the following (from the most expensive to the cheapest option): Activated Sludge, Waste Stabilisation Ponds, Oxidation Ditches, Trickling

[1] Based on unit land costs of 8 million Rs/acre (Rs. 1.2 Billion/150 acres) at the Kattar Bund site, the land costs are also included.

Filter and Aerated Lagoons. The lowest LCC options of Aerated Lagoons and Trickling Filters are very similar.

- The total cost for Trickling Filter is estimated to lie in the range between the cost for Oxidation Ditches and Aerated Lagoons, as confirmed by costs from Batumi (similar size to Kattar Bund WWTP) and Saudi Arabia (large-scale).

Recommendation:

Taking into account the comparison of treatment processes, the Trickling Filter process is the preferred option due to low capital and O&M costs, as well as low land requirements, and meets the NEQS standards. The Trickling Filter process provides the lowest Life-cycle Cost option *meeting land availability*. Additional stages of the Trickling Filter can be constructed to service adjacent and future development in the future. It requires modest technical skills, with the key mechanical equipment being pumps, hence would be within the scope of WASA-L staff to operate. The Consultant recommends to acquire 150 acres of land keeping in view the future expansion and buffer zone for nearby localities.

4.8 PREFERRED TECHNOLOGY

In order to select the most appropriate treatment method for the Kattar Bund WWTP, both plant performance and economic parameters must be taken into consideration. The following criteria are normally applied:

- BOD and SS removal
- Simplicity
- Land Requirement
- Construction cost
- O&M cost
- Power consumption
- Sludge Removal cost

According to the qualitative assessment, Trickling Filters are considered the most adequate wastewater treatment process in Kattar Bund. The next section compares the capital costs (CAPEX), equipment replacement costs and operating costs (OPEX) for typical treatment processes, and also considers the cost of flood protection works and the 50m vegetated buffer zone.

Note: In Faisalabad, the JICA Sewerage Master Plan compared a range of treatment processes and concluded that waste stabilization pond was the best option, assuming land could be acquired. In the situation where sufficient land was not available, Trickling Filters was the next best option.

To minimise O&M costs, the use of primary sedimentation tanks (PST) is the preferred method for primary sludge collection, with anaerobic digestion to produce biogas and subsequent combustion to produce power which runs the WWTP. It is noted that, on an international basis, unit power costs are very low in Pakistan which distorts the life-cycle costing of biogas systems. However, in the future, it is expected that unit power costs will rise in order to recover the costs of providing municipal services to more typical levels found in Asia.

Note: The main reason why Trickling Filters have fallen out of favour in the European context is be-cause there are higher demands for the removal of the nutrients nitrogen and phosphorus from the effluent. Waste stabilization ponds, aerated ponds and trickling filters tend to be not flexible with the removal of nutrients, however this is not so relevant in the Asian context, including in Pakistan. In contrast, Conventional Activated Sludge is very good at removing ammonia, and the Oxidation Ditch and Extended Aeration processes are also very effective at removing nitrogen and phosphorus, which is particularly relevant where the receiving waters are very sensitive to eutrophication. In an Asian context, with the opportunity of reusing effluent for irrigation, normal levels of nutrients in the treated effluent may be advantageous, including in the Kattar Bund catchment where treated effluent will be discharged to the Irrigation canal for agricultural re-use.also

1. Large area requirement, along with nuisance issues and probability of ground water contamination issues makes the WSP options unsuitable.
2. ALs requiring comparatively large areas and nuisance problem make it a less desirable option.
3. Trickling Filters require less area and produce a good quality of treated effluent. Power consumption is modest due to the intrinsic low power consumption and the opportunity for power reduction from biogas production (possibly resulting in self-sufficiency). The use of modern and efficient plastic media has improved the treatment efficiency and overcome previous problems with clogging of the rock media which provided a habitat for nuisance filter flies. It is a suitable option for

the Kattar Bund site area but odour issues from anaerobic digestion must be managed.

6. ASP require less area and produce a high standard of treated effluent, but at high O&M cost die to high aeration requirements (reduced due to biogas production). It is a suitable option for the Kattar Bund site area but odour issues from anaerobic digestion must be managed.
7. Oxidation Ditch system requires less area and produces a high-quality effluent (including nutrient removal) and low sludge odours (no anaerobic digestion) but at considerable O&M cost due to high aeration requirements and low opportunity for biogas production.

5 DESCRIPTION OF THE ENVIRONMENT

5.1 GENERAL

An environmental baseline study is intended to establish a data base against which potential impacts can be predicted and managed later. The existing environmental conditions around the proposed project have been considered with respect to physical, biological and socio-economic aspects. A site visit was conducted to survey the field area and to collect environmental data on physical, biological and socioeconomic parameters from area of influence AOI shown below in **Figure 5.1**. Further, interviews were held with the general public and stakeholders of the areas adjacent to the project area in order to seek the public opinion on the implementation of the proposed action.

A review is made of locally existing resources that are inclusive and those which are exclusive to the probability of getting affected by the execution of the project. Much of the information on the topography and land use, geophysical, climate and water resources came from published literature and previously conducted studies. The information given in the sections on air, sound, soil, and water quality is the result of detailed surveys conducted specifically for this EIA.

5.2 METHODOLOGY

The methodology employed to collect the baseline data and information regarding the social structure and various related parameters as discussed in sub-sections below:

5.2.1 Data Collection

The primary data was collected by visiting the project area and its nearby communities. The secondary data regarding physical parameters (topography, geology, seismology, and climate) was obtained by visiting relevant various government departments and their official websites. The biological parameters such as flora and fauna were studied by preparing a floristic list based on visual observation and fauna was studied by using opportunities approach. The species were recorded with reference to their existence in the project area. Information on wildlife fauna specie (mammals, amphibians, reptiles, birds, etc.) in the assessment area was compiled based on opportunistic observation, gathering the existing information and consultation with local experts, community members, government and Non-Government Organizations (NGOs). The socio- economic aspects were studied and analyzed by conducting socio-economic surveys.

5.2.2 Social Surveys

The purpose of social survey was to record the socio – economic conditions of people residing in the study area and to assess the expected project impacts on their life, subsistence systems and socio – cultural values. Prior to conducting the field surveys, the following steps were taken:

- Clear boundaries of the project area were identified.
- The sampling procedure in order to draw a representative sample size of the target population and households were designed.
- The tools for data collection i.e. questionnaires to access the socio-economic status of the area were developed.

5.2.3 Sampling Design

Social baseline data of the persons residing in the study area has been estimated and collected through random sampling by using pre-developed questionnaires.

5.2.4 Questionnaires

In order to test the validity and reliability of the proposed questionnaires, they were reviewed to assess whether questions needed to be clarified, changed or re-sequenced and then a final editing of questionnaires was conducted prior to their application in the project area. The sample of socio-economic questionnaires used is attached as **Annex** of this EIA Report.

5.2.5 Data Editing and Analysis

The filled questionnaires and recorded information were compiled by the same field investigators who were involved in the data collection. This was done immediately after completing the field investigations and the data sets were processed accordingly. Analysis of the data and preparation of conclusions in the minimum possible time was done using statistical techniques of data analysis.



Figure 5-1 Area of Influence of the Project (AOI)

5.3 PHYSICAL ENVIRONMENT (BASELINE CONDITIONS)

Baseline conditions refer to the existing physical, environmental and socio-economic status of project and study area. Based on baseline information, the project interventions are assessed, and mitigation measures are proposed accordingly. The baseline information also helps to indicate the specific issues to be monitored during renovation & installation and operational phases of project development. The baseline data (physical, biological and socio-economic parameters) related to project and study area is described in sub-sections below. Information provided is based on primary and secondary data collected by site visits, desk studies and consultation with locals respectively. This section gives the overview of the topology, geology, seismology and meteorological conditions whereas, it gives detailed information about following; surface water, ground water (if present in the project area vicinity) and air quality of project area. The detail of each parameter is discussed in sub-sections below.

The physical environment consists of existing land use at the project site including geology, pedology, hydrology, meteorology and climatology. The pre-project condition (i.e. baseline) of these components of the physical environment is described in detail. To identify the potential impacts on the physical, biological and socio-economic environment that is likely to arise from the project activities.

5.3.1 Topography & Geology

Lahore lies at an elevation of *approx.* 217m above sea level; it is generally flat and slopes towards the south and south-west. Wind direction is predominantly north-west, however during the monsoon season it is south-east. The Lahore metropolitan area comprises Early Pleistocene to Recent silty loess and silty clay deposits of the Ravi River. Foundation conditions are generally good.[2]

[2] Igbal, S.M., Ahmed, S., & Rashid, S. (2001). “Urban geology and environmental problems of Lahore city, Pakistan”. Journal of Nepal Geological Society. 23.



The Ravi River is transboundary with India and flows southwards on the western side of the city. Under the Indus Water Treaty (1960) between India and Pakistan, the waters of the Ravi and two other rivers were allocated to India. In 1988, Lahore experienced extreme floods from the Ravi River, causing substantial economic loss. In 2001, India constructed the Thein Dam upstream. Since then, the Ravi River flow has decreased substantially. The Shahpur Kandi Dam is also under construction downstream of the Thein Dam within India. The Ravi Urban Development Authority (RUDA, www.ruda.gov.pk) manages the Ravi River Embankment Project with the objective to improve the river environment adjacent to Lahore.

The area of interest for the current Feasibility Study is the Kattar Bund catchment, and the site for the Kattar Bund WWTP has already been identified by WASA-L which is currently going through the land acquisition process from private owners. The site is 150 acres (60ha) in size and is generally flat and at an elevation of *approx.* 208m above sea level. Also, topo survey of the project is shown in the **figure below**.

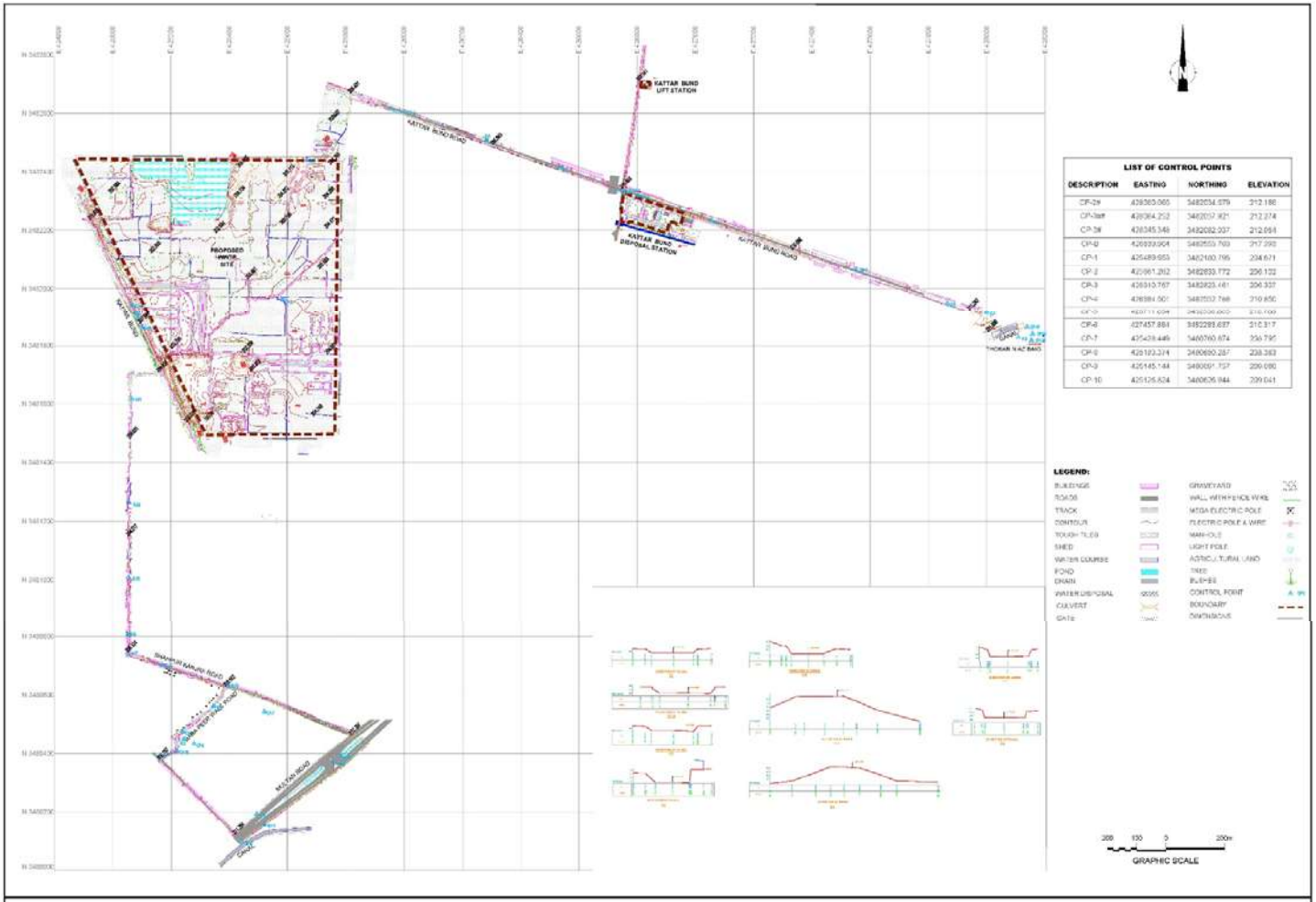


Figure 5-2 Topographic map of study area

5.3.2 Soil and Geotechnical Features

The area consists of young flood plain deposits comprising a few meters thick cover of very fine sand, Silt and Silty Clay. The area shows older features of Channel, meanders, scars and levees. The project area falls in the zone of Urban flooding, and flooding limits are very close to the proposed site. Medium to coarse loose sands are present in the vicinity of the project area at the surface, while at the subsurface it converts into dense to very dense consistency, with an increasing trend with increasing depth. Such loose sandy soils are present along the channel of the present status of River Ravi.

Swamps are also scattered along the river Ravi, consisting of fine sand, silt and minor bodies of the Silty Clay as Channel fillings and Clay plugs.

Older flood plain deposits can also be observed near Sheikhupura and Muridke comprising of fine to medium grained sand, silt and clay deposits; thickness of these deposits is from 6m to 12m. There are indications of the older flood plains also present at the project site which are to be investigated in detail during the proposed Geotechnical Investigation plan.

In the vicinity of the project area, earthy brown to brown silt, clay and sandy soils are present in which silt beds are largely hard laminated and sandy with interbeds of clay with layers or lenses of sand while base of the unit is not exposed.

Terrain of the proposed project site is generally flat. Sub-surface soils existing at the site belong to alluvial deposits transported by the rivers. These soils predominantly consist of Clayey Silt and Medium to Coarse Grain Sand with Silt, with few swamps as mentioned above.

A detailed geotechnical study will determine the surface and sub-surface conditions at the proposed project site and the physical, mechanical and chemical properties of the project site are to be evaluated in order to provide the structural engineer with sufficient information for the design of the most suitable and safe foundation. For this purpose, few drillings and other Geotechnical/Soil Investigation studies plan have been established and will be undertaken to support the Preliminary Engineering Design. During same proposed works, all necessary field and laboratory tests are to be executed for accurate classification of the project area surface and sub-surface soils. By the same proposed works, foundation depth and type would also be

evaluated. Surface and sub-surface water conditions would also be evaluated which would be very helpful for selection of the safe foundation depth and type.

Following are selected project photographs which reflect different soil types as discussed above at the project site with ongoing activities.



Figure 5-3 Site Photographs showing different types of soil

5.3.3 Seismology

According to seismic zoning of Pakistan, the project area lies in minor to moderate damage prone area. Distant earthquakes may cause damage to structures with fundamental period greater than 3 second corresponds to “Intensity V and VI of the M.M scale” (National Disaster Management Authority). The seismic zoning of Pakistan is given in figure below:

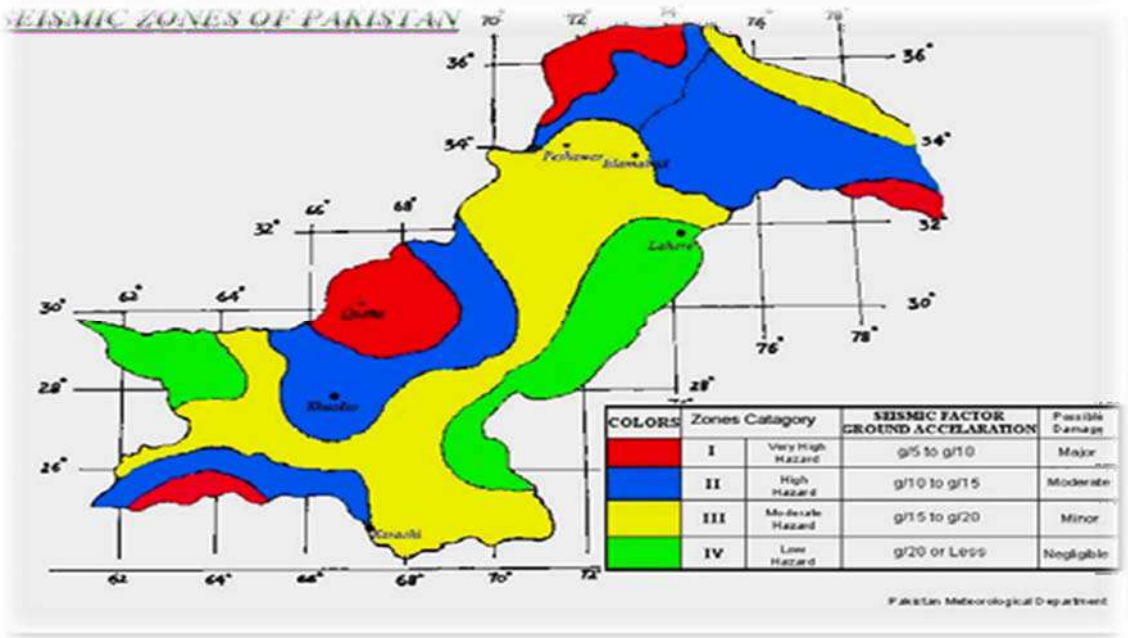


Figure 5-4 Seismic Zone of the Pakistan

5.3.4 Geography of project Area

Lying between 31°15′—31°45′ N and 74°01′—74°39′ E, Lahore is bounded on the north and west by the Sheikhupura District, on the east by the Indian Border at Wagah, and on the south by Kasur District. The Ravi River flows on the northern side of Lahore. Lahore city covers a total land area of 1014 square kilometers (391.50 sq mi).

5.3.5 Climate and Meteorology

Lahore has a semi-arid climate not receiving enough rainfall to feature the humid subtropical climate. The hottest month is May where temperatures routinely exceed 42°C (107F). The monsoon season starts in late July, and the wettest month is August with heavy rainfalls and evening thunderstorms with the possibility of cloudbursts and flash floods. The coolest month is January with dense fog.

The city's record high temperature was 52.8°C (127.1F), recorded on 5 June 2003. 48 °C (118 °F) was recorded on 10 June 2007. At the time the meteorological office recorded this official temperature in the shade, it reported a heat index in direct

sunlight of 55 °C (131 °F). The highest rainfall in a 24-hour period is 221 millimeters (8.7 in), recorded on 13 August 2008. 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 270C to 470C. The winter seasons lasts from November to March, with mean minimum and mean maximum temperature ranges from 20C to 18 0C.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 420C. 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.

iv) **Winter Season** Winter refers to the period from December to January. The lowest temperature is less than 20C, 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 24.50C. 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.

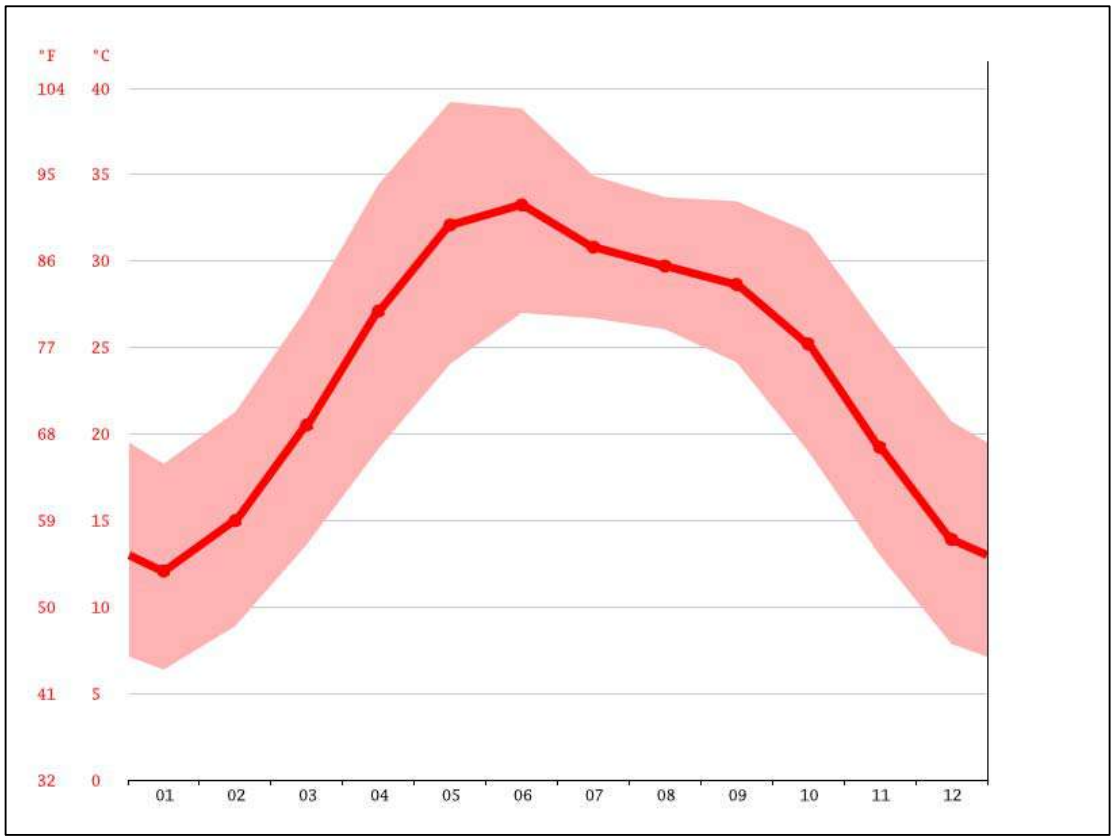


Figure 5-5 Average temperature of the Lahore.

(Source Lahore climate: Average Temperature, weather by month, Lahore weather averages - Climate-Data.org)

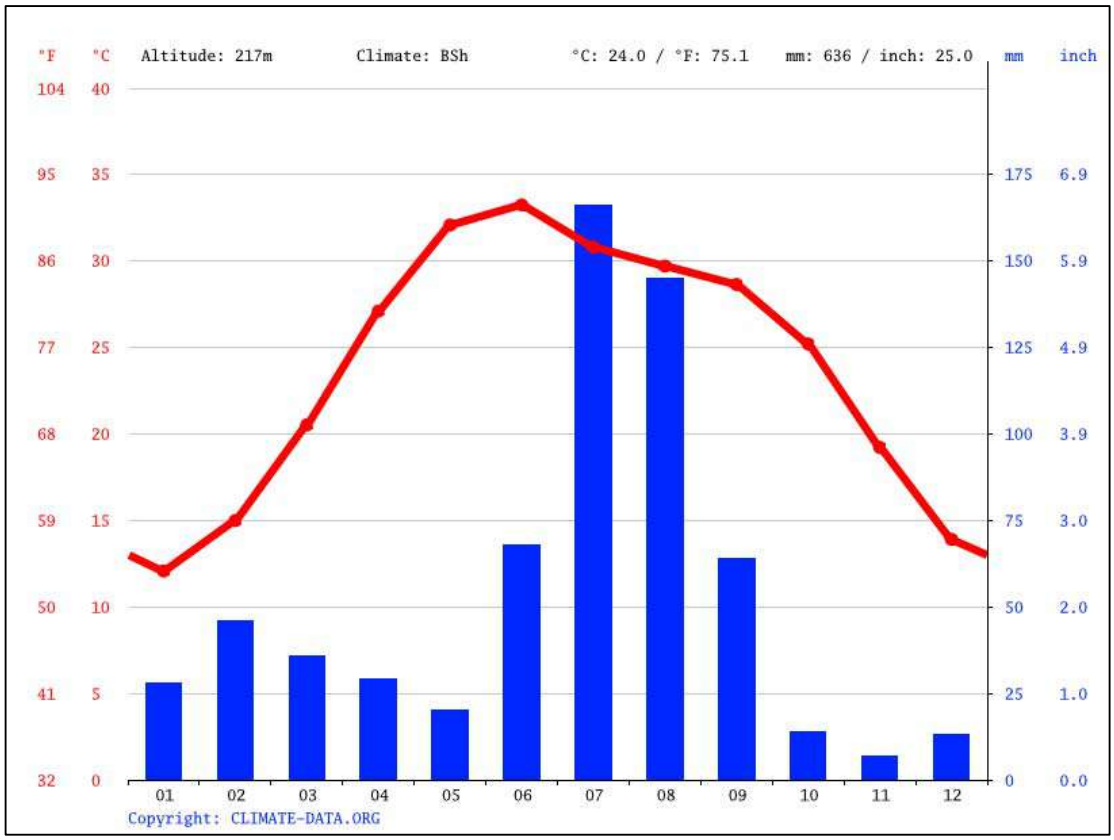


Figure 5-6 : Climate graph for Lahore

(Source: Lahore climate: Average Temperature, weather by month, Lahore weather averages - Climate-Data.org)

Table 5-1 Monthly climate characteristics in Lahore

	January	February	March	April	May	June	July	August	September	October	November	December
Av. Temp.	12.1 °C	15 °C	20.5 °C	27.1 °C	32.1 °C	33.2 °C	30.8 °C	29.7 °C	28.6 °C	25.2 °C	19.2 °C	13.9 °C
°C (°F)	(53.7) °F	(59) °F	(68.9) °F	(80.8) °F	(89.8) °F	(91.8) °F	(87.4) °F	(85.5) °F	(83.6) °F	(77.4) °F	(66.6) °F	(57) °F
Min. Temp.	6.4 °C	8.9 °C	13.6 °C	19.1 °C	24 °C	27 °C	26.7 °C	26.1 °C	24.1 °C	19 °C	13 °C	7.9 °C
°C (°F)	(43.5) °F	(48) °F	(56.5) °F	(66.4) °F	(75.3) °F	(80.6) °F	(80) °F	(78.9) °F	(75.5) °F	(66.2) °F	(55.4) °F	(46.1) °F
Max. Temp.	18.3 °C	21.3 °C	27.3 °C	34.4 °C	39.2 °C	38.8 °C	34.9 °C	33.7 °C	33.5 °C	31.7 °C	26.1 °C	20.7 °C
°C (°F)	(64.9) °F	(70.3) °F	(81.1) °F	(94) °F	(102.6) °F	(101.9) °F	(94.9) °F	(92.6) °F	(92.2) °F	(89.1) °F	(79) °F	(69.3) °F
Rainfall mm (in)	28	46	36	29	20	68	166	145	64	14	7	13
	-1	-1	-1	-1	0	-2	-6	-5	-2	0	0	0
Humidity (%)	70%	66%	55%	36%	30%	43%	70%	76%	69%	55%	58%	64%
Rainy days	3	4	4	4	4	7	14	13	7	2	1	1

Source: Lahore climate: Average Temperature, weather by month, Lahore weather averages - Climate-Data.org

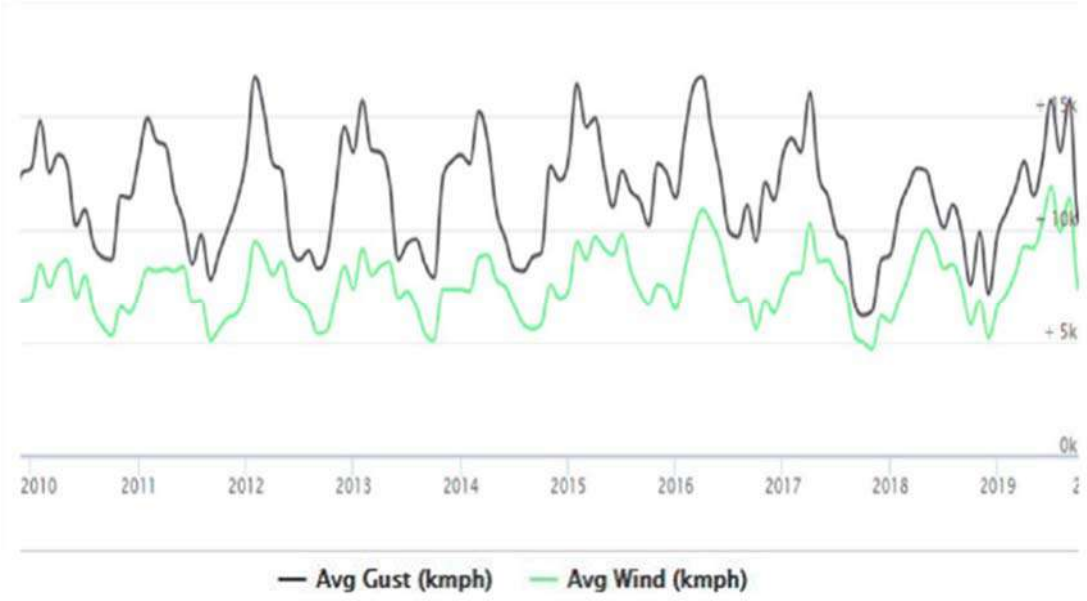


Figure 5-7 Average wind Speed and Gust in the Study Area

5.3.6 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. **Source WASA Punjab**

5.3.7 Surface Water Hydrology

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

5.3.7.1 River Ravi

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.

5.3.7.2 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 kilometers; 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 325 respectively.

5.3.7.3 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

5.3.7.4 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.

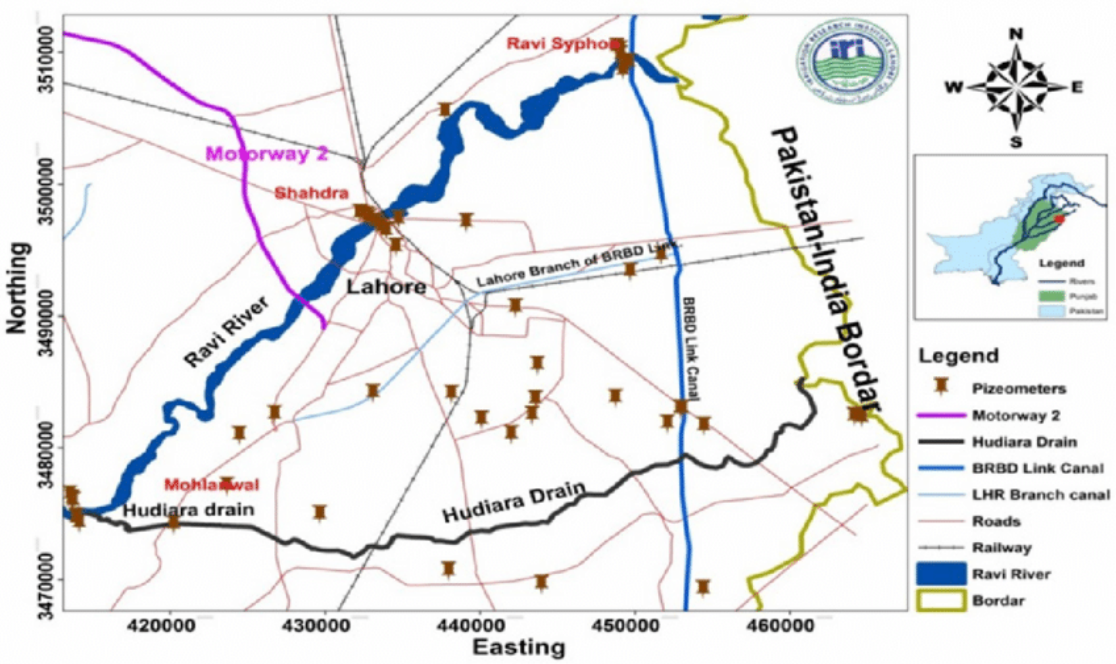


Figure 5-8 Hydrology map of the Lahore

5.3.8 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 Cantonment Drain is flowing through the project area in which minor drains of the study area falls.

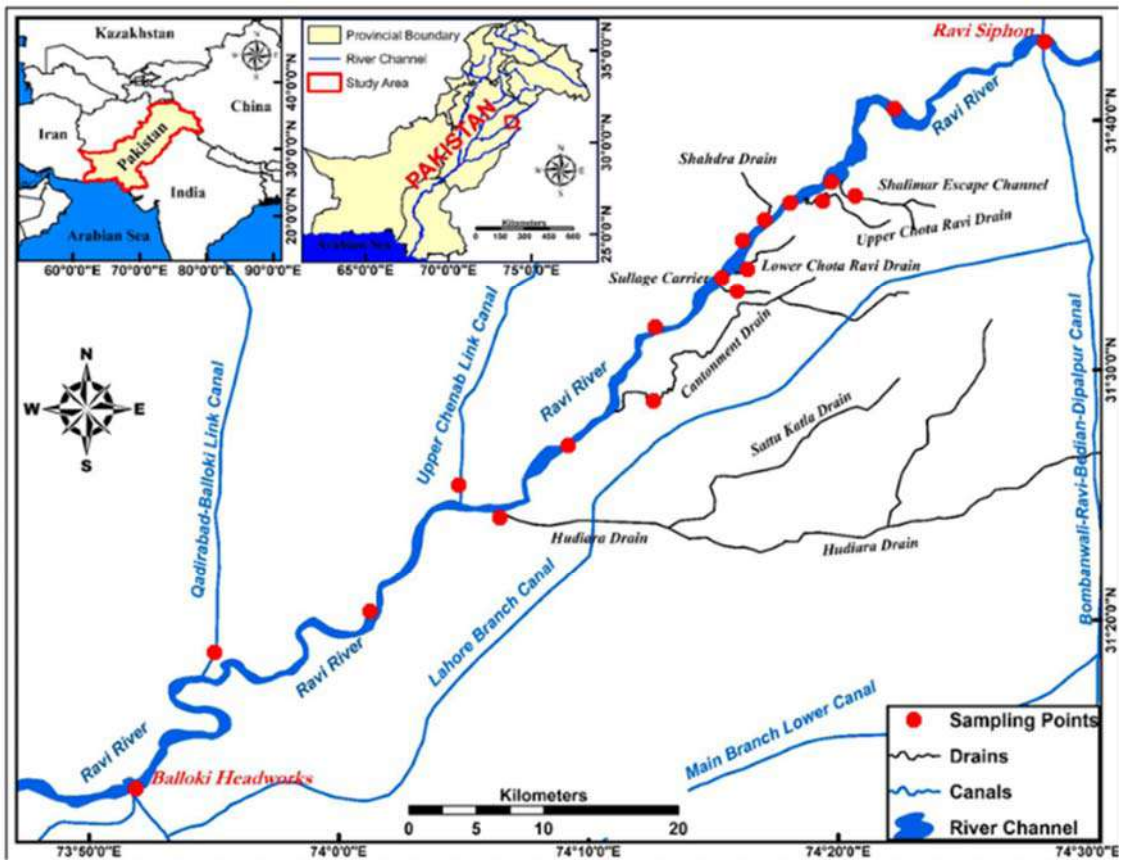


Figure 5-9 Map of all Drains in Lahore

5.4 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 February 10,2022 to February 22,2022 (Composite sampling for wastewater) and in May 16,2023 (air, noise and groundwater grab samples) for establishing the baseline profile of the Study Area. The monitoring reports have been attached as Annex-IV of this report.

5.4.1 Air Quality and Noise Levels

The Ambient Air Quality monitoring for Nitrogen Dioxide (NO2), Nitrogen Oxide (NO), Sulfur Dioxide (SO2), Carbon Monoxide (CO), Ozone (O3), Particulate Matter (PM2.5), Particulate Matter (PM10) and Suspended Particulate Matter (SPM) was

carried at the proposed Project Site. The sampling was conducted for 24 hours duration for NO_2, NO, SO_2, PM2.5, PM10 and SPM, 1 hour for O_3 and 8 hours for CO. 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 summary of results of ambient air and noise quality monitoring are given in the table below while the detailed reports are provided as Annex-IV. The table indicates that all parameters related to ambient air are well within the permissible limits of PEQS, 2016 but the noise levels are beyond the specified limits due to traffic and agricultural activities.

Table 5-2: Ambient air and Noise Quality Data

Sr. No.	Parameter	PEQS Limit	Results		
			Maximum	Minimum	Average
1	$PM_{2.5}$	35 ($\mu g/m^3$)	28.3 ($\mu g/m^3$)	20 ($\mu g/m^3$)	25.3 ($\mu g/m^3$)
2	PM_{10}	150 ($\mu g/m^3$)	136 ($\mu g/m^3$)	98.7 ($\mu g/m^3$)	123 ($\mu g/m^3$)
3	CO	5 (mg/m^3)	5.4 (mg/m^3)	3.3 (mg/m^3)	4.5 (mg/m^3)
4	NO	40 ($\mu g/m^3$)	19.8 ($\mu g/m^3$)	15.5 ($\mu g/m^3$)	18.3 ($\mu g/m^3$)
5	NO_2	80 ($\mu g/m^3$)	31.8 ($\mu g/m^3$)	22.4 ($\mu g/m^3$)	29.6 ($\mu g/m^3$)
6	SO_2	120 ($\mu g/m^3$)	17.9 ($\mu g/m^3$)	10.1 ($\mu g/m^3$)	15.4 ($\mu g/m^3$)
7	SPM	500 ($\mu g/m^3$)	280.7 ($\mu g/m^3$)	568.7 ($\mu g/m^3$)	245.9 ($\mu g/m^3$)
8	O_3	130 ($\mu g/m^3$)	22.6 ($\mu g/m^3$)	22.6 ($\mu g/m^3$)	22.6 ($\mu g/m^3$)
6	Average Noise levels (24 hour)	Day Time (R) 55 Night Time (R) 45	79 dB	48 dB	Day Time 56 dB Night Time 55 dB

5.4.2 Drinking/Groundwater Quality

Drinking water samples were taken near project site and was analyzed for physical and chemical parameters. Table below shows the results of ground water analysis:

Sr #	Parameters	Limit Values	Results
1	Residual Chlorine	0.2-0.5 mg/l	ND
2	Total hardness as CaCO3	<500 mg/l	232 mg/l
3	Chloride	<250 mg/l	37 mg/l
4	pH	6.5-8.5	8.1
5	Turbidity	< 5 NTU	0.8 NTU
6	Total dissolved solids (TDS)	< 1000 mg/l	446 mg/l
7	Color	≤ 15 TCU	ND
8	Nitrate (NO3)	≤ 50mg/l	ND
9	Nitrite (NO2)	≤ 3mg/l	ND
10	Taste	Non objectionable	Acceptable
11	Odor	Non objectionable	Acceptable
12	Phenolic Compounds	NGVS	ND
13	Cyanide (CN)	≤ 0.05 mg/l	ND
14	Fluoride	≤ 1.5 mg/l	0.2 mg/l
15	Chromium	≤ 0.05 mg/l	ND
16	Copper	2 mg/l	ND
17	lead	≤ 0.05 mg/l	ND

Sr #	Parameters	Limit Values	Results
18	Manganese	≤ 0.5 mg/l	0.1 mg/l
19	Mercury	≤ 0.01 mg/l	ND
20	Nickel	≤ 0.02 mg/l	ND
21	Boron	0.3 mg/l	ND
22	Cadmium	0.01 mg/l	ND
23	Selenium	0.01 mg/l	ND
24	Barium	0.7 mg/l	0.1 mg/l
25	Zinc	5.0 mg/l	ND
26	Aluminum	≤ 0.2 mg/l	ND
27	Antimony	≤ 0.005 mg/l	ND
28	Arsenic	≤ 0.05 mg/l	ND
29	Total Coliform	Must not be detectable in 100 ml of sample	ND
30	Fecal Coliform	Must not be detectable in 100 ml of sample	ND
31	E.Coli	Must not be detectable in 100 ml of sample	ND

5.5 BIOLOGICAL ENVIRONMENT / 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 biological environment consists of flora and fauna present in study as well as project area.

5.5.1 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).

5.5.1.1 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 (Acacia nilotica), Shisham (Dalbergia sissoo), Ber (Zizyphus sp), Sufeda (Eucalyptus camaldulensis), Mulberry (Morus alba), Neem (Azadirachta indica) , Sirris (Albizia lebbek), Dherek (Melia azedarach) , Date Palm (Phoenix dactylifera) Jaman (Syzygium cumini) , Bakain (Melia azadirachta) Guava (Psidium guajava), Sumbal (Bombac Cieba)

5.5.1.2 Shrubs & 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). 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.

5.5.1.3 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.



Figure 5-10 representation of local flora in project vicinity

5.5.2 Fauna

The project vicinity is not rich in multiple species of Fauna but some common animals are found in it

5.5.2.1 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 Mangoose (Herpestes auropunctatus). 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.

5.5.2.2 Birds

Important bird species found in the tract are Mynah (Acridotheres tristis), House Crow (Corvus splendens), House sparrow (Passer domesticus), Koel (Eudynamys scolopacea), Parrot (Psittacula krameria), Pigeon (Columba livia), Patridge Grey (Francolinus pondicerianus), Patridge Black (Francolinus francolinus), Quil (Coturnix coturnix), Little Egret (Egretta garzetta), Mallard (Anas platyrhynchos), Jal Kookri (Fulica atra), and Bulbul (Pycnontus cafer).

5.5.2.3 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.

5.5.3 Endangered species

There is no floral or fauna species inhabiting the project area that are included in the Red Data Book of IUCN. The populations of birds is reported to be reduced over time due to the conservation of open land into built up areas, excessive pesticide sprays in agricultural crops and loss of habitat.

5.5.4 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.

5.5.4.1 Crops

The agriculture and livestock are the main economic activity in the area. The main crops 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. 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.



Figure 5-11 Representation of the crops in project area

5.6 SOCIO ECONOMIC ASPECT

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

5.6.1 Study Area

Study area includes following area. 60 people are interviewed to assess socio economic condition of area of influence of the project

1. Canal Veiw
2. Niaz Baig
3. Munir Garden
4. Kattar Band Road
5. Thokar Niaz Baig
6. Shah Pur kaanjrra
7. Eden Garden
8. Francis Town
9. Gopi Rai Village
10. Near Disposal station

5.6.2 Demography

5.6.2.1 Population

The population census data for Lahore District has been collected from past census reports. The project area (*i.e.* catchment area of Kattar Bund WWTP) lies mostly within the City Tehsil and partially within the Model Town Tehsil. The part of the project area within the Model Town Tehsil is part of the Punjab University which does not contribute to the project area growth rate. The growing part of the project area is fully within the City Tehsil area.

Table 5-3 census data of Lahore city and Lahore district

Year	Population of Lahore District	Population of City Tehsil
1951	1,141,000	789,400
1961	1,633,000	1,227,996
1972	2,596,000	2,022,577
1981	3,555,000	2,101,215

Year	Population of Lahore District	Population of City Tehsil
1998	6,318,745	2,540,573
2017	11,119,985	3,653,616

The City Tehsil population in this table refers to the Lahore Municipality for 1951 and 1961, the Lahore Municipal Corporation for 1972 and 1981 and the Lahore City Tehsil for 1998 and 2017. The boundaries of these administrative areas have not always been the same and therefore the absolute populations are sometimes not directly comparable. However, the growth rates provided later in this chapter are as given by the Pakistan Bureau of Statistics and always refer to the same area within the specified period.

The general trend of population increase can be observed in the above data. The following figure shows this increasing trend graphically:

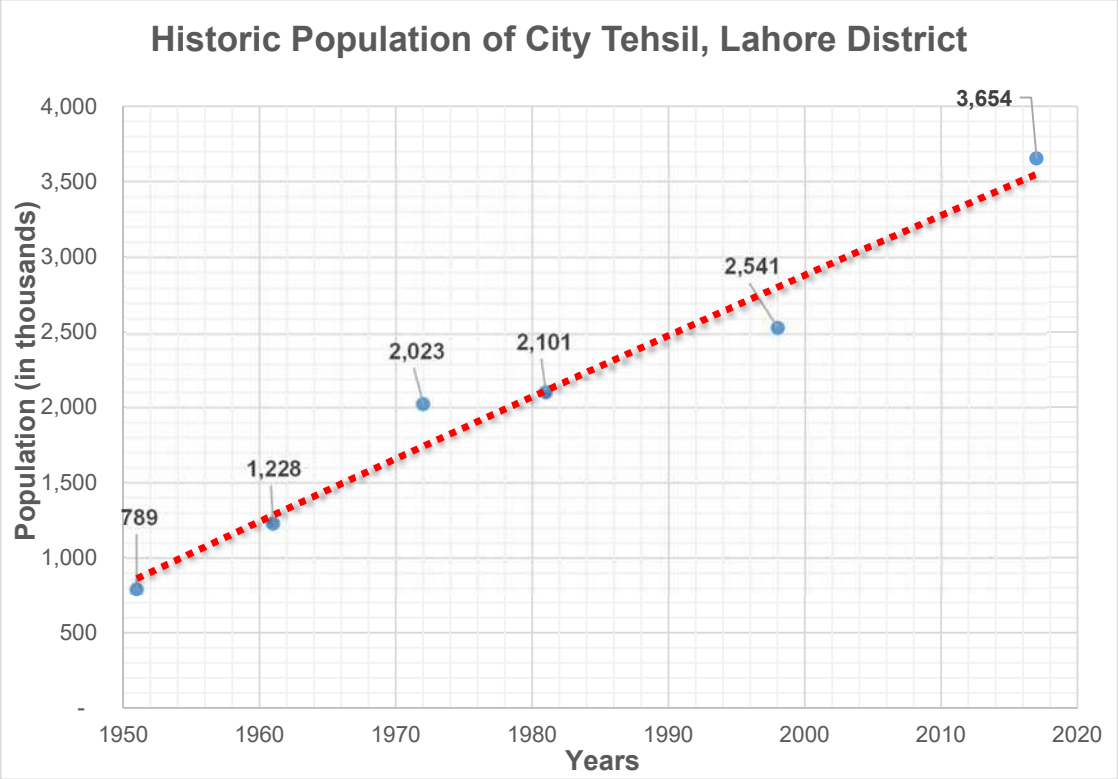


Figure 5-12 population growth trend of city tehsil, Lahore District

5.6.2.2 Population growth Trend

The past trends of population growth exhibit variable rate of growth per annum. It is observed in general that growth rates of urban areas of Punjab are on a decline with the passing of time. This is due to various factors such as: less space available for further settlements; inadequacy of existing infrastructure facilities, including water supply, sewerage, roads, health facilities, education and employment, *etc*. to support further population settlements.

The project area (*i.e.* Kattar Bund WWTP Catchment) lies in the urban part of Lahore District. The space limitation and lack of infrastructure facilities is also tending to slow down the population growth rate in the area. The table below shows the population growth rate of City Tehsil in Lahore District in previous census reports (1951 to 2017):

Table 5-4 population growth rate of Tehsil, District Lahore

Year Range	Growth Rate of Lahore District (% per Annum)	Growth Rate of City Tehsil (% per Annum)
1951-1961	3.70	4.52
1961-1972	4.10	4.64
1972-1981	3.80	3.50
1981-1998	3.50	3.09
1998-2017	3.02	2.65

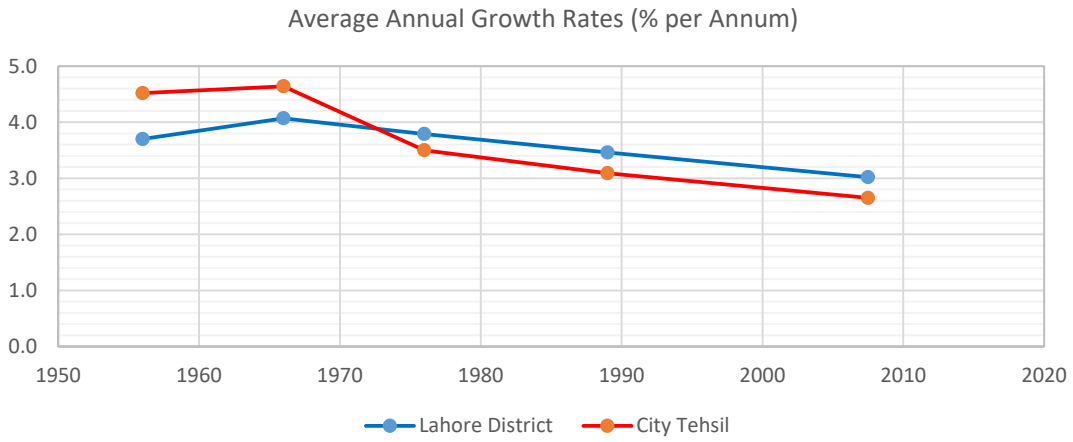


Figure 5-13 : Historic Growth Rate Trend of Lahore District and City Tehsil

5.6.2.3 Classes of Saturation Population

In the light of above discussion and considering block wise population census data, the blocks lying in project area have been divided into following categories:

a) High Density Areas (370 to 600 or more persons per hectare)
b) Medium Density Areas (200 to 370 persons per hectare)
c) Low Density Areas (<200 persons per hectare)

In this way, each block is assigned an appropriate saturation category by keeping in view the present population and population density. This categorization is required to assess the potential for further growth of population in each block.

5.6.3 Census 2017 Population in the Project Area

The results of Census 2017 have been acquired from Pakistan Bureau of Statistics. The population of project area has been estimated by overlaying the block boundaries and project area boundary. The total population of the project area as per the Census 2017 is determined to be **133,583** persons.

5.6.4 Method of Population Projection

It is clear from the trend of population projection, that geometric progression method is most suitable for projection of future population in the project area. This trend is in conformity with the general trends of population growth in the region. The equation of geometric progression method used for population projection is given below:

$$P_{Future} = P_O(1+R)^n$$

Where:

P Future = Projected Population

P_O = Population of base year

R = Population Growth Rate (%)

n = No. of years

The total population of project area has been estimated based on projected growth rates of City Tehsil of Lahore District. The population projection at blocks level is done by considering the existing distribution of population and saturation limit of each area respectively.

In view of the existing population distribution, the potential of population growth in each block has been assessed. Those blocks already exceeding their assigned saturation population value, have been considered to undergo no further increase in population. Therefore, population of these areas has been kept as constant in future years.

Punjab University area is designated for educational purposes only. The master plan of Punjab University does not include addition of any further hostels or residential colonies in their boundary. Therefore, population of blocks lying in Punjab University area are also kept the same in future years.

There is another type of blocks that follow geometric progression method up to a certain year in future, after which they tend to approach or exceed their saturation level of population growth. For such areas, the decreasing growth rate method involving saturation population of each category respectively has been adopted instead of geometric progression method. In this method, rate of growth is a function of population deficit of the area. The equation of decreasing growth rate method is given as below.

$$P_{Future} = P_{Last} + (S - P_{Last})\left(1 - e^{\overline{-Kd}(T_{Future} - T_{Last})}\right)$$

$$Kd = \frac{-Ln\left(\frac{S-P2}{S-P1}\right)}{T2-T1}$$

Where:

S = Saturation Population

K_d = growth rate based on population deficit

There is another type of blocks in the project area, that do not reach their saturation limit of population even by following the geometric progression method, hence they have potential to accommodate more people in future. Therefore, population of such blocks is projected using an adjusted increased growth rate. This adjustment is aimed at: i) accommodating that population which is restricted in those blocks exceeding or reaching their saturation limit and ii) equate the total projected population of blocks to that of Tehsil.

5.6.5 Projected Population

The population projection of project area has been done using the methods as defined in previous sections. The following table shows the projected population of project area:

Table 5-5 Projected Population of the Project Area

year	population		
	Low growth	High Growth	Mid Growth
2017	133,582	133,582	133,582
2022	147,607	148,958	148,281
2025	155,978	158,565	157,267
2030	169,652	175,173	172,392
2035	182,713	192,476	187,535
2040	194,848	210,412	202,488
2045	205,752	228,913	217,036
2050	215,135	247,910	230,962
2055	222,741	267,332	244,052

For planning and design purposes, the following population will be considered:

Table 5-6: Proposed Design Population of Project Area

Year	Design Population
2022	148,000
2025	157,000
2030	172,000
2035	188,000
2040	202,000
2045	217,000
2050	231,000
2055	244,000

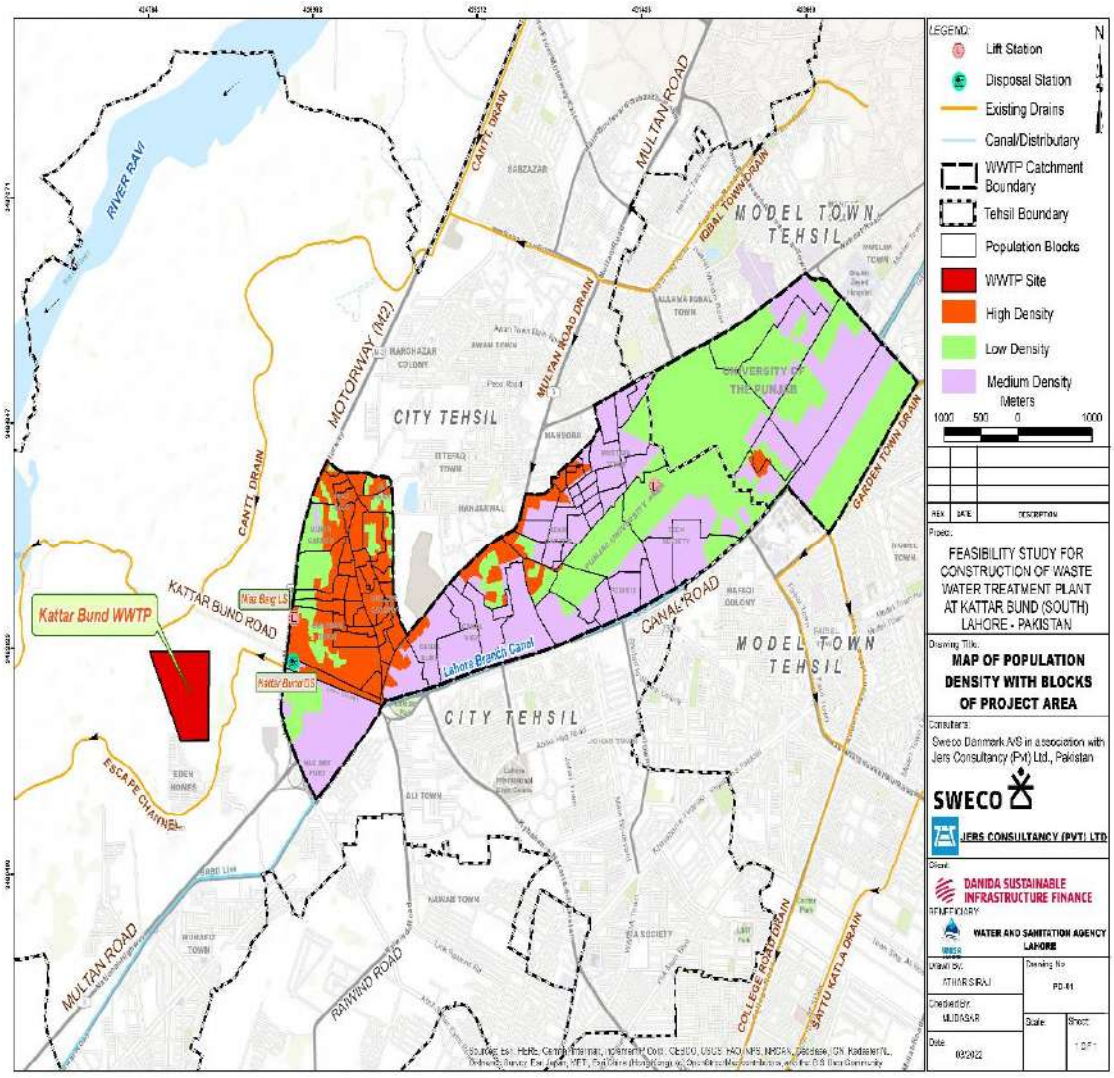


Figure 5-14 Layout Plan of Population Density Categories in Kattar Bund Catchment Area

5.6.5.1 Marriage and Marital Status

Endogamy is the prevalent style of marriage. Most of the people are monogamous. w. As per social survey, the majority of respondents (i.e., 81.37%) were married and 18.33% were unmarried.

Table 5-7 Marital status of respondents

Sr. No.	Marital Status	Number	Percentage
1	Married	49	81.66
2	Un-Married	11	18.33
Total		**60**	

5.6.5.2 Literacy

Educational distribution of the respondents shows that Fifteen (31.66%) of the respondents were illiterate. 13.33% were educated up to primary level. However, 15% and 23.33% were educated up to middle and matric level respectively. Moreover, 11.66% respondents were educated up to intermediate and 5% respondents described their education level up to graduation and above. Based on the field survey and discussion with the locals, it is noted that female literacy rate was even lower compared to males. Locals give least importance to female education. However, the trend is changing now as people are sending now their children to school.

Table 5-8 literacy rate of respondents

Sr. No.	Education of the Respondent	Number	Percentage
1	Illiterate	19	31.66
2	Primary	8	13.33
3	Middle	9	15
4	Matric	14	23.33
5	Intermediate	7	11.66
6	Graduation and above	3	5
Total		60	

5.6.5.3 Language

Punjabi is major language spoken in the area

5.6.5.4 Household

In Punjab, the average household size has decreased form 6.04 in 2015-2016 to 5.78 in 2018-2019. Household size has decreased across all quintiles in Punjab, except for quintile[3] 1 in urban areas which has seen a slight increase. In Pakistan as a whole, household sizes have increased among the poorest households in quintile 1 in both urban and rural households.

Table 5-9 Average household size of Punjab

Average Household Size, Punjab	Quintiles					
	Total	**Q1**	**Q2**	**Q3**	**Q4**	**Q5**
Members per household	5.78	7.45	6.66	6.01	5.56	4.61
Men	2.83	3.64	3.22	2.94	2.73	2.28
Women	2.95	3.82	3.44	3.07	2.83	2.33
Urban	5.68	7.89	7.06	6.53	5.97	4.81
Men	2.82	3.95	3.35	3.23	2.98	2.41
Women	2.86	3.94	3.72	3.3	2.99	2.4
Rural	5.84	7.38	6.56	5.81	5.27	4.3
Men	2.83	3.58	3.18	2.83	2.55	2.08
Women	3	3.79	3.37	2.98	2.72	2.22

Source: Household Integrated Economic Survey (HIES) 2018-2019

5.6.6 Economic Aspects

5.6.6.1 Occupation

The respondents were asked about their employment status. Majority (30%) of the respondents were associated with farming. 20% of the respondents were running their business-like shops while 11% of the respondents were working as private job of different fields. Almost 2% were engaged with different types of labor industrial and general labor for earning their livelihood, while 2% were engaged with retired jobs to earn their livelihood. Rest of the respondents were associated with their own business and government jobs as reflected

[3] A quintile corresponds to 20% of the population

Sr. No.	Profession	Number of Respondent	Percentage
1	Govt Job	2	3.33
2	Private Job	11	18.33
3	Business	20	33.33
4	Farming	18	30
5	Labor	2	3.33
6	Retired	2	3.33
7	Any other	3	5
8	Total	60	

5.6.6.2 Income levels

The National Bureau of Statistics of Pakistan does not have data available on income, expenditure, and poverty levels separately on city or district level, only for Punjab regional level divided into rural and urban population.

Table 5-10 Household income and expenditure Punjab 2018-2019

Total Monthly Average	Quintiles					
Punjab	**Total**	**Q1**	**Q2**	**Q3**	**Q4**	**Q5**
Household Income	42862	22719	29399	31914	39189	68212
Household Expenditure	36793	20152	24968	28636	34997	56630
Water and Sanitation exp.	17.79	3.46	6.72	9.7	16.82	43.68
Household Savings	6069	2566	4432	3278	4192	11582
Urban						
Household Income	55189	23813	28433	33893	41043	76527
Household Expenditure	47637	21877	26658	31299	37783	63760
Water and Sanitation exp.	33.49	5.47	11.93	14.9	23.96	57.2
Household Savings	7552	1936	1775	2595	3260	12767
Rural						
Household Income	35429	22535	29645	31133	37916	55601
Household Expenditure	30254	19862	24537	27586	33083	45817
Water and Sanitation exp.	8.58	3.09	5.29	7.4	11.26	20.75
Household Savings	5175	2672	5108	3547	4833	9785

Source: Household Integrated Economic Survey (HIES) 2018-2019

While Socioeconomic findings of the survey revealed that 23.33% of the respondents were falling in the income group of up to rupees 20000 to 30000. On the other hand,

21.66% were earning in the range of 30,001 to 40,000 rupees, and 41.66% of the respondents were earning their monthly income between the ranges of 40,001to 55,000 rupees per month. Whereas, 8.33% of the respondents were earning between 55,001 to 70,000 and 5% were earning above 70,000 per month.

Table 5-11 Average Monthly Income of the Respondents

Sr. No.	Average Monthly Income (Rs.)	Number of Respondent	Percentage
1	20000 to 30000	14	23.33
2	30001 to 40000	13	21.66
3	40001 to 55000	25	41.66
4	55001 to 70000	5	8.33
5	70001 and above	3	5
Total		**60**	

5.6.7 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.

5.6.8 Religion and culture

5.6.8.1 Religion

The population of the settlements in AOI is predominantly Muslim and followed by Christians. The Francis town has majority Christian population while other has majority Muslim population.

5.6.8.2 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. 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.

5.6.8.3 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.

5.6.9 Infrastructure facility

5.6.9.1 Educational institution

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. 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.

5.6.9.2 Health Facilities

Health facilities are generally inadequate in the AOI. In Lahore District the prevalence is 14.3%. The prevalence of hepatitis A and B in Lahore District is at 6% and 40.4% respectively (National Library of Medicine, 2022). According to WHO, poor sanitary conditions and lack of hygienic practice led to 90% of children in Pakistan being

infected with hepatitis before reaching 10 years of age (WHO, 2021). A number of health centres are available in Lahore, including 30 government hospitals in Lahore City, and health centres in each of the Tehsils (Bureau of Statistics, 2020). A series of programs and projects are on track in Pakistan to improve health status and reduce burden of communicable and non-communicable diseases. The Ministry of National Health in 2019 has made significant progress by devising comprehensive strategies to improve health. In this context the Action Plan – National Health Services, Regulations and Coordination Division 2019-2023 has been prepared and approved. Improving water, sanitation and hygiene services is part of the Punjab growth strategy 2023. In addition, a Health Sector Strategy 2019-2028 has been developed with environmental health among one of its focus areas. The strategy includes objectives of providing adequate and safe drinking water as well as adequate sanitation facilities to communities. The strategy is complemented by the Punjab Health Reforms Roadmap which is a focused on improving the existing health infrastructure. To avail health facilities, locals majorly go to Jinnah hospital and Sheikh Zyad Hospital Lahore.

5.6.9.3 Electricity

WAPDA (Water and Power Development Authority) is the main source of the power. WAPDA is providing electricity by Lahore Electric supply company (LESCO).

6 PUBLIC AND STAKEHOLDER CONSULTATION

6.1 GENERAL

Public Consultation refers to the process by which the concerns of the various stakeholders and local community who have a plausible stake in the environmental management and associated impacts of the project or activity are ascertained with a view to taking into account all the design and construction concerns in the project activity as appropriate. According to the IEE and EIA Review Regulations 2022 public consultation is mandatory for any socio-economic environmental study for the commencement of any project.

6.2 OBJECTIVES

The objectives of this process were to:

- Share information with stakeholders on the construction of the aforesaid treatment plants, and expected impacts on the physical, biological and socio-economic environment of the project area.
- Understand Stakeholder`s concerns regarding various aspects of the project, including construction and installation of the project components and the likely impacts of the construction related activities and operation of the project.
- Understand the perceptions, assessment of social impacts and concerns of local residents of the Lahore district.
- Disclose information about contact offices/ officers for any complaints/queries.
- Provide an opportunity to the public to provide valuable suggestions in the project design in a positive manner; and
- Reduce the chances of the conflicts through the early identification of controversial issues and consult them to find acceptable solutions.

6.3 METHODOLOGY

On the basis of the project location a survey plan was developed in order to gather details of the current socio-economic norms and activities. The survey plan is developed under the supervision of Environmental Expert.

6.4 STAKEHOLDER IDENTIFICATION

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.

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.

6.4.1 Primary stakeholder

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.

6.4.2 Secondary stakeholder

Secondary stakeholders are people or groups that are indirectly affected from the project activities or have their interest in the proposed project such as departments of GoP.

6.5 METHODOLOGY FOR CONSULTATION

Stakeholder consultation is a two-way flow of information and dialogue between the project proponent and stakeholders, specifically aimed at developing ideas that can help shape project design, resolve conflicts at an early stage assist in implementing solutions and monitor ongoing activities. Various techniques are used worldwide to carry out the stakeholder consultation that includes discussions, meetings and field visits. Details of the proposed project and related activities were explained to the local community and their responses were listened and addressed. The issues and suggestions raised were recorded in field notes for analysis, and interpretation, by reaching out to a wider segment of the population and using various communication

tools such as participatory needs assessment, community consultation meetings, and focus group discussions.

6.6 CONSULTATION PROCESS

Information disclosure, public consultation and discussion regarding the various aspects of the project with the people of the area are necessary. This process is intensified during the EIA Studies and rounds of Public Consultation were held with local community and various government departments as listed below. Surveys were carried out in order to investigate physical, biological and socio-economic resources falling within the immediate AOI of the project. Primary data collection included:

- Data collection regarding the socio-economic condition of study area.
- Pre-testing of socio-economic survey tools in the field.
- To consult the locals for collection of information on biological environment.

Various meeting with the stakeholders were held in order to fulfill the following objectives:

- Share information with stakeholders on the proposed project and expected impacts on community in the vicinity of the project.
- Understand Stakeholder`s concerns regarding various aspects of the project, including the existing condition of the upgrading requirements, and the likely impact of construction & installation and operational activities.
- Provide opportunity to the public to influence the project design in a positive manner.
- Obtain local and traditional knowledge, before decision making.
- Increase public confidence about the proponent, reviewers and decision makers.
- Reduce conflict through the early identification of controversial issues and work through them to find acceptable solutions.
- Dissemination of information through discussions, education and liaison.
- Documentation of information narrated by the stakeholders and mitigation measures proposed by the stakeholders.
- Incorporating the public concerns and their address in the EIA and eliciting their comments and feedback.
- Create a sense of ownership of the proposal in the mind of the stakeholders.

6.7 PUBLIC DISCLOSURES

Public disclosure is the outcome of all such activities where the public is involved at least in the information sharing process. This is an integral part of the process. So, before the proponent applies for NOC to the Punjab-EPA. This disclosure will be distributed properly among all stakeholders. It is the responsibility of the proponent and the consultants to display a public disclosure document in prominent places where community has easy access.

6.8 CONSULTATION WITH OFFICIALS

Following offices of government departments were consulted by the socio-environmental team of the consultants and concerned details about the project were noted down through personnel interviews, group meetings, etc. in their offices.

6.8.1 Environment Representative of WASA (proponent) – Primary Stakeholder

The meeting is arranged with WASA environment representative of the project. The project activities and environmental impacts are discussed in detail. WASA representative highlighted that all the project activities should be in environmentally Friendly Manners. WASA Managing Director was also present in the meeting.

Name of Representative: Samina Asif (Environmental Engineer)

Designation; Deputy Director

Date; 12-11-2022



Figure 6-1 Meeting with Environmental Management Representative of WASA

6.8.2 Project Responsible Authority

WASA is responsible authority from construction to operation and management team. A meeting is arranged with Director Syed Abid Raza (Operation and Maintenance) of WASA. The director inquired about the environmental issues of operation and maintenance. The consultant highlights the major environmental issues which can be faced during operation like odor, failure of WWTP to achieve efficiency, sludge problem.



Figure 6-2 Meeting with Director(O&M) WASA

6.8.3 Meeting With Environmental Protection Agency (EPA) – Secondary Stakeholder

A meeting is held in EPA office to discuss the project. EPA representative. The representative said that all the environmental guidelines and rules should be followed strictly followed in all phases of the project. Consultant briefed the representative that a proper EMP will be developed during EIA and all impacts will be minimized and will be according to the EPA guidelines

Name of Representative: Farooq Alam

Designation: Deputy Director (LAB)

Date: 24-03-2022

6.8.4 Meeting with Parks and Horticultural Authority (PHA) – Secondary Stakeholder

A meeting is held between consultant and PHA at PHA head office. The consultant suggested that the sludge of WWTP after biogas production can be reused in the parks as a natural manure. PHA agreed that such natural manure can be used in parks of Lahore after solving logistics issues.

PHA Representative: Mr. Zeeshan Javaid (DG PHA)

Mr. Shahzad Tariq (director Head quarter)

Mr. Jaleel Ahmed (PD Jillani Park)

Date; 23-09-2022

6.8.5 Meeting with Irrigation Dept – Primary Stakeholder

Many meetings are held between irrigation and consultant as treated effluent will be discharged into Lahore branch Canal. Irrigation dept required about the characteristics and nature of effluents. The consultant briefed about the quality of effluent and its use in irrigation. Irrigation dept satisfied with effluent and issued no objection certificate for the project. Moreover, the escape channel of Lahore branch canal will be lined after Kattar Bund disposal station.

Irrigation Representative: M. Amir Khan (Chief SPRU)

Dr. M. Javed (Director

Date: 01-04-2022

Irrigation Representative: Rana Tariq (XEN CBDC)

Mr. Shafiq (SDO)

Date: 25-03-2023

6.8.6 Meeting with Ravi Urban Development Authority (RUDA) – Secondary Stakeholder

A meeting is held between RUDA representative and Consultant in RUDA head Office Lahore. Consultant team briefed about the project and how it can solve the wastewater issues of Lahore. Moreover, Consultant informed that the project site is in the area of RUDA third phase which will be started after 25 years. RUDA have no objection regarding project location or overall project activities as it ultimately solves the issue of pollution of river Ravi.

RUDA Representative: M. Afzal (Director WWTP)

Naqi Iqbal (Deputy Director WWTP)

Abu Bakar (officer WWTP)

Date; 26-04-2022



Figure 6-3 Meeting with RUDA Representative

6.8.7 Meeting with Chief Engineer Punjab university – Secondary Stakeholder

Punjab university waste water is discharged into the kattar bund. So, a meeting is held between Chief engineer and consultant to discuss the project. Chief engineer enquired about the project scope. Consultant briefed about the project. Chief engineer appreciated the project.

Participant: Fiaz ul Hassan Sipra (chief Engineer)

Date: 10-10-2022

6.8.8 Meeting with Environmental Practitioners and Experts - Secondary Stakeholder

Meetings are held with different environmental Experts and practitioners

6.8.8.1 Ahtisham Raza (Environmental Specialist) (Integrated environment Consultancy

A meeting Is held in the office of integrated environmental Consultancy office on 03-11-2023. The consultants briefed about the project. Mr Ahtisham asked about the baseline conditions of the project and impacts due to the project. Consultants explain in detail the baseline and impacts of the project

6.8.8.2 Ms. Shamseela Falak (Environmental Specialist Core Environmental Consultancy

The consultants briefed about the project. Ms. Shamseela highlights that Lahore needs such projects to solve the issues of the Sewerage and sustainable use of the wastewater.

6.8.8.3 Osama Faheem (Assistant Director Environment Punjab intermediate cities improvement and investment program)

Mr. Osama highlights that for improvement of cities, such projects are required. This will make the city livable and will improve the overall sewerage condition of the cities.

6.9 COMMUNITY CONSULTATION

For ascertaining the perceptions of different stakeholders about the project, meetings were held with communities 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. The views of the beneficiaries were formally recorded. PAPs (primary stakeholders) were also consulted along with general public (randomly selected) who were residing or working in the AOI of the proposed project.

6.9.1 Location of public consultation

Public consultation is done in the following areas:

- Canal Veiw
- Niaz Baig
- Munir Garden

- Kattar Band Road
- Thokar Niaz Baig
- Shah Pur kaanjra
- Eden Garden
- Francis Town
- Gopi Rai Village
- Near Disposal station



Figure 6-4 Meeting with the MNA of area



Figure 6-5 meeting with local at Gopi Rai Village near Escape Channel



Figure 6-6 consultation with local at Gopi Rai Village

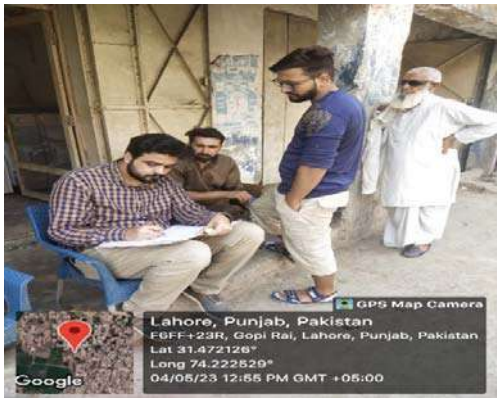


Figure 6-7 consultation with local at Gopi Rai Village



Figure 6-8 Consultation with local at Francis Town



Figure 6-9 consultation with local at Francis town



Figure 6-10 consultation with local at Shahpur Kaanjra



Figure 6-11 Consultation with Local at Shahpur Kaanjra



Figure 6-12 Consultation with Locals at Eden Value Homes



Figure 6-13 Consultation with Locals at Canal View Society



Figure 6-14 Public Consultation at Kattar Bund Road



Figure 6-15 Public Consultation at Kattar Bund Road



Figure 6-16 Public Consultation at Kattar Bund Road



Figure 6-18 Public Consultation at Kattar Bund road



Figure 6-17 Public Consultation at Niaz Baig

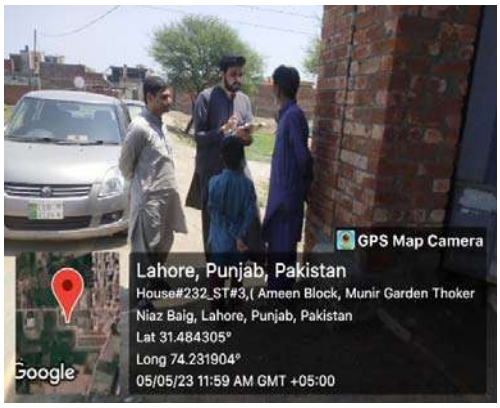


Figure 6-19 Public Consultation at Niaz Baig



Figure 6-20 Public Consultation at Munir Garden



Figure 6-21 Public Consultation at Munir Garden

6.9.2 Public concerns

Public concerns are recorded and mitigation should be implemented to resolve these concerns of the public. The issues and suggestions raised were recorded in field notes for analysis, and interpretation, by reaching out to a wider segment of the population and using various communication tools such as participatory needs assessment, community consultation meetings, and focus group discussions. The findings of the Community consultations have been addressed in various sections of the EIA report, and the mitigation plans have been incorporated into the EMMP.

Table 6-1 Summary of the concerns of the public and response to it

Sr. No	Issues/Feedback of Stakeholders	Response
1	Participants showed their concerns regarding demolition of their residential structures	Market based rates and additional financial assistance should be given to the project DPs, so they can build proper residential structures
2	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.
3	Construction activities must not hinder the movement of residents or their domestic animals for farming	Farming and other activities will not be hindered. Residents will be notified prior to the commencement of construction activities and alternate routes will be provided.
4	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.
5	No paved roads, high schools and paved streets are present in the settlements and there is no planning or prioritization model for the improvement of villages.	Project is established to improve the wastewater situation in city. This is out of project scope
6	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.

Sr. No	Issues/Feedback of Stakeholders	Response
7	The wastewater from Kattar Bund Disposal station into escape channel is causing to problems in Gopi Rai village due to overflow of wastewater	The wastewater will be carried into close pipes from disposal station to treatment plant and current issue of overflow will be solved
8	What will be done to the escape channel?	The escape channel will be lined and will carry only the water of canal
9	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.
10	No Health Centers were available in in any mouzas and people were deprived of health care facilities. Mostly diseases spread waste water.	The proposed project is not envisioned to provided health facilities. However, due to treatment of wastewater and conveyance of wastewater in close pipes will results in improvement of overall health issues of the project areas.
11	Priority for employment should be given to residing communities;	Yes, opportunities for employment will be generated for the locals and contractor shall be instructed to preferably hire local labor if sufficient skilled labor is available in the project area.

Sr. No	Issues/Feedback of Stakeholders	Response
12	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.
13	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.
14	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.	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. Moreover, Provision of Design will fix the issue.

6.10 PROPOSED CONSULTATION PLAN

The stakeholder consultation and engagement are 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.

6.10.1 Proposed Consultation Process

The framework for the future consultations is elaborated, but not limited to the following:.

Table 6-2 proposed framework for future consultation

Sr. No.	Stakeholders	Project Phase	Project Phase
1	Institutions/Department	Pre-Implementation During the Project Implementation At Closure period	One round of consultation before start of implementation of project. Bi-annually during operation phase Once before the closure of the project.

Sr. No.	Stakeholders	Project Phase	Project Phase
2	Local Communities/ Key Persons	Pre-Implementation During the Project Implementation At Closure period	Consultation at different stages, before implementation, periodic meetings during construction phase and at the time of project completion
3	NGOs/CBOs	Pre-Implementation During project Implementation At Closure period	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.

6.11 ADDRESSING PUBLIC CONCERNS

The best mechanism of effective communication between the community and the proponent is by the nomination of the Company Representative and all the issues/concerns of the community must be for future reference. This representative may be the member of the Grievances Redressed Committee (GRC).

6.11.1 Grievances Redressed Committee

Grievances Redressed Committee (GRC) will be formulated by the proponent to address to address the concerns of the locals during the construction as well as during operational phase. The main role of the GRC will be to resolve the issues of the community associated with aforesaid project, if any.

6.11.2 Grievance Redressed Mechanism (EPA Role)

- The agency shall evolve a Grievance Redressed Mechanism at every tier.
- An online platform will be deployed to allow concerned citizen or individual to register their grievance electronically and status of all status of all registered grievances shall be regularly updated.

- Summary of registered grievances shall be reported in the annual report specific to the aforesaid project on behalf of state of the Environment of Punjab.

6.12 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.

7 ANTICIPATED POTENTIAL ENVIRONMENTAL IMPACTS AND PROPOSED MITIGATION MEASURES

7.1 GENERAL

This section presents the screening process that identifies the environmental aspects and makes assessment of impact of different activities during the pre-construction, construction and operation phases of the proposed Feasibility, Detailed Engineering Design, Preparation of PC-I for Wastewater Treatment Plants (WWTP) at Kattar Bund Road, Lahore, Pakistan. The screening process has been a thorough review of literature, primary as well as secondary baseline data, and expert judgment, made assessment of the potential impacts of the said activities on the physical, biological and socioeconomic environment of the project. Mitigation measures have been proposed to reduce, minimize or compensate for the identified potential negative impacts.

The proposed project will involve the construction and operation phase impacts associated with the activities of the project at the proposed site. The environmental impacts of the project are identified situation analysis which are based on the following:

- Physical environment, particularly siting of the project
- Biological environment and
- Socio- economic environment

This section of the EIA report presents an evaluation of the screening process and identifies the existence, if any, of significant environmental impacts during the different phases of the project and provides, if necessary, the mitigation measures that may have to be adopted in order to reduce and minimize the negative impacts.

7.2 PURPOSE OF MITIGATION MEASURE

The basic purpose of mitigation measures is to reduce the impacts associated with the socio – economic environment up to maximum possible extent for construction / Feasibility, Detailed Engineering Design, Preparation of PC-I for Wastewater Treatment Plants (WWTP) at Kattar Bund Road, Lahore, Pakistan. The mitigation measures are suggested based on the following parameters

7.2.1 What is the Problem?

By the commencement of the aforesaid project, the ever-increasing per capita sewage flow for the city of Lahore will be catered by the proposed sewage network. The study area is commercial and industrial in nature is located at adequate distance from various sensitive receptors. In addition, to the noise and fugitive dust emissions anticipated to be generated during the construction phase, sludge waste management may arise at the project site. The major impact associated with the operation of aforesaid project includes; the management of the sludge waste generated, odor and nuisance created from the WWTP`s and noise nuisance created during the operational phase of the WWTP's and health & safety issues.

7.2.2 When problem will occur and when it should be addressed?

The impacts from the aforesaid project activities will occur during the construction and operational phase due to the civil works involved and the people residing in the project area. These issues include; noise generation, fugitive dust emission, sludge waste management, construction debris management, top-soil removal, health and safety issues and change in the geometric features of area. These all problems should be addressed on-site where they are being generated, to avoid the residual or adverse impacts.

7.2.3 Where problem should be addressed?

The problem will be generated from site development and operation of said constructed building floors. So, it should be addressed on source i.e. site at within the same time frame.

7.2.4 How the problem should be addressed?

Proper mitigation measures will be provided according to the nature of the impacts / problems. For example, against dust emissions sprinkling of water may be done on regular basis, for sludge waste proper sludge waste management may be adopted and to manage the construction debris from the aforesaid project activities.

7.2.5 Ways of achieving mitigation measures

- The proposed project design will follow the principle of sustainable development;
- Improved management and monitoring practices;

- By providing adequate mitigation measures for air, noise and land pollution during constructional and operational phases of the project and
- Replacement / Relocation / Rehabilitation

7.2.5.1 Changing in Planning Design

The proposed project is being constructed in Lahore district, Pakistan and no sensitive area, or preserved natural resource is present which could impact due to the commencement of aforesaid project as it is located in commercial area and industrial area. No replacement, relocation and rehabilitation will be required for the commencement of the aforesaid project.

There is no endangered and threatened species has been reported in the project & study area. Moreover, there is not any settlement or infra-structure present on-site that will be dislocated or dismantled due to the establishment of aforesaid project. Hence, there is no need to change the location of the project.

The anticipated impacts had been reduced significantly by adopting better management activities, as it will be carried out for betterment of the society. While environmental monitoring will be conducted on the regular basis to keep the sources of the air pollution, wastewater generation, noise and public-nuisances in check.

7.2.5.2 Compensation in Monetary Terms

Due to the establishment of the aforesaid project at the proposed location, some of the vegetation will be removed during the construction activities. No impact on the geography / landscape of area will be envisaged due to the installation of aforesaid project. However, there is no protected or environmentally sensitive area present within 5.0 Km vicinity of the project area periphery that could be impacted. Hence, no compensation in the monetary terms will be required. However, for the removal of one tree from the project area, 10 trees will be planted as the compensation.

7.2.5.3 Replacement, Relocation and Rehabilitation

The proposed project is being constructed at the proposed location in Lahore, Punjab and no sensitive area, human population or preserved natural resource is present which could be impacted due to the commencement of aforesaid project as it is located in commercial and agricultural area. Therefore, no major replacement,

relocation and rehabilitation will be required for the commencement of the aforesaid project activity.

7.2.5.4 Improved Monitoring and Management Practices

In order to mitigate negative impacts envisaged due to the aforesaid project will require adaptation of some improved monitoring and management practices which are covered in detail in the given EMP plan in this EIA report.

7.3 SIGINIFICANCE OF IMPACTS

Incorporation of the suggested mitigation measures reduces the adverse impact of the project and brings it within the acceptable limit. This step refers to the identification of the anticipated remaining impacts after mitigation measures have been applied. These impacts are referred as residual impacts. The said project will pose not any adverse impact or threat on any component of the environment. The impact assessment criteria are given below along with their impacts:

Table 7-1 Impact assessment Criteria

Impact	Criteria
No Impact	When the proposed activity will have no impact on biotic and abiotic factors.
Long Terms	When the impact is of high intensity with high spread and high duration or of high intensity with medium spread and medium duration
Moderate	When the impact is of moderate intensity with high spread and high duration or of high intensity with low / moderate spread and low duration.
Short Term	When the impact is of low intensity but with moderate spread and moderate duration or of moderate intensity.
Insignificant	When the impact is of low intensity, low spread and low duration.

The evaluation of impacts has been carried out on the basis of developing impact matrix, in which impacts have been rated on the basis of their significance. For rating impact significance, the following criterion has been developed.

The following scale has been used for the evaluation of impacts:

LA = Low Adverse (low / short-term damage to the environment)

MA = Medium Adverse (Moderate damage to the environment)

HA = High Adverse (severe damage to the environment)

LB = Low Beneficial (Less beneficial to the environment)

MB = Medium Beneficial (Moderately beneficial to the environment)

HB = High Beneficial (Highly beneficial to the environment)

N / A = Not Applicable

O = Insignificant / No Impact

7.4 METHODOLOGY FOR IMPACT EVALUATION

The methodology adopted for the evaluation of the impacts included the following assessment tools, such as project impact evaluation matrix.

7.4.1 Project impact evaluation Matrix

he 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 (construction and operational phases).

Table 7-2 Environmental impact Evaluation Matrix (Construction Phase)

Sr. No.		Physical Environment							Biological Environment			Socioeconomic Environment								
	Environmental Components / Project Activities	Topography	Soil Erosion/Contamination	Landscape	Air Quality	Hydrology and Drainage	Surface Water Quality	Groundwater Quality	Habitat Change	Vegetation	Fauna Movement	Public Health & Safety	Disruption of Public Utilities	Employment	Population Disturbance	Social Disorder	Cultural/Religious Values	Noise & Vibration	Local Economy/Benefits to Community	Traffic Management
1	Vegetation Clearing	O	LA	LA	LA	O	O	O	LA	LA	O	O	O	MB	LA	O	O	LA	O	LA
2	Construction camps	O	LA	LA	LA	O	O	O	O	LA	LA	LA	O	LB	LA	LA	O	LA	LB	O
3	Excavation operations	LA	LA	LA	LA	LA	LA	LA	LA	LA	LA	LA	LA	MB	LA	O	LA	MA	MA	LA
4	Transportation of construction materials	O	LA	O	MA	O	LA	O	O	O	LA	MA	LA	MB	LA	O	O	MA	LB	MA
5	Use of construction materials etc.	O	LA	O	LA	O	LA	LA	O	O	O	LA	LA	O	O	O	O	LA	LB	O
6	Earthwork / concrete work operations	O	LA	LA	LA	LA	LA	O	LA	O	LA	LA	O	MB	O	O	O	MA	MB	O
7	Waste Management	O	LA	O	LA	O	LA	LA	O	O	O	LA	O	MB	O	LA	O	O	O	O
8	Sludge Management from WWTP`s	O	LA	O	LA	O	MA	LA	O	O	O	LA	O	LB	LA	O	O	O	O	O

Legend:

O-Insignificant/No Impact, NA – Not Applicable, LA- Low Adverse, MA-Medium Adverse, LA – Low Beneficial, MB- Medium Beneficial

Table 7-3 Environmental Impacts Evaluation Matrix (Operational Phase)

Sr. No.		Physical Environment							Biological Environment			Socioeconomic Environment								
	Environmental Components / Project Activities	Hydrology / Drainage	Soil Erosion/ Quality	Surface Runoff	Air Quality	Landscape	Surface Water Quality	Groundwater Quality	Habitat Change	Vegetation	Fauna Movement	Public Health & Safety	Land Use	Employment	Community Development	Economic Activity	Communication System	Noise & Vibration	Local Economy/Benefits to Community	Traffic Management
1	Movement of Vehicular Traffic	O	O	O	LA	O	O	O	O	LA	LA	LA	O	HB	MB	MB	O	LA	HB	LA
2	Transportation of Goods / Passengers	O	O	O	LA	O	O	O	O	O	LA	MB	O	HB	MB	HB	MB	MA	HB	LA
3	Road Maintenance	LA	O	LA	LA	O	LA	O	O	O	LA	LA	O	HB	O	LA	LA	LA	O	LA
4	Pumping Machinery Maintenance	O	O	O	LA	O	LA	O	O	O	LA	MB	O	HB	MB	HB	HB	MA	HB	O
5	Sludge Treatment	LA	O	LA	LA	LA	LA	O	NA	MB	NA	LA	O	HB	O	O	NA	LA	LB	NA

Legend:

O-Insignificant/No Impact, NA – Not Applicable, LA- Low Adverse, MA-Medium Adverse, LA – Low Beneficial, MB- Medium Beneficial.

7.4.2 Impact Screening Checklist

The impact screening checklist is developed to screen out potentially insignificant environmental and social impacts from potentially significant adverse environmental and social impacts during planning & designing, construction & installation and operational phases of the project. The objective of impact screening process is to assess the significance of issues related to the air, water, noise, soil, transportation, civil work, communication, the hazards and external constraints. The beneficial and adverse impacts of project during planning & designing, renovation & installation and operational phases are identified based on their duration, location, frequency, extent, significance and reversibility. The impact of each activity on various environmental parameters is given below:

Table 7-4 Impact Screening Checklist

Sr. No.	Environmental Component	Impact Characteristics												
		Duration		Location		Frequency		Extent		Significance			Reversibility	
		Long	Short	Direct	Indirect	Cont.	Intermittent	Wide	Local	Large	Moderate	Minor	Rev.	Irrev.
Beneficial Impacts														
1	Employment Opportunity	◙		◙		◙		◙			◙		◙	
2	Economic Uplift in Country	◙		◙			◙	◙			◙			◙
3	Tree Plantation	◙		◙		◙			◙		◙		◙	
4	Water Quality	◙		◙		◙		◙		◙			◙	
Adverse Impacts														
1	Air Pollution		●	●			●		●			●	●	
2	Wastewater		●	●		●			●			●		●
3	Solid Waste/Construction Debris		●	●		●			●		●			●
4	Health and Safety		●		●		●		●			●		●
5	Odour & Sludge Handling		●	●			●		●		●			●

7.4.3 Approach for mitigation Measures

Following approaches may be used to mitigate the impacts of the project:

Avoid: Change of route or site details, to avoid damage to important ecological or Archaeological features.
Replace: Regenerate similar habitat of equivalent ecological value in different location.
Reduce: Filters, noise barriers, dust, enclosures, visual screening, wildlife corridors and changed time of activities to reduce the impact.
Restore: Site restoration at the end of the operational activities.
Compensate: Relocation of displaced communities, facilities for the affected communities, financial compensation for the affected individuals, etc.

7.5 EXPECTED POTENTIAL IMPACTS AND MITIGATION 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:

7.5.1 Impacts and Mitigation measures During Pre-Construction phase/ Design Phase

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

7.5.1.1 Topography / Drainage Design

The proposed project does not alter the overall topography and drainage patterns of the area. In fact, the WWTP will help in improving water quality situation and the overall ecosystem of Lahore city. The nature of proposed impact will be direct, low, short-term and hence significant.

Mitigation Measures

Mitigation measures will include provision of drains of adequate capacity around the proposed sites to divert storm water runoff from the adjacent agricultural area during the rain. The proposed embankments should be designed to improve aesthetic in the area by provision in design for landscaping, plantation of ornamental plants and grassy lawns. Potentially, also small-scale measures, like ponds and wetlands, *e.g.* receiving storm water runoff, to encourage biodiversity on-site.

7.5.1.2 Nuisance Hazards to Neighboring Areas

It is anticipated that the proposed WWTP will cause nuisances to surrounding areas due to foul smells and odour. The nature of the proposed impact will be direct, low, long-term and hence moderately significant.

Mitigation Measures

- To minimize this impact, such appropriate sites for installation WWTP should be selected so that minimum number of people are affected.
- In addition, design should include provision of buffer zone consisting of plantation belts around the proposed WWTP sites.
- Provision should be made in the design for proper drying and disposal of sludge produced.

7.5.1.3 Inadequate Design

Inadequate design may affect the proposed project due to deficiencies like improper estimation, pumping equipment and accessories, selection of improper pipe material and accessories vulnerable to leakages. At the design stage, correct generation of wastewater by considering population corresponding to the Project area will be calculated. The selection of machinery will be at least 15-20 years for smooth functioning of the WWTP. The nature of proposed impact will be direct, low, long-term and hence significant.

Mitigation Measures

The leakages will be controlled by appropriate selection of materials for pipe and accessories suitable for local conditions and provision of optimum pipe sizes.

7.5.1.4 Selection of Poor Construction Material

Ground water quality may be affected significantly due to leakages caused by poor selection of material for sewage pipes/force main and conveyance system. In the long run, it can result in health and hygiene problems in the service area. The impact is moderate, adverse and permanent in nature.

Mitigation Measures

Public health problems can be overcome by appropriate selection of the locally available construction material, which is safe for human use, and choice of pipe material and sizes fulfilling the requirement of the area.

7.5.1.5 Inadequate Buffer Zone

Inadequate buffer zone around the WWTP may cause inconvenience to the local population due to the running of heavy-duty pumps resulting in higher noise levels and odour generated by sewage especially in areas which are comparatively densely populated. The magnitude of this impact is high, adverse and permanent in nature.

Mitigation Measures

- Provision of buffer zone in the form of raised walls/plantation and round the clock maintenance in the form of oiling of parts producing noise and vibrations.
- Landscaping and plantation will improve the aesthetic value and ecological habitat of the project area as well as reducing the impact of noise on the surrounding environment.
- Perimeter fence (wire mesh 2m) to be included in design.

7.5.1.6 Health and safety of workers

Common facilities are to be included in the design for workers' wellbeing, *e.g*. adequate sanitary facilities, toilets and showers, separated for men and women. This includes appropriate quarters *e.g.* for staff to eat lunch and for breaks. In addition, staff training room *e.g.* for EHS training. Emergency first aid centre (may also be used for periodic worker health checks) and a PPE storage area to be provided.

7.5.1.7 WWTP Performance

A water quality laboratory for testing wastewater and sludge will also be provided. Effluent may be tested at influent, at selected process steps and just before the point of discharge to canal. Testing to provide knowledge base to optimise WWTP performance and to verify that the maximum pollution concentrations/thresholds are being met prior to discharge.

7.5.2 Expected potential Impacts and Mitigation Measures During Construction Phase

Construction of the Kattar Bund WWTP involves a large number of activities, *incl.* site preparation and civil works, clearing of vegetation, excavation, surface preparation, paving, access roads and facility building works. Due to these construction activities, various types of environmental as well as health and safety impacts are expected to occur, which are discussed in detail hereunder.

7.5.2.1 Air Pollution

During the construction phase of the proposed project, it is envisaged that dust pollution and exhaust gases of vehicular emissions/construction machinery may be generated, which may affect the environment of the proposed Project area and can cause respiratory tract problems to the residents near the project construction site. The magnitude of this impact is moderate, adverse and temporary in nature.

Mitigation Measures

- Monitoring and supervision for strict enforcement/fulfilment of contractual obligations by the construction contractor regarding control of dust and gaseous emission to minimize public nuisance, recording and mitigation of all legitimate community complaints, involvement of local community and proper system for addressing their concerns.
- All vehicles, machinery, equipment and generators used during construction activities will be kept in good working condition and properly tuned and maintained in order to minimize the exhaust emissions.
- Also, the vehicles carrying construction materials and the construction material storage areas should be covered with tarpaulin.
- Open burning of any kind of waste material should be prohibited at the site.

- Speed limits would be defined for the vehicles at the construction site. Maximum efforts will be done to keep the pollutants level within the defined limits of PEQS/NEQS.
- The construction contractor of the proposed project will ensure regular spraying of water on all temporary service and access roads to minimize the dust generation.
- These measures will be implemented by the Contractor and Supervisory Staff and will ensure that they are carried out as part of its contract supervision function.

7.5.2.2 Noise and Vibration

Noise is most pervasive environmental problems in the urban areas. Noise is a by-product of human activity and area of exposure increases as function of mobility and construction activities. The main sources are heavy machinery such as bulldozers, excavators, stabilizers, concrete mixing plant, drills, asphalt plants and other equipment. The above machinery is expected to generate noise levels that would be severe in certain project areas.

Mitigation Measures

All the mitigation measures mentioned below should be taken in order to minimize the impacts of noise in the Project area. These measures include, but are not limited to the following:

- Selection of up-to-date and well-maintained equipment with reduced noise levels ensured by suitable in-built damping techniques or with appropriate muffling devices.
- Providing the construction workers with suitable hearing protection like earmuffs and providing them adequate training.
- Preferably, restricting construction vehicle movements during night-time.
- Machinery with low noise level or machinery with noise shielding and absorption should be used.
- Contractors should comply with submitted work schedule, keeping noisy operations away from sensitive points; implement regular maintenance and repairs; and employ strict implementation of operation procedures.
- Vehicles and equipment used will be fitted, as applicable, with silencers and properly maintained.
- Hedges and high boundary walls should be used as noise barriers in sensitive areas such as schools, hospitals and mosques.

- Schedule the construction works such that the number and usage times of noisy equipment are reduced.
- Physically separate the noise sources and the sensitive receivers (both existing and planned) as far as practicable.
- In accordance with the Environmental Monitoring Plan, noise measurements will be carried out at locations and schedule specified to ensure the effectiveness of mitigation measures.

7.5.2.3 Ground Water

Construction waste, if left unattended, will result in forming leachate that will percolate through the soil strata and will reach underground water table and hence, will end up contaminating it. Also, the water for construction and consumption may come in conflict with local water demand. There is a probability that various materials like fuel, lubricant oil and other oily products, which are used during the construction phase may contaminate groundwater, if they are not handled properly.

Mitigation Measures

- Protection of groundwater reserves from any source of contamination, such as construction or oily wastes that will degrade its potable quality.
- The solid waste will be disposed of in designated landfill sites to sustain the water quality for domestic requirements and water required for construction may be obtained in such a way that the water availability and supply to nearby communities remains unaffected.

7.5.2.4 Improper Construction Techniques

Monitoring for different environmental and health and safety parameters is very important during different construction operations like excavation and lying of pipes. Provision of inadequate arrangements for monitoring and supervision of construction works may cause damage to the local environment in the form of enhanced public inconvenience, traffic jams, disposal of excavated material, *etc*. The magnitude of this impact is moderate, adverse and temporary in nature.

Mitigation Measures

- The supervisory/monitoring staff should be experienced and qualified enough to handle the excavated material and its disposal in designated places without harming local environment.
- Supervision and training for the contractor's staff should be provided and implemented.
- If necessary, a traffic management plan should be made covering any works and vehicle transports affecting the public road infrastructure (one way traffic, diversions, etc.) to be coordinated with the relevant authority and the police.

7.5.2.5 Soil Erosion

The project area is plain with paved road structure. Soil erosion and contamination may occur on the roadside and at the contractor's camp due to the following likely impacts:

- Excavation process can destabilize the surrounding land surface, particularly if excavated area is left unfilled for a long time, which may lead to rainfall induced soil erosion.
- Leakages of oil, lubricants, chemicals and other similar substances from their storage sites and from engines of the generators, machines, equipment and vehicles.
- Non-provision of septic tanks with the temporary work site toilets, constructed for the labours and others, can contaminate the receiving soils because of raw nature of the effluents; and
- Also washing of the machinery and equipment without proper drainage of the washout water can adversely affect the soil quality.

Mitigation Measures

- All spills will be disposed of as required, and the site will be restored back to its original condition.
- Excavation would be kept confined to the specified foundation spots as per the engineering drawings.
- Site camps for the resident labours should not be set on the land marked for developing green belts.

- Oils, lubricants, chemicals and other listed hazardous materials should be safe from rainfall and away from any potential source of fire; and
- Septic tanks of adequate capacities should be constructed for receiving and treating wastewater from all temporary worksite toilets and the temporary container offices. The toilet wastewater should not be discharged untreated onto the adjacent lands.

7.5.2.6 Disposal of Excavated Soil

The construction activities and buried infrastructure will require the excavation of significant quantities of soil. This will result in excavated material that can be used for re-profiling of the roads. The impacts on the loss of resource are considered to be moderate adverse and temporary in nature.

Mitigation Measures

Where possible, material should be reused on site for re-profiling to minimize the amount of soil used and the soil to be disposed.

7.5.2.7 Solid and Hazardous Waste

Construction activities such as excavation, clearing of vegetation, *etc*. will generate waste materials like excavated soil and domestic waste from workers. Other types of waste that are likely to be generated during construction include:

- Recyclables – paper, cardboard, glass, plastic, wood, metals, etc.
- Organic waste – food waste, vegetation; and
- Hazardous Waste – including for example, chemical wastes such as coating substances, solvents, used chemical drums and used spill kit materials.

Any surplus construction waste will be sent to the nearby solid waste landfill site. Assuming that excavation and demolition will be kept to a minimum and considering the construction will only be temporary and will be disposed of to landfill. The waste generated during construction would have a moderate, adverse effect and is temporary in nature.

Mitigation Measures

Construction debris and demolition material will not be allowed to accumulate during construction phase. All such material is to be disposed of on daily basis. Waste piles will only be allowed if the contractors meet the following requirement at the site:

- Pile only contains passive waste (*e.g*. wood, metal, plastic, dry concrete) and no food waste, hazardous waste or wastewater.
- Waste pile is controlled so that it does not spread and start to impede other activities and stays at a height that it does not become a safety hazard. Barricades may also be placed around the pile to delineate the safe distance for other workers.
- Waste piles are positioned so that they are not visible to the general public where they could have a negative visual impact.
- If the waste pile contains plastic, paper or other light-weight material it needs to be covered with a tarpaulin; and
- Liquid waste, such as grey wastewater, sewage, slurry and other wastewater will be collected from source by a designated tanker and taken off-site for disposal at safe disposal facility.
- Solid waste and hazardous waste management plan for construction phase.

7.5.2.8 Flora

Tree cutting is involved for land clearing for the installation of the WWTP. The conversion of agriculture land will have moderate negative impact on the floral species and vegetation. However, the impact will be minimized after the landscaping.

Mitigation Measures

The proposed mitigation measures will include:

- Incorporate technical design measures to minimize removal of the trees, if possible.
- Landscaping and plantation will improve the aesthetic value and ecological habitat of the project area.
- A landscape will be properly designed with provision of new trees/plantations around the boundary, roadside and stretches of open land. The vegetation for the attenuation of air pollution would be most needed in the areas where ground level concentrations of the pollutants are expected to rise.

7.5.2.9 Fauna

During construction, any existing species of fauna could be affected by disturbance and fragmentation, as the construction area may represent a barrier to the species and result in the splitting up of populations. During the construction phase, there will be adverse impact on the mammals, birds and reptiles of the area, due to the construction activities involving excavation, movement of labour, carriageway of goods and machinery to various sites along the project area.

Given that the species of fauna are thought to be present at low density, the number of individuals affected by the proposed Project is likely to be relatively low. Furthermore, the loss of this habitat would not constitute a large impact. The magnitude of this impact is expected to be low adverse and temporary in nature.

Mitigation Measures

- The camps will be properly fenced and gated to check the entry of animals in search of eatable goods. Similarly, wastes of the camps will be properly disposed of to prevent the chances of eating by animals, which may become hazardous to them.
- Special measures will be adopted to minimize impacts on birds, such as avoiding noise generating activities during the critical periods of breeding.
- Staff working on the project should be given clear orders, not to shoot, snare or trap any bird.
- The Contractor will decide to minimize the vibration, noise pollution through good engineering practices.

7.5.2.10 Occupational Health and Safety of Workers

The health and safety issues are associated with the operation of construction machinery and equipment, excavation works (working in trenches), working in confined spaces, and the storage of flammable materials which may cause minor and severe injuries to workers. Moreover, concrete releasing agents and cleaning agents may cause toxic effects on the workers. The magnitude of this impact is moderately adverse.

Mitigation Measures

- Occupational safety measures such as use of well-maintained machinery and equipment and training of workers in the construction safety shall be taken.

- Ensure provision of protective clothing (PPE) for laborers handling hazardous materials, e.g. helmet, adequate footwear, gloves, high visibility vests, etc.
- The safety of the public at all stages of the construction will be ensured through appropriate public education and safety measures such as use of sign boards, barriers and flags and proper illumination at night.
- The flammable and combustible substances will be properly stored in designated areas and Material Safety Data Sheets (MSDS) will be used for proper handling.
- Firefighting equipment will be placed at an easily accessible place and inspected on regular basis.
- Contractor to develop a health and safety management plan for the construction phase.

7.5.2.11 Socio-Economic Impacts

In project area, no significant changes are envisaged in traditional lifestyle and occupation of local people residing in the nearby communities as it is being established at adequate distance from various sensitive receptors. The local people are rather benefited due to the provision of job opportunities. No impact is envisaged due to influx of workers as local will be preferred and hired for working. Social issues may arise which will cause minor negative impact on the social lifestyle of people. Moreover, health and safety related issues may arise during the construction activities. These impacts are in-significant can be further reduced significantly by adopting best management practices. The nature of the proposed impact will be direct, low, short-term and hence significant.

Mitigation Measures

Following mitigation measures will be adopted to reduce the socio-economic impact on the community:

- Good relations with local communities will be promoted by encouraging contractor to provide opportunities for skilled and un-skilled employment to the locals as well as on job training.
- The contractor should prefer hiring local labour from adjacent communities.
- In case of not hiring the locals, contractor will restrict his permanent staff to interfere unnecessarily with the locals to avoid any social problems.

- The contractor will keep the copy of National Identity Card (CNIC) of his employees and will warn the workers not to involve in any anti-social activities otherwise they may face dire consequences.
- At the time of hiring, the contractor must ensure that workers should be good repute.
- First aid kits having all the necessary first aid stuff will be available at site.
- Routine medical check-ups of all the field staff including unskilled labour needs to be conducted by qualified physician and surgeon.
- Trainings of workers should be carried out for operating various constructional machinery, safety procedures should be adopted, environment awareness should be carried out, equip all workers with safety boots, helmets, and protective masks and monitoring for their proper and sustained usage will be carried out. In case of accidents, contractor will provide free medical treatment to the community.
- The contractor will be responsible for sensitivity towards the local customs and traditions.

7.5.2.12 Borrow pits/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;
- 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.

7.5.2.13 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 siting 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 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.

7.5.2.14 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. This impact can be categorized as direct, moderate, site-specific, short term, temporary, high probability and reversible.

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
- 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.

7.5.2.15 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 Kattar Bund 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 will be prepared by the contractor and implemented to avoid traffic accidents, jams/public inconvenience.

7.5.2.16 Climate Change and Green House Gas Abatement

The main sources of Greenhouse Gases (CO2, CH4, NOx 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.

Mitigation Measures

- Regular monitoring of the vehicles for engine efficiency;
- All stakeholders (WASA, 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 equipment 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.

7.5.2.17 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

- An Emergency Response Plan (ERP) for earthquakes and manmade disasters should be developed by contractor in coordination with SC and WASA should be implemented in close consultation with the RESCUE Services and other concerned departments;
- Training of the Contractor and WASA 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 WASA management.

7.5.2.18 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 labor 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 pacific, 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 laborer 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 heath 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 WASA; 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.

7.5.2.19 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.
- 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.

7.5.2.20 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.

7.5.2.21 Social/ Cultural Conflicts

During the construction phase of the project, conflicts may arise between labor force and Local communities. 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.

7.5.2.22 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. 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;

Mitigation Measures

- 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 COVIID-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.

7.5.2.23 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.

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 construction's 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 Standard Operating Procedures (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.
- 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.

7.5.2.24 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
- Only those (sub-)contractors should be employed which meet legislation for not using child labour
- 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.

7.5.3 Expected Potential impacts and mitigation measures during operation phase

Various types of environmental impacts are expected to occur during the operation phase of the proposed project which are discussed hereunder. Note that most impacts are relevant irrespective of the treatment process, however those specific to Trickling Filters are highlighted.

7.5.3.1 Air Pollution

The operation of all wastewater treatment plants results in direct emissions from the biological processes of greenhouse gases (GHG), such as carbon dioxide (CO_2),

methane (CH_4), and nitrous oxide (N_2O), as well as indirect emissions resulting from energy generation. In a defined system boundary, the emissions of GHG from different scenarios can be estimated and evaluated. The GHG emissions include: 1) direct emission of GHG from wastewater treatment comprising emission of CO_2 due to degradation of organic matters, emission of N_2O during the process of nitrification and denitrification and emissions of CH_4 and N_2O from anaerobic digestion during sludge treatment (*esp.* Trickling Filter and Activated Sludge), and 2) indirect emissions of GHG from sludge treatment (all processes), usage of electrical power and chemicals during the operation and maintenance of the treatment plant and disposal of sludge. The magnitude of this impact will be moderately adverse.

Mitigation Measures

- Air quality monitoring should be carried out on quarterly basis for parameters like CO, CO2, NO2, SO2 and PM10 (Particulate Matter).
- The carbon footprints must be calculated considering all relevant sources and sinks within the system or activity.
- The methodology used to estimate GHG emissions must be based on the Intergovernmental Panel on Climate Change (IPCC).
- Assess the possible reduction potential of GHG emissions to obtain carbon credit.
- The residual impact after implementing the mitigation will be slight adverse. Plantation of trees inside and outside the boundary of the plant shall be carried out, and low sulphur fuel should be used to minimize the effect of air pollution.
- Problem of Filter Flies which is of particular relevant for Trickling Filters using rock media. Kattar Bund WWTP will utilise plastic media which substantially reduces this problem by avoiding blocked spaces between rocks which harbour filter flies.
- If the trickling filters are operated at flowrates substantially lower than design, there may be insufficient wetting of the filter support material, hence gaps occur in which filter flies may breed and become a nuisance, esp. in the hot weather season – this is particularly a problem when the WWTP is located adjacent to residential areas. Although this was a problem in the past when the filter media was crushed rock (and hence difficult to control the density of the packing), the problem is significantly reduced with the modern use of plastic material. The problem of filter flies may be dealt with via a range of operational methods, e.g.:
- Utilise the new technology of plastic media rather than the old technology of crushed rock (the use of plastic material is proposed in Faisalabad as well as

Lahore, however it is noted that Karachi is utilising rock media which is an old technology);

- Maintain the flowrate to each filter according to design in order to avoid gaps where filter flies may breed (this may require taking trickling filter units out of service when the WWTP operates at low capacity);
- Periodic flooding of the filter at a standard time schedule which flushes out any filter fly eggs;
- High pressure spraying of the filter media in areas which have become clogged;
- Chemical sprays;
- Develop air quality monitoring plan for operations phase.

7.5.3.2 Odour

The operation of all WWTPs results in generation of odour which causes nuisance to the residential community in the surroundings of the WWTP and the people passing by this area for schools, mosque and shops *etc*. The magnitude of this impact will be moderately adverse.

Mitigation Measures

- Screening of wastewater should be regularly done, and screening waste should be disposed of safely.
- Landscaping and plantation will improve the aesthetic value and ecological habitat of the project area.
- A landscape will be properly designed with provision of new trees/plantations around the boundary, roadside and stretches of open land. The vegetation for the attenuation of air pollution & odour problems would be most needed in the areas where ground level concentrations of the pollutants are expected to rise.
- Vegetation barrier may also help reducing Odour in the surroundings of the area.
- Implement a Stakeholder Engagement Plan for the operations phase that includes a grievance mechanism in which affected persons can register complaints/contact WASA about odour and other perceived nuisances.

7.5.3.3 Noise and Vibration

Due to the operation of proposed pumping stations, noise and vibration may be produced due to the running of pumping machinery and standby generators which

will be a constant source of nuisance to the local population of the nearby communities. The magnitude of this impact is considered to be moderately adverse.

Mitigation Measures

- 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. Items of equipment which have high level of noise and vibration should be within a sound-attenuation building.
- Implement a noise management plan for the operations phase.

7.5.3.4 Solid / Sludge Waste

Solid waste will be generated from the screens installed at the WWTP, or sludge during maintenance/cleaning of the WWTP. Sludge is a by-product of the treatment process and will be dewatered to a semi-solid state suitable for composting. The solid waste and sludge will result in foul odour and attract disease vectors. The growth of pathogens and associated risks will increase, which may affect the health of the community, if handled improperly. The magnitude of this impact is considered to be moderately adverse.

Mitigation Measures

- Sludge must be treated using appropriate treatment technologies and further utilized in the production of biogas in the anaerobic digester.
- The sludge is to be dewatered with centrifuges to reduce the volume and the separated water (Reject water) will be further treated.
- Regular inspection and maintenance should be scheduled and implemented to ensure removal of solid waste and sludge when accumulated.
- Proper disposal of sludge for agricultural re-use or to the designated long-term sludge storage site; and
- Implementation of sludge handling and storage procedures should be ensured.
- Develop sludge management plan/strategy for operation phase, including regular testing of sludge to ensure that it meets the appropriate standards for sludge re-use in agriculture.

7.5.3.5 Occupational Health and Safety Issues

The occupational health and safety issues are mostly associated with the operation of machinery and equipment, handling of fuel, noise, odour, exposure to disease vectors, *etc*. The magnitude of this impact is considered to be major-adverse, short-term.

Mitigation Measures

- The issues related to operation of machinery and equipment will be controlled by efficient management, staff training, maintenance of machinery and equipment, and other preventive measures.
- Proper Storage and Handling of fuel (esp. for the stand-by generator).
- First Aid kit should be provided at WWTP.
- Provision of Safe drinking water; and
- Provision of Personal Protective Equipment (PPE) to employees, incl. masks, gloves etc.
- Require that suppliers train WASA staff in new equipment.
- Develop a H&S policy and management plan for operation phase including the anaerobic digestor where there are explosion risks due to methane leakage, and working in confined spaces. All workers to receive appropriate training for their job descriptions, and should have the appropriate qualifications.
- Health and safety requirements to be included in any maintenance contracts.

7.5.3.6 Ecological Resources

No negative impacts are envisaged on the flora of the area during the operational phase. New trees/plants will render a positive impact on the flora of the area and will also cause positive impact on the landscape of the area, which will be permanent in nature. Presence of adequate flora will absorb emissions, through photosynthesis, emitted from generators and odour from sewage thus purifying the air. The magnitude of this impact is moderately beneficial.

Mitigation Measures

- This aspect is considered to be beneficial; hence no special mitigation measures are required.

7.5.3.7 Emergency Preparedness and Response

The operation of the WWTP may encounter emergencies like operation failure. In addition, disasters such as earthquakes and fires may occur which have to be considered for minimizing their impacts. This impact is moderate adverse.

Mitigation Measures

- An Emergency Response Plans for floods, earthquakes, and manmade disasters should be developed by WASA-L management. Emergency Response Plan will be implemented in close consultation with Fire Fighting Department and paramedics. In addition, training of staff/employees regarding the emergency procedures/plans should be regularly conducted.
- Responsible person to implement the Emergency Response Plan should be clearly designated.
- The staff should be trained timely and concise response procedures.
- Emergency numbers should be clearly posted so that a quick action is taken when an emergency arises.
- Firefighting systems should be calibrated and maintained regularly; and
- Regular drills for fire emergencies should be carried out.

7.5.3.8 Water pollution

- Water quality may be tested on-site at influent, at selected WWTP process steps and prior to the point of discharge to the canal. Testing to provide knowledge base to optimize WWTP performance and to verify that the maximum pollution concentrations/thresholds are being met prior to discharge.
- Mitigation – develop a test protocol including procedure for sample taking, how and where it will be tested, and the recording of results.

7.6 OVERALL ASSESMENT

7.6.1 Main issues and concerns

During the field surveys, significant efforts were made to identify the main environmental, ecological and social issues related to the implementation of the proposed project. Residents and stakeholders were also contacted for obtaining salient information of the project. Following is the list of main issues and concerns:

- Disturbance to the public movement during construction activity.

- Noise and air pollution due to the operation of construction machinery during construction phase of the project will create a nuisance for the nearby residential area.
- Disruption of existing public utilities during construction phase.
- Oil spillages from construction machinery, resulting in soil and drinking/spring water contamination.
- Health and safety problem of the workers may also arise during the construction and operation phase of the project.

7.6.2 Potential Environmental Enhancement Measures

After the completion of the proposed project, residents of the Lahore City will get the following benefits:

- Environmental nuisance created by the untreated disposal of wastewater of Lahore city will be overcome by the construction of the WWTP at the designated site.
- The Project will reduce the organic pollution discharged to the Ravi River by approx. 10,000 kg/day. This will improve conditions for aquatic life.
- Treated effluent will be returned to the irrigation system for agricultural re-use. The remaining nutrients will support crop growth on the farms.
- The return of treated effluent supports the nexus between the Department of Irrigation (which will release raw water to WASA for the production of potable water for drinking water purposes) and WASA (which will discharge treated water back to the irrigation system to service downstream farms). This is an example of implementing a “circular economy” in agricultural re-use as shown in the figure below:

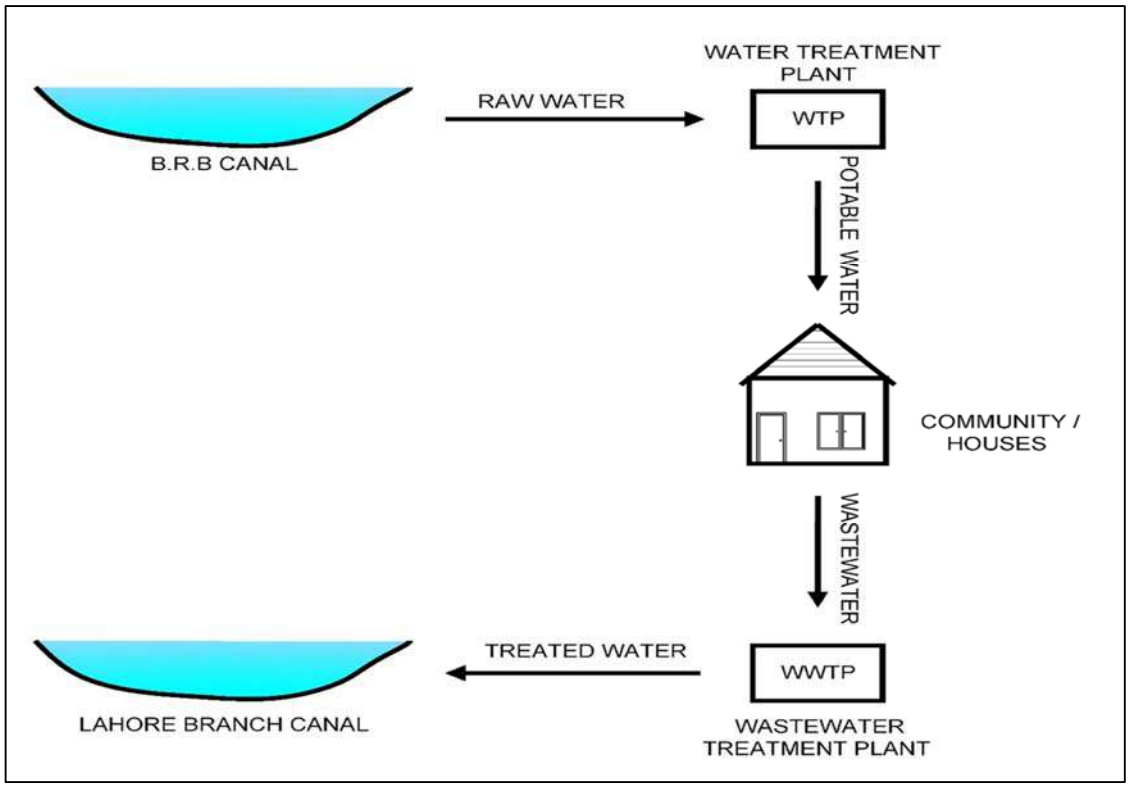


Figure 7-1 Circular Economy

- Improvement in health conditions of the residents of project area.
- Decrease in health budget of the residents of the project area.
- Elimination of existing sewage disposal system replaced by the enhanced conveyance system along with treatment of wastewater fulfilling the adequate capacity required.
- Dissolved oxygen levels will remain intact in the lakes and water bodies as the treated wastewater will be disposed of in the water bodies. It will enhance the overall ecological aspect of the project area.
- Farmers will be benefited as they will be provided the treated water for irrigation purposes.
- Business will spin-off in the agricultural sector around the project area.

To consolidate these positive impacts, Tree plantation within the project area will act as environmental enhancement measure. Trees of native species will be grown on all open spaces and along boundary of project. Untreated wastewater will not enter into River Ravi after implementation of the project, this will save environment and aquatic life.

7.6.3 Cumulative Impacts of the Project

Numerous Environmental Hazards are associated with untreated wastewater including ground water contamination, impact on disease burden, decrease in soil productivity, contamination of vegetable and crops grown with wastewater become contaminated with pathogens especially when consumed in raw form. Sometimes the foul smelling of untreated wastewater originates from the industrial and residential areas and creates a sense of nuisance for the residents of the different areas, and ultimately it degrades the overall aesthetics of the city. Therefore, there is an immediate need for construction of 6 Nos. of WWTPs as planned in Lahore Master Plan, in order to treat the major pollution load of Lahore city. Kattar Bund WWTP is one of six WWTPs planned for Lahore for the treatment of Kattar Bund catchment. This will contribute to the improvement of overall ecological habitats located within Lahore city.

The proposed project will not cause potentially significant environmental and social adverse impacts on the local environment after adequate and timely implementation of the mitigation measures during pre-construction/design phase, construction phase and operational phase of the aforesaid project. Most of the environmental impacts are moderately adverse in nature. However, these impacts can be mitigated by the implementation of Environmental Management Plan (EMP). By proper implementation of Environmental Management and Mitigation Plan during the construction phase of the project, it is envisaged that the proposed project will be environmentally feasible in the near future.

8 ENVIRONMENTAL MANAGEMENT AND MONITORING PLAN

8.1 GENERAL

A comprehensive management plan is necessary to implement the recommendations and suggestions for environmental protection included in chapter 7.

The objective of the Environmental Management and Monitoring Plan (EMMP) is to address all the major environmental issues and provide framework for the implementation of the proposed mitigation measures by assigning responsibilities during the construction and operational phases of the project. The proper implementation of the EMP will ensure that all the adverse environmental impacts identified in the EIA report are adequately mitigated, either totally eliminated or minimized to an acceptable level and required actions to achieve those objectives are successfully adopted by the concerned institutions or regulatory agencies.

The implementation of EMMP should be carefully coordinated with the design and construction program of the project to ensure that relevant mitigation measures are implemented at the appropriate stage and that adequate resources are properly allocated to achieve the desired results. This EMMP has been prepared to satisfy the requirements of the Pakistan Initial Environmental Examination (IEE) and Environmental Impact Assessment (EIA) Review Procedures, 2022.

For effective environmental management, the management of the project should assign the necessary responsibilities to its Health, Safety and Environment team, which should be responsible for environmental monitoring of the project.

8.2 OBJECTIVES OF EMMP

The primary objectives of EMP are to:

- Define the responsibilities of the project proponent and other role players during the pre-construction, construction and operational phases;
- Facilitate the implementation of the mitigation measures by providing technical details of each project impact, and proposing an implementation schedule of the proposed mitigation measures
- To develop a monitoring mechanism and identify monitoring parameters to ensure that all the proposed mitigation measures are completely and effectively implemented;

- Identify training requirements at various levels and provide a plan for the implementation of training sessions;
- Identify the resources required to implement the EMP and outline corresponding financing arrangements; and
- Providing a cost estimate for all the proposed EMP actions.'

8.3 INSTITUTIONAL ARRANGEMENTS

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

The key players involved during construction phase of the proposed Project are the WASA as employer/proponent, Punjab Environmental Protection Agency, 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;

- WASA/Proponent/Employer;
- SC's; and
- Contractor's Environmental Manager/ HSE Expert.

The employer/ proponent (WASA) 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.

8.3.1 Roles and Responsibilities During Construction Phase

8.3.1.1 WASA

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.

8.3.1.2 Supervision Consultant

A professional consulting firm will be hired by WASA 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 WASA are respected. The Project Engineer will have a full-time field based environmental specialist to ensure the implementation of EMP. The environmental 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 Expert 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 HSE for implementing each of the activity as given in EMP. he 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 SC 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 are 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).

8.3.1.3 Contractor

The Contractor will be responsible for the implementation of the Proposed Project under the supervision of the WASA (Lahore) & Consultant. The Contractor will be bound to follow the provisions of the contract documents especially about environmental protection and apply good construction techniques and methodology without damaging the environment. Obligation of the contractor, to safeguard, mitigate adverse impacts and rehabilitate the environment should be addressed through environmental provisions in the contract document and through adequate implementation at site.

- HSE Manager of contractor will be responsible for Implementation of the mitigation measures at construction site;
- HSE Manager 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.
- HSE Manager of contractor will be responsible for the implementation of EMP and to take effective measures against corrective actions plan;
- HSE Manager 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;
- HSE Manager will conduct the environmental, health and safety trainings for the staff and labors; and
- 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; o 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.

8.3.1.4 EPA Punjab

EPA 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 representative of WASA 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 WASA and all other relevant stakeholders as provided in the EMP and NOC through random site visits and meetings.

8.3.2 Roles and Responsibilities during Operation Phase

The proposed Project will be administrated by WASA during the O&M phase.

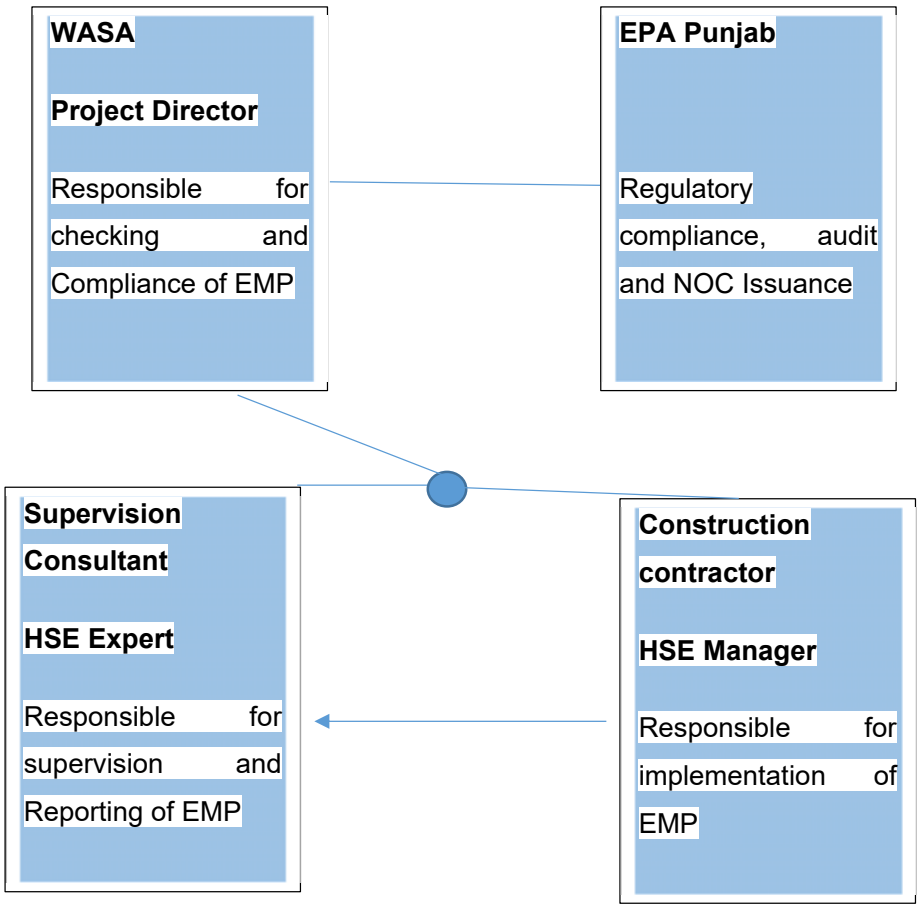
the Project Director of the proposed Project shall depute / hire Environment Expert during operation phase. The specific responsibilities of Environment expert are as follows:

- Coordinating with the operational staff working 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 WASA, EPA-Punjab, and other departments of Lahore District to ensure compliance of EMP during operation phase.

8.3.3 Summary of roles and responsibilities

The summary is shown below.



8.4 ENVIRONMENTAL MANAGEMENT AND MONITORING FRAMEWORK

The purpose of environmental management and monitoring framework is to facilitate the implementation of environmental commitments, included in environmental impact assessment study. The proponent is committed for protection of environment and for sustainable management of its related operation and activities. The environmental management and monitoring plan are given below:

Table 8-1 Environmental Management Plan

KEY:

- DC = Design Consultant
- SC = Supervision Consultant
- CC = Construction Contractor
- WASA = Water & Sanitation Agency (Lahore)
- EPA = Environmental Protection Agency

Sr. No	Aspect	Impacts	Mitigation Measures	Responsibility
(PRE-CONSTRUCTION PHASE / DESIGN PHASE)				
1.	Topography and Drainage Design	▪ The proposed project does not alter the overall topography and drainage patterns of the project area. ▪ The proposed waste- water treatment plants (WWTP`s) may cause hindrance to local drainage due to its embankments.	▪ Provision of drains of adequate capacity around the proposed STP sites to divert storm water runoff from the adjacent agricultural area during the rain. ▪ The proposed embankments should be designed to improve aesthetics in the area by provision in design for landscaping, plantation of ornamental plants and grassy lawns.	DC

Sr. No	Aspect	Impacts	Mitigation Measures	Responsibility
2.	Inadequate Design	▪ Inadequate design may not meet the quantity of sewage generated, pumping equipment and accessories. ▪ Selection of inadequate pipe material.	▪ Correct generation of wastewater by considering population corresponding to the total project area. ▪ The selection of machinery especially pumps having design life for at least 20 years for smooth functioning of the WWTPS. ▪ The number of considerations for selecting design periods of WWTPS and allied civil work, which includes expansion trends and financial position of the sponsoring/ client institution.	DC
3.	Inadequate Buffer Zone	▪ Noise and Vibration due to running of heavy-duty pumps and machinery resulting in inconvenience to local people.	▪ Provision of buffer zone in the form of raised walls and plantation and oiling of parts of machinery causing noise and vibration.	DC
4.	Nuisance Hazards to Neighboring areas	▪ The proposed sewage treatment plants are anticipated to cause nuisance to surrounding areas due to foul smelling.	▪ Such sites should be selected for construction of WWTP`s so that minimum number of people is affected.	DC

Sr. No	Aspect	Impacts	Mitigation Measures	Responsibility
			▪ Design should include provision of buffer zone consisting of thick plantation around the proposed STP sites. ▪ Provision should be made in the design for proper drying and disposal of sludge produced.	
5.	Selection of Poor Construction Materials	▪ Health and Hygiene of the service area.	▪ Selection of the construction material which minimizes the possibility of leakage from the pipes present in the serving areas.	DC
6.	Site clearance, establishment of contractor sites, etc.	▪ WASA-L agency requirement for establishment of the WWTP and its components.	▪ Obtaining the Site Clearances/ Environmental Protection Licences (EPLs) for the operation of WWTP/Sludge composting and drying area, Concrete batching plant etc., and required approvals from other relevant institutions (Environmental Protection Department EPD, Punjab).	Implementation: Contractor Supervision: WASA-L

Sr. No	Aspect	Impacts	Mitigation Measures	Responsibility
7	Information dissemination and access to grievance redress mechanism	▪ Public knowledge about the project. ▪ Public consultation and inclusive engagement. ▪ Community complaints	▪ Information dissemination to the public one month prior to site set-up. ▪ Establishing forums for public consultation on environmental and social impacts of the civil works. Ensure that consultation is gender responsive and inclusive, prompting the participation of women and marginalised groups. ▪ Information on the grievance redress mechanism to be posted at the relevant union councils and housing societies.	Implementation: Contractor, Consultant Supervision: WASA-L
(CONSTRUCTION PHASE)				
1.	Site Demarcation	▪ To contain all project activities within the site boundaries and prevent activities from extending beyond	▪ Cordon off the construction site with visible marking (e.g. reflective tape etc.) ▪ Visible site demarcation to cordon the project site	CC, SC and WASA
2.	Topography	▪ Visual changes to the topography	▪ Project design should consider aesthetic concerns.	CC, SC and WASA
3.	Vegetation removal and removing topsoil,	▪ Muddy runoff and slick conditions of roads especially during rainy seasons.	▪ Earthworks shall be carried out during dry weather periods and all exposed surfaces	Implementation: Contractor

Sr. No	Aspect	Impacts	Mitigation Measures	Responsibility
	followed by setting out, excavations and backfilling.		shall be covered to prevent sediment moving onto roads.	Supervision: WASA-L
		▪ Loosening of sub-surface soil and erosion, especially during heavy rains	▪ Earthworks shall be carried out during dry weather periods and all exposed surfaces shall be covered to prevent siltation of any streams, canals etc. Minimize earthworks during the rainy season.	
		▪ Deposition of sediment in main drainage network, natural and man-made drainage patterns/structures. ▪ Blockages of drainage structures leading to increase in flash floods during heavy rains and the breeding of insects. ▪ Deposition of sediment and an increase in turbidity in aquatic environments and the ponds/lakes.	▪ Stockpiling of earth shall be carried out at a safe distance away from any streams, canals, waterbodies etc. Temporary soil dumps shall be placed at least 50 m away from any streams, canals, waterbodies etc., and covered with a thick polythene cover. ▪ Other construction material containing small/fine particles shall be stored in a place not subjected to flooding and in such a manner that these materials will not be washed away by runoff.	

Sr. No	Aspect	Impacts	Mitigation Measures	Responsibility
			▪ Bunds, bales of hay shall be used around the site to stop silt runoff from entering any water courses. ▪ Soil from excavations etc. shall be used for levelling as appropriate. ▪ If necessary, silt/sedimentation traps shall be used to capture any silt or sediment from any runoff from site.	
4.	Air Pollution	During the construction phase of the proposed project, it is envisaged that dust pollution and exhaust gases of vehicular emissions/construction machinery may be generated, which may affect the environment of the proposed Project area and can cause respiratory tract problems to the residents near the project construction site. The magnitude of this impact is moderate, adverse and temporary in nature.	▪ Monitoring and supervision for strict enforcement/fulfilment of contractual obligations by the construction contractor regarding control of dust and gaseous emission to minimize public nuisance, recording and mitigation of all legitimate community complaints, involvement of local community and proper system for addressing their concerns. ▪ All vehicles, machinery, equipment and generators used during construction activities will be kept in good working condition and properly tuned and	SC, CC and WASA, EPA

Sr. No	Aspect	Impacts	Mitigation Measures	Responsibility
			maintained in order to minimize the exhaust emissions. ▪ Also, the vehicles carrying construction materials and the construction material storage areas should be covered with tarpaulin. ▪ Open burning of any kind of waste material should be prohibited at the site. ▪ Speed limits would be defined for the vehicles at the construction site. Maximum efforts will be done to keep the pollutants level within the defined limits of PEQS/NEQS. ▪ The construction contractor of the proposed project will ensure regular spraying of water on all temporary service and access roads to minimize the dust generation. ▪ These measures will be implemented by the Contractor and Supervisory Staff and	

Sr. No	Aspect	Impacts	Mitigation Measures	Responsibility
			will ensure that they are carried out as part of its contract supervision function.	
5.	Noise and Vibration	Noise is most pervasive environmental problems in the urban areas. Noise is a by-product of human activity and area of exposure increases as function of mobility and construction activities. The main sources are heavy machinery such as bulldozers, excavators, stabilizers, concrete mixing plant, drills, asphalt plants and other equipment. The above machinery is expected to generate noise levels that would be severe in certain project areas.	▪ Selection of up-to-date and well-maintained equipment with reduced noise levels ensured by suitable in-built damping techniques or with appropriate muffling devices. ▪ Providing the construction workers with suitable hearing protection like earmuffs and providing them adequate training. ▪ Preferably, restricting construction vehicle movements during night-time. ▪ Machinery with low noise level or machinery with noise shielding and absorption should be used. ▪ Contractors should comply with submitted work schedule, keeping noisy operations away from sensitive points; implement regular maintenance and repairs; and	SC, CC, WASA and EPA

Sr. No	Aspect	Impacts	Mitigation Measures	Responsibility
			employ strict implementation of operation procedures. ▪ Vehicles and equipment used will be fitted, as applicable, with silencers and properly maintained. ▪ Hedges and high boundary walls should be used as noise barriers in sensitive areas such as schools, hospitals and mosques. ▪ Schedule the construction works such that the number and usage times of noisy equipment are reduced. ▪ Physically separate the noise sources and the sensitive receivers (both existing and planned) as far as practicable. ▪ In accordance with the Environmental Monitoring Plan, noise measurements will be carried out at locations and schedule specified to ensure the effectiveness of mitigation measures.	

Sr. No	Aspect	Impacts	Mitigation Measures	Responsibility
6.	Ground Water	▪ Construction waste, if left unattended, will result in forming leachate that will percolate through the soil strata and will reach underground water table and hence, will end up contaminating it. Also, the water for construction and consumption may come in conflict with local water demand. There is a probability that various materials like fuel, lubricant oil and other oily products, which are used during the construction phase may contaminate groundwater, if they are not handled properly.	▪ Protection of groundwater reserves from any source of contamination, such as construction or oily wastes that will degrade its potable quality. ▪ The solid waste will be disposed of in designated landfill sites to sustain the water quality for domestic requirements and water required for construction may be obtained in such a way that the water availability and supply to nearby communities remains unaffected.	CC, SC, WASA and EPA
7. .	Improper Construction Techniques	▪ Monitoring for different environmental and health and safety parameters is very important during different construction operations like excavation and lying of pipes. Provision of inadequate arrangements for monitoring and supervision of construction works may cause damage to the local environment in the form of enhanced public inconvenience,	▪ The supervisory/monitoring staff should be experienced and qualified enough to handle the excavated material and its disposal in designated places without harming local environment. ▪ Supervision and training for the contractor's staff should be provided and implemented.	CC, SC and WASA

Sr. No	Aspect	Impacts	Mitigation Measures	Responsibility
		traffic jams, disposal of excavated material, *etc*. The magnitude of this impact is moderate, adverse and temporary in nature.	▪ If necessary, a traffic management plan should be made covering any works and vehicle transports affecting the public road infrastructure (one way traffic, diversions, *etc*.) to be coordinated with the relevant authority and the police.	
8.	Soil Erosion	▪ Excavation process can destabilize the surrounding land surface, particularly if excavated area is left unfilled for a long time, which may lead to rainfall induced soil erosion. ▪ Leakages of oil, lubricants, chemicals and other similar substances from their storage sites and from engines of the generators, machines, equipment and vehicles. ▪ Non-provision of septic tanks with the temporary work site toilets, constructed for the labours and others, can contaminate the receiving soils because of raw nature of the effluents; and	▪ All spills will be disposed of as required, and the site will be restored back to its original condition. ▪ Excavation would be kept confined to the specified foundation spots as per the engineering drawings. ▪ Site camps for the resident labours should not be set on the land marked for developing green belts. ▪ Oils, lubricants, chemicals and other listed hazardous materials should be safe from rainfall and away from any potential source of fire; and	CC, SC and WASA

Sr. No	Aspect	Impacts	Mitigation Measures	Responsibility
		▪ Also washing of the machinery and equipment without proper drainage of the washout water can adversely affect the soil quality.	▪ Septic tanks of adequate capacities should be constructed for receiving and treating wastewater from all temporary worksite toilets and the temporary container offices. The toilet wastewater should not be discharged untreated onto the adjacent lands.	
9.	Disposal of Excavated Soil	The construction activities and buried infrastructure will require the excavation of significant quantities of soil. This will result in excavated material that can be used for re-profiling of the roads. The impacts on the loss of resource are considered to be moderate adverse and temporary in nature.	Where possible, material should be reused on site for re-profiling to minimize the amount of soil used and the soil to be disposed.	CC, SC, WASA
10.	Placement of WWTP/PS equipment and sludge drying areas.	Mixing of sewage with flood water during flood events.	Fixing and construction of sensitive equipment and sludge drying areas of the WWTP above the predicted flood inundation depths. Construction of the paving of the sludge drying beds to be made as an impermeable	Implementation: Contractor Supervision: WASA-L and Consultant

Sr. No	Aspect	Impacts	Mitigation Measures	Responsibility
			layer to ensure that leachate/drainage and any accidental spills will remain on the surface and will not penetrate to the groundwater or water table.	
11.	Solid and Hazardous Waste	Construction activities such as excavation, clearing of vegetation, *etc*. will generate waste materials like excavated soil and domestic waste from workers. Other types of waste that are likely to be generated during construction include: ▪ Recyclables – paper, cardboard, glass, plastic, wood, metals, etc. ▪ Organic waste – food waste, vegetation; and ▪ Hazardous Waste – including for example, chemical wastes such as coating substances, solvents, used chemical drums and used spill kit materials. Any surplus construction waste will be sent to the nearby solid waste landfill site. Assuming that excavation and demolition will be kept to a	▪ Construction debris and demolition material will not be allowed to accumulate during construction phase. All such material is to be disposed of on daily basis. Waste piles will only be allowed if the contractors meet the following requirement at the site: ▪ Pile only contains passive waste (e.g. wood, metal, plastic, dry concrete) and no food waste, hazardous waste or wastewater. ▪ Waste pile is controlled so that it does not spread and start to impede other activities and stays at a height that it does not become a safety hazard. Barricades may	SC and CC, WASA

Sr. No	Aspect	Impacts	Mitigation Measures	Responsibility
		minimum and considering the construction will only be temporary and will be disposed of to landfill. The waste generated during construction would have a moderate, adverse effect and is temporary in nature.	also be placed around the pile to delineate the safe distance for other workers. ▪ Waste piles are positioned so that they are not visible to the general public where they could have a negative visual impact. ▪ If the waste pile contains plastic, paper or other light-weight material it needs to be covered with a tarpaulin; and ▪ Liquid waste, such as grey wastewater, sewage, slurry and other wastewater will be collected from source by a designated tanker and taken off-site for disposal at safe disposal facility. ▪ Solid waste and hazardous waste management plan for construction phase. ▪	
12.	Flora	Tree cutting is involved for land clearing for the installation of the WWTP. The conversion of agriculture land will have moderate negative impact on the floral species and vegetation.	▪ Incorporate technical design measures to minimize removal of the trees, if possible. ▪ Landscaping and plantation will improve the aesthetic value and ecological habitat of the project area.	CC, SC and WASA

Sr. No	Aspect	Impacts	Mitigation Measures	Responsibility
		However, the impact will be minimized after the landscaping.	▪ A landscape will be properly designed with provision of new trees/plantations around the boundary, roadside and stretches of open land. The vegetation for the attenuation of air pollution would be most needed in the areas where ground level concentrations of the pollutants are expected to rise.	
13.	Fauna	During construction, any existing species of fauna could be affected by disturbance and fragmentation, as the construction area may represent a barrier to the species and result in the splitting up of populations. During the construction phase, there will be adverse impact on the mammals, birds and reptiles of the area, due to the construction activities involving excavation, movement of labour, carriageway of goods and machinery to various sites along the project area.	▪ The camps will be properly fenced and gated to check the entry of animals in search of eatable goods. Similarly, wastes of the camps will be properly disposed of to prevent the chances of eating by animals, which may become hazardous to them. ▪ Special measures will be adopted to minimize impacts on birds, such as avoiding noise generating activities during the critical periods of breeding.	CC, SC , WASA

Sr. No	Aspect	Impacts	Mitigation Measures	Responsibility
		Given that the species of fauna are thought to be present at low density, the number of individuals affected by the proposed Project is likely to be relatively low. Furthermore, the loss of this habitat would not constitute a large impact. The magnitude of this impact is expected to be low adverse and temporary in nature.	▪ Staff working on the project should be given clear orders, not to shoot, snare or trap any bird. ▪ The Contractor will decide to minimize the vibration, noise pollution through good engineering practices.	
14. 1	Occupational Health and Safety of workers	The health and safety issues are associated with the operation of construction machinery and equipment, excavation works (working in trenches), working in confined spaces, and the storage of flammable materials which may cause minor and severe injuries to workers. Moreover, concrete releasing agents and cleaning agents may cause toxic effects on the workers. The magnitude of this impact is moderately adverse.	▪ Occupational safety measures such as use of well-maintained machinery and equipment and training of workers in the construction safety shall be taken. ▪ Ensure provision of protective clothing (PPE) for laborers handling hazardous materials, *e.g.* helmet, adequate footwear, gloves, high visibility vests, *etc*. ▪ The safety of the public at all stages of the construction will be ensured through appropriate public education and safety measures such as use of sign boards,	CC and SC and EPA

Sr. No	Aspect	Impacts	Mitigation Measures	Responsibility
			barriers and flags and proper illumination at night. ▪ The flammable and combustible substances will be properly stored in designated areas and Material Safety Data Sheets (MSDS) will be used for proper handling. ▪ Firefighting equipment will be placed at an easily accessible place and inspected on regular basis. ▪ Contractor to develop a health and safety management plan for the construction phase.	

Sr. No	Aspect	Impacts	Mitigation Measures	Responsibility
15.	Socio Economic Impacts	In project area, no significant changes are envisaged in traditional lifestyle and occupation of local people residing in the nearby communities as it is being established at adequate distance from various sensitive receptors. The local people are rather benefited due to the provision of job opportunities. No impact is envisaged due to influx of workers as local will be preferred and hired for working. Social issues may arise which will cause minor negative impact on the social lifestyle of people. Moreover, health and safety related issues may arise during the construction activities. These impacts are in-significant can be further reduced significantly by adopting best management practices. The nature of the proposed impact will be direct, low, short-term and hence significant.	▪ Good relations with local communities will be promoted by encouraging contractor to provide opportunities for skilled and un-skilled employment to the locals as well as on job training. ▪ The contractor should prefer hiring local labour from adjacent communities. ▪ In case of not hiring the locals, contractor will restrict his permanent staff to interfere unnecessarily with the locals to avoid any social problems. ▪ The contractor will keep the copy of National Identity Card (CNIC) of his employees and will warn the workers not to involve in any anti-social activities otherwise they may face dire consequences. ▪ At the time of hiring, the contractor must ensure that workers should be good repute.	CC, SC, WASA

Sr. No	Aspect	Impacts	Mitigation Measures	Responsibility
			▪ First aid kits having all the necessary first aid stuff will be available at site. ▪ Routine medical check-ups of all the field staff including unskilled labour needs to be conducted by qualified physician and surgeon. ▪ Trainings of workers should be carried out for operating various constructional machinery, safety procedures should be adopted, environment awareness should be carried out, equip all workers with safety boots, helmets, and protective masks and monitoring for their proper and sustained usage will be carried out. In case of accidents, contractor will provide free medical treatment to the community. ▪ The contractor will be responsible for sensitivity towards the local customs and traditions.	

Sr. No	Aspect	Impacts	Mitigation Measures	Responsibility
16.	Borrow Pits/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.	▪ Necessary permits will be obtained for any borrow pits from the competent authorities; ▪ 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.	CC, SC, WASA

Sr. No	Aspect	Impacts	Mitigation Measures	Responsibility
17.	Construction Camps/ Camps Site	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.	▪ The project will seek to avoid siting 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 will be implemented to ensure safe handling,	CC, SC, WASA

Sr. No	Aspect	Impacts	Mitigation Measures	Responsibility
			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.	

Sr. No	Aspect	Impacts	Mitigation Measures	Responsibility
18.	Wastewater generation at camp sites	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. This impact can be categorized as direct, moderate, site-specific, short term, temporary, high probability and reversible.	▪ Domestic and chemical effluents from the construction camp will be disposed by the development of on-site sanitation systems ▪ 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.	CC, SC, WASA

Sr. No	Aspect	Impacts	Mitigation Measures	Responsibility
19.	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 Kattar Bund 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.	▪ 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;	CC, SC, WASA

Sr. No	Aspect	Impacts	Mitigation Measures	Responsibility
			▪ 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 will be prepared by the contractor and implemented to avoid traffic accidents, jams/public inconvenience.	

Sr. No	Aspect	Impacts	Mitigation Measures	Responsibility
20.	Climate change and greenhouse gases abatement	The main sources of Greenhouse Gases (CO2, CH4, NOx 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.	▪ Regular motioning of the vehicles for engine efficiency; ▪ All stakeholders (WASA, 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	CC, SC, WASA

Sr. No	Aspect	Impacts	Mitigation Measures	Responsibility
			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 equipment that will reduce maintenance costs and harmful emissions. • Alternative energy resources shall be considered where possible; and	

Sr. No	Aspect	Impacts	Mitigation Measures	Responsibility
21.	Natural or man-made disaster	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.	▪ An Emergency Response Plan (ERP) for earthquakes and manmade disasters should be developed by contractor in coordination with SC and WASA should be implemented in close consultation with the RESCUE Services and other concerned departments; ▪ Training of the Contractor and WASA staff and employees regarding the emergency procedures and plans should be regularly conducted; ▪ Emergency numbers should be clearly posted at active construction sites.	CC, SC, WASA

Sr. No	Aspect	Impacts	Mitigation Measures	Responsibility
22.	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 labor 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	▪ 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 laborer 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;	CC, SC, WASA

Sr. No	Aspect	Impacts	Mitigation Measures	Responsibility
		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 pacific, medium term, temporary and irreversible.	▪ 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 heath 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	

Sr. No	Aspect	Impacts	Mitigation Measures	Responsibility
			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 WASA; and	

Sr. No	Aspect	Impacts	Mitigation Measures	Responsibility
23.	Communicable Disease	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	▪ 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. ▪ 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	CC, SC, WASA

Sr. No	Aspect	Impacts	Mitigation Measures	Responsibility
		impact can be categorized as direct, medium, site-specific, short term, temporary, medium to high probability and reversible.	▪ Keep all the camps, offices, material depots, machinery yards and work sites open for the inspection of health and safety measures and related documents. ▪	

Sr. No	Aspect	Impacts	Mitigation Measures	Responsibility
24.	Discovery of Heritage sites/ Structures during Excavation	During excavation, there is a chance of finding artifacts which can be damaged	▪ . 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.	CC, SC, WASA

Sr. No	Aspect	Impacts	Mitigation Measures	Responsibility
25.	Social/ Cultural Conflicts	During the construction phase of the project, conflicts may arise between labor force and Local communities. 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.	▪ 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.	CC, SC, WASA

Sr. No	Aspect	Impacts	Mitigation Measures	Responsibility
26.	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. 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,	▪ 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	CC, SC, WASA

Sr. No	Aspect	Impacts	Mitigation Measures	Responsibility
		substance abuse, sexual assault and human trafficking;	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 COVIID-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;	

Sr. No	Aspect	Impacts	Mitigation Measures	Responsibility
			▪ 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.	

Sr. No	Aspect	Impacts	Mitigation Measures	Responsibility
27.	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.	▪ Awareness should be created among the females at individual and community levels about the construction's 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	CC, SC, WASA

Sr. No	Aspect	Impacts	Mitigation Measures	Responsibility
			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. ▪ 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. ▪	

Sr. No	Aspect	Impacts	Mitigation Measures	Responsibility
28.	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.	▪ 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	CC, SC, WASA

Sr. No	Aspect	Impacts	Mitigation Measures	Responsibility
			▪ 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.	

Sr. No	Aspect	Impacts	Mitigation Measures	Responsibility
(OPERATIONAL PHASE)				
1.	O & M Deficiencies	▪ Communicable devices in the service area, which will be a major public health hazard. This is possible through intrusion of contamination from leaking pipes and deficiency in operation and maintenance procedures.	▪ Regularly checking the water quality at effluent end of the WWTPS. ▪ Leaking pipes shall be immediately repaired by the WASA Staff. ▪ Pumping machinery shall be maintained properly. ▪ Stagnation of water shall be prevented through an efficient and effective O & M program. ▪ Generators shall be maintained and tuned properly so that emissions can be controlled.	WASA
2.	Air Pollution	▪ Movement of vehicles and machinery during normal operation and under maintenance work may impair air quality. ▪ Stack emissions of generators at site will produce hazardous gas like NO_2, SO_2, CO2, PM and CO. These gases will cause air	▪ Setting up of system to monitor air quality along project area in accordance with acceptable standards; ▪ Roadside tree plantations as applicable and feasible under harsh climatic conditions; plants should be selected in	WASA

Sr. No	Aspect	Impacts	Mitigation Measures	Responsibility
		pollution if not properly managed or mitigated.	accordance to their ability to absorb emissions; ▪ Air quality monitoring will be carried out on regular basis for parameters like CO, CO2, NO2, SO2 and PM10.	
3.	Noise and Vibration	▪ Nuisance to the Local Population.	▪ 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 periodic noting of noise levels. ▪ Enclose all plant and equipment along with the essential acoustics to reduce noise and vibration. ▪ A landscape will be properly designed with provision of new trees/ plantations around the boundary, roadside and stretches of open land. It will certainly reduce the impacts of Air, Noise pollution and Odor	WASA

Sr. No	Aspect	Impacts	Mitigation Measures	Responsibility
			problems due to the proposed project in the surrounding environment.	
4.	Groundwater	▪ Contamination of groundwater source may occur in case of corrosion or leakage of Conveyance system.	▪ The impact should be minimized by regular checks for leaks and corrosion etc. and maintenance of damaged pipes should be done periodically. ▪ Moreover, monitoring of groundwater will be conducted.	WASA
5.	Surface water	▪ The surface water may get contaminated by disposal of wastewater into the surface water bodies due to malfunctioning of WWTPS after some operational years.	▪ The water must be treated before disposing according to PEQS. The wastewater will be treated via WWTP`s before disposal. Regular maintenance of WWTPS will be ensured during throughout the design life of treatment plants.	WASA
6.	Odor	▪ Generation of odor which causes nuisance to the residential community in the surroundings off the Wastewater Treatment Plants and the people passing by this area for schools, mosque and shops etc.	▪ Installation of ventilating shafts after enclosure of collection chambers parallel to the wind direction. ▪ Vegetation barrier may also help reducing odor in the surroundings of the area	WASA

Sr. No	Aspect	Impacts	Mitigation Measures	Responsibility
			▪ A landscape will be properly designed with provision of new trees/ plantations around the boundary, roadside and stretches of open land. The vegetation for the attenuation of air pollution & Odor Problems would be most needed in the areas where ground level concentrations of the pollutants are expected to rise. ▪ Vegetation barrier may also help reducing odor in the surroundings of the area.	
7.	Breeding Ground for Disease Vector	▪ Currently, as the partial sewerage water is being disposed through temporary force main to the collection chamber. In Rainy days the wastewater becomes stagnant which acts as breeding grounds for disease vectors.	▪ After the construction of the proposed project, the wastewater will be disposed of properly which will eliminate the breeding grounds for disease vectors. ▪ Regular checks for spots which may serve as breeding grounds and spray of insecticides if any such spots are found.	WASA
8.	Energy Consumption	▪ Loss of Natural resource	▪ Regular maintenance of the equipment should be ensured to avoid excessive fuel consumption or leaks.	WASA

Sr. No	Aspect	Impacts	Mitigation Measures	Responsibility
			▪ Switch off machinery / appliances when not in use.	
9.	Solid Waste / Sludge Handling Problem	▪ Solid waste / Sludge generating from the Wastewater Treatment Plants (WWTPS) or sludge during maintenance/cleaning of Wastewater Treatment Plants (WWTPS).	▪ Regular inspection and maintenance will be scheduled and implemented to ensure removal of solid waste and sludge when accumulated. ▪ The solid waste shall be disposed of safely and dumping or burning of municipal solid waste in the surroundings should be strictly prohibited. ▪ Implementation of sludge handling and storage procedures should be ensured.	WASA
11.	Occupational Health and Safety Issues	▪ Operation of machinery and equipment, handling of fuel, noise odor, exposure to disease vectors etc.	▪ The issues related to operation of machinery and equipment will be controlled by efficient management, staff training, maintenance of machinery and equipment, and other preventive measures. ▪ Proper storage and handling of fuel. ▪ First Aid kits should be provided. ▪ Provision of safe drinking water.	WASA

Sr. No	Aspect	Impacts	Mitigation Measures	Responsibility
			▪ Provision of PPE`s to the employees including masks, gloves etc. ▪ The issues related to operation of machinery and equipment will be controlled by efficient management, staff training, maintenance of machinery and equipment, and other preventive measures.	
12.	Ecological Resources	▪ New trees / plants will render a positive impact on the flora of the area and will also cause positive impact on the landscape of the area, which will be permanent in nature.	▪ Not Required	WASA
13.	Screenings transportation from the pumping stations, sludge transportation from the WWTP and gully bowsers	▪ During the operation stage, prevention of impacts due to screenings transport vehicles from the pumping stations, sludge transport vehicles from the WWTP and gully bowsers.	▪ Identify sludge transport vehicle, gully bowser route avoiding use of local roads etc. where road widths are narrow and roadside space is limited for safe pedestrian movement. ▪ Plan sludge transport vehicle, gully bowser operations to avoid peak hours on the main roads, such that delays due to	WASA

Sr. No	Aspect	Impacts	Mitigation Measures	Responsibility
			sludge transport vehicle and gully bowser movements are minimized. ▪ As some of these roads are used by community children for playing, it is essential that proper vehicle and road safety measures are followed by the WWTP personnel.	
14.	Repairs, damages and maintenance work	▪ Nuisance to public from the malfunctioning of WWTP or pump stations, odour *etc*. ▪ Leakage of sewage to drainage paths and surface waterbodies	▪ Regular maintenance work, training of employees, application of preventive maintenance program, backup systems. ▪ Availability of a contingency management plan and team to tackle such cases with well trained staff, equipment and funds. ▪ Maintenance of pipelines in good condition and proofing to prevent leakages and contamination of adjacent drainage systems and waterbodies. ▪ Providing layout plans to other utility holders, in order to prevent installation of other utility lines without causing damages to sewer line. Use of danger tape/warning	WASA

Sr. No	Aspect	Impacts	Mitigation Measures	Responsibility
			tape to be laid above the pipe for identification. Close coordination is required.	
15	O&M works	▪ The weak opportunity for persons with disabilities and women to work in the operation and maintenance of the project.	▪ O&M will be the responsibility of contractor for first 5 years. After that the municipality and project's implementing institutions adopt initiatives that encourage increasing women opportunities to work in project operation.	WASA
16.	Emergency Preparedness and Response Plan	▪ The operation of the WWTPS may encounter emergencies like operation failure.	▪ An Emergency Response Plans for floods, earthquakes, and manmade disasters will be developed by management. ▪ Responsible person to implement the Emergency Response Plan should be clearly designated. ▪ The staff should be trained timely and concise response procedures. ▪ Emergency numbers should be clearly posted so that a quick action is taken when an emergency arises.	CC/WASA

KEY:

- DC = Design Consultant
- SC = Supervision Consultant
- CC = Construction Contractor
- WASA = Water & Sanitation Agency (Lahore)
- EPA = Environmental Protection Agency

Table 8-2: Environmental Monitoring Plan

	Mitigation Activities and Method of Monitoring	Location/Timing of Sampling	Parameters to be Monitored	Frequency of Monitoring	Responsibility
1	**Pre-construction Phase**				
1.1	Establishing data for Air Quality, Water Quality, Noise and Vibration	At least 2 locations at the boundary of WWTP site (upwind and downwind) and at 1 location each at the boundary of the major pump stations.	Air Quality: TSPM, PM_{10}, $PM_{2.5}$, NO_x, SO_x, O_3, Total VOCs, Ammonia, H_2S	Once prior to construction activities	Contractor, External Monitoring Committee
1.2		Houses surrounding WWTP and pump stations	Noise: Equivalent A weighted sound pressure level (LAeq)		Contractor, External Monitoring Committee
1.3		Houses surrounding WWTP and pump stations	Vibration: PPV with reference to vibration frequencies applicable for different categories of structures		Contractor, External Monitoring Committee
1.4		Proposed discharge point and	Surface water quality parameters in the Environmental Act –	Every month during the pre-construction period	Contractor, External Monitoring Committee

	Mitigation Activities and Method of Monitoring	Location/Timing of Sampling	Parameters to be Monitored	Frequency of Monitoring	Responsibility
		recommended locations during dry seasons	Tolerance Limit for the Discharge of Industrial Waste into Inland Surface Waters (refer relevant gazette).		
1.5		At least 2 locations surrounding WWTP (wells in the vicinity can be used); At least one location (well) at each main pump station location.	Groundwater Quality: All parameters specified by EPD.	Every month during the pre-construction period	Contractor, External Monitoring Committee
1.6	Measurement of river flow rate	At the point of effluent discharge	Flow rate of the receiving waterbody by establishing an automatic gauge station.	Daily prior to construction activities	WASA-L, Monitoring Committee
1.7	Temporarily relocating common amenities such as community sources of water, bus shelters, playgrounds, cultural properties etc.	Temporary relocation sites	The affected community is satisfied with the temporary relocation sites, discussions with the affected community.	Both prior to relocation and after relocation	WASA-L, Design and Supervision Consultant, External monitoring committee

	Mitigation Activities and Method of Monitoring	Location/Timing of Sampling	Parameters to be Monitored	Frequency of Monitoring	Responsibility
1.8	Carrying out pre-crack survey of identified impacted houses prior to initiation of dewatering, trenching, excavating, drilling or tunnelling initiation for any project component.	Network locations, all tunnelling locations, WWTP/PS sites	Infrastructure status, cracks, deformations and other aspects existing	Once prior to dewatering, trenching, excavating, drilling or tunnelling	Contractor, External Monitoring Committee
1.9	Keeping land clearing to a minimum and removal of only marked trees for construction.	Project sites and surrounding areas	Decrease in felled number of trees.	After land clearing activities	Contractor, External Monitoring Committee
1.10	Covering the open bank areas using a suitable material until the construction work of the area commences.	Proposed site	Visual inspection especially after rainfall events, especially for erosion and landslide potential.	After significant rainfall events.	WASA-L, Design and Supervision Consultant, External Monitoring Committee
1.11	Monitoring surface water quality	Selected locations (*i.e.* for each project component - WWTP, PSs, discharge point *etc*., sampling locations used in the EIA report and sampling locations mentioned in EIA).	pH, EC, salinity, faecal coliform, phosphorus, BOD, COD, TSS, DO, TKN, ammonium, TDS, water level.	Every month	Contractor, External Monitoring Committee

	Mitigation Activities and Method of Monitoring	Location/Timing of Sampling	Parameters to be Monitored	Frequency of Monitoring	Responsibility
1.12	Monitoring groundwater levels at dug wells at selected locations and testing groundwater quality at same locations.	Selected locations, based on sampling locations used for the EIA report.	Water level, total depth, diameter, pH, EC, salinity, faecal coliform, phosphorus, BOD, COD, TSS, DO, TKN, ammonium, TDS.	Every month	Contractor, External Monitoring Committee
1.13	Community Grievances	Project Area of Influence	Number of community grievances and their timely resolution	Every month	Contractor, External Monitoring Committee
2	**Construction Phase**				
2.1	Controlling dust, noise and vibrations from construction sites	At all sites where project interventions are carried out. Air Quality: TSPM, PM_{10}, $PM_{2.5}$, NO_x, SO_x, O_3, Total VOCs, Ammonia, H_2S, noise and vibration testing bi-annually during construction.	Noise levels, vibration levels, dust levels at project sites. Emission certificates of motor vehicles. Method of transport of construction material.	Every week Emission certificates of construction vehicles to be checked and verified prior to use	Contractor, External Monitoring Committee

	Mitigation Activities and Method of Monitoring	Location/Timing of Sampling	Parameters to be Monitored	Frequency of Monitoring	Responsibility
			Wetting frequency of dust generating surfaces. Number of public complaints. Regulating/minimizing construction activities during peak hours and at night.		
2.2	Mitigation of nuisance to general public due to hindrance in accessibility	At all sites where pipe laying activities take place	Work zone management practices – if the approved work zone plan is maintained, required barricades, danger tape, signs *etc*. are installed, presence of traffic controller where required. Condition of the temporary walkways and traffic lanes.	Every week	Environmental Officer and the Environmental Specialist, Sociologist

	Mitigation Activities and Method of Monitoring	Location/Timing of Sampling	Parameters to be Monitored	Frequency of Monitoring	Responsibility
			Proper receipt, recording and management of complaints. Reduction of accidents. Prevention of traffic congestion and demarcation of construction areas. Prevention of accidents and injuries of workers and community members.		
2.3	Construction activities close to sensitive locations such as places of worship, schools, hospitals etc.	Along the sewer lines and at the PS sites and WWTP site	Physical observations. Discussion with the affected communities and the contractor	Three times a week during the construction period	Contractor, WASA-L, and External Monitoring Committee
2.4	Controlling spread of invasive species.	Solid waste disposal sites, construction sites	Waste management as per the stipulated guidelines.	Daily management of solid waste.	Contractor

	Mitigation Activities and Method of Monitoring	Location/Timing of Sampling	Parameters to be Monitored	Frequency of Monitoring	Responsibility
2.5	Public warning sign boards, information sign boards, signage systems etc.	Along the sewer lines, at the WWTP site and at PS sites	Physical observations. Discussion with the contractor.	Three times a week during the construction period	Contractor, WASA-L, and External Monitoring Committee
2.6	The haulage routes and times of haulage	The haulage routes	Physical observations. Discussions with the local authorities, police and the contractor	Three times a week	Contractor, WASA-L
2.7	Examination of equipment used, discussions with personnel involved, routine inspection of all sites to ensure that O&M procedures are properly followed	At all sites	Examination of equipment used, discussions with personnel involved, routine inspection of all sites to ensure that O&M procedures are properly followed	Once every two weeks	WASA-L
2.8	Proper disposal of solid, liquid and construction waste	At all sites where project interventions are carried out	Visual inspection of construction sites Public complaints	Every week	Environmental officer and the environmental specialist
2.9	Reinstatement of roads after trenching	Along all roads within project site after pipe laying activities have been completed and	Condition of road surface, road edges and checking with standards of Roads Department.	Throughout rehabilitation and on completion	Engineer in charge liaising with Roads Department

	Mitigation Activities and Method of Monitoring	Location/Timing of Sampling	Parameters to be Monitored	Frequency of Monitoring	Responsibility
		rehabilitation work is in progress and directly after completion.			
2.10	Proper disposal of solid, liquid and construction waste.	Construction sites	Waste management as per the stipulated guidelines.	Daily management of solid waste.	Contractor, WASA-L, External Monitoring Committee
2.11	Carrying out pre-crack survey of identified impacted houses during dewatering, trenching, excavating, drilling or tunnelling for any project component and upon completion of dewatering, trenching, excavating, drilling or tunnelling	Houses adjacent to pipeline routes/ PS sites/ WWTP site	Infrastructure status, cracks, deformations and other aspects	Once every 6 months	Contractor
2.12	Liaise with the Department of Archaeology to agree on construction procedure and mitigation/compensation for any damage that may be	All project sites	Potential discoveries of archaeological value	Continuous	Contractor

	Mitigation Activities and Method of Monitoring	Location/Timing of Sampling	Parameters to be Monitored	Frequency of Monitoring	Responsibility
	caused. Consult the Department of Archaeology to assess whether any sites have the potential to yield discoveries during site clearance. With assistance from the Department of Archaeology, a "chance finds procedure" of action to recognize and protect any important archaeological or cultural material that is found shall be developed. Take any other action recommended by the Department of Archaeology.				
2.13	Buffer tree cover at the WWTP site	Design drawings and at site after construction.	The design and construction details are in conformity.	During Design and after construction	WASA-L
2.14	Monitoring surface water quality, sea water quality and reporting of same to relevant	Selected locations (*i.e.* for each project component - WWTP,	pH, EC, salinity, faecal coliform, phosphorus, BOD, COD, TSS, DO, TKN,	Every month	WASA-L, Design and Supervision Consultant,

	Mitigation Activities and Method of Monitoring	Location/Timing of Sampling	Parameters to be Monitored	Frequency of Monitoring	Responsibility
	stakeholders (water quality monitoring committee)	PSs, discharge point *etc*., sampling locations used in the EIA report and sampling locations mentioned in EIA).	ammonium, TDS, water level.		External Monitoring Committee
2.15	Monitoring nitrate levels of surface water.	Two locations upstream and downstream of the discharge point	Nitrogen levels	Daily during the dry season	WASA-L, Design and Supervision Consultant, External Monitoring Committee
2.16	Monitoring groundwater levels at dug wells at selected locations and testing groundwater quality at the same locations.	Selected locations, based on sampling locations used for the EIA report.	Water level, total depth, diameter, pH, EC, salinity, faecal coliform, phosphorus, BOD, COD, TSS, DO, TKN, ammonium, TDS.	Every month	WASA-L, Design and Supervision Consultant, External Monitoring committee
2.17	Workers' grievances	All constructions sites	Number of community grievances and their timely resolution	Weekly basis of checking complaints registry.	Contractor, WASA-L, and External Monitoring Committee
2.18	Community grievances	All project locations	Number of community grievances and their timely resolution	Weekly basis of checking complaints registry.	Contractor, WASA-L, and External Monitoring Committee

	Mitigation Activities and Method of Monitoring	Location/Timing of Sampling	Parameters to be Monitored	Frequency of Monitoring	Responsibility
3	**Operation Phase**				
3.1	Proper functioning of the WWTP, PSs, Discharge Point, in terms of water quality and preventing deterioration of water quality in the receiving LBC. Monitoring surface water quality and reporting of same to relevant stakeholders (water quality monitoring committee).	Upstream and downstream water quality testing sites (refer EIA). Monitoring will be carried out at LBC canal.	pH, EC, salinity, faecal coliform, phosphorus, TKN, BOD, COD, DO, N, ammonium, TSS, TDS, water level.	Every month	WASA-L and External Monitoring Committee/ EPD
3.2	Two Nitrogen Sensors installed upstream and downstream of the discharge point to carryout spot sampling to monitor ammonia levels during the operational phase on a daily basis, during the dry season. If the result is beyond a threshold value (in	Two locations in upstream and downstream from the discharge point. Upstream and downstream of the discharge location	Nitrate levels Water quality levels	Daily during the dry season Daily	WASA-L and External Monitoring Committee/ EPD

	Mitigation Activities and Method of Monitoring	Location/Timing of Sampling	Parameters to be Monitored	Frequency of Monitoring	Responsibility
	comparison to the Inland Waters Discharge Standard), discharge to the Escape Channel may be required.				
3.3	Preventing nuisance to residents especially at night from pump stations/WWTP noise or vibrations (if any).	During night or as required per complaint received at the boundary of WWTP/pump stations and/or nearest house making complaint.	Noise and vibration levels	Annually or as decided on receiving complaints from the public	WASA-L
3.4	Preventing odour from sewage emanating from pump stations/WWTP	Routine inspection and on receiving complaints	Monitoring of hydrogen sulphide, VOCs (would be necessary on receiving complaints).	Case by case on receiving public complaints in addition to annual testing of air quality.	WASA-L
3.5	Nuisance to public from malfunctioning of system, accumulation of sewage on	Routine inspection and on receiving complaints or on occurrence of breakdowns	Number and magnitude of occurrences.	Annually or on event basis	WASA-L

	Mitigation Activities and Method of Monitoring	Location/Timing of Sampling	Parameters to be Monitored	Frequency of Monitoring	Responsibility
	site or at pump stations/WWTP, odour etc.		Deployment of Emergency Response Team.		
3.6	Monitoring groundwater levels at dug wells at selected locations and testing ground quality at same locations	Selected locations, based on sampling locations used for the EIA report.	Water level, total depth, diameter, pH, EC, salinity, faecal coliform, phosphorus, BOD, COD, TSS, DO, TKN, ammonium, TDS.	Monthly	WASA-L, Supervision Consultant, External Monitoring Committee
3.7	During the operation stage, prevention of impacts due to sludge transport vehicles from the WWTP and gully bowsers	At WWTP site	Identify sludge transport vehicle, gully bowser route avoiding use of local roads *etc.* where road widths are narrow and roadside space is limited for safe pedestrian movement. Plan sludge transport vehicle, gully bowser operations to avoid peak hours on main roads, such that delays due to sludge	Daily	WASA-L

	Mitigation Activities and Method of Monitoring	Location/Timing of Sampling	Parameters to be Monitored	Frequency of Monitoring	Responsibility
			transport vehicle and gully bowser movements are minimized. As some of these roads may be used by community children for playing, it is essential that proper vehicle and road safety measures are followed by the WWTP personnel.		
3.8	Proper procedure is followed if any dismantling takes place	Along the sewer lines, WWTP site	Physical observations and discussions with all parties concerned	Once a week during duration of sewer laying	WASA-L
3.9	Leakages in the WWTP/ PS	WWTP site and PS sites	Leakages/ malfunctioning	continuous	WASA-L
3.10	Occupational health and safety issues	WWTP site and PS sites	Adherence to occupational health and safety manual	Daily	WASA-L
3.11	Workers' grievances	All constructions sites	Number of community grievances and their timely resolution	Monthly basis of checking complaints registry.	WASA-L

	Mitigation Activities and Method of Monitoring	Location/Timing of Sampling	Parameters to be Monitored	Frequency of Monitoring	Responsibility
3.12	Community grievances	All project locations	Number of community grievances and their timely resolution	Monthly basis of checking complaints registry.	WASA-L

8.5 RESETTLEMENT AND LAND ACQUISITON PLAN FOR ALLIED WORKS

8.5.1 General

This Section presents resettlement plan for construction of overall Project for construction of Treatment plant, Pumping Station, wastewater conveyance and other allied works.

Resettlement issues of affected settlements located in the proposed area, caused by the project, have been assessed and described in this section. Social and economic impacts of the project on the people residing in the project area and on the general public of the area are also assessed. For this purpose, guidelines of Draft National Resettlement Policy (2002) were consulted. From a social perspective, the potential negative impacts of the project manifest itself are the following.

- Physical relocation of the people settled within the proposed project area.
- Loss of land and or other physical assets.
- Loss of livelihoods.

This section examines the social factors that will be affected by the development of the project and describes the strategies for compensation, based on the principle that people shall not suffer net losses as a result of the project, in accordance with Government of Pakistan law and guidelines.

8.5.2 Land Acquisition and Resettlement

Land acquisition is required for the construction of the Wastewater Treatment Plant and other allied works.

Land for setting up contractor's camp site and extracting barrow material will be acquired directly from private land owners by an agreement between contractors and land owners. .The provision of land act 1894 will not be involved because such acquisition is on temporary basis.

8.5.3 Regulatory Requirements

The land acquisition Act, 1894 regulates the acquisition of land and built up property for development projects and damage to other assets such as crops, trees and infrastructure. It recognizes only formal, registered title to land, and makes no provision for people with informal/unregistered or usufruct rights, who are likely to

suffer loss of assets or livelihoods as a result of the project. However, the lack of legal tenure does not negate an impact or the need for mitigation. National Resettlement Policy has, therefore, been formulated by the Ministry of Environment, Local Government and Rural Development, to ensure an equitable and uniform treatment of resettlement issues all over Pakistan. Resettlement Policy is intended to address the rehabilitation and resettlement of disrupted population and the restoration of their livelihoods, providing a basis for managing the resettlement needs arising from the project. The policy, however, have yet not been approved by the Govt. of Pakistan.

The objective of the Resettlement Policy is to ensure that the population displaced by the project is correspondingly benefited. Displaced persons should be:

- compensated for their losses at full replacement cost prior to relocation;
- Assisted with relocation and supported during the transitory period; and
- Assisted in improving or at least restoring their former living standards, income earning capacity and production levels.

8.5.4 Identification of Stakeholders Groups

Stakeholder's identification is carried out to ascertain, which groups of people are affected by the project and the extent of that impact, based on their proximity to the project area. Based on the delineation of the project corridor, two groups of stakeholders have been identified for the purpose of social assessment as follows;

- Project Affected Persons (PAPs) resident or operating business within the project area subject to a direct impact requiring relocation.
- The general population resident or operating business in the vicinity, who may subject to an indirect impact during the construction period or afterward.

  After detailed studies, it has been concluded that there would be no resettlement involved only the acquisition land will be involved.

8.6 ENVIRONMENTAL MONITORING

This section provides environmental monitoring Plan that identifies the roles and responsibilities of project staff involved in environmental monitoring and list the parameters that will be used in the monitoring process.

8.6.1 Objectives of Environmental Monitoring

The main objectives of the pre-construction and construction phase monitoring plans will be to:

- Monitor the actual impacts of the works on the project site physical, biological and socio – economic receptors. This will indicate the adequacy of the EIA assessment.
- Recommend mitigation measures for any unexpected impact or where the impact level exceeds the anticipated impacts.
- Ensure compliance with legal obligations including safety on construction site.
- To monitor the rehabilitation of the borrow areas and the restoration of construction campsites as described in the EMP.

The main objectives of monitoring during operational phase activities are as follows:

- Appraise the adequacy of the EIA with respect to the project`s predicted long term impacts of operation of the Wastewater Treatment Plants (WWTPS) on physical, biological and socio-economic environment.
- Evaluate the effectiveness of the mitigation measures proposed in the EMP and recommend improvements, when necessary; and
- Compile periodic environmental monitoring reports on the basis of recommendations provided in the EMP.

8.6.2 Environmental Monitoring Parameters

The following environmental parameters will be monitored at locations identified during the construction phase of the aforesaid project.

- Ambient Air Quality (NO_X, SO_X, CO and PM_{10})
- Ambient Noise level
- Ground Water Quality

8.6.3 Reporting Structure and Outcomes

Progress reporting will be the overall responsibility of the project director who will provide inputs to the supervision consultants for submission of progress reports to WASA, Lahore.

8.7 TRAINING AND CAPACITY BUILDING

An environmental training and technical assistance program will be carried out to build the capacity to effectively implement this EMP, as well as to facilitate the improved environmental management of future projects by increasing the environmental and social awareness of WASA staff in general. WASA with the collaboration of monitoring consultants will arrange the environmental trainings sessions for their staff. The objectives of this session will be to help establish appropriate systems, and to train WASA staff responsible for managing environment, operations and planning, who can then impart training at a broader level within and outside the WASA. The details of this training program are presented in table below:

Table 8-3 Capacity Building program / Technical assistance Services

Consultants	Contents	Trainees	Duration
Monitoring consultants/ organizations specializing in environmental management and monitoring	Short seminars and courses on: Environmental laws and regulations daily monitoring and supervision	Two seminars for WASA Project staff	2 Days
Monitoring consultants/ organizations specializing in social management and monitoring	Short seminars and courses on Social awareness	Two seminars for Project staff dealing in Social matters	2 Days
Monitoring consultants/ organizations specializing in Occupational, health and safety issue	Short lectures relating to Occupational Health and Safety	Two seminars for contractor's staff	2 Days

8.8 MEETINGS AND REPORTING MECHANISM

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

Table 8-4 Periodic reporting Mechanism

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

8.9 EQUIPMENT MAINTAINENCE DETAILS

PPE`s and other required machinery of latest technology with high efficiency will be purchased under this project. Maintenance of equipment such as pumps, solar panels, motors, pipelines, valves, gates, trickling filters etc. will be done twice a year for the smooth operation of project. The Design Built Operate and Transfer (DBOT) Contractor will be responsible for 5 years O&M of the WWTP.

8.10 EMMP COST

The contractor will be responsible for implementation of mitigation measures and environmental Monitoring during construction phase, whereas WASA 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 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 8-5 PPEs Cost

Personal Protective Equipment					
Item No.	**Description**	**Quantity**	**Unit**	**Rate (PKR)**	**Amount PKR**
1	Ear plugs (corded Reusable silicon Earplugs)	2400	Each	150	360,000
2	Helmets (PE shell with vents Lining; material: Plastic Chin strap included; Adjust head size by ratchet knob)	100	Each	5,000	500,000
3	Safety shoes (Renowned brand)	100	Each	7,500	750,000
4	Protective goggles (Anti-fog, Anti scratch, Poly-carbonate Scratch and impact resistant, side protection sheet)	100	Each	500	50,000
5	Gloves (made up of nylon, polyurethane with ironclad)	2400	Each	1000	2,400,000
6	Dust Mask (N-95)	8000	Each	150	1,200,000
7	First Aid Kit (pain killers, eyewash solution, antibiotic ointment, thermometer, plasters, sterile gauze dressings, sterile eye dressings, triangular bandages, crepe rolled bandages, safety pins, disposable sterile gloves and tweezers)	4	Each	25,000	100,000
				Total	**5,360,000**

Table 8-6 Training Cost

Consultants	Contents	Trainees	Duration	cost
Monitoring consultants/ organizations specializing in environmental management and monitoring	Short seminars and courses on: Environmental laws and regulations daily monitoring and supervision	Two seminars for WASA Project staff	2 Days	200000
Monitoring consultants/ organizations specializing in social management and monitoring	Short seminars and courses on Social awareness	Two seminars for Project staff dealing in Social matters	2 Days	200000
Monitoring consultants/ organizations specializing in Occupational, health and safety issue	Short lectures relating to Occupational Health and Safety	Two seminars for contractor's staff	2 Days	200000
			Total	600000

Table 8-7 Environmental and Social Testing, Mitigation and Training Cost

Health, Safety and Environment					
Sr. No.	**Description**	**Quantity**	**Unit**	**Rate (PKR)**	**Amount (PKR)**
1	Medical screening for workers (HIV screening, CBC, Hep. BsAg, HCV antibodies, LFTs, RFTs, e.t.c.	100	Persons	2,000	200,000
2	Tarpaulins (High Quality water proof PVC)	100	sft	1,000	100,000
3	Handling of hazardous material (Store all hazardous materials properly, separate incompatibles, and store in ventilated, dry, cool areas)	24	Monthly	10,000	240,000
4	Handling of solid waste (storage, collection, transportation, treatment, utilization, processing, and final disposal of solid wastes)	24	Monthly	20,000	480,000
5	DCP Fire extinguishers (6 kg) in case of fire (The material of the cylinder is steel. The extinguishing agent is mono ammonium phosphate and ammonium sulfate powder and the discharge time of the agent is 13 seconds)	10	Each	10,000	100,000
	CO2 Fire extinguishers (6 kg discharge time of the agent is 13 seconds).	10	Each	20,000	200,000

Health, Safety and Environment					
Sr. No.	**Description**	**Quantity**	**Unit**	**Rate (PKR)**	**Amount (PKR)**
	Fire alarm (Signal Transmission: Wired Alarm, Working Principle: Manual Alarm Button)	5	Each	10,000	40,000
6	Special Measures for Covid-19 (corona test, quarantine expense in case of corona measures to be taken announced by local government/provincial government, Hand sanitizers)	24	monthly	7,500	180,000
7	Cost of Personal Protective Equipment (PPE)*		Break up Provided		5,360,000
8	Providing and planting, Foxtail palm, Sukhchain, Hyophorbe lagenicaulis, Bakain, Chinaberry, Dharaik, Shesham, Toot, Beri and palm (Having Age 1.5 Years) at 15 ft center to center, including look after for one years, Manuring the plantation twice an year sparaying the pestisides, watering etc. complete in all respect. (Quality of plants as approved by Engineer incharge)	400		10000	4000000
9	Water Sprinkling to control dust	24		30000	00000
10	Environmental/HSE Expert	24	monthly	120000	2,880,000
11	Trainings				600,000

Health, Safety and Environment					
Sr. No.	**Description**	**Quantity**	**Unit**	**Rate (PKR)**	**Amount (PKR)**
				Total Cost (A)	**15,100,000**

Table 8-8 Environmental Monitoring Cost During Construction

Environmental Monitoring Cost								
Components	**Parameters**	**No. of Samples**			**Frequency**	**Responsibility**	**Duration**	**Cost (PKR)**
		Sampling Points	**Frequency**	**Total**				
Construction Phase (24 months)								
Air Quality	All PEQS parameters	2	8	16	Quarterly	Contractor	24 hours	480,000
Ground Water Quality	All PEQS parameters	2	8	16	Quarterly	Contractor	-	256,000
Surface Water Quality	All PEQS parameters	2	8	16	Quarterly	Contractor	-	256,000
Noise Level	-	2	8	16	Quarterly	Contractor	24 hours	40,000
							Sub-Total(B)	**1,032,000**

Table 8-9 Environmental Monitoring Cost during Operation

Environmental Monitoring Cost								
Components	**Parameters**	**No. of Samples**			**Frequency**	**Responsibility**	**Duration**	**Cost (PKR)**
		Sampling Points	**Frequency**	**Total**				
Operation Phase (60 months)								
Air Quality	All PEQS parameters	2	10	16	Biannually	Contractor	24 hours	480,000
Ground Water Quality	All PEQS parameters	2	10	16	Biannually	Contractor	-	256,000
Noise Level	-	2	10	16	Biannually	Contractor	24 hours	50,000
							Sub-Total(C)	**786,000**

So, the total cost of EMMP is sum of (A+B+C) in above tables which is equal to 16,918,000 PKR or 16.918 million PKR

9 CONCLUSION AND RECOMMENDATIONS

9.1 GENERAL

This section presents conclusions of the EIA study of proposed Project. The overall objective of this EIA is to carry out a detailed environmental assessment of the project area; to assess impacts caused by the different activities of the proposed project and to address measures to mitigate adverse environmental impacts arising from the execution of the proposed project. The conclusions mentioned below are based on the findings of detailed environmental assessment, which has been carried out as per requirement of Environmental Protection Agency (EPA).

9.2 MAIN ISSUES AND CONCERNS

During the field surveys, significant efforts were made to identify the main environmental, ecological and social issues related to the implementation of the proposed project. Residents and stakeholders were also contacted for obtaining salient information of the project. Following is the list of main issues and concerns:

- Disturbance to the public movement during constructional activity.
- Noise and air pollution due to the operation of construction machinery during construction phase of the project.
- Disruption of existing public utilities during construction phase.
- Oil spillages from construction machinery, resulting in soil and drinking / spring water contamination.
- Health and safety problem of the workers may also arise during the construction and operation phases of the project.

All the adverse impacts of the proposed project have properly been mitigated and a comprehensive EMP has been formulated. The implementation of EMP will help to reduce the adverse impacts of the aforesaid project.

9.3 CONCLUSIONS

After the completion of the proposed project, residents of the project area will get the following benefits;

- Environmental nuisance created by the untreated disposal of wastewater of Lahore city will be overcome by the construction of the WWTP at the designated site.
- The Project will reduce the organic pollution discharged to the Ravi River by approx. 10,000 kg/day. This will improve conditions for aquatic life.
- Treated effluent will be returned to the irrigation system for agricultural re-use. The remaining nutrients will support crop growth on the farms.
- The return of treated effluent supports the nexus between the Department of Irrigation (which will release raw water to WASA for the production of potable water for drinking water purposes) and WASA (which will discharge treated water back to the irrigation system to service downstream farms).
- Improvement in health conditions of the residents of the project area.
- Decrease in health budget of the residents of the project area.
- Elimination of existing sewage disposal system replaced by the enhanced conveyance system along with treatment of wastewater fulfilling the adequate capacity required.
- Dissolved oxygen levels will remain intact in the lakes and water bodies as the treated waste water will be disposed of in the water bodies. It will enhance the overall ecological aspect of the project area.
- Farmers will be benefited as they will be provided the treated water for irrigation purposes.
- There will be reduction of flooding at downstream Escape Channel after the implementation of this project
- Business will spin – off in the agricultural sector around the project area.

9.4 RECOMMENDATIONS

- The construction activities shall be phased to confine the disruption of traffic. Traffic diversion / re – routing plans, if found necessary, shall be made with the help of traffic police for smooth flow of traffic. The vehicles carrying the construction materials will not be allowed to enter the town during rush hours.
- Inclusion of further access routes to facilitate the accessibility of vehicles and pedestrians to and from the proposed Project site.
- Site demarcation must be ensured and land use of the project area should remain intact.

- Strict supervision of the excavation process should be carried out and residents should be informed in advance about the excavation activity.
- Noise measurements will be carried out at locations and schedule specified to ensure the effectiveness of mitigation measures.
- Odour should minimize by installing ventilators and vegetation arrangements.

As a conclusion of the study, the proposed project will not cause potentially significant environmental and social adverse impacts on the local environment after implementation of the mitigation measures. Results of the EIA Study have shown that overall, the project is environmentally feasible. Most of the environmental impacts are moderate adverse in nature. However, these impacts can be mitigated by the implementation of Environmental Management Plan. Overall; the impacts related to construction phase could be minimized by the implementation of the proper mitigation measures.

9.4.1 Contractor`s Obligations

- **Environmental Mitigation Measures**
  The contractor should carry out the mitigation measures according to the guidelines and satisfaction of the client. Environmental management and monitoring is to be performed as per environmental management and monitoring plans.
- **Existing infrastructure / Utilities**
  The contractor should make necessary arrangements to protect the existing infrastructure / existing utilities and if not avoidable should compensate the damages occurred to the utilities at his own expense.
- **First Aid Facilities**
  The contractor should arrange first aid facilities at site for any emergency purpose. Contractor should designate one of the staff members to act as lead person for emergency response and safety issues.
- **Health and Safety of Workers**
  The Contractor should make arrangements for the health and safety of the workers and general public by; providing safety equipment such as helmets, gloves, safety harnesses etc.; erection of safety signage at potentially dangerous working areas; making proper lighting arrangements should be provided for night shift working; providing insurance against accidental death

and injuries to workers and public; restricting public and animal access to construction site by providing fence on the periphery.

- **Employment of Local Personnel**

  The contractor should subject to availability and workability, employ maximum number of workers from the local area.

- **Disposal of Waste**

  The Contractor should in consultation with and the approval of Resident Engineer (RE) of the Project select and abide by the selection, sites for disposal of waste construction material, solid waste and waste water.

- **Location of Labor Camps, Material Depots, Equipment and Machinery, approach routes and roads etc.**

  Where Government owned land is available for location of Labor Camps, Material Depots, Equipment and Machinery Yard, Link Road or other activities related to these matters the Contractor should choose particular sites within the overall project area indicated in consultation with RE. These activities shall not be allowed outside this land. If the Contractor chooses to locate his facilities on a private land, he himself should be responsible for any compensation, resettlement or rehabilitation process and costs.

- **Socio-economic, Cultural values and Heritage**

  The contractor should be bound to:

  a) Ensure that no damage or disruption is caused to the public services being supplied to the people e.g. education, health, electricity supply, drinking water supply facilities for public gathering or religious congregations.
  b) Ensure the contractor or his employees remain refrained from the local tribal tensions.
  c) Ensure that existing ownership of land around the project is respected.
  d) Ensure that if some construction material, has to be procured from or through a member of local community, it must be by a proper Social Framework Agreement.
  e) Ensure that no damage or adverse effect is caused to archaeological (present or chance find) sites, graveyards and burial places.
  f) Ensure that privacy of local women is respected and any violator is strictly disciplined.

The above clauses have been suggested in technical context. These should be got vetted by qualified law officer before incorporation into the Tender Documents or the Contract Documents.

Annexure-I

Punjab Environment Protection Act 1997

(Amended 2017)

THE PUNJAB ENVIRONMENTAL PROTECTION ACT, 1997

(XXXIV of 1997)

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1. Short title, extent and commencement

2. Definitions

3. Establishment of the Punjab Environmental Protection Council

4. Functions and powers of the Council

5. Establishment of the Provincial Environmental Protection Agency

6. Functions of the Provincial Agency

7. Powers of the Provincial Agency

8. Omitted

9. Establishment of the Provincial Sustainable Development Funds

10. Management of the Provincial Sustainable Development Fund

11. Prohibition of certain discharges or emissions

12. Initial environmental examination and environmental impact assessment

13. Prohibition of import of hazardous waste

14. Handling of hazardous substances

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16. Environmental protection order

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18. Offences by bodies corporate

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20. Environmental Tribunals

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SCHEDULE

TEXT

[1]THE [2][PUNJAB] ENVIRONMENTAL PROTECTION ACT, 1997

(XXXIV of 1997)

[6th December, 1997]

An
Act

to provide for the protection, conservation, rehabilitation and improvement of the environment, for the prevention and control of pollution, and promotion of sustainable development

WHEREAS, it is expedient to provide for the protection, conservation, rehabilitation and improvement of the environment, prevention and control of pollution, promotion of sustainable development, and for matters connected therewith and incidental thereto;

It is hereby enacted as follows:–

1. Short title, extent and commencement.– (1) This Act may be called the [3][Punjab] Environmental Protection Act, 1997.

(2) It extends to the whole of [4][the Punjab].

(3) It shall come into force at once.

2. Definitions.– In this Act, unless there is anything repugnant in the subject or context,**–**

(i) "adverse environmental effect" means impairment of, or damage to, the environment and includes–

(a) impairment of, or damage to, human health and safety or to biodiversity or property;

(b) pollution; and

(c) any adverse environmental effect as may be specified in the regulations;

(ii) "agriculture waste" means waste from farm and agricultural activities including poultry, cattle farming, animal husbandry, residues from the use of fertilizers, pesticides and other farm chemicals;

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[1]This Act of Parliament received the assent of the President on 3 December 1997, and was published in the Gazette of Pakistan, Extraordinary, dated 6 December 1997.This Act was originally in the Federal ambit, however, the subject on which this law was enacted devolved to the provinces by virtue of 18th Amendment in the Constitution, hence it was adapted, with amendments, for the province of the Punjab by the Punjab Environmental Protection (Amendment) Act 2012 (XXXV of 2012).

[2]Substituted for the word "Pakistan" by the Punjab Environmental Protection (Amendment) Act 2012 (XXXV of 2012), w.e.f.18.4.2012, s.3; and published in the Punjab Gazette (Extraordinary), pages 41061-41065.

[3]Substituted for the word "Pakistan" by the Punjab Environmental Protection (Amendment) Act 2012 (XXXV of 2012), w.e.f.18.4.2012, s.3; and published in the Punjab Gazette (Extraordinary), pages 41061-41065.

[4]Substituted for the word "Pakistan" by the Punjab Environmental Protection (Amendment) Act 2012 (XXXV of 2012), w.e.f.18.4.2012, s.3; and published in the Punjab Gazette (Extraordinary), pages 41061-41065.

(iii) "air pollutant" means any substance that causes pollution of air and includes soot, smoke, dust particles, odor, light, electro-magnetic, radiation, heat, fumes, combustion exhaust, exhaust gases, noxious gases, hazardous substances and radioactive substances;

(iv) "biodiversity" or "biological diversity" means the variability among living organisms from all sources, including *inter alia* terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; including diversity within species, between species and of eco-systems;

(v) "Council" means the [5][Punjab] Environmental Protection Council established under section 3;

(vi) "discharge" includes spilling, leaking, pumping, depositing, seeping, releasing, flowing out, pouring, emitting, emptying or dumping;

(vii) "ecosystem" means a dynamic complex of plant, animal and micro-organism communities and their non-living environment interacting as a functional unit;

(viii) "effluent" means any material in solid, liquid or gaseous form or combination thereof being discharged from industrial activity or any other source and includes a slurry, suspension or vapour;

(ix) "emission standards" means the permissible standards established by the [6][Provincial Agency] for emission of air pollutants and noise and for discharge of effluent and waste;

(x) "environment" means–

(a) air, water and land;

(b) all layers of the atmosphere;

(c) all organic and inorganic matter and living organisms;

(d) the ecosystem and ecological relationships;

(e) buildings, structures, roads, facilities and works;

(f) all social and economic conditions affecting community life; and

(g) the inter-relationships between any of the factors in sub-clauses (a) to (f);

(xi) "environmental impact assessment" means an environmental study comprising collection of data, prediction of qualitative and quantitative impacts, comparison of alternatives, evaluation of preventive, mitigatory and compensatory measures, formulation of environmental management and training plans and monitoring arrangements, and framing of recommendations and such other components as may be prescribed;

[5]Substituted for the word "Pakistan" by the Punjab Environmental Protection (Amendment) Act 2012 (XXXV of 2012), w.e.f.18.4.2012, s.4; and published in the Punjab Gazette (Extraordinary), pages 41061-41065.

[6]Substituted for the words "Federal Agency or a Provincial Agency" by the Punjab Environmental Protection (Amendment) Act 2012 (XXXV of 2012), w.e.f.18.4.2012, s.4; and published in the Punjab Gazette (Extraordinary), pages 41061-41065.

(xii) "Environmental Magistrate" means the Magistrate of the First Class appointed under section 24;

(xiii) "Environmental Tribunal" means the Environmental Tribunal constituted under section 20;

[7][(xiv) * * * * * * * * * * *]

(xv) "factory" means any premises in which industrial activity is being undertaken;

[8][(xvi) "Government" means Government of the Punjab;]

[9][(xvii) "Government Agency" includes–

(a) a department, an attached department or any other office of the Government; and

(b) a development authority, local authority, company or a body corporate established or controlled by the Government;]

(xviii) "hazardous substance" means–

(a) a substance or mixture of substances, other than a pesticide as defined in the Agricultural Pesticides Ordinance, 1971 (II of 1971), which, by reason of its chemical activity or toxic, explosive, flammable, corrosive, radioactive or other characteristics causes, or is likely to cause, directly or in combination with other matters, an adverse environmental effect; and

(b) any substance which may be prescribed as a hazardous substance;

(xix) "hazardous waste" means waste which is or which contains a hazardous substance or which may be prescribed as hazardous substance or which may be prescribed as hazardous waste, and includes hospital waste and nuclear waste;

[10][(xx) * * * * * * * * * * *]

(xxi) "hospital waste" includes waste medical supplies and materials of all kinds, and waste blood, tissue, organs and other parts of the human and animal bodies, from hospitals, clinics and laboratories;

(xxii) "industrial activity" means any operation or process for manufacturing, making, formulating, synthesising, altering, repairing, ornamenting, finishing, packing or otherwise treating any article or substance with a view to its use, sale, transport, delivery or disposal, or for mining, for oil and gas exploration and development, or for pumping water or

[7]Omitted by the Punjab Environmental Protection (Amendment) Act 2012 (XXXV of 2012), w.e.f.18.4.2012, s.4; and published in the Punjab Gazette (Extraordinary), pages 41061-41065.

[8]Substituted by the Punjab Environmental Protection (Amendment) Act 2012 (XXXV of 2012), w.e.f.18.4.2012, s.4; and published in the Punjab Gazette (Extraordinary), pages 41061-41065.

[9]Substituted by the Punjab Environmental Protection (Amendment) Act 2012 (XXXV of 2012), w.e.f.18.4.2012, s.4; and published in the Punjab Gazette (Extraordinary), pages 41061-41065.

[10]Omitted by the Punjab Environmental Protection (Amendment) Act 2012 (XXXV of 2012), w.e.f.18.4.2012, s.4; and published in the Punjab Gazette (Extraordinary), pages 41061-41065.

sewage, or for generating, transforming or transmitting power or for any other industrial or commercial purpose;

(xxiii) "industrial waste" means waste resulting from an industrial activity;

(xxiv) "initial environmental examination" means a preliminary environmental review of the reasonably foreseeable qualitative and quantitative impacts on the environment of a proposed project to determine whether it is likely to cause an adverse environmental effect for requiring preparation of an environmental impact assessment;

(xxv) "local authority" means any agency set-up or designated by the [11][Government] by notification in the official Gazette to be a local authority for the purposes of this Act;

(xxvi) "local council" means a local council constituted or established under a law relating to local government;

(xxvii) "motor vehicle" means any mechanically propelled vehicle adapted for use upon land whether its power of propulsion is transmitted thereto from an external or internal source, and includes a chassis to which a body has not been attached, and a trailer, but does not include a vehicle running upon fixed rails;

(xxviii) "municipal waste" includes sewage, refuse, garbage, waste form abattoirs, sludge and human excreta and the like;

[12][(xxix) * * * * * * * * * * *]

(xxx) "noise" means the intensity, duration and character of sounds from all sources, and includes vibration;

(xxxi) "nuclear waste" means waste from any nuclear reactor or nuclear plant or other nuclear energy system, whether or not such waste is radioactive;

(xxxii) "person" means any natural person or legal entity and includes an individual, firm, association, partnership, society, group, company, corporation, co-operative society, Government Agency, non-governmental organization, community-based organization, village organization, local council or local authority and, in the case of a vessel, the master or other person having for the time being the charge or control of the vessel;

(xxxiii) "pollution" means the contamination of air, land or water by the discharge or emission of effluents or wastes or air pollutants or noise or other matter which either directly or indirectly or in combination with other discharges or substances alters unfavourably the chemical, physical, biological, radiational, thermal or radiological or aesthetic properties of the air, land or water or which may, or is likely to make the air, land or water unclean, noxious or impure or injurious,

[11]Substituted for the words "Federal Government or a Provincial Government" by the Punjab Environmental Protection (Amendment) Act 2012 (XXXV of 2012), w.e.f.18.4.2012, s.4; and published in the Punjab Gazette (Extraordinary), pages 41061-41065.

[12]Omitted by the Punjab Environmental Protection (Amendment) Act 2012 (XXXV of 2012), w.e.f.18.4.2012, s.4; and published in the Punjab Gazette (Extraordinary), pages 41061-41065.

disagreeable or detrimental to the health, safety, welfare or property of persons or harmful to biodiversity;

[13][(xxxiv) "prescribed" means prescribed by the rules or regulations;]

(xxxv) "project" means any activity, plan, scheme, proposal or undertaking involving any change in the environment and includes–

(a) construction or use of buildings or other works;

(b) construction or use of roads or other transport systems;

(c) construction or operation of factories or other installations;

(d) mineral prospecting, mining, quarrying, stone-crushing, drilling and the like;

(e) any change of land use or water use; and

(f) alteration, expansion, repair, decommissioning or abandonment of existing buildings or other works, roads or other transport systems, factories or other installations;

(xxxvi) "proponent" means the person who proposes or intends to undertake a project;

[14][(xxxvii) "Provincial Agency" means the Provincial Environmental Protection Agency established under the Act, or any Government Agency, local council or local authority exercising the powers and functions of the Provincial Agency;]

[15][(xxxvii-a) "Punjab Environmental Quality Standards" mean the standards prepared by the Provincial Agency and approved by the Council;]

(xxxviii) "regulations" means regulations made under this Act;

(xxxix) "rules" means rules made under this Act;

(xl) "sewage" means liquid or semi-solid wastes and sludge from sanitary conveniences, kitchens, laundries, washing and similar activities and from any sewerage system or sewage disposal works;

(xli) "standards" means qualitative and quantitative standards for discharge of effluents and wastes and for emission of air pollutants and noise either for general applicability or for a particular area, or from a particular production process, or for a particular product, and includes the [16][Punjab] Environmental Quality Standards, emission standards and other standards established under this Act and the rules and regulations made thereunder;

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[13]Substituted by the Punjab Environmental Protection (Amendment) Act 2012 (XXXV of 2012), w.e.f.18.4.2012, s.4; and published in the Punjab Gazette (Extraordinary), pages 41061-41065.

[14]Substituted by the Punjab Environmental Protection (Amendment) Act 2012 (XXXV of 2012), w.e.f.18.4.2012, s.4; and published in the Punjab Gazette (Extraordinary), pages 41061-41065.

[15]Inserted by the Punjab Environmental Protection (Amendment) Act 2012 (XXXV of 2012), w.e.f.18.4.2012, s.4; and published in the Punjab Gazette (Extraordinary), pages 41061-41065.

[16]Substituted for the word "National" by the Punjab Environmental Protection (Amendment) Act 2012 (XXXV of 2012), w.e.f.18.4.2012, s.2; and published in the Punjab Gazette (Extraordinary), pages 41061-41065.

(xlii) "sustainable development" means development that meets the needs of the present generation without compromising the ability of future generations to meet their needs;

[17][(xliii) * * * * * * * * * * *]

(xliv) "vessel" includes anything made for the conveyance by water of human beings or of goods; and

(xlv) "waste" means any substance or object which has been, is being or is intended to be, discarded or disposed of, and includes liquid waste, solid waste, waste gases, suspended waste, industrial waste, agricultural waste, nuclear waste, municipal waste, hospital waste, used polyethylene bags and residues from the incineration of all types of waste.

3. Establishment of the [18][Punjab] Environmental Protection Council.– [19][(1) The Government shall, by notification in the official Gazette, establish a Council to be known as the Punjab Environmental Protection Council consisting of–

i)	Chief Minister of the Punjab; or such other person as nominated by the Chief Minister;	Chairperson
ii)	Minister Incharge of the Environment Protection Department;	Vice Chairperson
iii)	such other persons not exceeding thirty five as the Government may appoint, of which at least twenty five shall be non-official including at least three Members of the Provincial Assembly of the Punjab, five representatives of the Chambers of Commerce and Industry and one or more representatives of the Chambers of Agriculture, Medical and legal profession, trade unions and non- governmental organizations concerned with the environment and sustainable development, and scientists, technical experts and educationalists20[:] 21[Provided that at least one female member of the Assembly and at least four women shall be appointed as non-official members; and]	Members
iv)	Secretary to the Government, Environment	Member/Secretary]

[17]Omitted by the Punjab Environmental Protection (Amendment) Act 2012 (XXXV of 2012), w.e.f.18.4.2012, s.4; and published in the Punjab Gazette (Extraordinary), pages 41061-41065.

[18]Substituted for the word "Pakistan" by the Punjab Environmental Protection (Amendment) Act 2012 (XXXV of 2012), w.e.f.18.4.2012, s.5; and published in the Punjab Gazette (Extraordinary), pages 41061-41065.

[19]Substituted by the Punjab Environmental Protection (Amendment) Act 2012 (XXXV of 2012), w.e.f.18.4.2012, s.5; and published in the Punjab Gazette (Extraordinary), pages 41061-41065.

[20]Substituted for the semi-colon and word "; and" by the Punjab Fair Representation of Women Act 2014 (IV of 2014), w.e.f. 12.3.2014, s.2 and the Schedule; and published in the Punjab Gazette (Extraordinary), pages 2733-2744.

[21]Added by the Punjab Fair Representation of Women Act 2014 (IV of 2014), w.e.f. 12.3.2014, s.2 and the Schedule; and published in the Punjab Gazette (Extraordinary), pages 2733-2744.

Protection Department.

(2) The Members of the Council, other than *ex-officio* members, shall be appointed in accordance with the prescribed procedure and shall hold office for a term of three years.

(3) The Council shall frame its own rules of procedure.

(4) The Council shall hold meetings as and when necessary, but not less than two meetings shall be held in a year.

(5) The Council may constitute committees of its members and entrust them with such functions as it may deem fit, and the recommendations of the committees shall be submitted to the Council for approval.

(6) The Council or any of its committees may invite any technical expert or representative of any Government Agency or non-governmental organization or other person possessing specialized knowledge of any subject for assistance in performance of its functions.

4. Functions and powers of the Council.– (1) The Council shall**–**

(a) co-ordinate and supervise enforcement of the provisions of this Act;

(b) approve comprehensive [22][Punjab] environmental policies and ensure their implementation within the framework of a [23][Punjab] conservation strategy as may be approved by the [24][Government] from time to time;

(c) approve the [25][Punjab] Environmental Quality Standards;

(d) provide guidelines for the protection and conservation of species, habitats, and biodiversity in general, and for the conservation of renewable and non-renewable resources;

(e) coordinate integration of the principles and concerns of sustainable development into [26][Punjab] development plans and policies; and

(f) consider the [27][Punjab] Environment Report and give appropriate directions thereon.

(2) The Council may, either itself or on the request of any person or organisation, direct the [28][Provincial Agency] or any Government Agency to prepare, submit, promote or implement projects for the protection, conservation, rehabilitation

[22]Substituted for the word "National" by the Punjab Environmental Protection (Amendment) Act 2012 (XXXV of 2012), w.e.f.18.4.2012, s.2; and published in the Punjab Gazette (Extraordinary), pages 41061-41065.

[23]Substituted for the word "National" by the Punjab Environmental Protection (Amendment) Act 2012 (XXXV of 2012), w.e.f.18.4.2012, s.2; and published in the Punjab Gazette (Extraordinary), pages 41061-41065.

[24]Substituted for the words "Federal Government" by the Punjab Environmental Protection (Amendment) Act 2012 (XXXV of 2012), w.e.f.18.4.2012, s.2; and published in the Punjab Gazette (Extraordinary), pages 41061-41065.

[25]Substituted for the word "National" by the Punjab Environmental Protection (Amendment) Act 2012 (XXXV of 2012), w.e.f.18.4.2012, s.2; and published in the Punjab Gazette (Extraordinary), pages 41061-41065.

[26]Substituted for the word "National" by the Punjab Environmental Protection (Amendment) Act 2012 (XXXV of 2012), w.e.f.18.4.2012, s.2; and published in the Punjab Gazette (Extraordinary), pages 41061-41065.

[27]Substituted for the word "National" by the Punjab Environmental Protection (Amendment) Act 2012 (XXXV of 2012), w.e.f.18.4.2012, s.2; and published in the Punjab Gazette (Extraordinary), pages 41061-41065.

[28]Substituted for the words "Federal Agency" by the Punjab Environmental Protection (Amendment) Act 2012 (XXXV of 2012), w.e.f.18.4.2012, s.2; and published in the Punjab Gazette (Extraordinary), pages 41061-41065.

and improvement of the environment, the prevention and control of pollution, and the sustainable development of resources, or to undertake research in any specified aspect of environment.

5. Establishment of the [29][Provincial] Environmental Protection Agency.– [30][(1) The Government shall, by notification in the official Gazette, establish the Provincial Environmental Protection Agency to exercise the powers and perform the functions assigned to it under this Act, the rules and the regulations.]

(2) The [31][Provincial Agency] shall be headed by a Director-General, who shall be appointed by the [32][Government] on such terms and conditions as it may determine.

(3) The [33][Provincial Agency] shall have such administrative, technical and legal staff as the [34][Government] may specify, to be appointed in accordance with such procedure as may be prescribed.

(4) The powers and functions of the [35][Provincial Agency] shall be exercised and performed by the Director-General.

[36][(5) The Director General may, by general or special order, delegate any of the functions of the Provincial Agency exercised by him under subsection (4) to any other officer appointed under subsection (3).]

(6) For assisting the [37][Provincial Agency] in the discharge of its functions, the [38][Government] shall establish Advisory Committees for various sectors, and appoint as members thereof eminent representatives of the relevant sector, educational institutions, research institutes and non-governmental organizations.

6. Functions of the [39][Provincial Agency].– (1) The [40][Provincial Agency] shall–

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[29]Substituted for the word “Pakistan” by the Punjab Environmental Protection (Amendment) Act 2012 (XXXV of 2012), w.e.f.18.4.2012, s.6; and published in the Punjab Gazette (Extraordinary), pages 41061-41065.

[30]Substituted by the Punjab Environmental Protection (Amendment) Act 2012 (XXXV of 2012), w.e.f.18.4.2012, s.6; and published in the Punjab Gazette (Extraordinary), pages 41061-41065.

[31]Substituted for the words “Federal Agency” by the Punjab Environmental Protection (Amendment) Act 2012 (XXXV of 2012), w.e.f.18.4.2012, s.2; and published in the Punjab Gazette (Extraordinary), pages 41061-41065.

[32]Substituted for the words “Federal Government” by the Punjab Environmental Protection (Amendment) Act 2012 (XXXV of 2012), w.e.f.18.4.2012, s.2; and published in the Punjab Gazette (Extraordinary), pages 41061-41065.

[33]Substituted for the words “Federal Agency” by the Punjab Environmental Protection (Amendment) Act 2012 (XXXV of 2012), w.e.f.18.4.2012, s.2; and published in the Punjab Gazette (Extraordinary), pages 41061-41065.

[34]Substituted for the words “Federal Government” by the Punjab Environmental Protection (Amendment) Act 2012 (XXXV of 2012), w.e.f.18.4.2012, s.2; and published in the Punjab Gazette (Extraordinary), pages 41061-41065.

[35]Substituted for the words “Federal Agency” by the Punjab Environmental Protection (Amendment) Act 2012 (XXXV of 2012), w.e.f.18.4.2012, s.2; and published in the Punjab Gazette (Extraordinary), pages 41061-41065.

[36]Substituted by the Punjab Environmental Protection (Amendment) Act 2017 (XIX of 2017), published in the Punjab Gazette (Extraordinary), dated: 08 November 2017, pp 3139 - 3140, s.2

[37]Substituted for the words “Federal Agency” by the Punjab Environmental Protection (Amendment) Act 2012 (XXXV of 2012), w.e.f.18.4.2012, s.2; and published in the Punjab Gazette (Extraordinary), pages 41061-41065.

[38]Substituted for the words “Federal Government” by the Punjab Environmental Protection (Amendment) Act 2012 (XXXV of 2012), w.e.f.18.4.2012, s.2; and published in the Punjab Gazette (Extraordinary), pages 41061-41065.

[39]Words “Federal Agency” substituted by the Punjab Environmental Protection (Amendment) Act, 2012 (XXXV of 2012)

[40]Substituted for the words “Federal Agency” by the Punjab Environmental Protection (Amendment) Act 2012 (XXXV of 2012), w.e.f.18.4.2012, s.2; and published in the Punjab Gazette (Extraordinary), pages 41061-41065.

(a) administer and implement the provisions of this Act and the rules and regulations made thereunder;

(b) prepare, in coordination with the appropriate Government Agency and in consultation with the concerned sectoral Advisory Committees, [41][* * * *] environmental policies for approval by the Council;

(c) take all necessary measures for the implementation of the [42][* * * *] environmental policies approved by the Council;

(d) prepare and publish an annual [43][Punjab] Environmental Report on the state of the environment;

(e) prepare or revise, and establish the [44][Punjab] Environmental Quality Standards with approval of the Council:

Provided that before seeking approval of the Council, the [45][Provincial Agency] shall publish the proposed [46][Punjab] Environmental Quality Standards for public opinion in accordance with the prescribed procedure; and

(f) ensure enforcement of the [47][Punjab] Environmental Quality Standards;

[48][(g) establish standards for the quality of the ambient air, water and land, by notification in the official Gazette;]

(h) co-ordinate environmental policies and programmes nationally and internationally;

(i) establish systems and procedures for surveys, surveillance, monitoring, measurement, examination, investigation, research, inspection and audit to prevent and control pollution, and to estimate the costs of cleaning up pollution and rehabilitating the environment in various sectors;

(j) take measures to promote research and the development of science and technology which may contribute to the prevention of pollution, protection of the environment, and sustainable development;

(k) certify one or more laboratories as approved laboratories for conducting tests and analysis and one or more research institutes as

[41]Omitted the word “national” by the Punjab Environmental Protection (Amendment) Act 2012 (XXXV of 2012), w.e.f.18.4.2012, s.7; and published in the Punjab Gazette (Extraordinary), pages 41061-41065.

[42]Omitted the word “national” by the Punjab Environmental Protection (Amendment) Act 2012 (XXXV of 2012), w.e.f.18.4.2012, s.7; and published in the Punjab Gazette (Extraordinary), pages 41061-41065.

[43]Substituted for the word “National” by the Punjab Environmental Protection (Amendment) Act 2012 (XXXV of 2012), w.e.f.18.4.2012, s.2; and published in the Punjab Gazette (Extraordinary), pages 41061-41065.

[44]Substituted for the word “National” by the Punjab Environmental Protection (Amendment) Act 2012 (XXXV of 2012), w.e.f.18.4.2012, s.2; and published in the Punjab Gazette (Extraordinary), pages 41061-41065.

[45]Substituted for the words “Federal Agency” by the Punjab Environmental Protection (Amendment) Act 2012 (XXXV of 2012), w.e.f.18.4.2012, s.2; and published in the Punjab Gazette (Extraordinary), pages 41061-41065.

[46]Substituted for the word “National” by the Punjab Environmental Protection (Amendment) Act 2012 (XXXV of 2012), w.e.f.18.4.2012, s.2; and published in the Punjab Gazette (Extraordinary), pages 41061-41065.

[47]Substituted for the word “National” by the Punjab Environmental Protection (Amendment) Act 2012 (XXXV of 2012), w.e.f.18.4.2012, s.2; and published in the Punjab Gazette (Extraordinary), pages 41061-41065.

[48]Substituted by the Punjab Environmental Protection (Amendment) Act 2012 (XXXV of 2012), w.e.f.18.4.2012, s.7; and published in the Punjab Gazette (Extraordinary), pages 41061-41065.

environmental research institutes for conducting research and investigation, for the purposes of this Act;

(l) identify the needs for, and initiate legislation in various sectors of the environment;

(m) render advice and assistance in environmental matters, including such information and data available with it as may be required for carrying out the purposes of this Act:

Provided that the disclosure of such information shall be subject to the restrictions contained in the proviso to sub-section (3) of section 12;

(n) assist the local councils, local authorities, Government Agencies and other persons to implement schemes for the proper disposal of wastes so as to ensure compliance with the standards established by it;

(o) provide information and guidance to the public environmental matters;

(p) recommend environmental courses, topics, literature and books for incorporation in the curricula and syllabi of educational institutions;

(q) promote public education and awareness of environmental issues through mass media and other means, including seminars and workshops;

(r) specify safeguards for the prevention of accidents and disasters which may cause pollution, collaborate with the concerned person in the preparation of contingency plans for control of such accidents and disasters, and co-ordinate implementation of such plans;

(s) encourage the formation and working of non-governmental organizations, community organizations and village organizations to prevent and control pollution and promote sustainable development;

(t) take or cause to be taken all necessary measure for the protection, conservation, rehabilitation and improvement of the environment, prevention and control of pollution and promotion of sustainable development; and

(u) perform any function which the Council may assign to it.

(2) The [49][Provincial Agency] may–

(a) undertake inquires or investigation into environmental issues, either of its own accord or upon complaint from any person or organisation;

(b) request any person to furnish any information or data relevant to its functions;

(c) initiate with the approval of the [50][Government], requests for foreign assistance in support of the purposes of this Act and enter into arrangements with foreign agencies or organizations for the exchange

[49]Substituted for the words “Federal Agency” by the Punjab Environmental Protection (Amendment) Act 2012 (XXXV of 2012), w.e.f.18.4.2012, s.2; and published in the Punjab Gazette (Extraordinary), pages 41061-41065.

[50]Substituted for the words “Federal Government” substituted by the Punjab Environmental Protection (Amendment) Act, 2012 (XXXV of 2012)

of material or information and participate in international seminars or meetings;

(d) recommend to the [51][Government] the adoption of financial and fiscal programmes, schemes or measures for achieving environmental objectives and goals and the purposes of this Act, including–

(i) incentives, prizes awards, subsidies, tax exemptions, rebates and depreciation allowances; and

(ii) taxes, duties, cesses and other levies;

(e) establish and maintain laboratories to help in the performance of its functions under this Act and to conduct research in various aspects of the environment and provide or arrange necessary assistance for establishment of similar laboratories in the private sector; and

(f) provide or arrange, in accordance with such procedure as may be prescribed, financial assistance for projects designed to facilitate the discharge of its functions.

7. Powers of the [52][Provincial Agency].– Subject to the provisions of this Act, the [53][Provincial Agency] may–

(a) lease, purchase, acquire, own, hold, improve, use or otherwise deal in and with any property both movable and immovable;

(b) sell, convey, mortgage, pledge, exchange or otherwise dispose of its property and assets;

(c) fix and realize fees, rates and charges for rendering any service or providing any facility, information or data under this Act or the rules and regulations made thereunder;

(d) enter into the contracts, execute instruments, incur liabilities and do all acts or things necessary for proper management and conduct of its business;

(e) appoint with the approval of the [54][Government] and in accordance with such procedures as may be prescribed, such advisers, experts and consultants as it considers necessary for the efficient performance of its functions on such terms and conditions as it may deem fit;

(f) summon and enforce the attendance of any person and require him to supply any information or document needed for the conduct of any enquiry or investigation into any environmental issue;

(g) enter and inspect and under the authority of a search warrant issued by the Environmental Tribunal or Environmental Magistrate, search at

[51]Substituted for the words “Federal Government” by the Punjab Environmental Protection (Amendment) Act 2012 (XXXV of 2012), w.e.f.18.4.2012, s.2; and published in the Punjab Gazette (Extraordinary), pages 41061-41065.

[52]Substituted for the words “Federal Agency” by the Punjab Environmental Protection (Amendment) Act 2012 (XXXV of 2012), w.e.f.18.4.2012, s.2; and published in the Punjab Gazette (Extraordinary), pages 41061-41065.

[53]Substituted for the words “Federal Agency” by the Punjab Environmental Protection (Amendment) Act 2012 (XXXV of 2012), w.e.f.18.4.2012, s.2; and published in the Punjab Gazette (Extraordinary), pages 41061-41065.

[54]Substituted for the words “Federal Government” by the Punjab Environmental Protection (Amendment) Act 2012 (XXXV of 2012), w.e.f.18.4.2012, s.2; and published in the Punjab Gazette (Extraordinary), pages 41061-41065.

any reasonable time, any land, building, premises, vehicle or vessel or other place where or in which, there are reasonable grounds to believe that an offence under this Act has been or is being committed;

(h) take samples of any materials, products, articles or substances or of the effluents, wastes or air pollutants being discharged or emitted or of air, water or land in the vicinity of the discharge or emission;

(i) arrange for test and analysis of the samples at a certified laboratory;

(j) confiscate any article used in the commission of the offence where the offender is not known or cannot be found within a reasonable time:

Provided that the power under clauses (f), (h), (i), and (j) shall be exercised in accordance with the provisions of the Code of Criminal Procedure, 1898 (Act V of 1898), or the rules made under this Act and under the direction of the Environmental Tribunal or Environmental Magistrate; and

[55][(k) establish the Punjab Environmental Coordination Committee comprising the Director General as its convener and such other members as the Government may appoint to exercise such powers and perform such functions as may be delegated or assigned to it by the Government for carrying out the purposes of this Act.]

[56][8. *Establishment, powers and functions of the Provincial Environmental Protection Agencies*.– * * * * * * * * * *]

9. Establishment of the Provincial Sustainable Development Funds.– [57][(1) There shall be established a Provincial Sustainable Development Fund.]

(2) The Provincial Sustainable Development Fund shall be derived from the following sources, namely:–

(a) grants made or loans advanced by the [58][Government or the Federal Government];

(b) aid and assistance, grants, advances, donations and other non-obligatory funds received from foreign governments, [59][Punjab] or international agencies, and non-governmental organizations; and

(c) contributions from private organizations, and other persons.

(3) The Provincial Sustainable Development Fund shall be utilized in accordance with such procedure as may be prescribed for–

[55]Substituted by the Punjab Environmental Protection (Amendment) Act 2012 (XXXV of 2012), w.e.f.18.4.2012, s.8; and published in the Punjab Gazette (Extraordinary), pages 41061-41065.

[56]Omitted by the Punjab Environmental Protection (Amendment) Act 2012 (XXXV of 2012), w.e.f.18.4.2012, s.9; and published in the Punjab Gazette (Extraordinary), pages 41061-41065.

[57]Substituted by the Punjab Environmental Protection (Amendment) Act 2012 (XXXV of 2012), w.e.f.18.4.2012, s.10; and published in the Punjab Gazette (Extraordinary), pages 41061-41065.

[58]Substituted for the words “Federal Government or the Provincial Governments” by the Punjab Environmental Protection (Amendment) Act 2012 (XXXV of 2012), w.e.f.18.4.2012, s.10; and published in the Punjab Gazette (Extraordinary), pages 41061-41065.

[59]Substituted for the word “National” by the Punjab Environmental Protection (Amendment) Act 2012 (XXXV of 2012), w.e.f.18.4.2012, s.2; and published in the Punjab Gazette (Extraordinary), pages 41061-41065.

(a) providing financial assistance to the projects designed for the protection, conservation, rehabilitation and improvement of the environment, the prevention and control of pollution, the sustainable development of resources and for research in any specified aspect of environment; and

(b) any other purpose which in the opinion of the Board will help achieve environmental objectives and the purposes of this Act.

10. Management of the Provincial Sustainable Development Fund.– [60][(1) The Provincial Sustainable Development Fund shall be managed by a Board known as the Provincial Sustainable Development Fund Board consisting of-

(i)	Chairman, Planning and Development Board;	Chairperson
(ii)	Such officers of the Government, not exceeding six, as the Government may appoint including Secretaries incharge of the Finance, Industries and Environment Departments;	Members
(iii)	such non-official persons not exceeding ten as the Government may appoint including representatives of the Chamber of Commerce and Industry, non-governmental organizations and major donors; and	Members
(iv)	Director General of the Provincial Agency.	Member/Secretary]

(2) In accordance with such procedure and such criteria as may be prescribed, the Board shall have the power to–

(a) sanction financial assistance for eligible projects;

(b) invest moneys held in the Provincial Sustainable Development Fund in such profit-bearing government bonds, savings schemes and securities as it may deem suitable; and

(c) take such measures and exercise such powers as may be necessary for utilization of the Provincial Sustainable Development Fund for the purposes specified in sub-section (3) of section 9.

(3) The Board shall constitute committees of its members to undertake regular monitoring of projects financed from the Provincial Sustainable Development Fund and to submit progress reports to the Board which shall publish an Annual Report incorporating its annual audited accounts, and performance evaluation based on the progress reports.

11. Prohibition of certain discharges or emissions.– (1) Subject to the provisions of this Act and the rules and regulations made thereunder no person shall discharge or emit or allow the discharge or emission of any effluent or waste or air pollutant or noise in an amount, concentration or level which is in excess of the

[60]Substituted by the Punjab Environmental Protection (Amendment) Act 2012 (XXXV of 2012), w.e.f.18.4.2012, s.11; and published in the Punjab Gazette (Extraordinary), pages 41061-41065.

[61][Punjab] Environmental Quality Standards or, where applicable, the standards established under [62][* * * * * * *] clause (g) of sub-section (1) of section 6.

(2) The [63][Government] may levy a pollution charge on any person who contravenes or fails to comply with the provisions of sub-section (1), to be calculated at such rate, and collected in accordance with such procedure as may be prescribed.

(3) Any person who pays the pollution charge levied under sub-section (2) shall not be charged with an offence with respect to that contravention or failure.

(4) The provisions of sub-section (3) shall not apply to projects, which commenced industrial activity on or after the thirtieth day of June, 1994.

12. Initial environmental examination and environmental impact assessment.– (1) No proponent of a project shall commence construction or operation unless he has filed with the [64][Provincial Agency] an initial environmental examination or, where the project is likely to cause an adverse environmental effect, an environmental impact assessment, and has obtained from the [65][Provincial Agency] approval in respect thereof.

(2) The [66][Provincial Agency] shall–

(a) review the initial environmental examination and accord its approval, or require submission of an environmental impact assessment by the proponent; or

(b) review the environmental impact assessment and accord its approval subject to such conditions as it may deem fit to impose, or require that the environmental impact assessment be re-submitted after such modifications as may be stipulated, or reject the project as being contrary to environmental objectives.

(3) Every review of an environmental impact assessment shall be carried out with public participation and no information will be disclosed during the course of such public participation which relates to**–**

(i) trade, manufacturing or business activities, processes or techniques of a proprietary nature, or financial, commercial, scientific or technical matters which the proponent has requested should remain confidential, unless for reasons to be recorded in writing, the Director-General of

[61]Substituted for the word “National” by the Punjab Environmental Protection (Amendment) Act 2012 (XXXV of 2012), w.e.f.18.4.2012, s.2; and published in the Punjab Gazette (Extraordinary), pages 41061-41065.

[62]The words “sub-clause (i) of” Omitted by the Punjab Environmental Protection (Amendment) Act 2017 (XIX of 2017), published in the Punjab Gazette (Extraordinary), dated: 08 November 2017, pp 3139 - 3140, s.3

[63] Substituted for the words “Federal Government” by the Punjab Environmental Protection (Amendment) Act 2012 (XXXV of 2012), w.e.f.18.4.2012, s.2; and published in the Punjab Gazette (Extraordinary), pages 41061-41065.

[64]Substituted for the words “Federal Agency” by the Punjab Environmental Protection (Amendment) Act 2012 (XXXV of 2012), w.e.f.18.4.2012, s.2; and published in the Punjab Gazette (Extraordinary), pages 41061-41065.

[65]Substituted for the words “Federal Agency” by the Punjab Environmental Protection (Amendment) Act 2012 (XXXV of 2012), w.e.f.18.4.2012, s.2; and published in the Punjab Gazette (Extraordinary), pages 41061-41065.

[66]Substituted for the words “Federal Agency” by the Punjab Environmental Protection (Amendment) Act 2012 (XXXV of 2012), w.e.f.18.4.2012, s.2; and published in the Punjab Gazette (Extraordinary), pages 41061-41065.

the [67][Provincial Agency] is of the opinion that the request for confidentiality is not well-founded or the public interest in the disclosure outweighs the possible prejudice to the competitive position of the project or its proponent; or

(ii) international relations, [68][Punjab] security or maintenance of law and order, except with the consent of the [69][Government]; or

(iii) matters covered by legal professional privilege.

(4) The [70][Provincial Agency] shall communicate its approval or otherwise within a period of four months from the date the initial environmental examination or environmental impact assessment is filed complete in all respects in accordance with the prescribed procedure, failing which the initial environmental examination or, as the case may be, the environmental impact assessment shall be deemed to have been approved, to the extent to which it does not contravene the provisions of this Act and the rules and regulations made thereunder.

(5) Subject to sub-section (4) the [71][Government] may in a particular case extend the aforementioned period of four months if the nature of the project so warrants.

(6) The provisions of sub-sections (1), (2), (3), (4) and (5) shall apply to such categories of projects and in such manner as may be prescribed.

(7) The [72][Provincial Agency] shall maintain separate Registers for initial environmental examination and environmental impact assessment project, which shall contain brief particulars of each project and a summary of decisions taken thereon, and which shall be open to inspection by the public at all reasonable hours and the disclosure of information in such Registers shall be subject to the restrictions specified in sub-section (3).

[73][**13. Prohibition of import of hazardous waste**.– No person shall import hazardous waste into the Punjab.]

14. Handling of hazardous substances.– Subject to the provisions of this Act, no person shall generate, collect, consign, transport, treat, dispose of, store, handle or import any hazardous substance except–

[67]Substituted for the words “Federal Agency” by the Punjab Environmental Protection (Amendment) Act 2012 (XXXV of 2012), w.e.f.18.4.2012, s.2; and published in the Punjab Gazette (Extraordinary), pages 41061-41065.

[68]Substituted for the word “National” by the Punjab Environmental Protection (Amendment) Act 2012 (XXXV of 2012), w.e.f.18.4.2012, s.2; and published in the Punjab Gazette (Extraordinary), pages 41061-41065.

[69]Substituted for the words “Federal Government” by the Punjab Environmental Protection (Amendment) Act 2012 (XXXV of 2012), w.e.f.18.4.2012, s.2; and published in the Punjab Gazette (Extraordinary), pages 41061-41065.

[70]Substituted for the words “Federal Agency” by the Punjab Environmental Protection (Amendment) Act 2012 (XXXV of 2012), w.e.f.18.4.2012, s.2; and published in the Punjab Gazette (Extraordinary), pages 41061-41065.

[71]Substituted for the words “Federal Government” by the Punjab Environmental Protection (Amendment) Act 2012 (XXXV of 2012), w.e.f.18.4.2012, s.2; and published in the Punjab Gazette (Extraordinary), pages 41061-41065.

[72]Substituted for the words “Federal Agency” by the Punjab Environmental Protection (Amendment) Act 2012 (XXXV of 2012), w.e.f.18.4.2012, s.2; and published in the Punjab Gazette (Extraordinary), pages 41061-41065.

[73]Substituted by the Punjab Environmental Protection (Amendment) Act 2012 (XXXV of 2012), w.e.f.18.4.2012, s.12; and published in the Punjab Gazette (Extraordinary), pages 41061-41065.

(a) under a licence issued by the [74][Provincial Agency] and in such manner as may be prescribed; or

(b) in accordance with the provisions of any other law for the time being in force, or of any international treaty, convention, protocol, code, standard, agreement or other instrument to which Pakistan is a party.

15. Regulation of motor vehicles.– (1) subject to the provisions of this Act and the rules and regulations made thereunder, no person shall operate a motor vehicle from which air pollutants or noise are being emitted in an amount, concentration or level which is in excess of the [75][Punjab] Environmental Quality Standards, or where applicable the standards established under clause (g) of sub-section (1) of section 6.

(2) For ensuring compliance with the standards mentioned in sub-section (1), the [76][Provincial Agency] may direct that any motor vehicle or class of vehicles shall install such pollution control devices or other equipment or use such fuels or undergo such maintenance or testing as may be prescribed.

(3) Where a direction has been issued by the [77][Provincial Agency] under sub-section (2) in respect of any motor vehicles or class of motor vehicles, no person shall operate any such vehicle till such direction has been complied with.

16. Environmental protection order.– [78][(1) Where the Provincial Agency is satisfied that the discharge or emission of any effluent, waste, air pollutant or noise, or the disposal of waste, or handling of hazardous substance, or any other act or omission is likely to occur, or is occurring, or has occurred, in violation of any provision of this Act, rules or regulations or of the conditions of a license, or is likely to cause, or is causing, or has caused an adverse environmental effect, the Provincial Agency may, after giving the person responsible for such discharge, emission, disposal, handling, act or omission an opportunity of being heard, by order, direct such person to take such measures as the Provincial Agency may consider necessary within such period as may be specified in the order.]

(2) In particular and without prejudice to the generality of the foregoing power, such measures may include–

(a) immediate stoppage, preventing, lessening or controlling the discharge, emission, disposal, handling, act or omission, or to minimize or remedy the adverse environmental effect;

(b) installation, replacement or alteration of any equipment or thing to eliminate or control or abate on a permanent or temporary basis, such discharge, emission, disposal, handling, act or omission;

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[74]Substituted for the words “Federal Agency” by the Punjab Environmental Protection (Amendment) Act 2012 (XXXV of 2012), w.e.f.18.4.2012, s.2; and published in the Punjab Gazette (Extraordinary), pages 41061-41065.

[75]Substituted for the word “National” by the Punjab Environmental Protection (Amendment) Act 2012 (XXXV of 2012), w.e.f.18.4.2012, s.2; and published in the Punjab Gazette (Extraordinary), pages 41061-41065.

[76]Substituted for the words “Federal Agency” by the Punjab Environmental Protection (Amendment) Act 2012 (XXXV of 2012), w.e.f.18.4.2012, s.2; and published in the Punjab Gazette (Extraordinary), pages 41061-41065.

[77]Substituted for the words “Federal Agency” by the Punjab Environmental Protection (Amendment) Act 2012 (XXXV of 2012), w.e.f.18.4.2012, s.2; and published in the Punjab Gazette (Extraordinary), pages 41061-41065.

[78]Substituted by the Punjab Environmental Protection (Amendment) Act 2012 (XXXV of 2012), w.e.f.18.4.2012, s.13; and published in the Punjab Gazette (Extraordinary), pages 41061-41065.

(c) action to remove or otherwise dispose of the effluent, waste, air pollutant, noise, or hazardous substances; and

(d) action to restore the environment to the condition existing prior to such discharge, disposal, handling, act or omission, or as close to such conditions may be reasonable in the circumstances, to the satisfaction of the [79][Provincial Agency].

(3) Where the person, to whom directions under sub-section (1) are given, does not comply therewith, the [80][Provincial Agency] may, in addition to the proceeding initiated against him under this Act or the rules and regulations, itself take or cause to be taken such measures specified in the order as it may deems necessary, and may recover the costs of taking such measures from such person as arrears of land revenue.

17. Penalties.– (1) Whoever contravenes or fails to comply with the provisions of sections 11, 12, 13, or section 16 or any order issued thereunder shall be punishable with fine which may extend to [81][five million] rupees, and in the case of a continuing contravention or failure, with an additional fine which may extend to one hundred thousand rupees for every day during which such contravention or failure continues and where such contravention or failure continues:

Provided that if contravention of the provision of section 11 also constitutes contravention of the provisions of section 15, such contravention shall be punishable under sub-section (2) only.

(2) Whoever contravenes or fails to comply with the provisions of section 14 or 15 or any rule or regulation or conditions of any licence, any order or direction issued by the Council or by the [82][Provincial Agency] shall be punishable with fine which may extend to [83][five hundred thousand] rupees, and in case of continuing contravention, or failure with an additional fine which extend to one thousand rupees for every day during which such contravention continues.

(3) Where an accused has been convicted of an offence under sub-section (1) and (2), the Environmental Tribunal and Environmental Magistrate shall, in passing sentence, take into account the extent and duration of the contravention or failure constituting the offence, and the attendant circumstances.

(4) Where an accused has been convicted of an offence under sub-section (1) and the Environmental Tribunal is satisfied that as a result of the commission of the offence monetary benefits have accrued to the offender, the Environmental Tribunal may order the offender to pay, in addition to the fines under

[79]Substituted for the words and comma “Federal Agency or, Provincial Agency” by the Punjab Environmental Protection (Amendment) Act 2012 (XXXV of 2012), w.e.f.18.4.2012, s.13; and published in the Punjab Gazette (Extraordinary), pages 41061-41065.

[80]Substituted for the words “Federal Agency or Provincial Agency” by the Punjab Environmental Protection (Amendment) Act 2012 (XXXV of 2012), w.e.f.18.4.2012, s.13; and published in the Punjab Gazette (Extraordinary), pages 41061-41065.

[81]Substituted for the words “one million” by the Punjab Environmental Protection (Amendment) Act 2012 (XXXV of 2012), w.e.f.18.4.2012, s.14; and published in the Punjab Gazette (Extraordinary), pages 41061-41065.

[82]Substituted for the words “Federal Agency or Provincial Agency” by the Punjab Environmental Protection (Amendment) Act 2012 (XXXV of 2012), w.e.f.18.4.2012, s.14; and published in the Punjab Gazette (Extraordinary), pages 41061-41065.

[83]Substituted for the words “one hundred thousand” by the Punjab Environmental Protection (Amendment) Act 2012 (XXXV of 2012), w.e.f.18.4.2012, s.14; and published in the Punjab Gazette (Extraordinary), pages 41061-41065.

sub-section (1), further additional fine commensurate with the amount of the monetary benefits.

(5) Where a person convicted under sub-sections (1) or sub-section (2); and had been previously convicted for any contravention under this Act, the Environmental Tribunal or, as the case may be, Environmental Magistrate may, in addition to the punishment awarded thereunder–

(a) endorse a copy of the order of conviction to the concerned trade or industrial association, if any, or the concerned Provincial Chamber of commence and Industry or the Federation of Pakistan Chambers of Commerce and Industry;

(b) sentence him to imprisonment for a term which may extend up to two years;

(c) order the closure of the factory;

(d) order confiscation of the factory, machinery, and equipment, vehicle, material or substance, record or document or other object used or involved in contravention of the provisions of the Act:

Provided that for a period of three years from the date of commencement of this Act, the sentence of imprisonment shall be passed only in respect of persons who have been previously convicted for more than once for any contravention of section 11, 13,14 or 16 involving hazardous waste;

(e) order such person to restore the environment at his own cost, to the conditions existing prior to such contravention or as close to such conditions as may be reasonable in the circumstances to the satisfaction of the [84][Provincial Agency]; and

(f) order that such sum be paid to any person as compensation for any loss, bodily injury, damage to his health or property suffered by such contravention.

(6) The Director-General of the [85][Provincial Agency] or an officer generally or specially authorised by him in this behalf may, on the application of the accused compound an offence under this Act with the permission of the Environmental Tribunal or Environmental Magistrate in accordance with such procedure as may be prescribed.

(7) Where the Director-General of the [86][Provincial Agency] is of the opinion that a person has contravened any provision of this Act, he may, subject to the rules, by notice in writing to that person require him to pay to the [87][Provincial

[84]Substituted for the words and commas “Federal Agency or,as the case may be , Provincial Agency” by the Punjab Environmental Protection (Amendment) Act 2012 (XXXV of 2012), w.e.f.18.4.2012, s.14; and published in the Punjab Gazette (Extraordinary), pages 41061-41065.

[85]Substituted for the words “Federal Agency or of a Provincial Agency” by the Punjab Environmental Protection (Amendment) Act 2012 (XXXV of 2012), w.e.f.18.4.2012, s.14; and published in the Punjab Gazette (Extraordinary), pages 41061-41065.

[86]Substituted for the words “Federal Agency or of a Provincial Agency” by the Punjab Environmental Protection (Amendment) Act 2012 (XXXV of 2012), w.e.f.18.4.2012, s.14; and published in the Punjab Gazette (Extraordinary), pages 41061-41065.

[87]Substituted for the words and commas “Federal Agency or, as the case may be, Provincial Agency” by the Punjab Environmental Protection (Amendment) Act 2012 (XXXV of 2012), w.e.f.18.4.2012, s.14; and published in the Punjab Gazette (Extraordinary), pages 41061-41065.

Agency] an administrative penalty in the amount set out in the notice for each day the contravention continues; and a person who pays an administrative penalty for a contravention shall not be charged under this Act with an offence in respect of such contravention.

(8) The provisions of sub-sections (6) and (7) shall not apply to a person who has been previously convicted of offence or who has compounded an offence under this Act or who has paid an administrative penalty for a contravention of any provision of this Act.

18. Offences by bodies corporate.– Where any contravention of this Act has been committed by a body corporate, and it is proved that such offence has been committed with the consent or connivance or, or is attributed to any negligence on the part of, any director, partner, manager, secretary or other officer of the body corporate, such director, partner, manager, secretary or other officer of the body corporate, shall be deemed guilty of such contravention along with the body corporate and shall be punished accordingly:

Provided that in the case of a company as defined under the Companies Ordinance, 1984 (XLVII of 1984), only the Chief Executive as defined in the said Ordinance shall be liable under this section.

Explanation.– For the purposes of this section, "body corporate" includes a firm, association of persons and a society registered under the Societies Registration Act, 1860 (XXI of 1860), or under the Co-operative Societies Act, 1925 (VII of 1925).

19. Offences by Government Agencies, local authorities or local councils.– Where any contravention of this Act has been committed by any Government Agency, local authority or local council, and it is proved that such contravention has been committed with the consent or connivance of, or is attributable to any negligence on the part of the Head or any other officer of the Government Agency, local authority or local council, such Head or other officer shall also be deemed guilty of such contravention along with the Government Agency, local authority or local council and shall be liable to be proceeded against and punished accordingly.

20. Environmental Tribunals.– (1) The [88][Government] may, by notification in the official gazette, establish as many Environmental Tribunals as it considers necessary and, where it establishes more than one Environmental Tribunal, it shall specify territorial limits within which, or the class of cases in respect of which, each one of them shall exercise jurisdiction under this Act.

(2) An Environmental Tribunal shall consist of a Chairperson who is, or has been, or is qualified for appointment as, a Judge of the High Court to be appointed after consultation with the Chief Justice of the High Court and two members to be appointed by the [89][Government] of which at least one shall be a technical member with suitable professional qualifications and experience in the environmental field as may be prescribed.

[88]Substituted for the words "Federal Government" by the Punjab Environmental Protection (Amendment) Act 2012 (XXXV of 2012), w.e.f.18.4.2012, s.2; and published in the Punjab Gazette (Extraordinary), pages 41061-41065.

[89]Substituted for the words "Federal Government" by the Punjab Environmental Protection (Amendment) Act 2012 (XXXV of 2012), w.e.f.18.4.2012, s.2; and published in the Punjab Gazette (Extraordinary), pages 41061-41065.

(3) For every sitting of the Environmental Tribunal, the presence of the Chairperson and not less than one Member shall be necessary.

[90][(4) A decision of an Environmental Tribunal shall be expressed in terms of the opinion of the majority, or if the case has been decided by the Chairperson and only one of the members and there is a difference of opinion between them, the decision of the Environmental Tribunal shall be expressed in terms of the opinion of the Chairperson.]

(5) An Environmental Tribunal shall not, merely by reason of a change in its composition, or the absence of any member from any sitting, be bound to recall and rehear any witness who was given evidence, and may act on the evidence already recorded by, or produced, before it.

(6) An Environmental Tribunal may hold its sittings at such places within its territorial jurisdiction as the Chairperson may decide.

(7) No act or proceeding of an Environmental Tribunal shall be invalid by reason only of the existence of vacancy in, or defect in the constitution of, the Environmental Tribunal.

(8) The terms and conditions of service of the Chairperson and members of the Environmental Tribunal shall be such as may be prescribed.

21. Jurisdiction and powers of Environmental Tribunals.– (1) An Environmental Tribunal shall exercise such powers and perform such functions as are, or may be, conferred upon or assigned to it by or under this Act, or the rules and regulations made thereunder.

(2) All contravention punishable under sub-section (1) of section 17 shall exclusively be triable by an Environmental Tribunal.

(3) An Environmental Tribunal shall not take cognizance of any offence triable under sub-section (2) except on a complaint in writing by–

(a) the [91][Provincial Agency] [92][or an officer authorized by it] or any Government Agency or local council; and

(b) any aggrieved person, who has given notice of not less than thirty days to the [93][Provincial Agency] [94][or an officer authorized by it] of the alleged contravention and of his intention to make a complaint to the Environmental Tribunal.

[90]Substituted by the Punjab Environmental Protection (Amendment) Act 2012 (XXXV of 2012), w.e.f.18.4.2012, s.15; and published in the Punjab Gazette (Extraordinary), pages 41061-41065.

[91]Substituted for the words “Federal Agency” by the Punjab Environmental Protection (Amendment) Act 2012 (XXXV of 2012), w.e.f.18.4.2012, s.2; and published in the Punjab Gazette (Extraordinary), pages 41061-41065.

[92]Inserted by the Punjab Environmental Protection (Amendment) Act 2017 (XIX of 2017), published in the Punjab Gazette (Extraordinary), dated: 08 November 2017, pp 3139 - 3140, s.4

[93]Substituted for the words “Federal Agency or the Provincial Agency concerned” by the Punjab Environmental Protection (Amendment) Act 2012 (XXXV of 2012), w.e.f.18.4.2012, s.16; and published in the Punjab Gazette (Extraordinary), pages 41061-41065.

[94]Inserted by the Punjab Environmental Protection (Amendment) Act 2017 (XIX of 2017), published in the Punjab Gazette (Extraordinary), dated: 08 November 2017, pp 3139 - 3140, s.4

(4) In exercise of its criminal jurisdiction, the Environmental Tribunal shall have the same powers as are vested in Court of Session under the Code of Criminal Procedure, 1898 (Act V of 1898).

(5) In exercise of the appellate jurisdiction under section 22 the Environmental Tribunal shall have the same powers and shall follow the same procedure as an appellate court in the Code of Civil Procedure, 1908 (Act V of 1908).

(6) In all matters with respect to which no procedure has been provided for in this [95][Act], the Environmental Trib unal shall follow the procedure laid down in the Code of Civil Procedure, 1908 (Act V of 1908).

(7) An Environmental Tribunal may, on application filed by any officer duly authorised on this behalf by the Director-General of the [96][Provincial Agency], issue bailable warrant for the arrest of any person against whom reasonable suspicion exists of his having been involved in contravention punishable under sub-section (1) of section 17:

Provided that such warrant shall be applied for, issued, and executed in accordance with the provisions of the Code of Criminal Procedure, 1898 (Act V of 1898):

Provided further that if the person arrested executes a bond with sufficient sureties in accordance with the endorsement on the warrant, he shall be released from custody, failing which he shall be taken or sent without delay to the officer-in-charge of the nearest police station.

(8) All proceedings before the Environmental Tribunal shall be deemed to be judicial proceedings within the meaning of sections 193 and 228 of the Pakistan Penal Code (Act XLV of 1860), and the Environmental Tribunal shall be deemed to be a court for the purposes of sections 480 and 482 of the Code of Criminal Procedure, 1898 (Act V of 1898).

(9) No court other than an Environmental Tribunal shall have or exercise any jurisdiction with respect to any matter to which the jurisdiction of an Environmental Tribunal extends under this Act or the rules and regulations made thereunder.

(10) Where the Environmental Tribunal is satisfied that a complaint made to it under sub-section (3) is false and vexatious to the knowledge of the complainant, it may, by an order, direct the complainant to pay to the person complained against such compensatory costs which may extend to one hundred thousand rupees.

22. Appeals to the Environmental Tribunal.– (1) Any person aggrieved by any order or direction of the [97][Provincial Agency] under any provision of this Act and rules or regulations made thereunder may refer an appeal with the Environmental Tribunal within thirty days of the date of communication of the impugned order or direction to such person.

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[95]Misprinted in the Gazette as “Ordinance”.

[96]Substituted for the words “Federal Agency or of Provincial Agency” by the Punjab Environmental Protection (Amendment) Act 2012 (XXXV of 2012), w.e.f.18.4.2012, s.16; and published in the Punjab Gazette (Extraordinary), pages 41061-41065.

[97]Substituted for the words “Federal Agency or any Provincial Agency” by the Punjab Environmental Protection (Amendment) Act 2012 (XXXV of 2012), w.e.f.18.4.2012, s.17; and published in the Punjab Gazette (Extraordinary), pages 41061-41065.

(2) An appeal to the Environmental Tribunal shall be in such form, contain such particulars and be accompanied by such fees as may be prescribed.

23. Appeals from orders of the Environmental Tribunal.– (1) Any person aggrieved by any final order or by any sentence of the Environmental Tribunal passed under this Act may, within thirty days of communication of such order or sentence, prefer an appeal to the High Court.

(2) An appeal under sub-section (1) shall be heard by a Bench of not less than two Judges.

24. Jurisdiction of Environmental Magistrates.– (1) Notwithstanding anything contained in the Code of Criminal Procedure, 1898 (Act V of 1898), or any other law for the time being in force, but subject to the provisions of this Act, all contraventions punishable under sub-section (2) of section 17 shall exclusively be triable by a judicial Magistrate of the first class as Environmental Magistrate especially empowered in this behalf by the High Court.

(2) An Environmental Magistrate shall be competent to impose any punishment specified in sub-sections (2) and (4) of section 17.

(3) An Environmental Magistrate shall not take cognizance of an offence triable under sub-section (1) except on a complaint in writing by**–**

(a) the [98][Provincial Agency], or Government Agency or local council; and

(b) any aggrieved person.

25. Appeals from orders of Environmental Magistrates.– Any person convicted of any contravention of this Act or the rules or regulations by an Environmental Magistrate may, within thirty days from the date of his conviction, appeal to the Court of Sessions, whose decision thereon shall be final.

[99][**26. Power to delegate**.– The Government may, by notification in the official Gazette, delegate any of its or of the Provincial Agency's powers or functions under this Act, the rules or the regulations to any Government Agency, local council or local authority.]

[100][**27. Power to give directions**.– In the performance of its functions, the Provincial Agency shall be bound by the directions given to it in writing by the Government.]

[101][**28. Indemnity**.– No suit, prosecution or other legal proceedings shall lie against the Government, the Council, the Provincial Agency, the Director General of the Provincial

[98]Substituted for the words and comma "Federal Agency, Provincial Agency" by the Punjab Environmental Protection (Amendment) Act 2012 (XXXV of 2012), w.e.f.18.4.2012, s.18; and published in the Punjab Gazette (Extraordinary), pages 41061-41065.

[99]Substituted by the Punjab Environmental Protection (Amendment) Act 2012 (XXXV of 2012), w.e.f.18.4.2012, s.19; and published in the Punjab Gazette (Extraordinary), pages 41061-41065.

Section 27 substituted by the Punjab Environmental Protection (Amendment) Act, 2012 (XXXV of 2012).

[101]Substituted by the Punjab Environmental Protection (Amendment) Act 2012 (XXXV of 2012), w.e.f.18.4.2012, s.21; and published in the Punjab Gazette (Extraordinary), pages 41061-41065.

Agency, members, officers, employees, experts, advisors, or consultants of the Provincial Agency or the Environmental Tribunal, an Environmental Magistrate or any other person for anything which is in good faith done or intended to be done under this Act or the rules or the regulations.]

29. Dues recoverable as arrears of land revenue.– Any dues recoverable by the [102][Provincial Agency] under this Act, or the rules or regulations made thereunder shall be recoverable as arrears of land revenue.

30. Ordinance to override other laws.– The provisions of this Act shall have effect notwithstanding anything inconsistent therewith contained in any other law for the time being in force.

31. Power to make rules.– The [103][Government] may, by notification in the official Gazette, make rules for carrying out the purposes of this Act including rules for implementing the provisions of the international environmental agreements, specified in the Schedule to this Act.

32. Power to amend the Schedule.– The [104][Government] may, by notification in the official Gazette, amend the Schedule so as to add any entry thereto or modify or omit any entry therein.

33. Power to make regulations.– (1) For carrying out the purposes of this Act, the [105][Provincial Agency] may, by notification in the official Gazette and with the approval of the [106][Government], make regulations not inconsistent with the provisions of this Act or the rules made thereunder.

(2) In particular and without prejudice to the generality of the foregoing power, such regulations may provide for**–**

(a) submission of periodical reports, data or information by any Government Agency, local authority or local council in respect of environmental matters;

(b) preparation of emergency contingency plans for coping with environmental hazards and pollution caused by accidents, natural disasters and calamities;

(c) appointment of officers, advisors, experts, consultants and employees;

(d) levy of fees, rates and charges in respect of services rendered, actions taken and schemes implemented;

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[102]Substituted for the words “Federal Agency or Provincial Agency” by the Punjab Environmental Protection (Amendment) Act 2012 (XXXV of 2012), w.e.f.18.4.2012, s.22; and published in the Punjab Gazette (Extraordinary), pages 41061-41065.

[103]Substituted for the words “Federal Government” by the Punjab Environmental Protection (Amendment) Act 2012 (XXXV of 2012), w.e.f.18.4.2012, s.2; and published in the Punjab Gazette (Extraordinary), pages 41061-41065.

[104]Substituted for the words “Federal Government” by the Punjab Environmental Protection (Amendment) Act 2012 (XXXV of 2012), w.e.f.18.4.2012, s.2; and published in the Punjab Gazette (Extraordinary), pages 41061-41065.

[105]Substituted for the words “Federal Agency” by the Punjab Environmental Protection (Amendment) Act 2012 (XXXV of 2012), w.e.f.18.4.2012, s.2; and published in the Punjab Gazette (Extraordinary), pages 41061-41065.

[106]Substituted for the words “Federal Government” by the Punjab Environmental Protection (Amendment) Act 2012 (XXXV of 2012), w.e.f.18.4.2012, s.2; and published in the Punjab Gazette (Extraordinary), pages 41061-41065.

(e) monitoring and measurement of discharges and emissions;

(f) categorization of projects to which, and the manner in which, section 12 applies;

(g) laying down of guidelines for preparation of initial environmental examination and environmental impact assessment and Development of procedures for their filling, review and approval;

(h) providing procedures for handling hazardous substances; and

(i) installation of devices in, use of fuels by, and maintenance and testing of motor vehicles for control of air and noise pollution.

34. Repeal, savings and succession.– (1) The Pakistan Environmental Protection Ordinance, 1983 (XXXVII of 1983) is hereby repealed.

(2) Notwithstanding the repeal of the Pakistan Environmental Protection Ordinance, 1983 (XXVII of 1983), any rules or regulations or appointments made, orders passed, notifications issued, powers delegated, contracts entered into, proceedings commenced, rights acquired liabilities incurred, penalties, rates, fees or charges levied, things done or action taken under any provisions of that Ordinance shall, so far as they are not inconsistent with the provisions of this Act, be deemed to have been made, passed, issued, delegated, entered into, commenced, acquired, incurred, levied, done or taken under this Act.

[107][(3) * * * * * * * * * * *]

[108][(4) Notwithstanding the omission of section 8 of the Act by the Punjab Environmental Protection (Amendment) Act 2012 (XXXV of 2012), any rules, regulations or appointments made, orders passed, notifications issued, powers delegated, contracts entered into, proceedings taken, rights acquired, liabilities incurred, penalties imposed, rates, fees or charges levied or other things done or actions taken under the provisions of said section, shall continue to have effect unless recalled withdrawn or cancelled.]

[107]Omitted by the Punjab Environmental Protection (Amendment) Act 2012 (XXXV of 2012), w.e.f.18.4.2012, s.23; and published in the Punjab Gazette (Extraordinary), pages 41061-41065.

[108]Added by the Punjab Environmental Protection (Amendment) Act 2017 (XIX of 2017), published in the Punjab Gazette (Extraordinary), dated: 08 November 2017, pp 3139 - 3140, s.5; and deemed to have been so added on and from 18 April 2012 when the Punjab Environmental Protection (Amendment) Act 2012 (XXXV of 2012 came into force.

SCHEDULE

(*See* section 31)

1. International Plant Protection Convention, Rome, 1951.
2. Plant Protection Agreement for the South-East Asia and Pacific Region (as amended), Rome, 1956.
3. Agreement for the Establishment of a Commission for Controlling the Desert Locust in the Eastern Region of its Distribution Area in South-West Asia (as amended), Rome, 1963.
4. Convention on Wetlands of International importance Especially as Waterfowl Habitat, Ramsar, 1971 and its amending Protocol, Paris, 1982.
5. Convention Concerning the Protection of World Cultural and Natural Heritage (World Heritage Convention), Paris, 1972.
6. Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), Washington, 1973.
7. Convention on the Conservation of Migratory Species of Wild Animals, Bonn, 1979.
8. Convention on the Law of the Sea, Montego Bay, 1982.
9. Vienna Convention for the Protection of the Ozone Layer, Vienna, 1985.
10. Montreal Protocol on Substances that Deplete the Ozone Layer, Montreal, 1987 and amendments thereto.
11. Agreement on the Network of Aquaculture Centres in Asia and the Pacific, Bangkok, 1988.
12. Convention on the Control of Transboundary Movements of Hazardous Waste and Their Disposal, Basel, 1989.
13. Convention on Biological Diversity, Rio De Janeiro, 1992.
14. United Nations Framework Convention on Climate Change, Rio De Janeiro, 1992.

The Punjab Gazette

PUBLISHED BY AUTHORITY

LAHORE WEDNESDAY NOVEMBER 08, 2017

PROVINCIAL ASSEMBLY OF THE PUNJAB

NOTIFICATION

November 08, 2017

No.PAP/Legis-2(174)/2017/1671. The Punjab Environmental Protection (Amendment) Bill 2017, having been passed by the Provincial Assembly of the Punjab on October 25, 2017, and assented to by the Governor of the Punjab on October 30, 2017, is hereby published as an Act of the Provincial Assembly of the Punjab.

THE PUNJAB ENVIRONMENTAL PROTECTION (AMENDMENT) ACT 2017

ACT XIX OF 2017

[First published, after having received the assent of the Governor of the Punjab, in the Gazette of the Punjab (Extraordinary) dated November 08, 2017.]

An
Act

further to amend the Punjab Environmental Protection Act, 1997.

It is necessary further to amend the Punjab Environmental Protection Act, 1997 *(XXXIV of 1997)* to rationalize the provisions about the delegation of powers of the Director General, filing of complaints and incidental matters.

Be it enacted by the Provincial Assembly of the Punjab as follows:

1. **Short title and commencement** – (1) This Act may be cited as the Punjab Environmental Protection (Amendment) Act 2017.

(2) It shall come into force at once.

2. **Amendment in section 5 of Act XXXIV of 1997.**– In the Punjab Environmental Protection Act, 1997 *(XXXIV of 1997)*, for brevity cited as the Act, in **section 5, for** subsection (5), the following shall be substituted:

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"(5) The Director General may, by general or special order, delegate any of the functions of the Provincial Agency exercised by him under subsection (4) to any other officer appointed under subsection (3)."

3. **Amendment in section 11 of Act XXXIV of 1997.**– In the Act, in section 11, in subsection (1), after the words "standards established under", the words " sub-clause (i) of" shall be omitted.

4. **Amendment in section 21 of Act XXXIV of 1997.**– In the Act, in section 21, in subsection (3), after the words "Provincial Agency", wherever occur, the words "or an officer authorized by it" shall be inserted.

5. **Amendment in section 34 of Act XXXIV of 1997.**– In the Act, in section 34, after subsection (2), the following subsection (3) shall be added and shall be deemed to have been so added on and from 18 April 2012 when the Punjab Environmental Protection (Amendment) Act 2012 (XXXV of 2012) came into force:

"(3) Notwithstanding the omission of section 8 of the Act by the Punjab Environmental Protection (Amendment) Act 2012 (XXXV of 2012), any rules, regulations or appointments made, orders passed, notifications issued, powers delegated, contracts entered into, proceedings taken, rights acquired, liabilities incurred, penalties imposed, rates, fees or charges levied or other things done or actions taken under the provisions of said section, shall continue to have effect unless recalled withdrawn or cancelled.".

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Annexure-II

IEE/EIA Regulations,2022

EXTRA ORDINARY ISSUE

REGISTERED No. L-7532

The Punjab Gazette

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LAHORE FRIDAY DECEMBER 16, 2022

GOVERNMENT OF THE PUNJAB
LAW AND PARLIAMENTARY AFFAIRS DEPARTMENT

NOTIFICATION
(150 of 2022)

16 DECEMBER 2022

Notification No.01/EPA/EIA/MISC/21/4214, dated 16.12.2022 issued by the Environment Protection Department, is hereby published in the Punjab Gazette (Extraordinary) for general information:

"GOVERNMENT OF THE PUNJAB
ENVIRONMENT PROTECTION DEPARTMENT

Dated, Lahore 16 December 2022

NOTIFICATION

No.01/EPA/EIA/MISC/21/4214.- In exercise of the powers conferred under section 33 of the Punjab Environmental Protection Act, 1997 (*XXXIV of 1997*), the Environmental Protection Agency, Punjab, with the approval of the Government, is pleased to make the following regulations:

1. **Short title and commencement**.- (1) These regulations may be cited as the Punjab Environmental Protection (Review of Initial Environmental Examination and Environmental Impact Assessment) Regulations 2022.

(2) They shall come into force at once.

2. **Definitions**.- (1) In the regulations, unless the context or subject otherwise requires:

(a) "Act" means the Punjab Environmental Protection Act, 1997 (XXXIV of 1997);

(b) "Agency" means the Environmental Protection Agency, Punjab;

(c) "Director General" means the Director General of the Agency;

(d) "regulations" means the Punjab Environmental Protection (Review of Initial Environmental Examination and Environmental Impact Assessment) Regulations 2022; and

(e) "Schedule" means the Schedule appended to the regulations.

(2) A word or expression used but not defined in the regulations shall have the same meaning as assigned to it in the Act.

3. **Project requiring an initial environmental examination**.- A proponent of a project falling in any category listed in Schedule-I shall file an initial environmental examination with the Agency and the provisions of section 12 of the Act shall apply to such projects.

4. **Project requiring an environmental impact assessment**.- A proponent of a project falling in any category listed in Schedule-II shall file an environmental impact assessment with the Agency and the provisions of section 12 of the Act shall apply to such projects.

5. **Projects not requiring an initial environmental examination or environmental impact assessment**.- (1) A proponent of a project not falling in any category listed in Schedule-I

and II shall not be required to file an initial environmental examination or environmental impact assessment:

Provided that the proponent shall file:

(a) an environmental impact assessment, if the project is likely to cause an adverse environmental effect; and

(b) an application for projects not listed in Schedule-I and II, in respect of which the Agency has issued guidelines for construction and operation, for approval accompanied by an undertaking, an affidavit and any other document as prescribed in checklist that the aforesaid guidelines shall be fully complied with.

(2) Notwithstanding anything contained in sub-regulation (1), the Agency may direct the proponent of a project, whether or not listed in Schedule-I or II, to file an initial environmental examination or environmental impact assessment, for reasons to be recorded in such direction:

Provided that no such direction shall be issued without the recommendation in writing of the Environmental Assessment Advisory Committee constituted under regulation 22.

6. Review Fee.- The proponent shall pay, at the time of submission of an initial environmental examination or environmental impact assessment, a nonrefundable Review Fee to the Agency as per rates specified in Schedule-III.

7. Filing of initial environmental examination and environmental impact assessment.- (1) Every initial environmental examination or environmental impact assessment shall be accompanied by:

(a) an application, in the form prescribed in Schedule-IV; and

(b) copy of receipt showing payment of the Review Fee.

(2) Five ring bound printed paper copies and one electronic copy (PDF or Word format) of an initial environmental examination or environmental impact assessment shall be filed with the Agency.

8. Preliminary scrutiny.- (1) The Agency, within ten working days of filing of initial environmental examination or environmental impact assessment, shall:

(a) confirm that the initial environmental examination or environmental impact assessment is complete for the purposes of initiation of the review process; or

(b) require the proponent to submit such additional information as may be required; or

(c) return the initial environmental examination or environmental impact assessment to the proponent,

clearly listing the contents requiring further study and discussion.

(2) In case the proponent fails to submit the required documents or conduct further study or discussion after three notices served to him by the Agency, with a gap of not less than seven days, his application shall be closed and he shall be required to submit a fresh application for approval.

(3) In case of closure of application under sub-regulation (2), the Review Fee shall remain valid for a period of six months from the date of closure of application.

(4) Nothing in sub-regulation (1) shall prohibit the Agency from requiring the proponent to submit additional information at any stage during the review process.

9. Public participation.- (1) In the case of an environmental impact assessment, the Agency shall, simultaneously with issuance of confirmation of completeness under clause (a) of sub-regulation (1) of regulation 8, cause to be published in any English or Urdu national newspaper and in a local newspaper of general circulation in the area affected by the project, a public notice mentioning the type of the project, its exact location, the name and address of the proponent, and the places at which the environmental impact assessment of the project can, subject to the restrictions in sub-section (3) of section 12 of the Act, be accessed.

(2) The notice issued under sub-regulation (1) shall fix a date, time, and place for public hearing of any comments on the project or its environmental impact assessment.

(3) The date fixed under sub-regulation (2) shall not be less than seven days from the date of publication of the notice.

(4) The Agency may circulate the environmental impact assessment to concerned Government Agencies, local authority or local council for their comments, if any.

(5) During the public hearing, the proponent shall provide sufficient details of the nature of the project, the adverse environmental impacts of the project and the preventive, mitigatory or compensatory measures to be taken by the proponent to address such impacts.

(6) All comments received by the Agency from the public or any Government Agency, local authority or local council shall be collated, tabulated, and shall be duly considered before a decision on the environmental impact assessment.

10. Review.- (1) The Agency shall make every effort to carry out its review of the initial environmental examination within thirty days, and environmental impact assessment within forty-five days, of issuance of confirmation of completeness under clause (a) of sub-regulation (1) of regulation 8.

(2) In reviewing the initial environmental examination or environmental impact assessment, the Agency may consult such

Committee of Experts as may be constituted for the purpose by the Director General, and may also solicit views of the Sectoral Advisory Committee, if any, constituted by Government under subsection (6) of section 5 of the Act.

(3) The Director General may, where he considers it necessary, constitute a Committee to inspect the site of a project and submit its report on such matters as may be specified.

(4) Depending upon the type of project, the review of the initial environmental examination or environmental impact assessment by the Agency may:

(a) be based on quantitative and qualitative assessment of documents and data furnished by the proponent, comments from public and Government Agencies, local authority or local council received under regulation 9, and views of the depending upon the type of project, Committees under sub-regulations (2) and (3); and

(b) consider the life cycle of the project, best available technologies and any social impacts of the project through its life cycle, assess any relevant measures of reduction, recycling, or re-use that may be employed by the project proponent.

11. Approval.- On completion of review, approval of the Agency shall be communicated to the proponent in the form prescribed in Schedule-V in case of an initial environmental examination, and in the form prescribed in Schedule-VI in case of an environmental impact assessment.

12. Conditions of approval.- (1) Every approval of an initial environmental examination or environmental impact assessment shall, in addition to such conditions as may be imposed by the Agency, be subject to the condition that the project shall be designed and constructed strictly in accordance with the initial environmental examination or environmental impact assessment, unless any variation thereto have been specified in the approval by the Agency.

(2) Where the Agency accords its approval subject to certain conditions, the proponent shall:

(a) before commencing construction of the project, acknowledge acceptance of stipulated conditions by executing an undertaking in the form prescribed in Schedule-VII; and

(b) before commencing operation of the project, obtain from the Agency written confirmation that the conditions of approval, and the requirements in the initial environmental examination or environmental impact assessment, as the case may be, relating to

design, construction, adoption of preventive, mitigatory, compensatory and other measures, and other relevant matters have been duly complied with.

13. Confirmation of compliance.- (1) The request for confirmation of compliance under clause (b) of sub-regulation (2) of regulation 12 shall be accompanied by an Environmental Management Plan indicating the measures and procedures proposed to be taken to manage or mitigate the environmental impacts for the life of the project, including provisions for monitoring, reporting and auditing.

(2) Where a request for confirmation of compliance is received from a proponent, the Agency may carry out such inspection of the site, plant and machinery, and seek such additional information from the proponent as it may deemed fit:

Provided that every effort shall be made by the Agency to provide the requisite confirmation or otherwise within fifteen days of receipt of the request, with complete information, from the proponent.

(3) The Agency may, while issuing the requisite confirmation of compliance, impose such other conditions as to the Environmental Management Plan, and operation, maintenance and monitoring of project as it deemed fit, and such conditions shall be deemed to be included in the conditions to which approval of the project is subject.

14. Deemed approval.- The four months period for communication of the Agency's approval stipulated in subsection (4) of section 12 of the Act shall commence from the completion of preliminary scrutiny under clause (a) of sub-regulation (1) of regulation 8.

15. Extension in review period.- Where the Government in a particular case extends the period of four months for communication of approval prescribed in subsection (5) of section 12 of the Act, it shall, in consultation with the Agency, indicate the various steps of the review process to be taken during the extended period, and the estimated time required for each step.

16. Validity period of approval.- (1) The approval accorded by the Agency under section 12 of the Act read with regulation 11 shall be valid, for commencement of construction, for a period of three years from the date of issue.

(2) After issuance of confirmation of compliance under regulation 13, the approval for the commencement of operation of the project or business shall be valid for a period of three years from the date of issuance of the confirmation of compliance.

(3) The proponent may apply to the Agency for extension in validity periods mentioned in sub-regulations (1) and (2) which may be granted by the Agency in its discretion for such period not exceeding three years at a time, if conditions of environmental approval do not require significant change:

Provided that the Agency may require proponent to submit a fresh initial environmental examination or environmental impact

assessment, if the changes in location, design, construction, and operation of the project so warrant.

17. Entry and inspection.- (1) For the purposes of verification of any matter relating to review or to conditions of approval of an initial environmental examination or environmental impact assessment prior to, during, or after the commencement of construction or operation of a project, duly authorized staff of the Agency shall be entitled to enter and inspect a project site, factory building and plant, and equipment installed therein.

(2) The proponent shall ensure full cooperation of project staff at site to facilitate the inspection and provide such information and documentation as may be required by the Agency for this purpose and pursuant thereto.

18. Monitoring.- (1) After issue of approval, the proponent shall submit a report to the Agency on completion of construction of the project.

(2) After the commencement of operation of the project or business, the proponent shall submit an annual report summarizing the operational performance of the project, with reference to the conditions of approval and maintenance, and preventive, mitigatory or compensatory measures being adopted by the project and compliance with the Environmental Management Plan submitted under regulation 13.

(3) To enable the Agency to effectively monitor compliance with the conditions of approval, the proponent shall furnish such additional information as the Agency may require.

19. Cancellation of approval.- (1) Notwithstanding anything contained in the regulations, if, at any time, on the basis of information or report received or inspection carried out, the Agency is of the opinion that the conditions of approval have not been complied with, or that the information supplied by the proponent in the approved initial environmental examination or environmental impact assessment is incorrect, it shall issue notice to the proponent to show cause within two weeks of its receipt thereof, why the approval should not be cancelled.

(2) If no reply is received or if the reply is considered unsatisfactory, the Agency may, after affording the proponent an opportunity of being heard:

(a) require the proponent to take such measures and to comply with such conditions within such period as it may specify, failing which the approval shall stand cancelled; or

(b) cancel the approval.

(3) On cancellation of the approval, the proponent shall cease construction or operation of the project forthwith.

(4) The Agency may circulate the cancellation of approval of a

project to the concerned Government Agencies.

(5) Action taken under the regulations shall be without prejudice to any other action that may be taken against the proponent under the Act or rules or regulations or any other law for the time being in force.

20. Registers of initial environmental examination and environmental impact assessment projects.- Separate registers (hard or soft) to be maintained by the Agency for initial environmental examination and environmental impact assessment projects under subsection (7) of section 12 of the Act shall be in the form prescribed in Schedule-VIII.

21. Environmentally sensitive areas.- (1) The Agency may, by notification in the official Gazette, designate an area to be an environmentally sensitive area.

(2) For an area to be declared as an environmentally sensitive, the District Administration concerned or any other concerned Government Agency (Wildlife and Parks Department and Forest Department, *etc.*) shall forward the following, in writing, to the Agency:

(a) the specific area along with Khasra and Khewat Nos. to be declared as environmentally sensitive; and
(b) the reasons for declaring as above.

(3) Notwithstanding anything contained in regulations 3, 4 and 5, the proponent of a project situated in an environmentally sensitive area shall be required to file an environmental impact assessment with the Agency.

(4) The Agency may from time-to-time issue guidelines to assist proponents and other persons involved in environmental assessment process to plan and prepare projects located in environmentally sensitive areas.

(5) Where guidelines have been issued under sub-regulation (3), projects shall be planned and prepared, to the extent practicable, in accordance therewith and any departure therefrom justified in environmental impact assessment pertaining to projects.

22. Environmental Assessment Advisory Committee.- For purposes of rendering advice on all aspects of environmental assessment, including guidelines, procedures and categorization of projects, the Director General shall constitute an Environmental Assessment Advisory Committee comprising:

(a)	Director (EIA)	Chairman
(b)	one representative of Industries, Commerce, Investment and Skills Development Department	Member
(c)	one representative of Chamber of Commerce and Industries	Member

(d)	Deputy Director (EIA)	Secretary

23. Other approvals.- Issue of an approval under section 12 of the Act read with regulation 11 shall not absolve a proponent of the duty to obtain any other approval or consent that may be required under any law for the time being in force.

24. Savings.- All orders made, notifications issued, actions taken under the Pakistan Environmental Protection Agency, Review of Initial Environmental Examination and Environmental Impact Assessment Regulations, 2000 shall remain in force until amended, altered or repealed by the provisions of the regulations.

SECRETARY
GOVERNMENT OF THE PUNJAB
ENVIRONMENT PROTECTION DEPARTMENT"

AKHTAR JAVAID
SECRETARY
Government of the Punjab
Law and Parliamentary Affairs Department

SCHEDULE - I
(See Regulation 3)
List of projects requiring an IEE

A: Agriculture, Livestock and Fisheries etc.

1. Controlled Poultry Farms, Hatchery, Livestock, stud and fish farms with total cost more than Rs 10 million
2. Projects involving repacking, formulation or warehousing of agricultural products

B: Energy

1. Hydroelectric power generation *from 1 MW to* 50MW
2. Transmission lines *from* 11 kV *to 132 kV,* and large distribution projects *up to 132 kV*
3. Oil and gas transmission systems
4. Renewable Energy projects (including *wind and solar) greater than 05 MW upto 100MW and* biogas plants *for commercial purposes)*
5. Waste-to-energy generation projects

C. Manufacturing and processing

1. Apparel (including garments and leather stitching units), cotton, spinning mills, woolen mills, weaving mills and manual carpet weaving units;
2. Food processing industries including beverages, milk and dairy products with total cost less than Rs 200 million
3. Synthetic resins, plastics and man-made fibers
4. Flour mill, Rice mills, edible oils, fats and vegetable ghee and Feed Mills
5. Rubber products with total cost less than Rs. 100 million
6. Chemical formulation units
7. Brick Kilns

D. Mining and mineral processing

1. Commercial extraction of sand gravel, limestone, clay, Sulphur and other minerals not included in schedule III with total cost less than 500 million
2. Exploration of coal, gold, copper, Sulphur and precious stones
3. Crushing, grinding and separation processes including stone crushers

E. Transport

Federal or Provincial highways (except the maintenance, rebuilding or reconstruction of existing metalled roads) with total cost less than Rs 50 million

F. Water management, dams, irrigation and flood protection

1. Small Dams and reservoirs

2. Irrigation and drainage projects

G. Water Supply and Treatment

Water supply schemes and treatment plants with total cost less than Rs. 50 million

H. Waste disposal

Non-hazardous scrap yard / warehouse.

I. Urban development and tourism

1. Housing Schemes less than 300 kanals including Land sub-divisions
2. Multistoried buildings, residential apartments, educational institutions, restaurants and hotels with height more than 70 feet and area more than 02 kanals.
3. Medical colleges and universities, research institutes
4. Hospitals less than 50 beds
5. Urban development projects

J. Other projects

Any other project for which filing of an IEE is required by the *Provincial* Agency under sub regulation (2) of Regulation 5

SCHEDULE II
(See Regulation 4)
List of projects requiring an EIA

A. Energy

1. Hydroelectric power generation over 50MW
2. Transmission lines more than 132 kV and grid stations
3. Nuclear power plants
4. Petroleum refineries
5. Oil and gas extraction projects including exploration, production, gathering systems, separation and storage
6. Renewable Energy projects (including wind and solar) more than 100 MW

B. Manufacturing and processing

1. Cement plant
2. Chemical manufacturing units, including pharmaceuticals and cosmetic
3. Sugar mills and Distilleries
4. Food processing industries including, beverages, milk and dairy products with total cost more than Rs 200 million
5. Paper and paperboard, paper pulping, paints and dyes,
6. Textile units comprising of dyeing & printing
8. Pesticides and fertilizer manufacturing units
9. Poultry waste processing units / rendering units
10. Tannery and leather units
11. Rubber projects with total cost more than Rs. 100 million
12. Battery Manufacturing and Recycling Plants
13. Ceramics and glass units
14. Electro plating and nickel/chrome plating including Surgical Units
15. Cutlery units
16. Slaughter House
17. Iron and steel rolling mills
18. Steel Furnaces
19. Smelting plants
20. Auto mobile manufacturing and assembling units
21. Resource Recovery Units

C. Mining and mineral processing

1. Mining and processing of coal, gold, copper, Sulphur and precious stones

2. Mining and processing of major non-ferrous metals.
3. Commercial extraction of sand using dredger

D. Transport

1. Airports
2. Highways, Motorways, Express ways or major roads
3. Ports and harbor development for ships of 500 gross tons and above
4. Railway works
5. Flyovers, underpass and bridges having total length of more than 500 meters

E. Water management, dams, irrigation and flood protection

1. Medium and large Dams and reservoirs

F. Water supply, Sewerage System and treatment

1. Water supply schemes and treatment plants (excluding the Reverse Osmosis, Ultra filtration and such like) with total cost more than Rs. 50 million
2. Wastewater channels / Sewerage System Schemes
3. Combined Wastewater Treatment Plants with treatment capacity greater than $100m^3/hr$

G. Waste Storage and Disposal

1. Landfill sites
2. Waste Incinerators and autoclaves
3. Hazardous substance or waste storage warehouse

H. Urban development and tourism

1. Housing Schemes more than 300 kanals
2. Large-scale tourism development projects
3. Hospitals having more than 50 Beds
4. Hotels with more than 100 rooms
5. Industrial estates (including export processing zones)

I. Environmentally Sensitive Areas

All projects situated in environmentally sensitive areas

J. Other projects

Any other project for which filing of an EIA is required by the *Provincial* Agency under sub-regulation (2) of Regulation 5.

SCHEDULE III
[See Regulation 6 & 7(b)]

IEE and EIA Review Fee

Total Project Cost	IEE	EIA
Upto Rs. 5,000,000	NIL	NIL
Rs. 5,000,001 to 10,000,000	Rs. 10,000	Rs. 15,000
Greater than Rs. 10,000,000	Rs. 15,000	Rs. 30,000

SCHEDULE IV
[(See Regulation 7(1)(a)]
Application Form

1.	Proponent details	i. Name of proponent ii. Name of CEO/Partner/MD/Proprietor iii. Office address of proponent iv. Email of proponent
2.	Consultant details	i. Name of consultant ii. Valid certificate of Practice of consultant iii. Letter of authority from proponent in favor of consultant
3.	Project details	i. Location of project _____ ii. Alternative sites, if any_____ iii. Google or scale map of project (and alternative) vicinity clearly showing the distance from nearest settlement, water bodies or other notable geographical features/protected or reserved forests/National Parks/Environmentally Sensitive Areas (Attached) ☐ iv. Objective of project _____ v. Description of project through its life cycle, including details of costs, land required, capacity and production capability, as applicable _____ vi. Project sub-components that fall within list of projects enumerated in Schedule I or II and, if so, details of each_____
4.	Project Category	i. Mention Schedule of Regulations ii. Attached: IEE ☐ EIA ☐
5.	IEE / EIA details	i. Baseline data on meteorology, ambient air quality and groundwater quality ii. Assessment of potential adverse environmental impacts iii. Identification of environmental impacts of the project through its life cycle iv. Assessment of social impacts of project v. Identification and description of preventive, mitigatory and compensatory measures to be adopted vi. Environment Management Plan vii. Monitoring arrangements viii. Project construction labor details_____ ix. Project operation details

Verification. I do solemnly affirm and declare that the information given above and contained in the attached IEE / EIA is true and correct to the best of my knowledge and belief.

Name and designation of proponent ----------
Official stamp/seal) ----------
Signature ----------
Date ----------

SCHEDULE VI
(See Regulation 11)
Decision on IEE

1. Name and Address of Proponent ----------

2. Description of Project ----------

3. Location of Project ----------

4. Date of Filling of IEE ----------

5. After careful review of the IEE, the Provincial Agency has decided –

(a) to accord its approval, subject to the following conditions:

---

or

(b) that the proponent should submit an EIA on the following grounds:

[Delete (a) or (b), whichever is inapplicable]

Dated: ----------

Tracking No. ----------

SCHEDULE VII
[See Regulation 11]

Decision on EIA

1. Name and Address of Proponent ----------
2. Description of Project ----------
3. Location of Project ----------
4. Date of Filling of EIA ----------

5. After careful review of the EIA, and all comments thereon, the Provincial Agency has decided:

(a) to accord its approval, subject to the following conditions:

---or

(b) that the proponent should submit an EIA with the following modifications–

--- or

(c) to reject the project, being contrary to environmental objectives, for the following reasons:

[Delete (a)/(b)/(c), whichever is inapplicable]

Date: ----------

Tracking No. ----------

SCHEDULE VIII
[See Regulation 12(2)(a)]

UNDERTAKING

I, ---------- (full name and address) as proponent for ---------- (name, description and location of project) do hereby solemnly affirm and declare that I fully understand and accept the conditions contained in the approval accorded by the Provincial Agency bearing tracking no. ---------- dated ---------- and undertake to design, construct and operate the project strict in accordance with the said conditions and the IEE/EIA/IEE Checklist.

Date ----------

Signature, ----------
Name and Designation of Proponent

Official stamp/seal ----------

Witnesses
(full names and addresses)
1. ----------
2. ----------

SCHEDULE IX

[See Regulation 20]

FORM OF REGISTERS FOR IEE AND EIA PROJECTS

No.	Description	Relevant Information
1.	Tracking Number	
2.	Category type (as per Schedules I and II)	
3.	Name of Proponent	
4.	Name and designation of contact person	
5.	Description and Category of project	
6.	Location of project	
7.	Project capital cost	
8.	Date of receipt of IEE/EIA/	
9.	Approval granted (Yes/No)	
10.	Date of approval granted or refused	
11.	Date of extension of approval validity	
12.	Date of Issue of confirmation of compliance	
13.	Date of cancellation, if applicable	

Annexure-III

Location, Land Use and Layout Plans

424764 426988 429212 431436 433660

3487071

3484847

3482623

3480400

RIVER RAVI

CANTT. DRAIN

SABZAZAR

IQBAL TOWN DRAIN

WAHDAT COLONY

MUSLIM TOWN

AWAN TOWN

MULTAN ROAD

ALLAMA IQBAL TOWN

MOTORWAY (M2)

MARGHAZAR COLONY

UNIVERSITY OF THE PUNJAB

MANSORA

ITTEFAQ TOWN

MUSTAFA TOWN

NIAZ BAIG

ALI PARK

MUNIR GARDEN

HANJARWAL

AZAM GARDEN

PUNJAB UNIVERSITY AREA

TECH SOCIETY

GARDEN TOWN DRAIN

MODEL TOWN

GULZAR COLONY

PCSIR II

KATTAR BUND ROAD

Kattar Bund WWTP

Niaz Baig LS

GULSHAN TOWN

Kattar Bund DS

CANAL VIEW

CANAL BURG

WAFAQI COLONY

FAISAL TOWN

Lahore Branch Canal

CANAL ROAD

CANAL COLONY

JOHAR TOWN

NLC DRY PORT

EDEN HOMES

ESCAPE CHANNEL

ALI TOWN

COLLEGE ROAD DRAIN

Niaz Baig Distributary

NAWAB TOWN

MULTAN ROAD

MUHAFIZ TOWN

PIA SOCIETY

RAIWIND ROAD

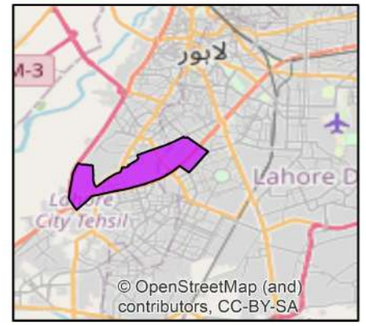
SATTU KATLA DRAIN

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

LEGEND:

- Lift Station
- Disposal Station
- Existing Drains
- Canal/Distributary
- WWTP Catchment Boundary
- WWTP Site

N



Meters

1000 500 0 1000

REV.	DATE	DESCRIPTION

Proect:

FEASIBILITY STUDY FOR CONSTRUCTION OF WASTE WATER TREATMENT PLANT AT KATTAR BUND (SOUTH) LAHORE - PAKISTAN

Drawing Title:

PROJECT BOUNDARY

Consultants:

Sweco Danmark A/S in association with Jers Consultancy (Pvt) Ltd., Pakistan

SWECO

JERS CONSULTANCY (PVT) LTD

Client:

DANIDA SUSTAINABLE INFRASTRUCTURE FINANCE

BENEFICIARY:

WATER AND SANITATION AGENCY LAHORE

Drawn By:	Drawing No.	
ATHAR SIRAJ	PB-01	
Checked By: MUDASAR	Scale:	Sheet: 1 OF 1
Date: 04/2022		

426988 429212 431436 433660

3487071 3484847 3482623 3480400

CANTT. DRAIN
SABZAZAR
IQBAL TOWN DRAIN
WAHDAT COLONY
CANTT. DRAIN
AWAN TOWN
ALLAMA IQBAL TOWN
MOTORWAY (M2)
MULTAN ROAD
MARGHAZAR COLONY
PUNJAB UNIVERSITY
MUSTAFA TOWN
NIAZ BAIG
ALI PARK
HANJARWAL
AZAM GARDEN
TECH SOCIETY
MUNIR GARDEN
GULZAR COLONY
GULSHAN TOWN
PCSIR II
CANAL VIEW
WAFAQI COLONY
KATTAR BUND ROAD
CANAL BURG
Lahore Branch Canal
CANAL ROAD
ESCAPE CHANNEL
CANAL COLONY
MULTAN ROAD
NLC DRY PORT
Niaz Baig Distributary
JOHAR TOWN
COLLEGE ROAD DRAIN
SATTU KATLA DRAIN
ALI TOWN
MUHAFIZ TOWN
NAWAB TOWN
PIA SOCIETY

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

LEGEND:

N

Landuse Type

- Agricultre
- Baren
- Commercial
- Education
- Govt
- Green
- Health
- Industrial
- Planned Areas
- Ponding Area
- Unplanned Areas
- Hostel Area

Meters

780 390 0 780

REV.	DATE	DESCRIPTION

Proect:

FEASIBILITY STUDY FOR CONSTRUCTION OF WASTE WATER TREATMENT PLANT AT KATTAR BUND (SOUTH) LAHORE - PAKISTAN

Drawing Title:

LANDUSE MAP OF PROJECT AREA

Consultants:

Sweco Danmark A/S in association with Jers Consultancy (Pvt) Ltd., Pakistan

SWECO

JERS CONSULTANCY (PVT) LTD

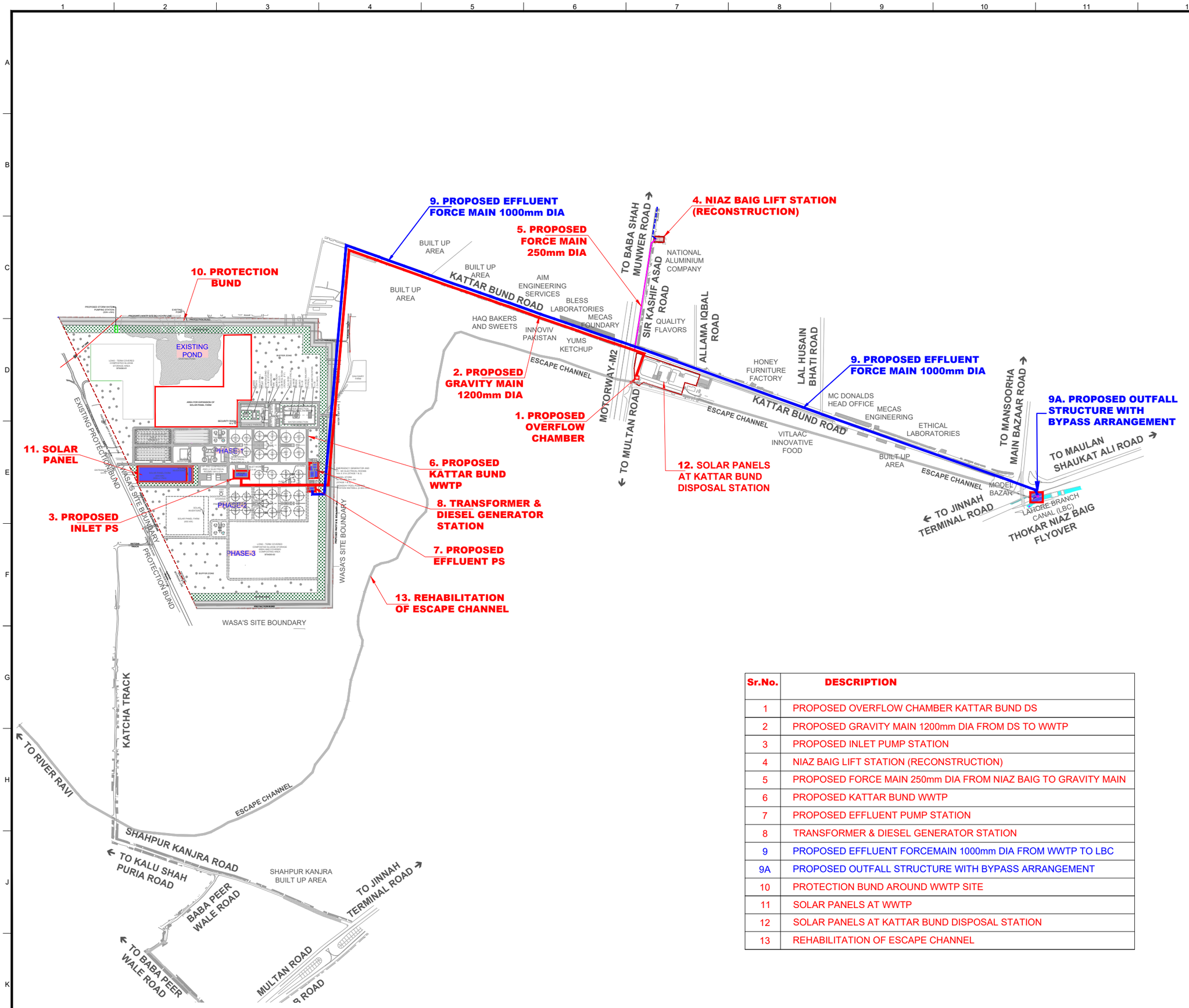
Client:

DANIDA SUSTAINABLE INFRASTRUCTURE FINANCE

BENEFICIARY:

WATER AND SANITATION AGENCY LAHORE

Drawn By:	Drawing No.	
ATHAR SIRAJ	LU-01	
Checked By: MUDASAR	Scale:	Sheet: 1 OF 1
Date: 06/2022		



Sr.No.	DESCRIPTION
1	PROPOSED OVERFLOW CHAMBER KATTAR BUND DS
2	PROPOSED GRAVITY MAIN 1200mm DIA FROM DS TO WWTP
3	PROPOSED INLET PUMP STATION
4	NIAZ BAIG LIFT STATION (RECONSTRUCTION)
5	PROPOSED FORCE MAIN 250mm DIA FROM NIAZ BAIG TO GRAVITY MAIN
6	PROPOSED KATTAR BUND WWTP
7	PROPOSED EFFLUENT PUMP STATION
8	TRANSFORMER & DIESEL GENERATOR STATION
9	PROPOSED EFFLUENT FORCEMAIN 1000mm DIA FROM WWTP TO LBC
9A	PROPOSED OUTFALL STRUCTURE WITH BYPASS ARRANGEMENT
10	PROTECTION BUND AROUND WWTP SITE
11	SOLAR PANELS AT WWTP
12	SOLAR PANELS AT KATTAR BUND DISPOSAL STATION
13	REHABILITATION OF ESCAPE CHANNEL

N

300 150 0 300m

GRAPHIC SCALE

REV.	DATE	DESCRIPTION
-	-	-

Project:

FEASIBILITY STUDY FOR CONSTRUCTION OF WASTE WATER TREATMENT PLANT AT KATTAR BUND (SOUTH) LAHORE - PAKISTAN

Drawing Title:

PLAN OF INVESTMENT

Consultants:

Sweco Danmark A/S in association with Jers Consultancy (Pvt) Ltd., Pakistan

SWECO

JERS CONSULTANCY (PVT) LTD

Client:

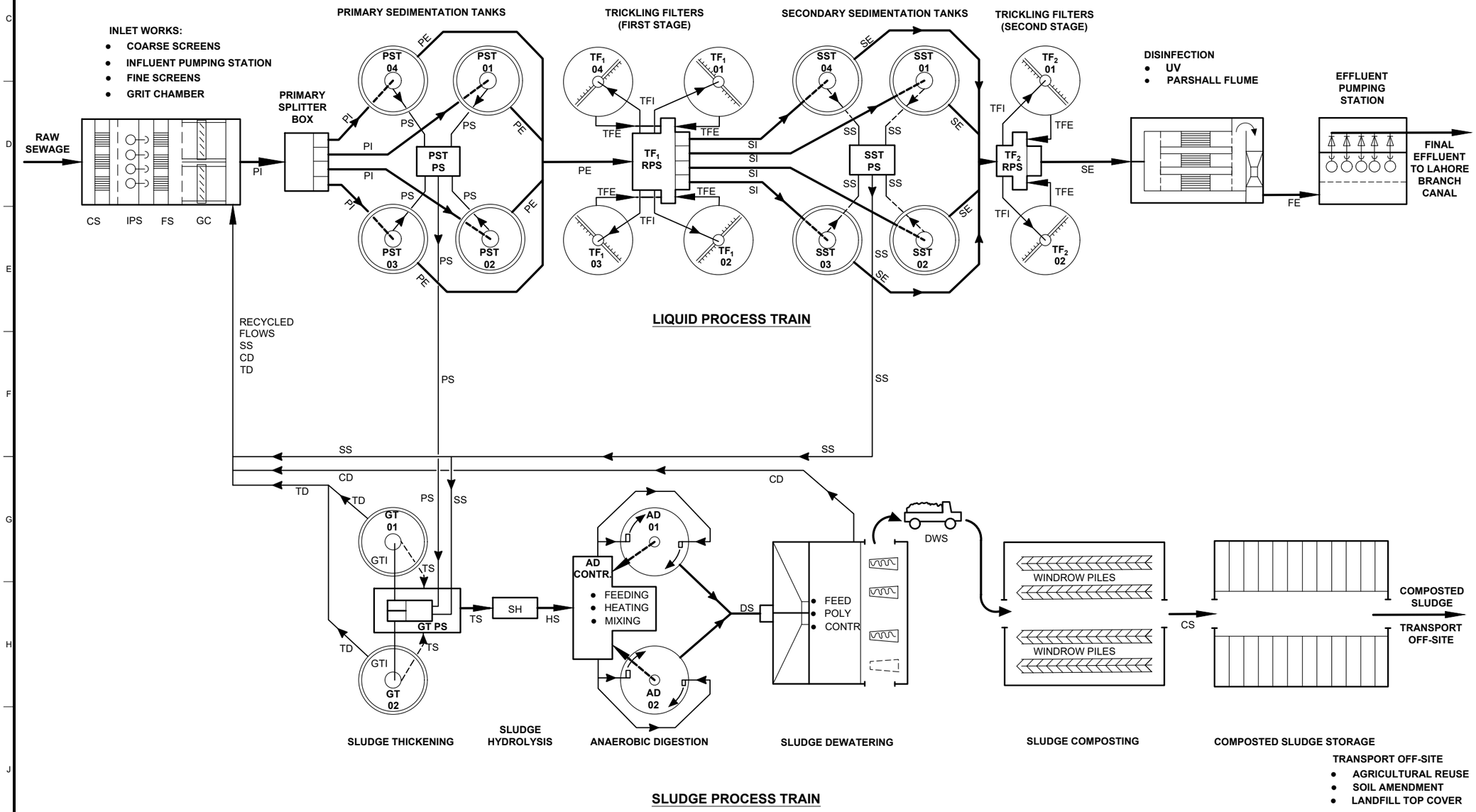
DANIDA SUSTAINABLE INFRASTRUCTURE FINANCE

BENEFICIARY:

WATER AND SANITATION AGENCY LAHORE

Drawn By:	Drawing No.
ATHAR SIRAJ	KB-STP-PR-001
Checked By: JAMES CORNING	Scale: AS SHOWN / Sheet: 1 OF 1
Date: SEP, 2022	

PROCESS FLOW DIAGRAM



SYMBOL	MATERIAL
CD	CENTRATE DRAIN
CS	COMPOSTED SLUDGE
DS	DIGESTED SLUDGE
DWS	DEWATERING SLUDGE
FE	FINAL EFFLUENT
GTI	GRAVITY THICKENER INFL.
HS	HYDROLYSED SLUDGE
PE	PRIMARY EFFLUENT
PI	PRIMARY INFLUENT
PS	PRIMARY SLUDGE
RS	RAW SEWAGE
SE	SECONDARY EFFLUENT
SI	SECONDARY INFLUENT
SS	SECONDARY SLUDGE
TD	THICKENER DRAIN
TFE	TRICK. FILTER EFFLUENT
TFI	TRICK. FILTER INFLUENT
TS	THICKENED SLUDGE

REV.	DATE	DESCRIPTION
-	-	-

Project:

FEASIBILITY STUDY FOR CONSTRUCTION
OF WASTE WATER TREATMENT PLANT
AT KATTAR BUND (SOUTH)
LAHORE - PAKISTAN

Drawing Title:

PROCESS FLOW DIAGRAM

Consultants:

Sweco Danmark A/S in association with Jers Consultancy (Pvt) Ltd., Pakistan

SWECO

JERS CONSULTANCY (PVT) LTD

Client:

DANIDA SUSTAINABLE INFRASTRUCTURE FINANCE

BENEFICIARY:

WATER AND SANITATION AGENCY LAHORE

Drawn By:	Drawing No.
ATHAR SIRAJ	KB-STP-PR-002
Checked By: JAMES CORNING	Scale: --- / Sheet: 1 OF 1
Date: DEC. 2022	

Annexure-IV

Wastewater and Environmental Monitoring Reports

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DISCLAIMER

This report is produced in compliance with the Client's Request for **M/S "Sweco Danmark A/S** in cooperation with **Jers Consultancy (Pvt.) Ltd."** The information contained in this report was collected and produced from site visit and monitoring data. The information supplied and contained in this report is, to the best of our knowledge, correct and up to date. "**Tti Testing Laboratories (Tti)"** accepts no responsibility for changes made to this document by any third party once report is submitted to the client

ABBREVIATIONS

APHA:	American Public Health Administration
BDL	Below Detectable Limit
CO:	Carbon Monoxide
EPA:	Environmental Protection Agency
NOx:	Oxides of Nitrogen
NEQS:	National Environmental Quality Standards
PEPA:	Pakistan Environmental Protection Act 1997
PM:	Particulate Matter
SO_2:	Sulphur Dioxide
SOP:	Standard Operating Procedures
Tti	Tti Testing Laboratories
USEPA:	United states Environmental Protection Agency

UNITS

m:	Meter
°C:	Degree Celsius
sec:	Seconds
ppm:	Parts per Million
mg/l:	Milligram per Litre
mg/Nm^3:	Milligram per Normal cubic meter
$\mu g/m^3$:	Microgram per cubic meter
$mg.kg^{-1}$	Milligram per kilogram

Introduction

1 Introduction:

This section describes the project location and scope of services performed by Tti Testing Laboratories.

1.1 Project Background

Due to over population and rapid industrialization, wastewater generation has increased in both industrial and domestic sectors. Wastewater is defined as any water that has been negatively affected in quality by humans. Wastewater is comprised of liquid and solid waste that is discharged from domestic residences, commercial properties, industrial plants, and agriculture facilities or land. Wastewater contains a wide range of contaminants at various concentrations. Wastewater is used water that has been affected by domestic, industrial and commercial use. The composition of wastewater is thus constantly changing and highly variable, which is why it is so difficult to pinpoint a singular definition of the word itself. The composition of wastewater is 99.9% water and the remaining 0.1% is what is removed. This 0.1% contains organic matter, microorganisms and inorganic compounds. Wastewater effluents are released to a variety of environments, such as lakes, ponds, streams, rivers, estuaries and oceans. Wastewater also includes storm runoff, as harmful substances wash off roads, parking lots and rooftops. Due to release of Municipal and Industrial Wastewater, water quality has deteriorated significantly and is regarded harmful because of presence of Inorganic and organic contaminants.

Water and Sanitation Agency (WASA), Lahore (Fig 1-1) along with Dandia Sustainable Infrastructure Finance (DSIF) intends to establish the Wastewater Treatment Plant (WWTP) as Kattar Bund near Gopi Rai Village, Lahore. The consultancy work of subject project was contracted to M/S Sweco Danmark A/S in cooperation with Jers Consultancy (Pvt.) Ltd. The project is a milestone for improvement in wastewater treatment sector in the best interest of public.

In order to establish wastewater treatment plant at said site, M/S Sweco Danmark A/S in cooperation with Jers Consultancy (Pvt.) Ltd. hired the services of Tti Testing Laboratories to conduct wastewater composite sampling and analysis at Kattar Bund Disposal Station for a continuous period of 15 days on a 24 hours basis.

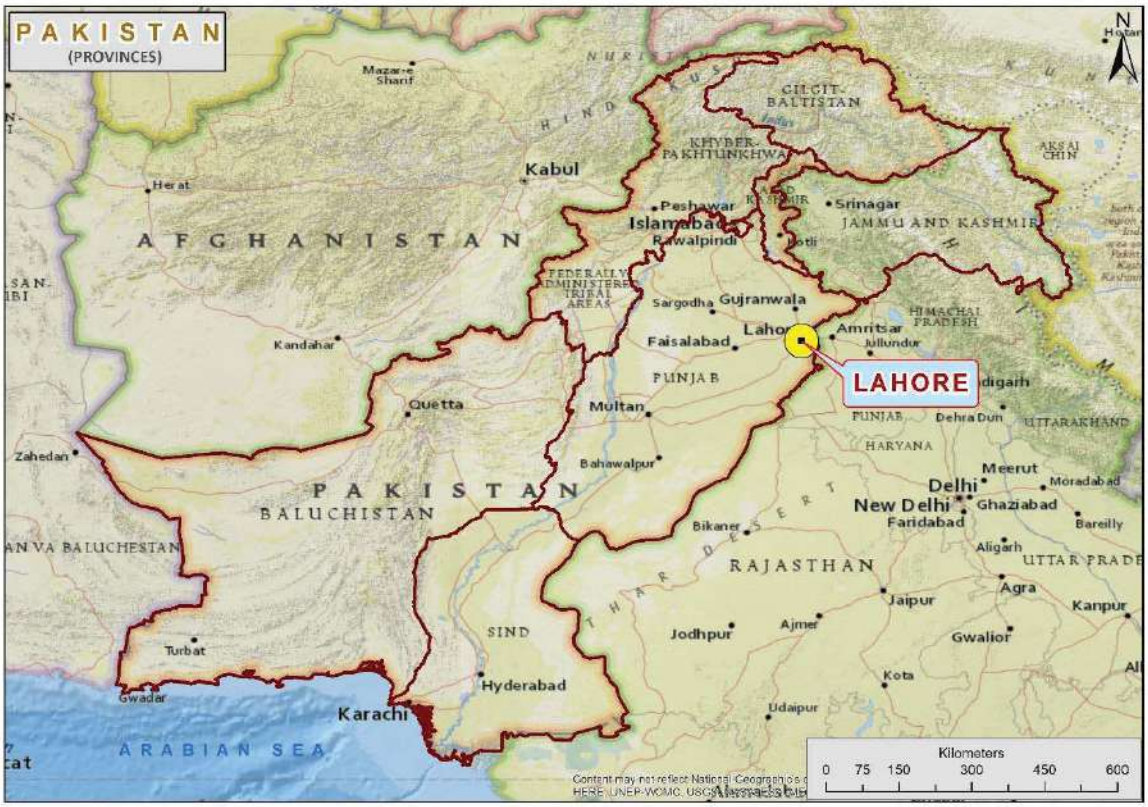


Figure 1-1 Location Map of Lahore

1.2 Objectives

The objective of this study was to:

- Conduct Composite sampling for 15 days at stated location. The activity was carried out for 15 days consecutively. Sample was collected after every 01 hour from Kattar Bund Disposal Station.
- Conduct analysis of composite samples from stated site and examine organic, inorganic and biological pollution load in the water samples.

1.3 Scope of Services

Wastewater composite sampling was conducted at advised location for following environmental parameters.

- 15 Days Continuous Composite Sampling.
- Analysis of all composite samples as per parameters stated in TORs.

1.4 Sampling Location

One location (Kattar Bund Disposal Station) was selected as per TORs provided by Jers Consultancy (Pvt.) Ltd. and details have been mentioned in Table 1.1-A:

	Location	Coordinates
1	Kattar Bund Disposal Station near Gopi Rai Village, Lahore	31°28'29.76"N, 74°13'42.24"E

Table 1.1-A Sampling Location

Methodology

2 Methodology:

Following is the brief description of methodology adopted for the Feasibility study:

2.1 Identification of Locations & Technical Survey:

01 location was finalized for the initiation of composite sampling. Field visits were carried out with Tti Technical team to identify feasibility of sampling point for the above stated activity. Risk assessment of sampling point was conducted and proper mitigation measures adopted to ensure the activity was carried out in a safe manner.

2.2 Monitoring Plan

On the basis of location, a monitoring plan was developed in order to achieve precision and accuracy in the sampling of the required environmental parameters. 01 team was designated for 24 hours at composite sampling site for consecutive 15 days.

Moreover, sampling after every one hour was conducted and composite samples for each day were prepared and shifted to Laboratory maintaining sample integrity.

It was ensured that proper preservation protocols were adopted to maintain sample integrity.

2.3 Sampling and Analysis Methods

The sampling and testing methods are given in following sections of the report.

1. USEPA approved methodologies were adopted for Composite sampling.
2. APHA Methodologies were adopted for all water preservation and analysis activities.
3. Sampling methodology was adopted as per Punjab Environmental Quality Standards (PEQS).
4. Sampling Methodology was approved by M/S Sweco Danmark A/S in cooperation with Jers Consultancy (Pvt.) Ltd. before mobilization to site and sampling work was supervised by M/S Sweco Danmark A/S in cooperation with Jers Consultancy (Pvt.) Ltd. representative(s).

2.3.1 Composite Sampling and Preservation:

Composite samples were prepared by collecting grab samples after every 01 hour from selected wastewater disposal station. Moreover, each sample was preserved to temperature <4°C and composite sample was prepared after every 24 hours. The activity was noted in Chain of custody forms to ensure sample integrity during logistics and preservation was performed as per APHA recommendation i.e., Heavy metal

preservation with Nitric acid solution, COD preservation by Sulphuric acid solution and overall preservation at low temperature.

2.3.2 Wastewater Analysis:

Analysis was performed as per Table 2-1 utilizing APHA & USEPA guidelines:

Sr. #	Parameters	Method	
		Description	**Based on Reference**
1.	Temperature or temperature increase	Thermometric Method	APHA-2550 B
2.	pH value	Electrometric Method	APHA-4500H B
3.	Biological oxygen demand	Manometric	APHA-5210 B
4.	Chemical oxygen demand	Colorimetric	APHA-5220 D
5.	Total suspended solids	Gravimetric	APHA-2540 D
6.	Total dissolved solids	Gravimetric	APHA-2540 C
7.	Grease and oil	Gravimetric	APHA-5520 B
8.	Nitrogen, Total Kjeldahl (TKN)	Titrimetric	APHA-4500 Norg B
9.	Phosphorous, Total	Digestion/Colorimetric	APHA-4500P B+C
10.	Faecal Coliforms	Membrane Filtration	APHA 9222 D
11.	E. coli	Membrane Filtration	APHA-9230 C
12.	Total Coliforms	Membrane Filtration	APHA 9222 B
13.	Solids, Settleable (1 hour)	Settle ability (I.Cone)	APHA-2540 F
14.	Density	Inhouse Method	-
15.	Biological oxygen demand of Supernatant of primary settled sample	Manometric	APHA-5210 B
16.	Chemical oxygen demand of Supernatant of primary settled sample	Colorimetric	APHA-5220 D

Sr. #	Parameters	Method	
		Description	Based on Reference
17.	Total suspended solids of Supernatant of primary settled sample	Gravimetric	APHA-2540 D

Additional Parameters to be analyzed in 4 days' samples (1st, 5th, 10th & 15th)

Sr. #	Parameters	Method	
		Description	Based on Reference
1.	Phenolic compounds	Colorimetric	APHA-5530 D
2.	Chloride	Titrimetric	APHA-4500 Cl^- B
3.	Fluoride	SPADNS Method	APHA-4500F D
4.	Cyanide	Colorimetric	APHA-4500 CN E
5.	Anionic detergents	Colorimetric	APHA-5540 C
6.	Sulfate	Turbidimetric	4500 – SO_4 E
7.	Sulfide	Colorimetric	APHA-4500-SO_3 E
8.	Pesticides	High Resolution Gas Chromatography/High Resolution Mass spectrometry	Based on USEPA 1699
9.	Cadmium	AAS/ICP-OES	APHA-3111B/3120 B
10.	Chromium	AAS/ICP-OES	APHA-3111B/3120 B
11.	Copper	AAS/ICP-OES	APHA-3111B/3120 B
12.	Lead	AAS/ICP-OES	APHA-3111B/3120 B
13.	Mercury	AAS/ICP-OES	APHA-3111B/3120 B
14.	Selenium	AAS/ICP-OES	APHA-3111B/3120 B
15.	Nickel	AAS/ICP-OES	APHA-3111B/3120 B
16.	Silver	AAS/ICP-OES	APHA-3111B/3120 B

Sr. #	Parameters	Method	
		Description	**Based on Reference**
17.	Total toxic metals	Calculated	-
18.	Zinc	AAS/ICP-OES	APHA-3111B/3120 B
19.	Arsenic	AAS/ICP-OES	APHA-3111B/3120 B
20.	Barium	AAS/ICP-OES	APHA-3111B/3120 B
21.	Iron	AAS/ICP-OES	APHA-3111B/3120 B
22.	Manganese	AAS/ICP-OES	APHA-3111B/3120 B
23.	Boron	AAS/ICP-OES	APHA-3111B/3120 B
24.	Chlorine	Colorimetric	APHA-4500-Cl G
25.	Volatile Suspended volatile (VSS)	Gravimetric	APHA-2540 E

Table 2-1 Parameters for Wastewater Analysis

Results & Discussion

This chapter will shed light on the results obtained from Wastewater Analysis. Results will be stated and compared with Punjab Environmental Quality Standards and their probable causes and health hazards will be discussed as per observations and secondary data.

3 Analysis Results

3.1 Wastewater Analysis Results:

In this section results of wastewater analysis from the selected location will be discussed taking into account parameters which have shown significant concentration or which may be of importance with respect to human health:

3.1.1 Temperature

Multiple temperature variations were observed at the time of sampling, highest temperature was observed as 28°C and lowest temperature was 16°C, as shown in below graph in figure 3-25.

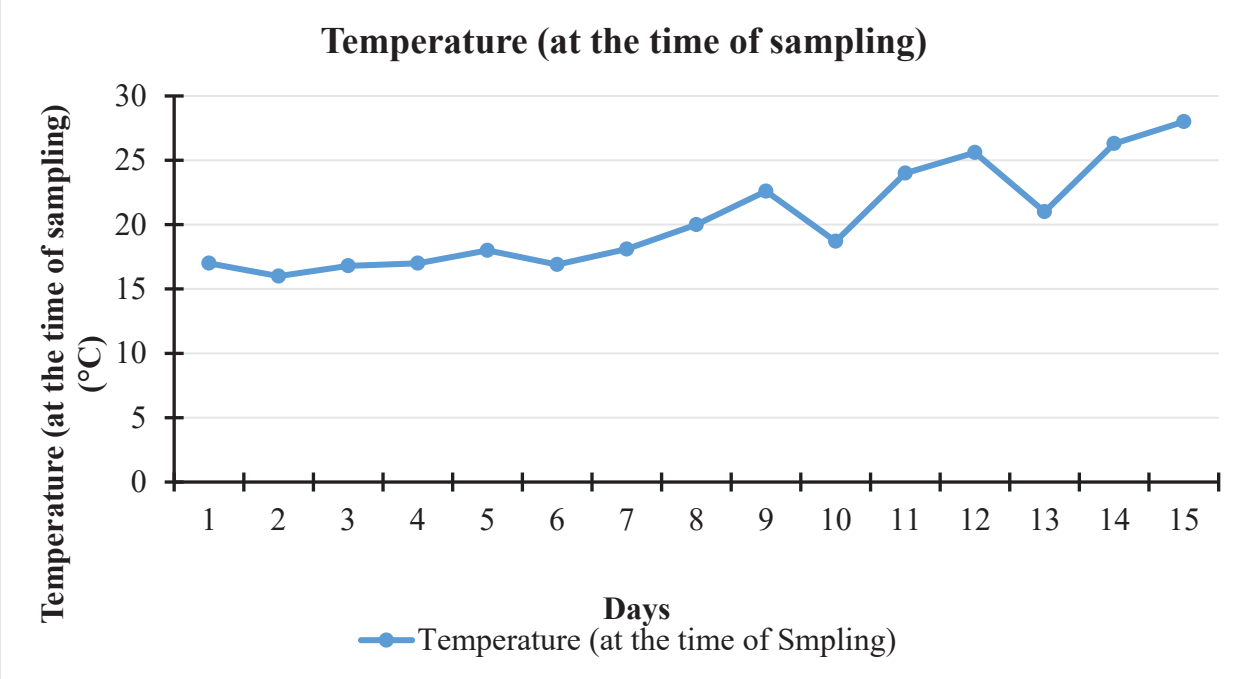


Figure 3-1 Variation of Temperature (at the time of sampling) in Analyzed Samples

3.1.2 pH

pH is a measure of how acidic/basic water is. The range goes from 0 to 14, with 7 being neutral. pHs of less than 7 indicate acidity, whereas a pH of greater than 7 indicates a base. pH is really a measure of the relative amount of free hydrogen and hydroxyl ions in the water. Water that has more free hydrogen ions is acidic, whereas water that has more free hydroxyl ions is basic. The pH of water determines the solubility (amount that can be dissolved in the water) and biological availability (amount that can be utilized by aquatic life) of chemical constituents such as nutrients (phosphorus, nitrogen, and carbon) and heavy metals (lead, copper, cadmium, etc.).

Results & Discussion:

The wastewater samples collected from Kattar Bund Disposal Station showed the highest value of pH (at the time of sampling) as 9.5 pH Unit and lowest value as 6.5 pH Unit. The results of pH (at the time of sampling) are shown in the graph below figure 3-19. While pH (at 25°C) showed highest value as 7.92 pH Unit and lowest value as 6.79 pH Unit. The results of pH (at 25°C) are shown in graph below figure 3-20.

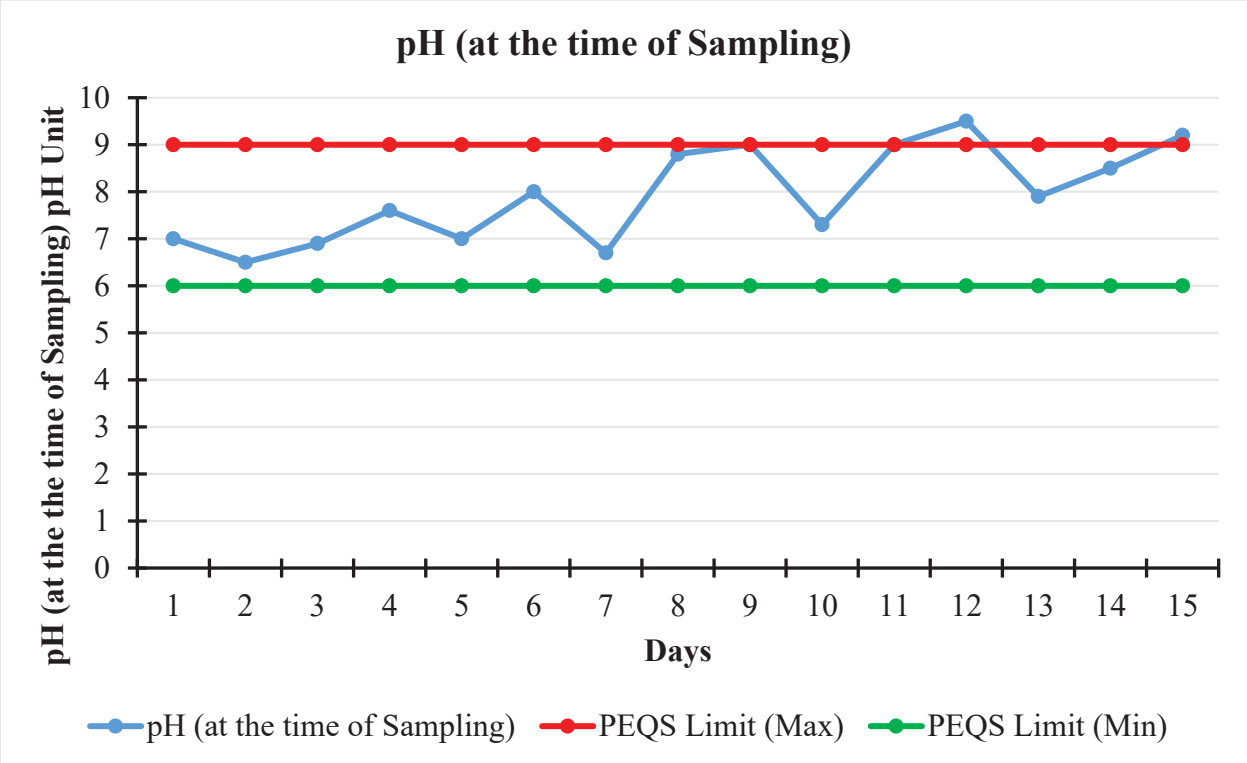


Figure 3-2 Temporal Analysis of pH Values in Analyzed Samples

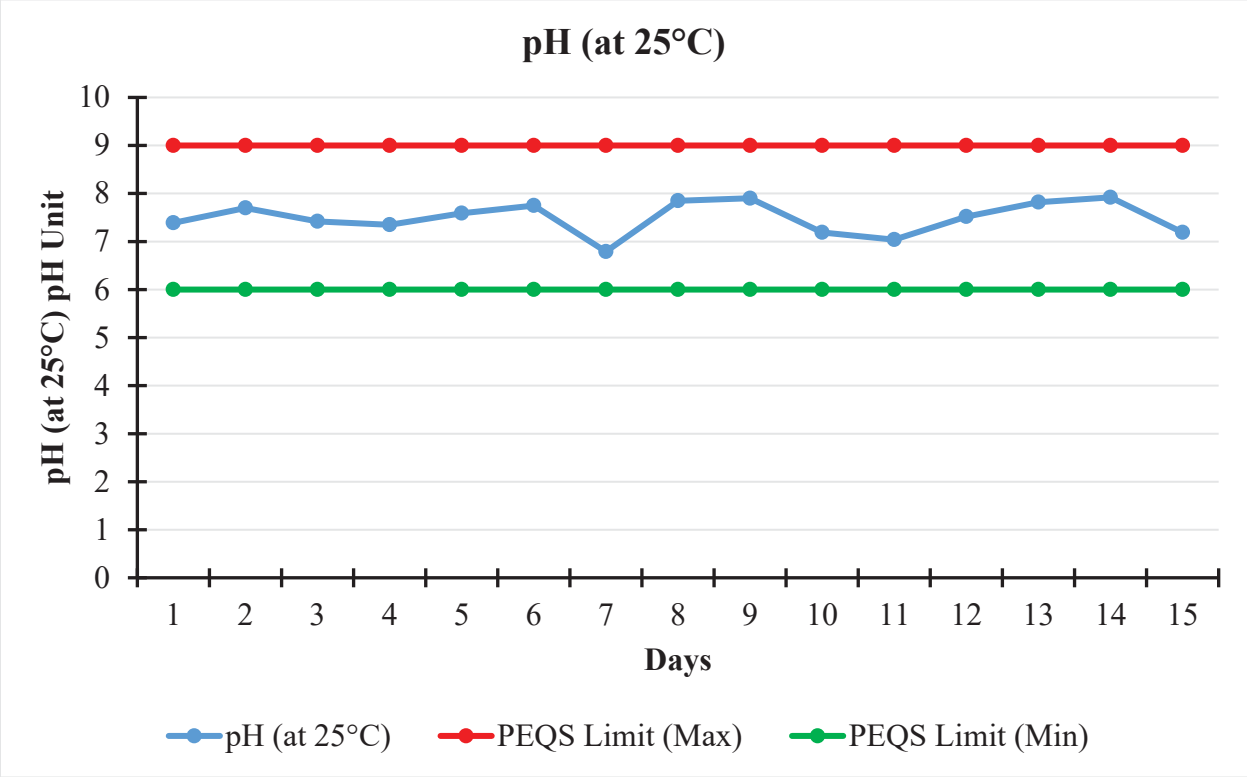


Figure 3-3 Temporal Analysis of pH Values in Analyzed Samples

Impacts of pH:

pH affects most biochemical processes in water such as enzyme activity and solubilization and uptake of certain ions such as ammonia. pH limits biodiversity distribution in aquatic habitat.

Potential Sources of Variation

Direct measurement of the pH level of wastewater effluent can vary dramatically due to variation in water temperature, water flow and the chemical makeup of water.

pH Stabilization Techniques

- Certain acidic chemicals used to lower wastewater pH are: Sulfuric acid (H_2SO_4) is the cheapest and most readily available. It is strongly corrosive, dense, oily and clear or dark brown (depending on purity). Sulfuric acid should be of the USP (United States Pharmaceutical) grade, free of heavy metals.
- pH can be increased by adding strong base in the water like Sodium hydroxide or Sodium carbonate

3.1.3 Total Dissolved Solids

Total dissolved solids (TDS) is a measure of the dissolved combined content of all inorganic and organic substances present in a liquid in molecular, ionized, or micro-granular (colloidal sol) suspended form. TDS concentrations are often reported in parts per million (ppm). Water TDS concentrations can be determined using a digital meter.

Results

The wastewater samples collected from Kattar Bund Disposal Station showed highest value of TDS as 1059 mg/l and lowest value as 810 mg/l. Graphical representation is as follows:

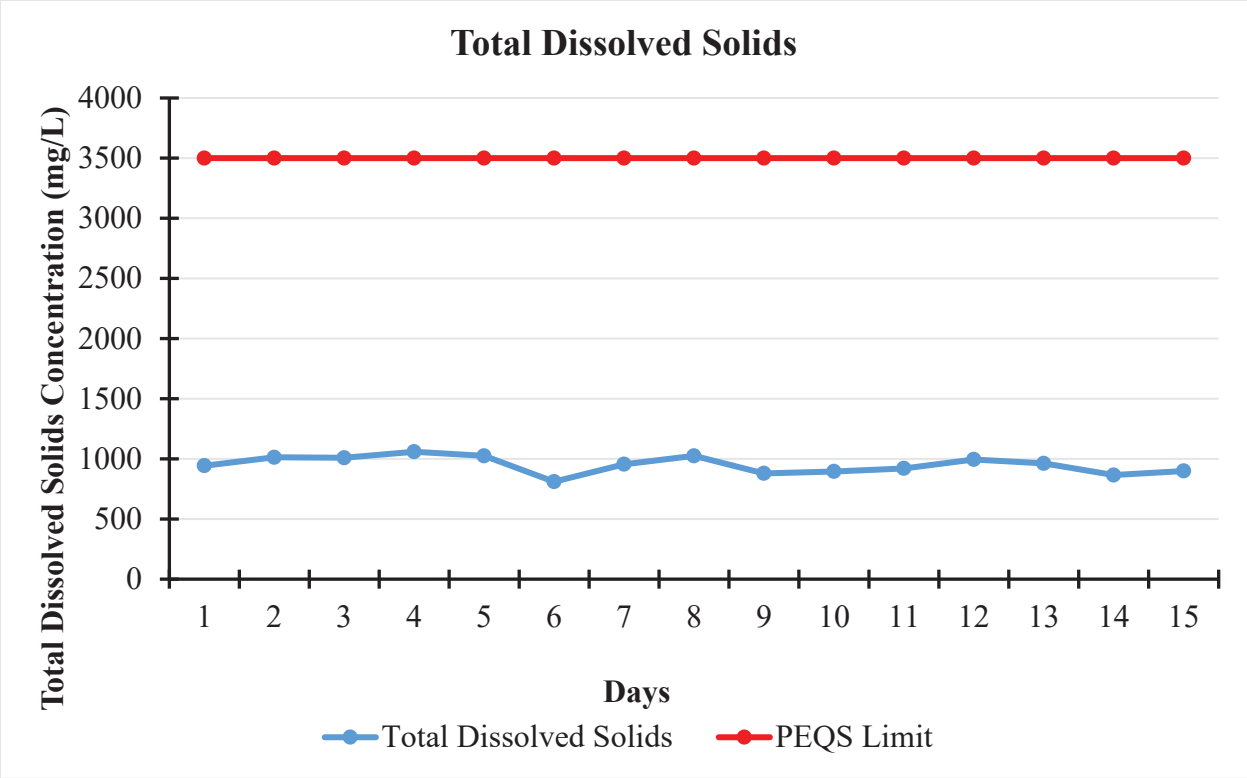


Figure 3-4 Temporal Analysis of TDS Concentration in Analyzed Samples

Impacts of TDS:

TDS test is an indicator of aesthetics. An elevated level of TDS, by itself, does not indicate that the water presents a health risk. However, elevated levels of specific ions included in the TDS measurement, such as nitrate, arsenic, aluminum, copper, or lead, could present health risks.

Potential Sources:

Primary sources for TDS in receiving waters are agricultural runoff and residential (urban) runoff, clay-rich mountain waters, leaching of soil contamination, and point source water pollution discharge from industrial or sewage treatment plants

Removal Techniques:

The most commonly used method for TDS removal and reduction are:

- Physical adsorption
- Reverse osmosis
- Distillation
- Precipitation
- Membrane filtration
- Bacteria-based bioremediation

3.1.4 Total Suspended Solids

Total suspended solids (TSS) are the dry-weight of suspended particles that are not dissolved, in a sample of water that can be trapped by a filter that is analyzed using a filtration apparatus. It is a water quality parameter used to assess the quality of a specimen of any type of water or water body, ocean water for example, or wastewater after treatment in a wastewater treatment plant.

Results & Discussion:

The wastewater samples collected from Kattar Bund Disposal Station showed highest value of TSS as 267 mg/l and lowest value as 108 mg/l. Graphical representation is as below figure 3-17. While the values of TSS (Primary Settled Sample) was highest as 142 mg/l and lowest value as 14 mg/l. Graphical representation is as below figure 3-18.

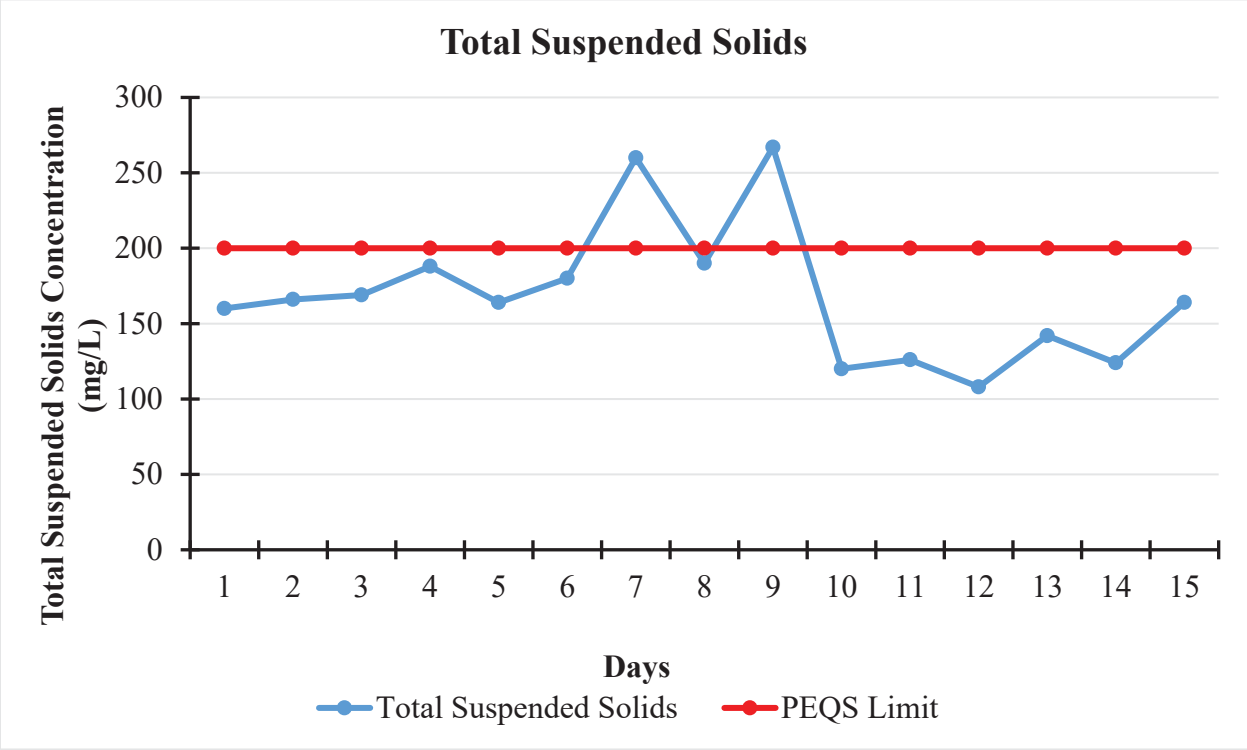


Figure 3-5 Temporal Analysis of TSS Concentration in Analyzed Samples

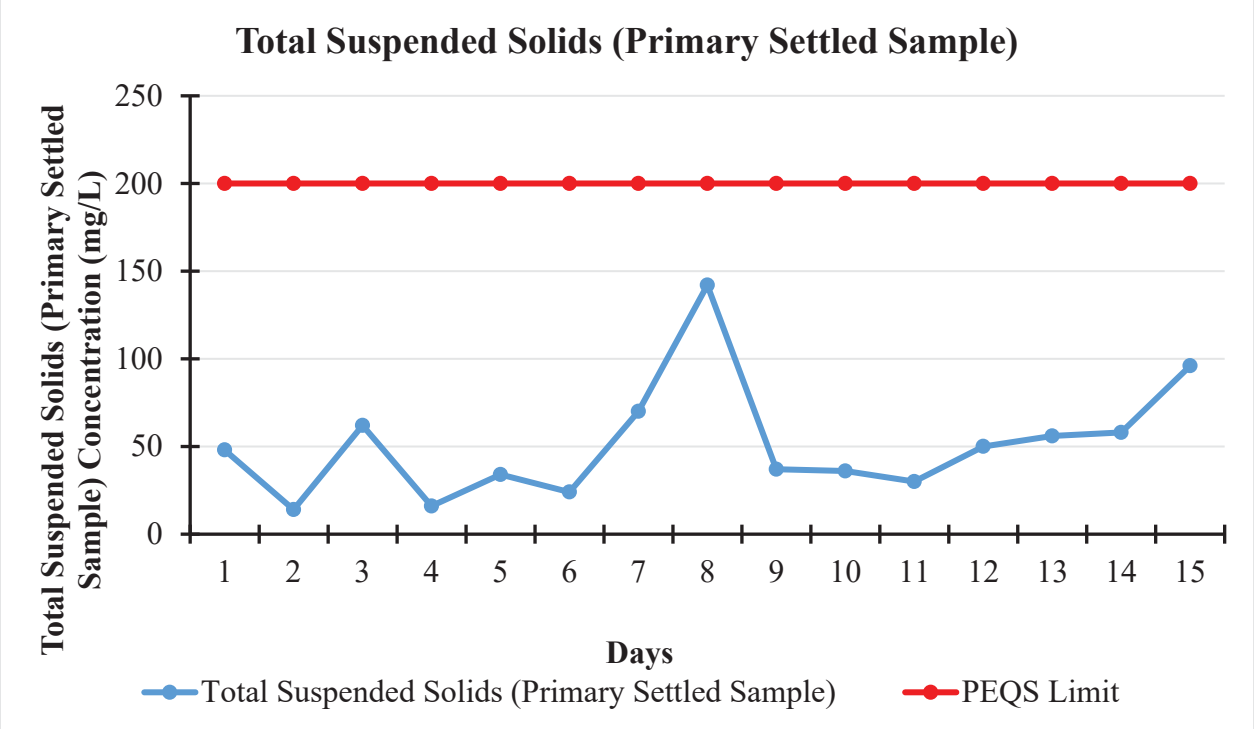


Figure 3-6 Temporal Analysis of TSS (Primary Settled Sample) Concentration in Analyzed Samples

Impacts of TSS:

High concentrations of suspended solids can cause many problems for stream health and aquatic life. High TSS in a water body can often mean higher concentrations of bacteria, nutrients, pesticides, and metals in the water.

Potential Sources

Sources of total solids include industrial discharges, sewage, fertilizers, road runoff, and soil erosion. Total solids are measured in milligrams per liter (mg/L). Total solids are important to measure in areas where there are discharges from sewage treatment plants, industrial plants, or extensive crop irrigation. In particular, streams and rivers in arid regions where water is scarce and evaporation is high tend to have higher concentrations of solids and are more readily affected by human introduction of solids from land use activities.

Removal Techniques

The main removal techniques are sedimentation / clarification or filtration techniques. Adsorption can also support in removing suspended solids as well as chemical treatment.

3.1.5 Biological Oxygen Demand:

Biochemical oxygen demand (BOD) represents the amount of oxygen consumed by bacteria and other microorganisms while they decompose organic matter under aerobic (oxygen is present) conditions at a specified temperature. It is measured as degree of organic pollution in wastewater and it is an important parameter to measure for assessing the water quality. The permissible limit of BOD is 80mg/l in inland water and 250 mg/l in sewage treatment.

Results & Discussion:

The wastewater samples collected from Kattar Bund Disposal Station showed the highest value of BOD_5 389 mg/l and the lowest value of BOD_5 was 103 mg/l. Overall graphical representation can be observed in Fig 3-1. Meanwhile highest value of BOD (Primary Settled Sample) was 291 mg/l and the lowest value of BOD (Primary Settled Sample) was 84 mg/l. Overall graphical representation can be observed in Fig 3-2. The BOD values of primary settled sample represent organic load of wastewater after primary settling of large suspended particles which play a major role in contributing to the overall BOD.

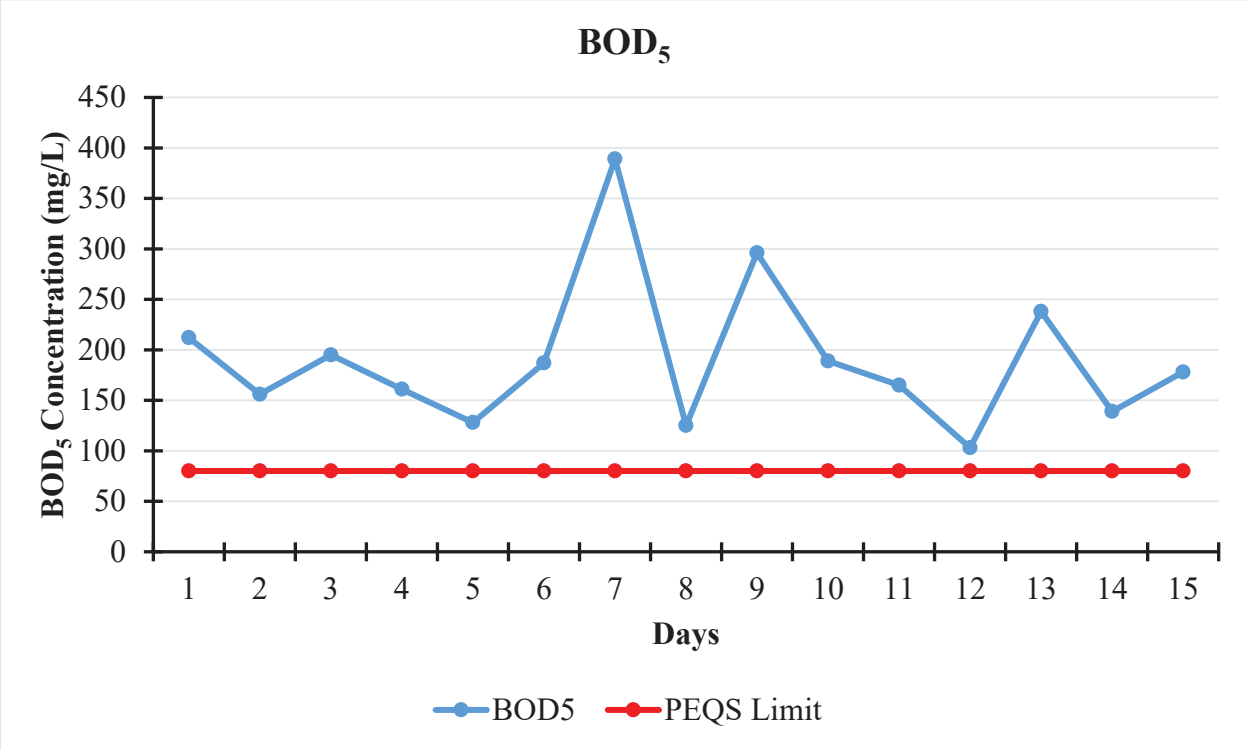


Figure 3-7 Temporal Analysis of BOD^5 Concentration in Analyzed Samples

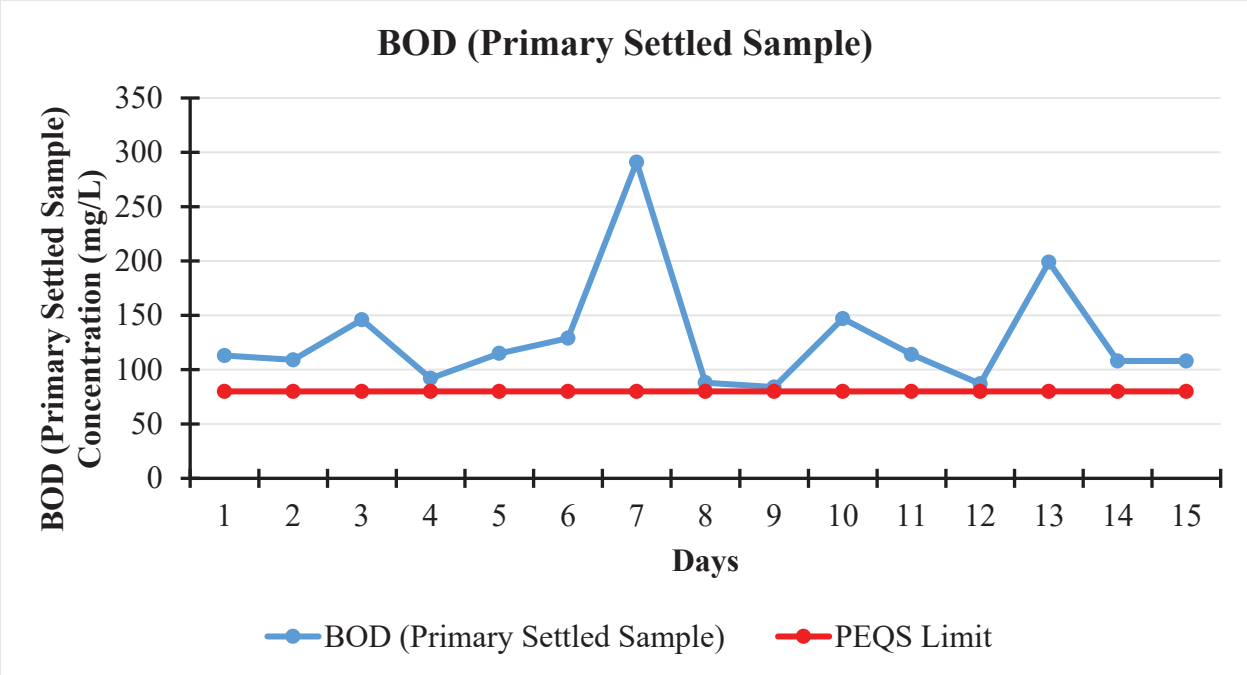


Figure 3-8 Temporal Analysis of BOD (Primary Settled Sample) Concentration in Analyzed Samples

Most values of Biological Oxygen Demand observed were more than PEQS limits of 80 mg/L for release into water bodies. The values of BOD were directly proportional with Chemical Oxygen Demand, as the latter represents the overall organic load in wastewater. Moreover, it was observed that high concentration of suspended solids, especially volatile suspended solids resulted in higher values of BOD.

Impacts:

High BOD concentrations reduce oxygen availability, degrade aquatic habitats and biodiversity. It also deteriorates water quality making it unfit for human consumption. Increase in organic pollution can also lead to eutrophication which further decreases water quality.

Potential Sources:

Most industrial effluent which carries a high organic load have an impact on Biological Oxygen Demand. This includes process wastewater from Textile industries, chemical industries with organic chemicals e.g. Alcohols, aldehydes & Organic solvents, Food and Beverages industries carrying waste product material, fertilizer industries etc. Moreover, municipal wastewater from housing societies and colonies also has an impact on overall biological oxygen demand as grey water has high concentration of organic contamination.

Removal Techniques:

Biological Treatment technologies especially activated sludge technique is mostly applied for removal of organic loading such as COD & BOD. Moreover, reduction of suspended solids and settling can reduce BOD by upto 40%. Biological techniques utilize growth of specialized microbial culture which consumes organic loading and converts it into Carbon Dioxide and Water by natural metabolism process.

3.1.6 Chemical Oxygen Demand

The COD is the estimate of oxygen required for the portion of organic matter in wastewater that is subjected to oxidation and is calculated by the amount of oxygen consumed by organic matter from boiling with oxidation agent i.e. acidic potassium dichromate solution. COD is a water quality measure used not only to determine the amount of biologically active substances such as bacteria but also biologically inactive organic matter in water. It is an important and rapidly measured variable for characterizing water bodies, sewage, industrial wastes, and treatment plant effluents. The permissible limit of COD in wastewater is 150mg/l.

Results & Discussion:

The wastewater samples collected from Kattar Bund Disposal Station showed the highest value of COD 678 mg/l and the lowest value of COD 176 mg/l. The figure 3-3 below shows the graphical representation of COD concentration in the samples collected from the selected site.

The highest value of COD (Primary Settled Sample) is 473 mg/l and the lowest value of COD (Primary Settled Sample) 131 mg/l. The figure 3-4 below shows the graphical representation of COD concentration in the samples collected from the selected site. Similar to the primary settled BOD discussed above, the primary settled COD will represent total organic load after primary settling. These values are essential in identifying impact of settling tanks as well as understanding the nature of suspended solids present.

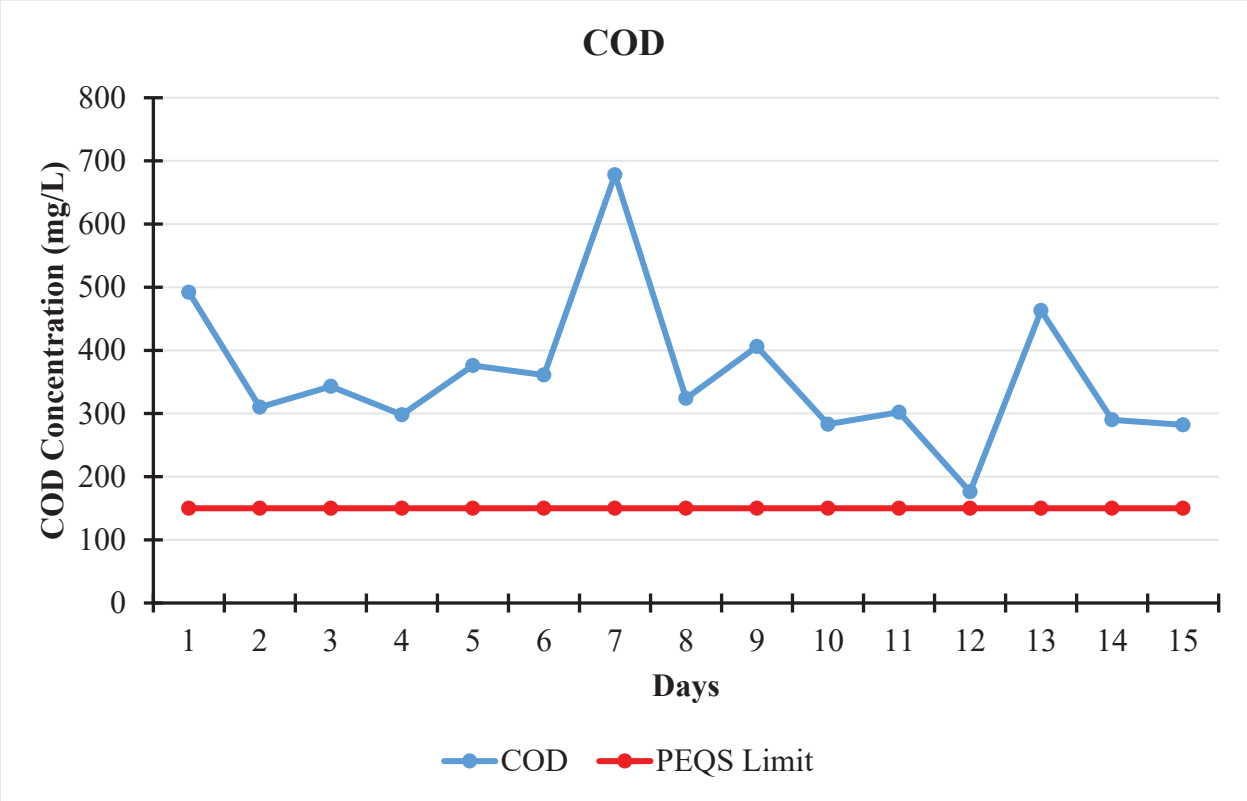


Figure 3-9 Temporal Analysis of COD Concentration in Analyzed Samples

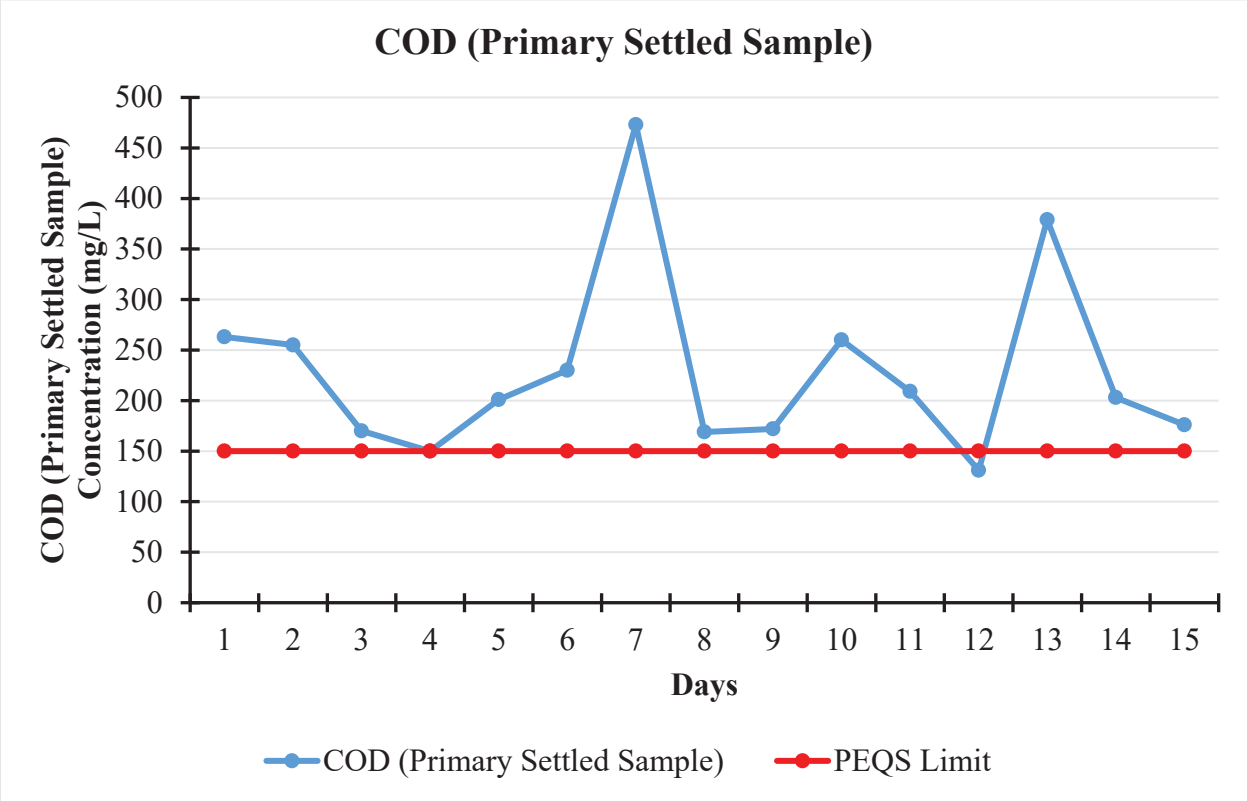


Figure 3-10 Temporal Analysis of COD (Primary Settled Sample) Concentration in Analyzed Samples

Health Impacts:

It is important to monitor COD because it reflects the level of pollution and contamination present in a water sample. In wastewater treatment, organic compounds can react with chlorine-containing disinfectants in the final steps of treatment to form THM's. This is a major problem due to the carcinogenic nature of THM's. Additionally, high organic content in effluent can contribute to pollution in receiving waterways and water supplies.

Potential Sources:

Residual food waste from bottles and cans, antifreeze, emulsified oils are all high in COD and are common sources of COD. COD increases as the concentration of organic material increases. It also increases if inorganic compounds susceptible to oxidation by the oxidant (typically dichromate) are present. Water with high COD typically contains high levels of decaying plant matter, human waste, or industrial effluent.

Removal Techniques:

If COD is elevated in wastewater, treatment methods such as aerobic and anaerobic biological treatment, filtration, coagulation and flocculation should be used to remove organic and inorganic material. Before treated effluent is discharged, the COD should be measured to prevent contamination in receiving water supplies and ecosystems.

3.1.7 Volatile Suspended Solids:

Volatile suspended solids (VSS) are a water quality measure obtained from the loss on ignition of the mass of measured total suspended solids. This ignition generally takes place in an oven at a temperature of 550 °C to 600 °C. It represents the amount of volatile matter present in the solid fraction of the measured solution.

Analysis Results & Discussion:

The wastewater samples collected from Kattar Bund Disposal Station showed the highest value of VSS 66 mg/l and the lowest value of VSS was 43 mg/l. VSS were analyzed in 4th days' samples (1st, 5th, 10th & 15th). There is no PEQS standard set for VSS, the overall analysis results and trends can be observed in Figure 3-5.:

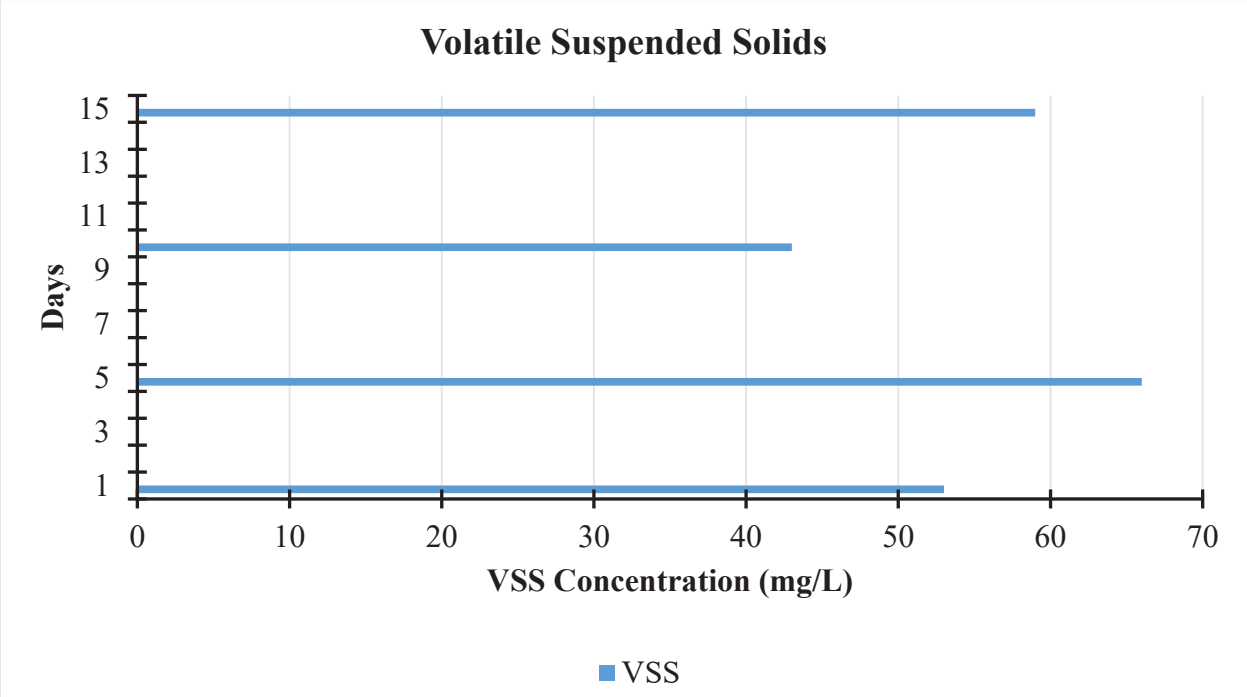


Figure 3-11 Temporal Analysis of VSS Concentration in Analyzed Samples

Volatile Suspended solids increase and decrease trend is as per the trend observed of suspended solid concentration. Further reduction in Volatile & total suspended solids may be due to deposition or precipitation.

Volatile Suspended Solids represent the fraction of suspended solid contents which are organic in nature. This data is used to estimate organic pollution load reduction in the scenario of removal of suspended solids. This can be utilized in wastewater treatment plant design as well as Financial Feasibility of utilizing Filtration based techniques.

Health Impacts of VSS:

VSS is primarily organic suspended pollution load and organic pollution can be associated with high levels of disease-causing microorganisms such as viruses, parasites and some bacteria, which can cause symptoms such as nausea, cramps, diarrhea, and associated headaches.

Sources of VSS in Water:

VSS can be discharged into water bodies by the release of industrial effluents as well as municipal effluent which includes grey water as well.

Removal Techniques:

The most widely used methods for removing volatile suspended solids from wastewater are screening, sedimentation and skimming. These excess bio-solids generated during treatment can be thickened and ultimately hauled offsite, land applied or used as a compost amendment.

3.1.8 Sulphate:

Sulphates are widely distributed in nature and may be present in natural waters in concentrations ranging from a few to several thousand milligrams per liter. Mine drainage water through pyrite oxidation, chemical industries utilizing sulphate based chemicals can contribute major amount of Sulphate in industrial wastewater. Salts, acid derivatives, and peroxides of sulfate are widely used in industry. The permissible of Sulfates according to PEQ's is 600 mg/L.

Results & Discussion:

The wastewater samples collected from Kattar Bund Disposal Station showed the highest value of Sulfates 138 mg/l and the lowest value of Sulfate was 95 mg/l. Sulphates were analyzed in 4 days' samples (1st, 5th,

10th & 15th). Sulphate concentration was within the prescribed limits of 600 mg/L. Graphical representation of sulphates can be observed in Fig 3-6.

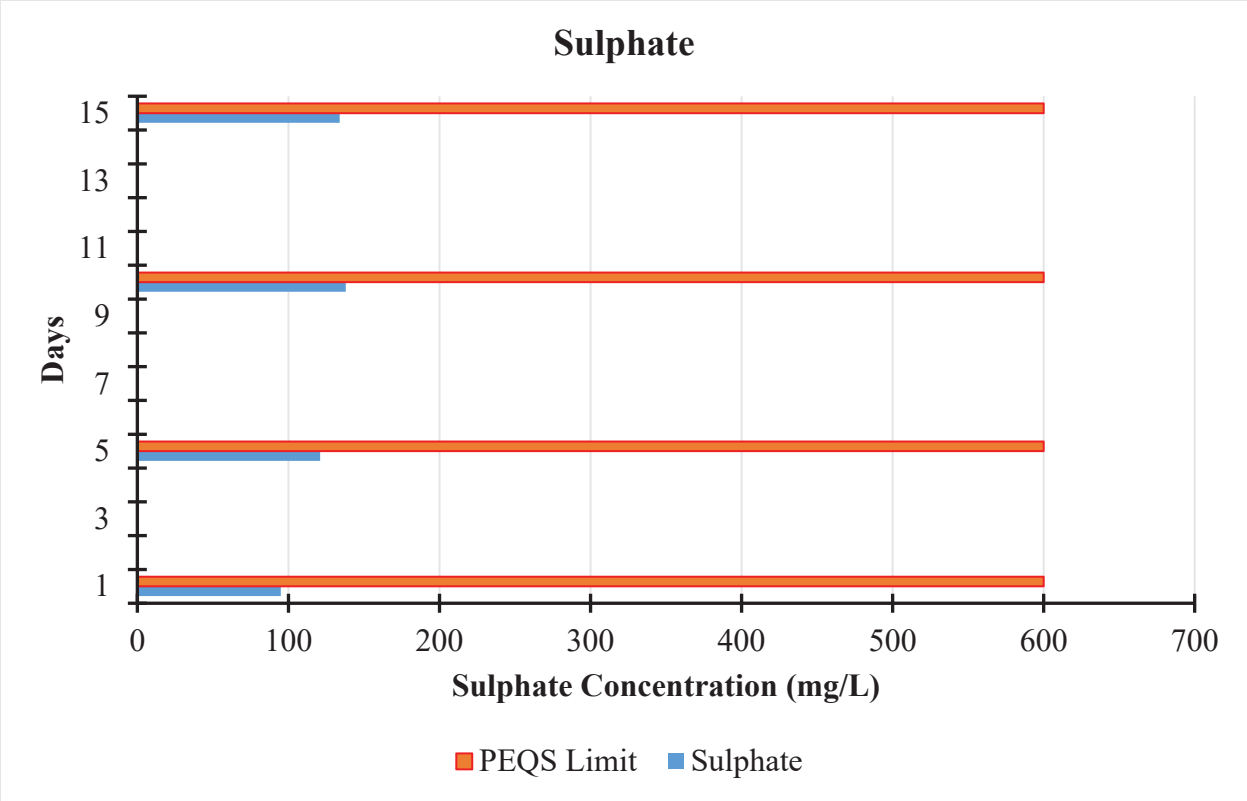


Figure 3-12 Temporal Analysis of Sulphate Concentration in Analyzed Samples

Impacts of Sulphates:

In general, sulphates if leached out to drinking water can cause laxative effects in humans if their concentration in higher than permissible limits. In combination with concentration of magnesium ions, the impact will be increased. There is limited data available on any other short or long term effects of sulphates in water.

Potential Sources:

Sulphates can be naturally occurring or the result of municipal or industrial discharges. Point sources include sewage treatment plants and industrial discharges such as tanneries, chemical plants, pulp mills, and textile mills. Runoff from fertilized agricultural lands also contributes sulfates to water bodies.

Removal Techniques:

Ion Exchange and filtration techniques are used for removal of large amounts of sulphates from water for industrial, commercial, livestock, public, and municipal applications.

3.1.9 Sulfide

Sulfide or Suphide is an inorganic anion of sulfer with the chemical formula S^{2-} or a compound containing one or more S^{2-} ions. The sulfide is found in three classes of compounds as inorganic sulfides, organic sulfides also called as thioethers and phosphine sulfides. The permissible limit of Sulfide is 1 mg/l.

Results and Discussion

According to the samples collected from Kattar Bund Disposal Station the highest values observed are 1.93 mg/l and the lowest observed are 1.205 mg/l. Sulfides were analyzed in 4 days' samples (1st, 5th, 10th & 15th). The graphical representation of trends of Sulfides at each location is shown in the figure below.

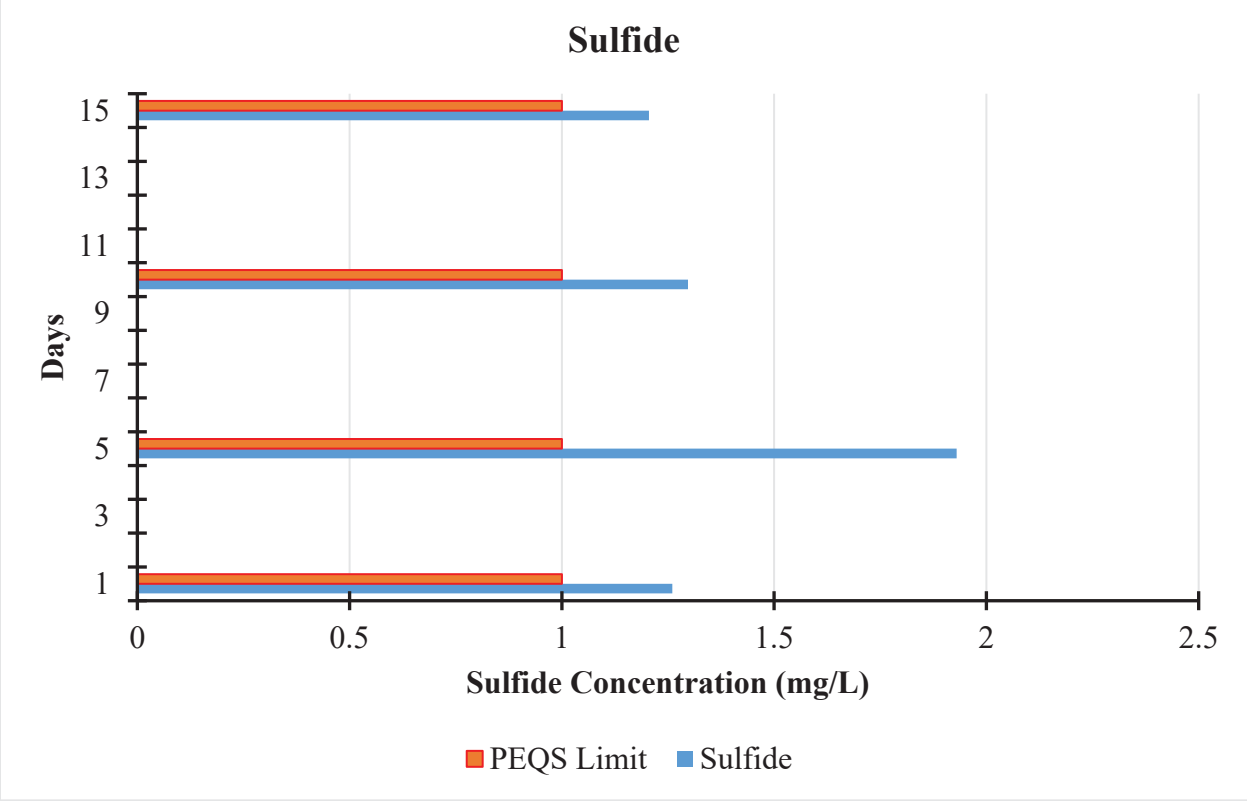


Figure 3-13 Temporal Analysis of Sulfide Concentration in Analyzed Samples

Impacts of Sulfide:

Humans may be exposed to hydrogen sulfide from endogenous production and from exogenous sources. H_2S irritates the mucous membranes of the body and the respiratory tract, among other things. Following exposure, short-term, or acute, symptoms may include a headache, nausea, convulsions, and eye and skin irritation. Injury to the central nervous system can be immediate and serious after exposure. However, Water with hydrogen sulfide alone does not cause disease. In rare cases, hydrogen sulfide odor may be from sewage pollution which can contain disease-producing contaminants.

Potential Sources:

Natural sources include non-specific and anaerobic bacterial reduction of sulfates and sulfur-containing organic compounds. Hydrogen sulfide is found naturally in crude petroleum, natural gas, volcanic gases, and hot springs. It is also found in groundwater. It is released from stagnant or polluted waters and manure or coal pits. The principal source on commercial level of hydrogen sulfide is recovery as a by-product in the purification of natural and refinery gases. It is also a by-product of kraft pulp and paper manufacturing and carbon disulfide production.

Removal Techniques:

The recommended technique for the removal of Hydrogen Sulphide from wastewater is oxidation. Hydrogen sulfide may be temporarily controlled by conducting a shock chlorination / disinfection of the well or water source. To remove low levels of hydrogen sulfide with NO bacterial problems, install an activated carbon filter.

3.1.10 Fluoride:

Fluoride is a naturally-occurring mineral which is found in all-natural waters to some extent – both seawater and fresh water. It is the 13th most abundant element on the Earth's crust; a chemical Ion of Fluorine. The permissible of Fluoride according to PEQ's is 10 mg/l.

Results & Discussion:

The wastewater samples collected from Kattar Bund Disposal Station showed highest value of Fluoride 0.34 mg/l and the lowest value of Fluoride was 0.28 mg/l. Fluorides were analyzed in 4 days' samples (1st, 5th, 10th & 15th). Graphical representation of the trends can be observed in Fig 3-8.

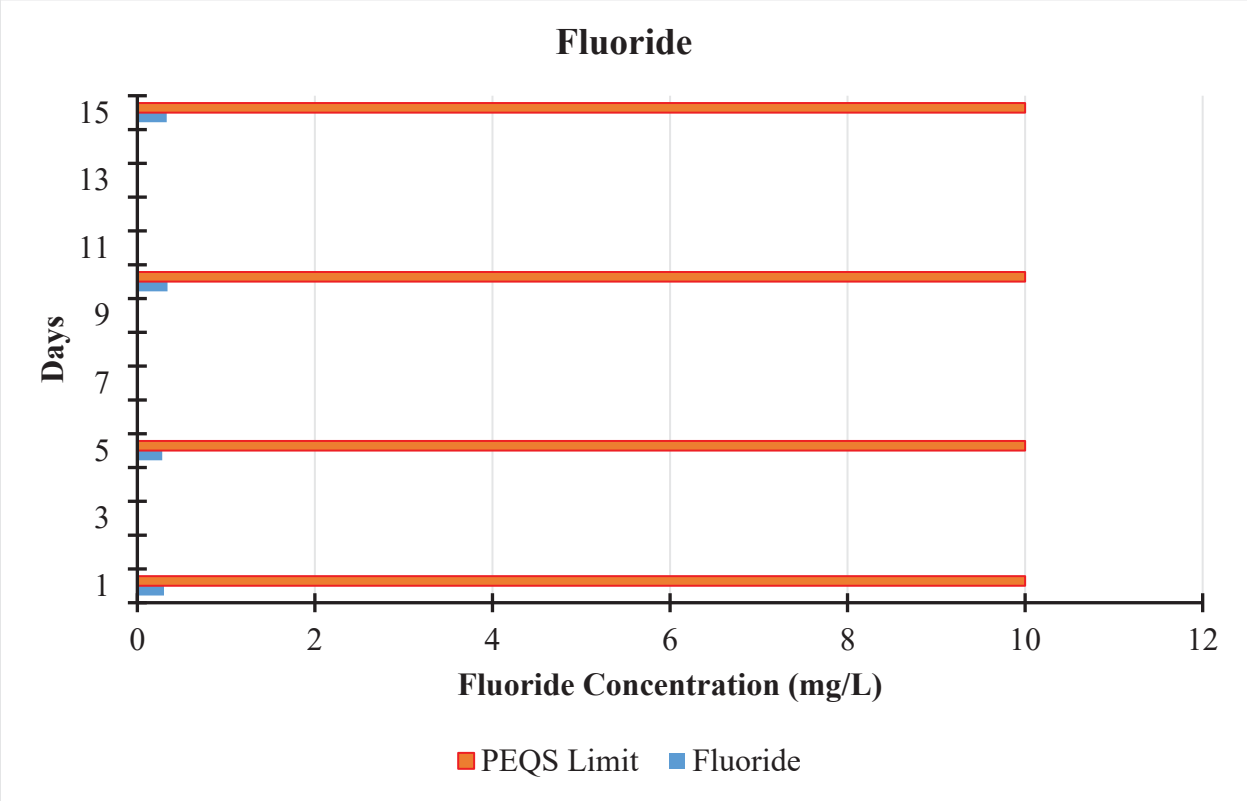


Figure 3-14 Temporal Analysis of Fluoride concentration in Analyzed Samples

Health Impacts of Fluoride:

While fluoride is a naturally occurring compound, it can still cause side effects when consumed in large doses. Dental fluorosis happens when you consume too much fluoride while your teeth are still forming under your gums. This results in white spots on the surface of your teeth. Skeletal fluorosis is similar to dental fluorosis, but it involves bones instead of teeth. Early symptoms include joint pain and stiffness.

Sources of Fluoride in Water:

Fluoride is used abundantly in industry especially the semiconductor and nano-technology industries as a glass and silica etchant. The most common source of fluoride in industry is Hydrofluoric Acid (HF) although buffered oxide etch (BOE) containing ammonium bifluoride (NH4-HF) is relatively common as well.

Removal Techniques:

Common techniques used for defluoridation are coagulation-precipitation, membrane process and ion exchange.

3.1.11 Cyanide:

Cyanide is a carbon–nitrogen radical, which may be found in a wide variety of organic and inorganic compounds. A common form, hydrogen cyanide is a colorless gas or liquid with a faint, bitter, almond-like odor. Cyanide, in some forms, is a very powerful and fast acting toxin. When combined with metals and organic compounds forms simple and complex salts and compounds, the most commonly used forms being hydrogen cyanide, sodium cyanide, and potassium cyanide. The permissible limit of cyanide is 1 mg/l.

Results & Discussion:

Cyanide was not detected in the wastewater samples at Kattar Bund Disposal Station.

Health Impacts of Cyanide:

Cyanide poisoning is poisoning those results from exposure to any of a number of forms of cyanide. Early symptoms include headache, dizziness, fast heart rate, shortness of breath, and vomiting This phase may then be followed by seizures, slow heart rate, low blood pressure, loss of consciousness, and cardiac arrest. Onset of symptoms usually occurs within a few minutes. Some survivors have long-term neurological problems.

Sources:

Cyanide can enter surface water through releases from metal finishing industries, iron and steel mills, runoff from disposal of cyanide wastes in landfills, pesticides, and the use of cyanide-containing road salts. Most cyanide in surface water forms hydrogen cyanide and evaporates. Cyanide is commonly found as a contaminant in wastewaters from various industries including metal cleaning, plating, electroplating, metal processing, automobile parts manufacture, steel tempering, mining, photography, pharmaceuticals, coal coking, ore leaching, plastics, etc.

Removal Techniques:

The most commonly used methods for cyanide removal are:

- Alkaline chlorination process
- Biological oxidation/biodegradation
- Hydrogen peroxide
- SO_2/air (INCO) process

- Ozonation
- Electro dialysis
- Reverse osmosis,
- Electro winning, hydrolysis/distillation
- Acidification/volatilization
- Flotation, iron cyanide precipitation, activated carbon, resin, catalytic oxidation and photolysis

3.1.12 Phosphorous:

Phosphorous is a key element for all living systems. It is the limiting nutrient for algae (autotrophic) growth in most fresh water bodies. The discharge of phosphorous to these waters therefore increases the potential for algae growth, which is the initiation of eutrophication. Eutrophication is characterized by increased availability of phosphorous for production of algae in water bodies. Wastewater therefore has great potential for enhancing eutrophication if not properly handled before discharge to aquatic environment.

Results & Discussion:

The wastewater samples collected from Kattar Bund Disposal Station showed maximum value of Total Phosphorous was 15 mg/l and the lowest value was 3.55 mg/l. There is no PEQS standard set for Phosphorous, Graphical Representation of the results can be observed in Fig 3-9.

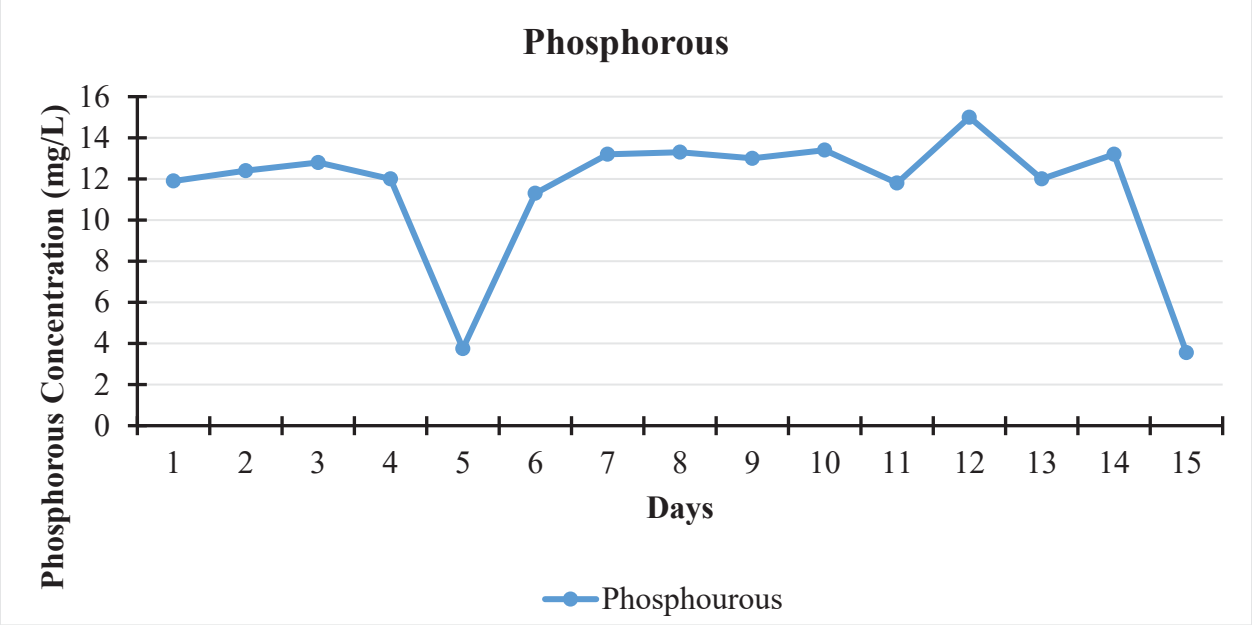


Figure 3-15 Temporal Analysis of Phosphorous Concentration in Analyzed Samples

Health Impacts of Phosphorous:

Harmful algal bloom species have the capacity to produce toxins dangerous to humans. Algal toxins are observed in marine ecosystems where they can accumulate in shellfish and more generally in seafood reaching dangerous levels for human as well as animal health. Examples include paralytic, neurotoxic and diarrheic shellfish poisoning. People are poisoned when consuming contaminated fish. Symptoms include gastrointestinal and neurological effects.

Sources of Phosphorous in Water:

The main sources of phosphorous in wastewater are the human and livestock excreta, phosphorous containing detergents and some municipal and industrial effluents. Drainage from agricultural land and from urban diffuse are also included in phosphorous contamination.

Removal Techniques:

Phosphorous can be remediated through techniques that are given below:

- Chemical precipitation
- Biological phosphorus removal
- Crystallization technologies
- Advanced chemical precipitation and nutrient removal
- Sludge-based processes
- Ion exchange, magnetic attraction and adsorbents have also been investigated for their potential to remove phosphorus from wastewater.

3.1.13 Oil and Grease

One of the complex environmental problems that triggers at present is oily wastewater contamination arising out of the activities related to engineering vehicular (automobile) workshop or garage, kitchens in houses and restaurants, gas stations, metal finishing house, petrochemical industry, edible oil production unit etc.

Results & Discussion:

Results showed that the highest value for oil & grease at Kattar Bund Disposal Station was found to be 28 mg/l, while lowest value was 3 mg/l. Graphical Representation of the results can be observed in Fig 3-10.

It is to be noted that the Oil and Grease analyzed by n-Hexane extraction method includes organic contamination which is extracted by n-Hexane as well.

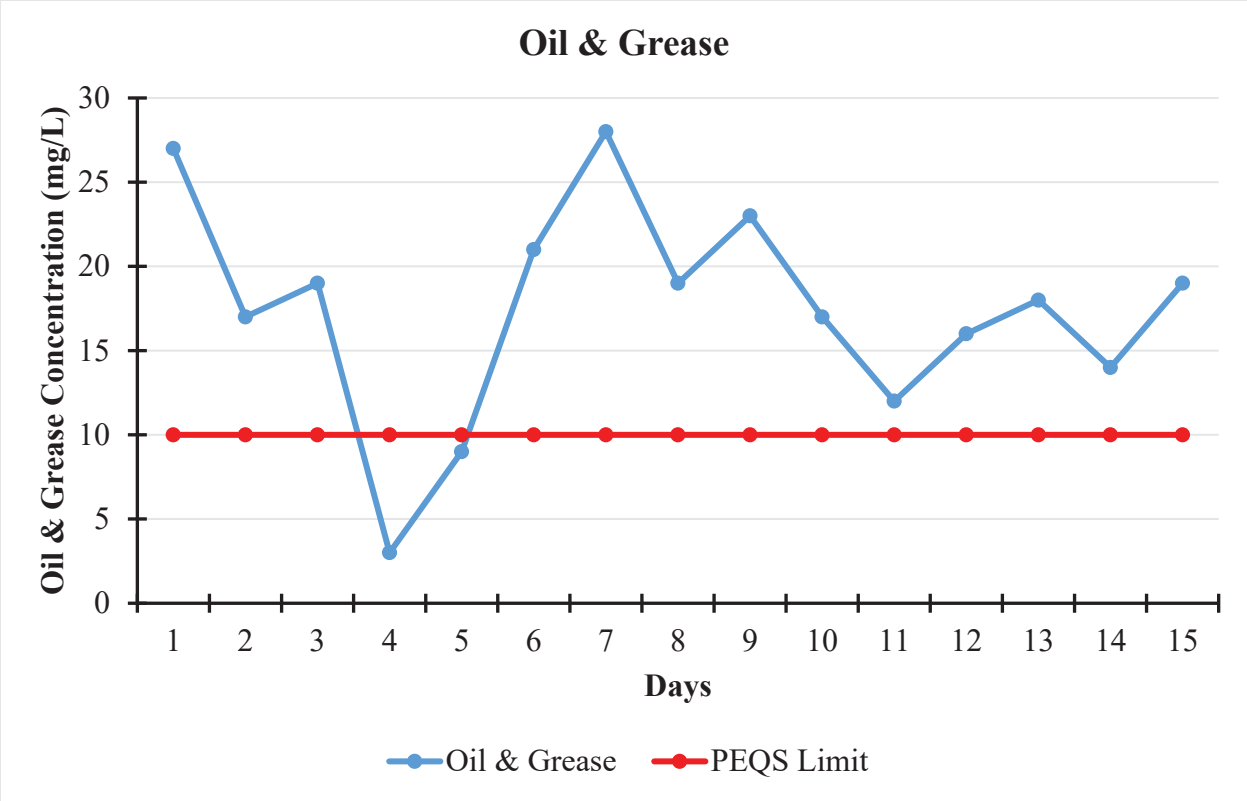


Figure 3-16 Temporal Analysis of Oil and Grease Concentration in Analyzed Samples

Impacts:

Due to contact of Oil and Grease with the skin different reactions takes place and as a result different types of skin diseases appear which may be mild variety as well as serious types. The various skin diseases may appear as itching, discoloration of skin, dermatitis, eczema, thickening of skin and xerodama etc. Due to prolonged contact to a particular area of skin, the morphology (structural pattern) of which is changed and the skin becomes ulcerated. Oil and grease tend to stick to the surface of drain and sewer pipes causing clogging that restricts the flow of sewage and may lead to sanitary sewer over flows. SSOs cause unpleasant odors and insect and rat infestation, and the sewage may make its way into water sources causing ground and surface water pollution.

Potential sources:

The largest source of wastewater is produced during oil extraction processes in most oil mills and the mill effluents such as palm oil mill effluent POME may be categorized as an oily wastewater due to its high

concentrations (4000 to 6000 mg/l) of oil and grease. Kitchen grey-water is reported as the highest contributor of oil and grease in domestic grey-water, though oil and grease is present in all grey-water streams. Some food processing industries such as slaughterhouses, dairy and meat packing industries are well known for producing effluents containing oil and grease.

Removal techniques:

There are usually various types of treatment techniques to remove O&G depending upon the type of waste water, pollutant load, available technology available and extent to which removal is required. Treatment techniques ranging from floatation in which, flotation is pouring into the water in the form of fine bubbles, the tiny air bubbles in the adhesion of oil particles suspended in the water, because the floating density of oil is less than that of water, the formation of a scum layer is separated from the water. Then comes, coagulation, in which coagulant agent is used to make large flocs which settles down and later removed. Then comes the biological treatment which involves microorganisms to breakdown waste particles into smaller ones and then can be removed by membrane techniques.

3.1.1 Settleable Solids:

Settleable solids are that portion of the suspended solids which are of sufficient size and weight to settle in a given period of time, usually one hour. There are those which will settle in an Imhoff Cone in one hour. The results are reported as milliliters of settled solids per liter of wastewater.

Results & Discussion:

The wastewater samples collected from Kattar Bund Disposal Station showed highest value of Settleable Solids as 0.9 mg/L and the lowest value was 0.4 mg/l. Temporal trends can be observed in Fig. 3-13.

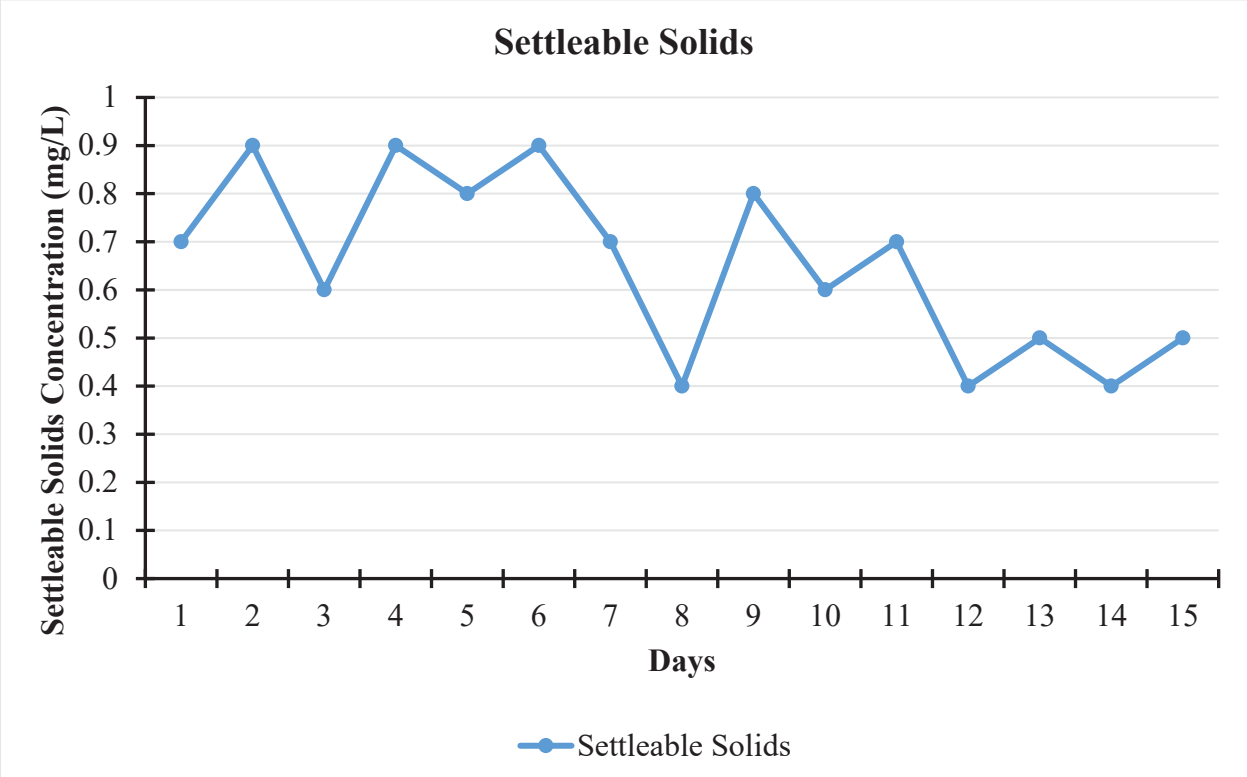


Figure 3-17 Temporal Analysis of Settleable Solids Concentration in Analyzed Samples

Sources of Settleable Solids in Water:

Primary sources for Solids or Settleable Solids in receiving waters are agricultural runoff and residential (urban) runoff, clay-rich mountain waters, leaching of soil contamination, and point source water pollution discharge from industrial or sewage treatment plants.

Health Impacts of Settleable Solids:

High concentrations of settleable solids can cause many problems for stream health and aquatic life. Settleable solids in a water body can often mean higher concentrations of bacteria, nutrients, pesticides, and metals in the water.

Removal Techniques:

Sedimentation processes are very effective in removing solids in industrial wastewater. Clarifiers, either rectangular or circular, are most commonly used in the application of sedimentation in wastewater treatment facilities.

3.1.2 Anionic Detergents:

Anionic detergent is a synthetic detergent in which a lipophilic hydrocarbon group of the molecule is an anion. A detergent molecule consists of a long hydrocarbon chain and a water-soluble negative ionic group. Definition: Anionic detergents are the sodium salts of the long-chain sulfonated alcohols or hydrocarbons.

Results & Discussions:

Anionic Detergents were not detected in the wastewater samples at Kattar Bund Disposal Station.

Sources of Anionic Detergents in Water:

The presence of the anionic detergents is due to the discharge of industrial and household waste waters. Although the anionic detergents levels are low, they raise health problems as these substances may favor the digestive absorption of some noxious or carcinogenic substances concomitantly present in the water source.

Health Impacts:

Phosphates in detergents can lead to freshwater algal blooms that releases toxins and deplete oxygen in waterways. When the algae decompose, they use up the oxygen available for aquatic life. Eye irritation is the other most frequent health hazard. As alkaline materials, detergents can cause chemical burns resulting in serious skin damage. Inhalation is another potential risk.

Removal Techniques:

Removal of Anionic Detergents from water can be done by micelle–clay composites and by Chemical Coagulation.

3.1.3 Phenolic Compounds:

Phenolic compounds are profoundly toxic to humans, animals, and aquatic life, and can also form carcinogenic chlorophenols in the presence of chlorine. The phenolic compounds consist of an aromatic hydrocarbon group bonded to a hydroxyl group (–OH). Phenols are often moderately water-soluble and smaller phenol molecules can be volatile. Phenols occur naturally in small, relatively harmless

concentrations. They are also synthesized on an industrial scale for use in disinfectants, medicinal products, and as ingredients for many polymers, resins, and rubbers for the plywood, tire, construction, automotive, and appliance industries. Small quantities are present in alcoholic beverages, pharmaceuticals, and cosmetics. They can be found in the wastewaters of these industries and others, such as oil & gas.

Results & Discussion:

Phenolic Compounds were not detected in the wastewater samples at Kattar Bund Disposal Station.

Sources of Phenolic Compounds in Water:

The existence of phenolic compounds in water can be attributed to natural and anthropogenic activities. Natural sources of phenolic compounds in water pollution include decomposition of dead plants and animals (organic matter) in the water. They are also synthesized by microorganisms and plants in the aquatic environment. Industrial, domestic, agricultural and municipal activities constitute the anthropogenic sources of water pollution with phenolic compounds.

Health Impacts:

Phenol is highly irritating to the skin, eyes, and mucous membranes in humans after acute (short-term) inhalation or dermal exposures. Phenol is considered to be quite toxic to humans via oral exposure. Anorexia, progressive weight loss, diarrhea, vertigo, salivation, a dark coloration of the urine, and blood and liver effects have been reported in chronically (long-term) exposed humans. Animal studies have reported reduced fetal body weights, growth retardation, and abnormal development in the offspring of animals exposed to phenol by the oral route.

Removal Techniques:

Phenols can be removed from water through different ways. Some of them are; Photocatalytic degradation of phenolic compounds, Ozonation, Extraction methods, Biological method and Adsorption as well.

3.1.4 Density:

A material's density is defined as its mass per unit volume. Put another way, density is the ratio between mass and volume or mass per unit volume. It is a measure of how much "stuff" an object has in a unit

volume (cubic meter or cubic centimeter). Density is essentially a measurement of how tightly matter is crammed together.

Results & Discussion:

The wastewater samples collected from Kattar Bund Disposal Station showed highest value of Density as 0.999 kg/m^3 and the lowest value was 0.998 kg/m^3. Temporal trends can be observed in Fig. 3-14.

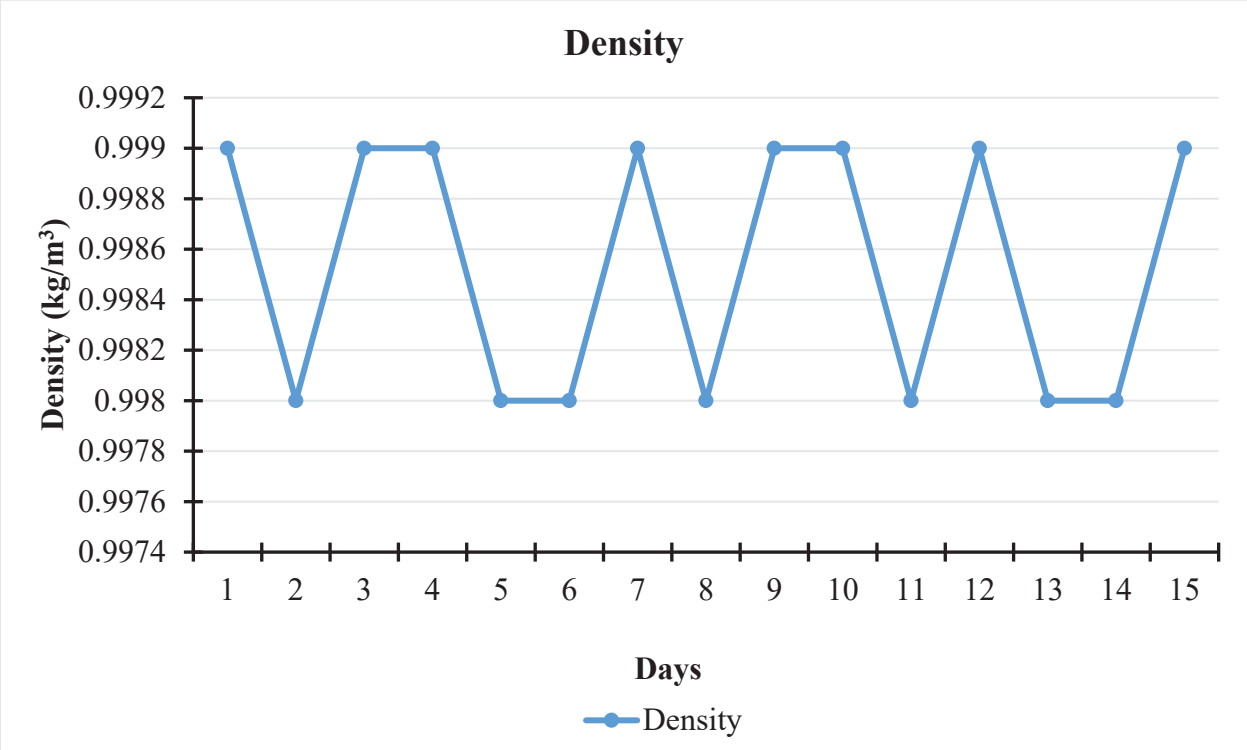


Figure 3-18 Temporal Analysis of Density in Samples

3.1.1 Chlorides:

Chlorides are salts resulting from the combination of the gas chlorine with a metal. Some common chlorides include sodium chloride (NaCl) and magnesium chloride (MgCl2). Chloride salts such as sodium chloride are often very soluble in water. Chlorine alone as Cl_2 is highly toxic and it is often used as a disinfectant. In combination with a metal such as sodium it becomes essential for life. Small amounts of chlorides are required for normal cell functions in plant and animal life.

Results:

The wastewater samples collected from Kattar Bund Disposal Station showed highest value of Chlorides as 155 mg/l and lowest value as 107 mg/l. The recorded concentration is shown in the figure below.

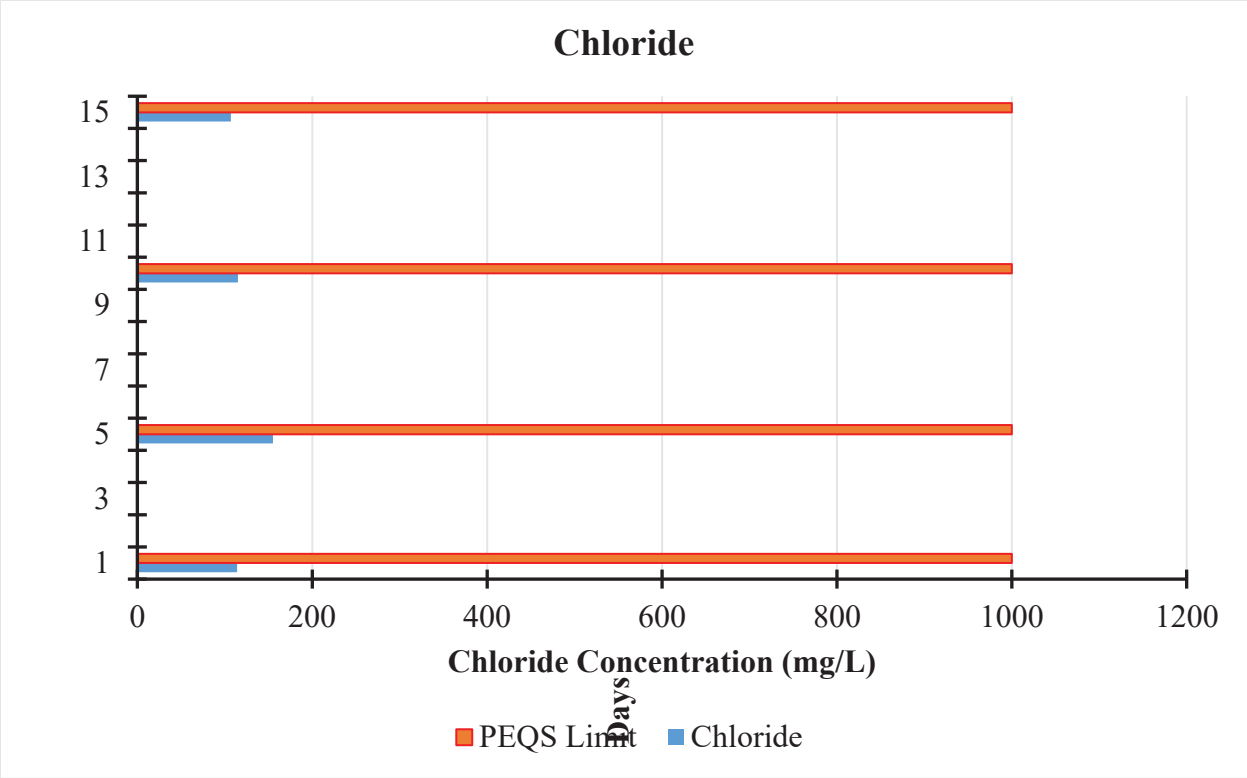


Figure 3-19 Temporal Analysis of Chloride Concentration in Analyzed Samples

Health Impacts of Chlorides:

Chloride toxicity has not been observed in humans except in the special case of impaired sodium chloride metabolism, e.g. in congestive heart failure. Healthy individuals can tolerate the intake of large quantities of chloride provided that there is a concomitant intake of fresh water. Too much chloride can cause high blood pressure, strokes, and cardiovascular disease.

Sources of Chlorides in Water:

Chloride is found in nearly all waters and is derived from a number of sources, including natural mineral deposits; seawater intrusion or airborne sea spray; agricultural or irrigation discharges; synthetic fertilizer, urban run-off due to the use of de-icing salts; or from sewage and industrial effluents.

Removal techniques:

Chloride can be removed from wastewater by reverse osmosis (RO) or deionization (DI).

3.1.1 Total Nitrogen (TKN)

Nitrogen is an intermediate product of the oxidation of ammonia to nitrate. It is widely used throughout chemical and pharmaceutical industries.

Result & Discussion:

The wastewater samples collected from Kattar Bund Disposal Station showed the highest value of Total Nitrogen (TKN) as 36.8 mg/l and lowest value was 17.4 mg/l. The graphical representation is as follows

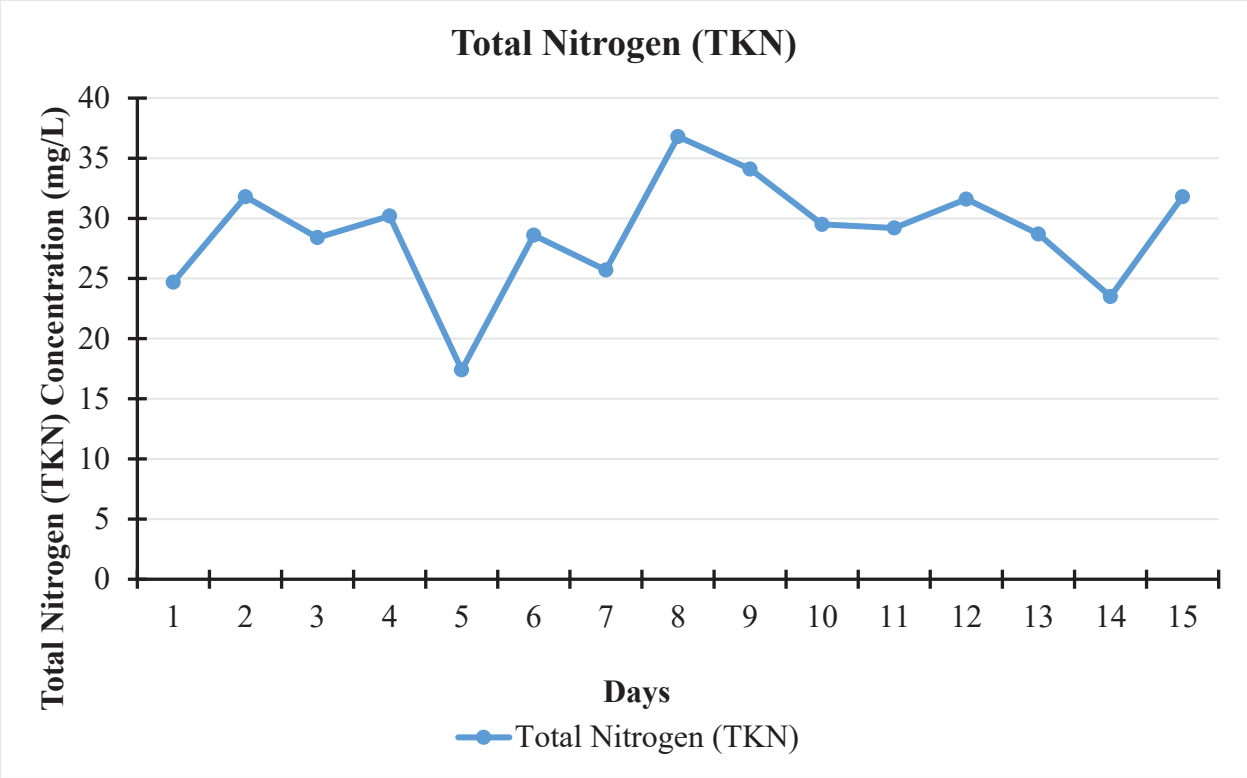


Figure 3-20 Temporal Analysis of Total Nitrogen (TKN) Concentration in Analyzed Samples

Impacts of Nitrogen:

Excess nitrogen in the atmosphere can produce pollutants such as ammonia and ozone, which can impair our ability to breathe, limit visibility and alter plant growth. When excess nitrogen comes back to earth from the atmosphere, it can harm the health of forests, soils and waterways. Too much nitrogen and phosphorus in the water causes algae to grow faster than ecosystems can handle. Significant increases in

algae harm water quality, food resources and habitats, and decrease the oxygen that fish and other aquatic life need to survive.

Sources of Nitrogen

Although nitrogen is abundant naturally in the environment, it is also introduced through sewage and fertilizers. Chemical fertilizers or animal manure is commonly applied to crops to add nutrients. It may be difficult or expensive to retain on site all nitrogen brought on to farms for feed or fertilizer and generated by animal manure. Unless specialized structures have been built on the farms, heavy rains can generate runoff containing these materials into nearby streams and lakes. Wastewater-treatment facilities that do not specifically remove nitrogen can also lead to excess levels of nitrogen in surface or groundwater.

Removal Techniques

Reverse osmosis systems can remove Nitrites/Nitrogen from water with a thin-film membrane, a process known as ion exchange.

3.1.2 Cadmium:

Cadmium is an element. Its most abundant naturally-occurring isotope is non-radioactive. It is found in nature in mineral forms and is obtained for commercial uses principally from cadmium ore, called greenockite, which is commonly found in association with zinc ore. Commercial production of cadmium ore depends on the mining of zinc. Cadmium is commercially available as an oxide, chloride, or sulfide. Cadmium metal (Cd^{2+}) refined from the ore is a silver-white, blue-tinged lustrous heavy metal solid at room temperature.

Results & Discussion:

Cadmium was not detected in the wastewater samples at Kattar Bund Disposal Station.

Sources:

Some common ways in which Cd is discharged into the atmosphere involve manufacturing processes in industries such as manufacturing of alloy and pesticides, smelting, and other anthropogenic practices such as inadequate disposal of tobacco, unused oils, pesticides, and batteries of Ni / Cd.

Cd is commonly found in effluents from a wide range of industries, such as nonferrous metals production, electroplating, and manufacturing of electronic products. Consequently, great attention is required for the

removal of Cd from wastewater before it reaches water bodies. In recent years, various methods (chemical precipitation, ion exchange, adsorption, membrane filtration and electrochemical treatment) for Cd removal from wastewater have been studied to meet the increasingly stringent environmental regulations.

Removal Techniques:

It is essential to eliminate these pollutants from wastewater before even being introduced into the natural environment. Different measures have been suggested to tackle heavy metals. There have been several approaches for removing heavy metals from wastewater, including membrane or filter removal, electrodialysis, adsorption, chemical precipitation, ultrafiltration, ion exchange method, and biological treatment.

Adsorption has been described as one of the most prevalent techniques among all published methods because of its easy process, effective and low cost. Different materials were used as adsorbents, such as carbon, fly ash, steel slag, and clay minerals.

3.1.3 Arsenic:

Arsenic contamination in the environment has been reported worldwide. However, As pollution in groundwater has been a serious health threat to the human beings. Arsenic is ubiquitous in environment and highly toxic to all forms of life. Arsenic exists mainly in four oxidation states – arsenate, arsenite, arsenic, and arsine. In general, inorganic arsenicals are more toxic than organic one. As III is usually more toxic than As V and dimethyl arsinous acid (DMAAIII) and monomethyl arsonous acid (MMAAIII) are more toxic than their parent compounds.

Results & Discussion:

The wastewater samples collected from Kattar Bund Disposal Station showed highest value 0.024 mg/l and the lowest value was 0.02 mg/l. Graphical Representation of Arsenic concentrations can be observed in Fig 3-11.

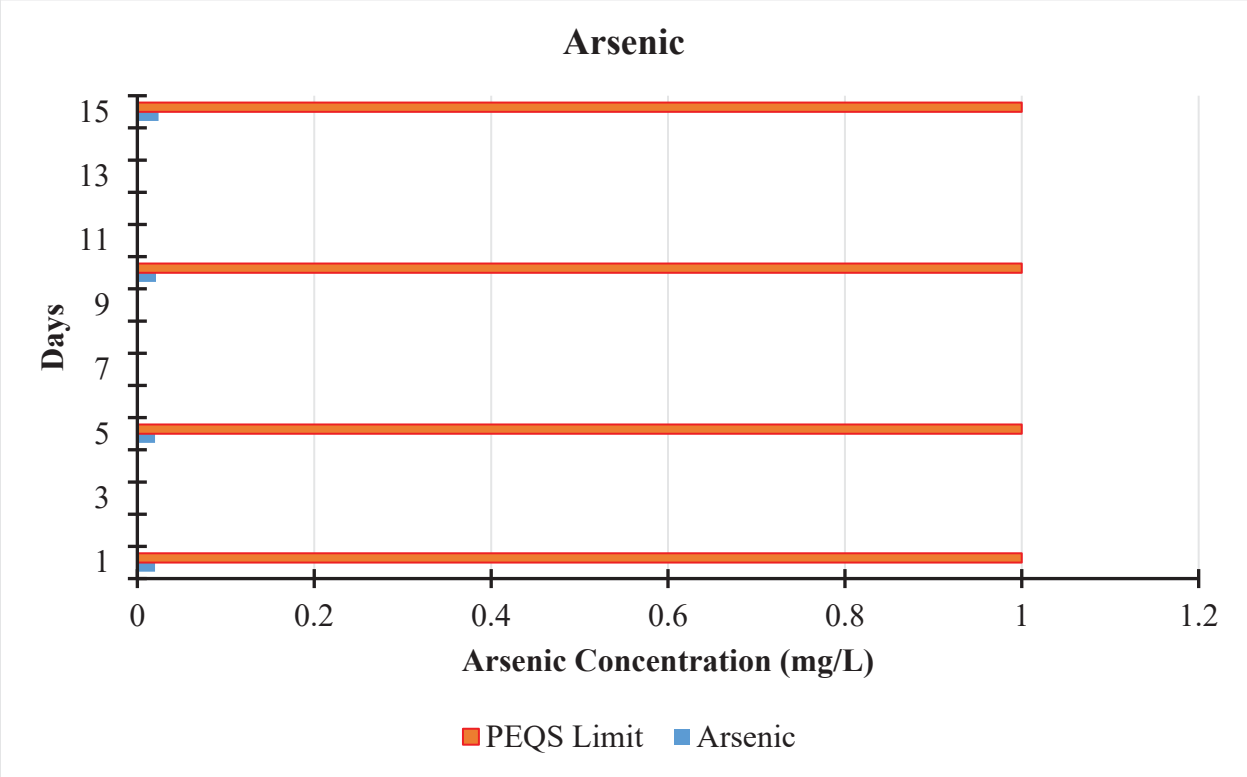


Figure 3-21 Temporal analysis of Arsenic Concentrations in Analyzed Samples

Impacts:

The various effects of As poisoning on human health are melanosis, leuco-melanosis, keratosis, hyperkeratosis, dorsum, non- petting edema, gangrene and skin cancer. Melanosis and keratosis are the most common presentations among the affected peoples. Excessive and long-term(suchas5–10years) human intake of toxic inorganic As leads to arsenicosis, which is a common term used for As related health effects including skin problems, skin cancers, internal cancers (bladder, kidney, lung), diseases of the blood vessels of the legs and feet, and possibly diabetes, high blood pressure and reproductive disorders.

Sources:

The primary source of As in the environment is the release of As from As-enriched minerals. While the anthropogenic sources include use of insecticides, herbicides and phosphate fertilizers, semi-conductor industries, mining and smelting, industrial processes, coal combustion, timber preservatives etc.

Removal Techniques:

Following are the methods through which arsenic can be removed:

- Membrane Technologies
- Oxidation
- Phytoremediation
- Electro kinetics
- Adsorption
- Coagulation-Flocculation
- Ion Exchange

3.1.4 Chromium:

Chromium is one of the major toxic elements found in tannery wastes as a consequence of chromium tanning and cannot be removed by ordinary treatment methods. Chromium occurs most frequently as both trivalent [Cr(III)] and hexavalent [Cr(VI)] states in aquatic environment. Trace amounts of Cr(III) is an essential micronutrient for sugar, protein and fat metabolism in mammals, while Cr(VI) is a primary contaminant, which is considered potential carcinogen that induces primary liver cancer

Results & Discussion:

The wastewater samples collected from Kattar Bund Disposal Station showed highest value of Cr as 0.019 mg/L and the lowest value of Cr was in day 10th sample in which Cr was not even detected. Temporal trends of chromium can be observed in Fig. 3-12.

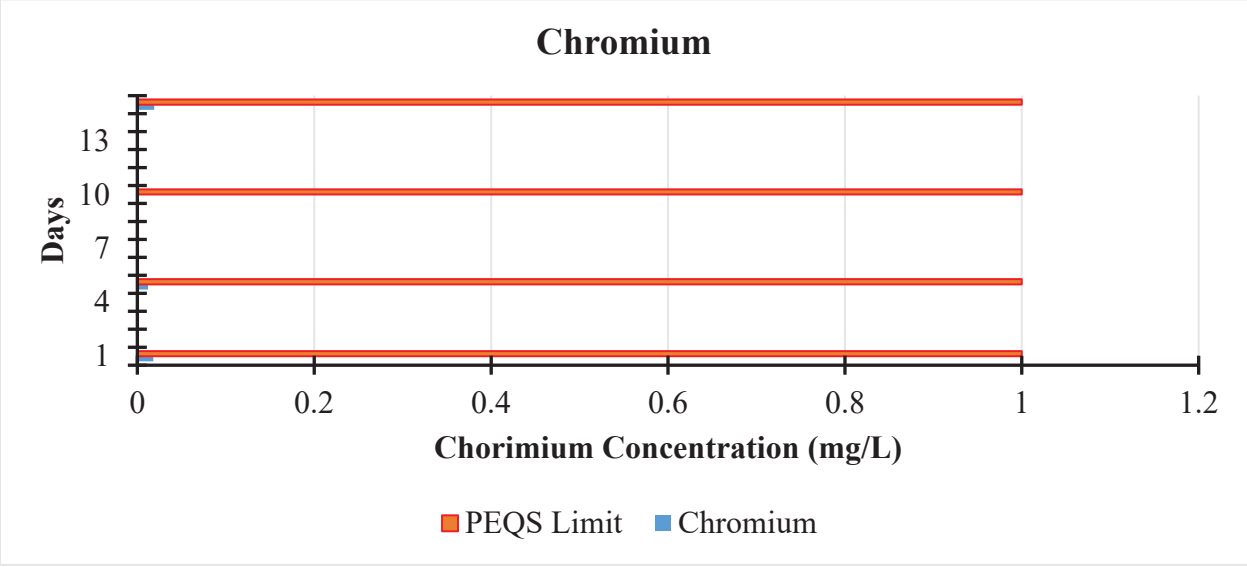


Figure 3-22 Temporal Analysis of Chromium Concentration in Analyzed Samples

Health Impacts of Chromium:

Chromium in its trivalent form can bioaccumulate in naturally occurring vegetables, fruits, meats, yeasts and grains. Various ways of food preparation and storage may alter the chromium contents of food. When food in stores in steel tanks or cans chromium concentrations may rise.

Chromium (VI) is known to cause various health effects. When it is a compound in leather products, it can cause allergic reactions, such as skin rash. After breathing it in chromium (VI) can cause nose irritations and nosebleeds.

Other health problems that are caused by chromium (VI) are:

- Skin rashes
- Upset stomachs and ulcers
- Respiratory problems
- Weakened immune systems
- Kidney and liver damage
- Alteration of genetic material
- Lung cancer
- Death

Sources of Chromium in Water:

Chromium isn't present easily in nature. The primary element containing chromium is the chromite. Also, fragments of chromium compounds are present in the soil. Several factories discharge the product and its compounds into the surface water. It is used in metal surface refineries and alloys. Stainless steel consists of chromium ranging from 12-15 per cent. Chromium metal is applied all over the world in amounts of around 20,000 tons per year. Chromium is such a major toxic heavy metal for both humans and the environment and often found in industrial wastewater, which is introduced into water streams from mining, tanning, electroplating, wood preservatives, paints, textile dyeing, and plants producing industrial inorganic chemicals and pigments

Removal Techniques:

Several treatment procedures such as adsorption, chemical precipitation, electrocoagulation, ion exchange, electrodialysis, and membrane separation are available for removal of Cr from wastewater. Among these, chemical precipitation is the common way for the removal. Membrane filtration, physical adsoprtion as well as Electrochemical Treatment are also applied as well.

3.1.5 Mercury:

Mercury is a naturally-occurring chemical element found in rock in the earth's crust, including in deposits of coal. On the periodic table, it has the symbol "Hg" and its atomic number is 80. Mercury has fascinated people for millennia, as a heavy liquid metal. However, because of its toxicity, many uses of mercury are being phased out or are under review. It is now mainly used in the chemical industry as catalysts. It is also used in some electrical switches and rectifiers.

Results & Discussion:

Mercury was not detected in the wastewater samples at Kattar Bund Disposal Station.

Sources of Mercury in Water:

Mercury enters wastewater from a variety of sources including dental practice wastes, which can contribute up to 50 % crude Hg concentrations, fertilizers, landfill leachate, paints, domestic waste inputs, groundwater infiltration, stormwater drainage contributions and historical sources of Hg.

Health Impacts of Mercury:

High doses of mercury can be fatal to humans, but even relatively low doses of mercury containing compounds can have serious adverse impacts on the developing nervous system, and have recently been linked with possible harmful effects on the cardiovascular, immune and reproductive systems5. Mercury and its compounds affect the central nervous system, kidneys, and liver and can disturb immune processes; cause tremors, impaired vision and hearing, paralysis, insomnia and emotional instability. During pregnancy, mercury compounds cross the placental barrier and can interfere with the development of the foetus, and cause attention deficit and developmental delays during childhood.

Removal Techniques:

Removing mercury from the water can be achieved using four processes: Coagulation/Filtration, Granular Activated Carbon, Lime Softening, and Reverse Osmosis.

Coagulation/filtration is a common treatment which uses $AlSO_4$ that reacts with the mercury to form a solid which can precipitate out of the water. The sludge then must be disposed of in a hazardous waste landfill. This process is beneficial because it costs very little and is reliable.

Granular activated carbon uses porous carbon media. This media is a very heavy charcoal material. As the water passes through, the dissolved contaminants are absorbed and held on the solid surface. This process has its limitations because the effectiveness depends on the concentration of mercury in the water.

Lime Softening uses excess Ca(OH) to raise the pH level and then the heavy metal precipitates out as Hg(OH). A benefit of this method is lower costs and proven reliability.

In reverse osmosis, water is pushed through a semi permeable membrane. A Common membrane material is a polyamide film. This produces high quality water, but is fairly expensive.

3.1.6 Selenium:

Selenium, a ubiquitous non-metal in nature, is potentially toxic to natural ecosystems due to its bioaccumulation potential. Due to increased monitoring and enforcement of selenium regulations, the need to be able to measure and treat selenium efficiently has taken on an increased importance. The principal aqueous forms of inorganic selenium are selenite (Se (IV)) and selenate (Se (VI)). Selenate, due to its high mobility and lack of affinity to conventional adsorbents, is typically much more difficult to treat and remove.

Results & Discussion:

Selenium was not detected in the wastewater samples at Kattar Bund Disposal Station.

Sources of Selenium in Water:

The contamination of the environment by selenium compounds can originate from various sources that include agricultural drainage water, mine drainage, residues from fossil fuel, thermoelectric power plants, oil refineries and metal ores.

Health Impacts of Selenium:

Selenium can cause stomach discomfort, headache, and rash. High doses can cause hair loss, fatigue, nausea, vomiting, and weight loss. Extremely high doses can lead to organ failure and death.

Removal Techniques:

Several technologies to remove selenium from wastewaters have been applied, and newer technologies have been developed in the past couple of years, or they are currently being developed. These technologies

include, but are not limited to, adsorption and biosorption, membrane separation technologies, coagulation/flocculation, oxidation/reduction methods and phytoremediation

3.1.7 Barium:

Barium is a silvery-white metal that can be found in the environment, where it exists naturally. It occurs combined with other chemicals, such as sulfur, carbon or oxygen. It is very light and its density is half that of iron. Barium oxidizes in air, reacts vigorously with water to form the hydroxide, liberating hydrogen. Barium reacts with almost all the non-metals, forming often poisoning compounds.

Results & Discussion:

Barium was not detected in the wastewater samples at Kattar Bund Disposal Station.

Health Impacts of Barium:

The uptake of very large amounts of barium that are water-soluble may cause paralyses and, in some cases, even death. Small amounts of water-soluble barium may cause a person to experience breathing difficulties, increased blood pressures, heart rhythm changes, stomach irritation, muscle weakness, changes in nerve reflexes, swelling of brains and liver, kidney and heart damage.

Sources of Barium in Water:

Barium can also enter the water bodies through industrial effluent discharge. Barium is a metal that occurs naturally in certain types of igneous and sedimentary rocks. Barium can enter the groundwater and well water when rocks that contain barium break down and dissolve.

Removal Techniques:

The treatment systems that can be used to remove barium from water ion exchange, reverse osmosis, lime softening, and electrodialysis**.**

3.1.8 Copper:

Copper is found as native metal and in minerals cuprite, malachite, azurite, chalcopyrite and bornite. It is also often a by-product of silver production. Sulphides, oxides and carbonates are the most important ores. Commonly encountered compounds are copper (II) salts, which often impart blue or green colors to such minerals as azurite, malachite, and turquoise, and have been used widely and historically as pigments.

Results & Discussion:

Copper was not detected in the wastewater samples at Kattar Bund Disposal Station.

Health Impacts of Copper:

Long-term exposure to copper can cause irritation of the nose, mouth and eyes and it causes headaches, stomachaches, dizziness, vomiting and diarrhea. Intentionally high uptakes of copper may cause liver and kidney damage and even death. Whether copper is carcinogenic has not been determined yet.

There are scientific articles that indicate a link between long-term exposure to high concentrations of copper and a decline in intelligence with young adolescents. Whether this should be of concern is a topic for further investigation.

Copper can interrupt the activity in soil, as it negatively influences the activity of microorganisms and earthworms. The decomposition of organic matter may seriously slow down because of this. When the soils of farmland are polluted with copper, animals will absorb concentrations that are damaging to their health. Mainly sheep suffer a great deal from copper poisoning, because the effects of copper are manifesting at fairly low concentrations.

Sources of Copper in Water:

The major sources of contamination of copper in wastewater are electroplating, paints and dyes, petroleum refining, fertilizers, mining and metallurgy, explosives, pesticides and iron and steel industries.

Copper can be released into the environment by both natural sources and human activities. Examples of natural sources are wind-blown dust, decaying vegetation, forest fires and sea spray. A few examples of human activities that contribute to copper release have already been named. Other examples are mining, metal production, wood production and phosphate fertilizer production.

Removal Techniques:

Conventional treatment methods such as oxidation processes, coagulation / flocculation, chemical precipitates, ion exchange, reverse osmosis, activated charcoal are used to remove toxic heavy metals from wastewater for many years. The current trend to be used is to find applications for various commercial agro-wastes and biological materials to remediate wastewater using the adsorption process.

3.1.9 Manganese

Manganese (Mn), chemical element, one of the silvery white, hard, brittle metals of Group 7 (VIIb) of the periodic table. It is often found in minerals in combination with iron. Manganese is a transition metal with a multifaceted array of industrial alloy uses, particularly in stainless steels. Manganese is second only to iron among the transition elements in its abundance in Earth's crust; it is roughly similar to iron in its physical and chemical properties but is harder and more brittle.

Results:

Manganese was not detected in the wastewater samples at Kattar Bund Disposal Station.

Health Impacts of Manganese:

Although manganese is an essential nutrient at low doses, elevated levels are a health concern. The likelihood of health impacts from manganese are dependent on factors such as the route of exposure, the chemical form, the age at exposure, and an individual's nutritional status. Certain groups that are more sensitive to manganese include infants, the elderly, and those with liver disease. Manganese effects occur mainly in the respiratory tract and in the brains. Symptoms of manganese poisoning are hallucinations, forgetfulness and nerve damage. Manganese can also cause Parkinson, lung embolism and bronchitis. When men are exposed to manganese for a longer period of time they may become impotent. A syndrome that is caused by manganese has symptoms such as schizophrenia, dullness, weak muscles, headaches and insomnia.

Sources of Manganese in Water:

Manganese may be present in water in the environment from natural sources such as rock and soil weathering or as a result of human activities such as mining, industrial discharges and landfill leaching. In general, manganese is more prevalent and found at higher concentrations in groundwater than surface water.

Removal techniques:

There are various technologies that have been used to treat manganese containing wastewater such as chemical precipitation, coagulation, flotation, ion-exchange, oxidation/filtration, electrochemical treatment, adsorption, and membrane filtration.

3.1.10 Silver:

Most silver is produced as a byproduct of copper, gold, lead, and zinc refining. Silver metal is used in electrical contacts and conductors, in mirrors, and in catalysis of chemical reactions. Its compounds are used in photographic film. Dilute silver nitrate solutions and other silver compounds are used as disinfectants and microbiocides.

Results & Discussion:

Silver was not detected in the wastewater samples at Kattar Bund Disposal Station.

Health Impacts of Silver:

Acute symptoms of overexposure to silver nitrate are decreased blood pressure, diarrhea, stomach irritation and decreased respiration. Chronic symptoms from prolonged intake of low doses of silver salts are fatty degeneration of the liver and kidneys and changes in blood cells. Long-term inhalation or ingestion of soluble silver compounds or colloidal silver may cause argyria and/or argyrosis. Silver in any form is not thought to be toxic to the immune, cardiovascular, nervous, or reproductive systems and is not considered to be carcinogenic.

The most common health effects associated with prolonged exposure to silver are the development of a characteristic, irreversible pigmentation of the skin (argyria) and/or the eyes (argyrosis). Argyria and argyrosis have been reported during placement of silver-containing solid materials into the skin or body, inhalation in occupational settings; and from the use of colloidal silver and silver-containing medicinal, smoking deterrents, dental materials, and silver solder.

Sources of Silver in Water:

Silver occurs uncombined, and in ores such as argentite and chlorargyrite (horn silver). However, it is mostly extracted from lead-zinc, copper, gold and copper-nickel ores as a by-product of mining for these metals. The metal is recovered either from the ore, or during the electrolytic refining of copper. The sources with the largest contribution of silver are estimated to be textiles (19 %), urine and faeces (from for example amalgam fillings and food) (15 %) as well as cleaning products (7 %).

3.1.11 Boron:

Boron is a non-metallic element and the only non-metal of the group 13 of the periodic table the elements. Boron is electron-deficient, possessing a vacant p-orbital. It has several forms, the most common of which is amorphous boron, a dark powder, unreactive to oxygen, water, acids and alkalis. It reacts with metals to form borides. At standard temperatures boron is a poor electrical conductor but is a good conductor at high temperatures.

Results & Discussion:

Boron was not detected in the wastewater samples at Kattar Bund Disposal Station.

Health impacts of boron:

Boron can infect the stomach, liver, kidneys and brains and can eventually lead to death. When exposure to small amounts of boron takes place irritation of the nose, throat or eyes may occur. It takes 5 g of boric acid to make a person ill and 20 grams or more to put its life in danger. In animals, acute excessive exposure has caused lethargy, rapid respiration, eye inflammation, swelling of the paws, shedding of the skin on the paws and tails, excitation during handling, and changes in the cells of the forestomach.

Sources of Boron in Water:

Contamination of water can come directly from industrial wastewater and municipal sewage, as well as indirectly from air deposition and soil runoff. Natural weathering processes, burning of coal in power plants, chemical plants, and manufacturing facilities releases boron into the air; and fertilizers, herbicides, and industrial wastes are among the sources of soil contamination Boron is not present in nature in elemental form. It is found combined in borax, boric acid, kernite, ulexite, colemanite and borates. Naturally occurring boron is present in groundwater primarily as a result of leaching from rocks and soils containing borates and borosilicates.

Removal Techniques:

Boron removal from an aqueous solution can be achieved by various techniques, e.g. chemical precipitation, adsorption, solvent extraction, reverse osmosis, electro-dialysis and membrane filtration.

3.1.12 Microbiological Contaminants:

Water is susceptible to contamination with microorganisms and organic matter among other pollutants regardless of the source. Significantly, microbial contaminants such as coliforms, E.coli, compromise the safety of the water. E. coli is a type of fecal coliform bacteria commonly found in the intestines of animals and humans. E. coli is short for Escherichia coli. Fecal coliforms are bacteria that are associated with human or animal waste. Presence of fecal coliforms in water may not be directly harmful, and does not necessarily indicate the presence of feces, however it does indicate an increased likelihood of harmful pathogens in the water.

Results & Discussion:

Microbial concentration was present in all samples with results upto 10^6 which indicated high concentration of Coliform, E Coli which are indicatory organisms for mixing of faecal matter in wastewater.

Health Impacts of Microbial Contamination:

The greatest risk from microbes in water is associated with consumption of drinking-water that is contaminated with human and animal excreta. Some of the pathogens that are known to be transmitted through contaminated drinking-water lead to severe and sometimes life-threatening disease. Examples include typhoid, cholera, diarrhea, giardiasis, dysentery, and gastroenteritis, hepatitis A, ear infection, abdominal cramps.

Sources of Microbial Contamination in Water:

Water bodies are vulnerable to microbial pathogen contamination from a variety of sources of human and animal fecal wastes and from the introduction and proliferation of non-fecal pathogenic microbes. Water sewage treatment plants, combined sewage overflow (CSO), non-collective sewage systems), domesticated animals (manure spreading, pit stock overflow), or wildlife are also the sources of microbial contamination.

Removal Techniques:

More typically, water treatment is required to remove or destroy pathogenic microorganisms. In many cases (e.g. poor quality surface water), multiple treatment stages are required, including, for example, coagulation, flocculation, sedimentation, filtration and disinfection.

Disinfection includes Chlorination, ozone, ultraviolet light, and chloramines are primary methods for disinfection. However, potassium permanganate, photo catalytic disinfection, nanofiltration, and chlorine dioxide can also be used.

3.1.13 Zinc

Zinc is a lustrous bluish-white metal. It is found in group IIb of the periodic table. It is brittle and crystalline at ordinary temperatures, but it becomes ductile and malleable when heated between 110°C and 150°C. It is a fairly reactive metal that will combine with oxygen and other non-metals, and will react with dilute acids to release hydrogen.

Results & Discussion:

Zinc was not detected in the wastewater samples at Kattar Bund Disposal Station.

Impacts on Human Health:

Zinc is a trace element that is essential for human health. When people absorb too little zinc they can experience a loss of appetite, decreased sense of taste and smell, slow wound healing and skin sores. Zinc-shortages can even cause birth defects. Although humans can handle proportionally large concentrations of zinc, too much zinc can still cause eminent health problems, such as stomach cramps, skin irritations, vomiting, nausea and anemia. Very high levels of zinc can damage the pancreas and disturb the protein metabolism, and cause arteriosclerosis. Extensive exposure to zinc chloride can cause respiratory disorders

Potential Sources:

Zinc occurs naturally in air, water and soil, but zinc concentrations are rising unnaturally, due to addition of zinc through human activities. Most zinc is added during industrial activities, such as mining, coal and waste combustion and steel processing. Some soils are heavily contaminated with zinc, and these are to be found in areas where zinc has to be mined or refined, or were sewage sludge from industrial areas has been used as fertilizer

Removal Techniques:

Various process applies to removal of zinc metals in industries like

- Precipitation

- Ion exchange
- Reverse osmosis
- Electro dialysis
- Electrochemical treatment
- Membrane separation
- Ultra - Nano filtration

3.1.14 Lead

Lead is a heavy, soft, malleable, bluish grey metal. Lead is of particular interest, because of its toxicity and its widespread presence in the environment. Lead is a well-known highly toxic metal considered as a priority pollutant. It is an industrial pollutant, which enters the ecosystem through soil, air and water. Lead is a systemic poison causing anemia, kidney malfunction, tissue damage of brain and even death in extreme poisoning situation. It is very toxic in nature.

Results & Discussion:

The wastewater samples collected from Kattar Bund Disposal Station showed the highest value of Lead as 0.09 mg/l and lowest value as 0.05 mg/l. Graphical representation is as follows:

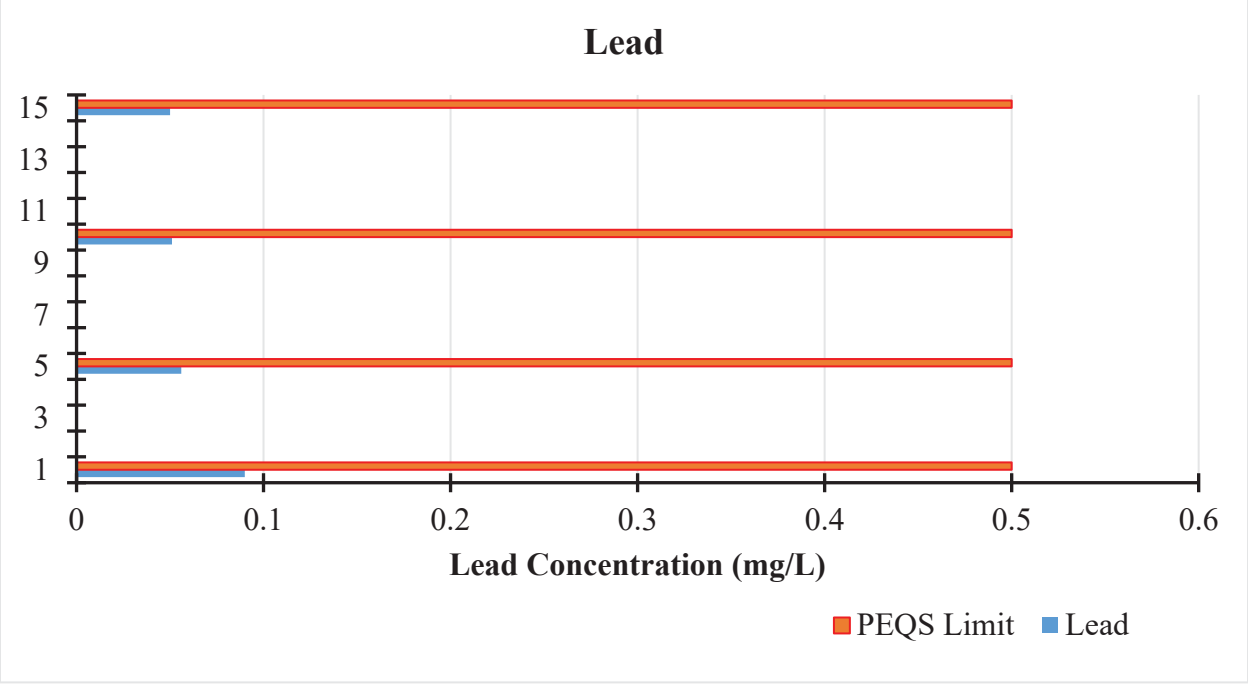


Figure 3-23 Temporal Analysis of Pb Concentration in Analyzed Disposal Station

Impacts on Human Health:

Lead is a systemic poison causing anemia, kidney malfunction, tissue damage of brain and even death in extreme poisoning situation. It is very toxic in nature. The presence of high levels of lead in the environment may cause long-term health risks to humans and ecosystems. According to the World Health Organization (WHO), the maximum permissible limit (MPL) of lead in drinking water is 0.05 mg/L. The permissible limit (mg/L) for Pb (II) in wastewater, given by Environmental Protection Agency (EPA), is 0.05 mg/L

Potential Sources:

Lead pollution, spreading over earth and ground water, comes from natural sources and industrial effluents. Processing industries, such as acid battery manufacturing, metal plating and finishing, ammunition, tetraethyl lead manufacturing, ceramic and glass industries and environmental clean-up services treat and disposal of lead contaminated water are the major sources of lead pollution

Removal Techniques:

To mitigate the lead ions pollution, many processes like

- Adsorption
- Precipitation
- Coagulation
- Ion exchange
- Cementation
- Electro-dialysis
- Electro-winning
- Electro-coagulation
- Reverse osmosis

3.1.15 Nickel

Ni is the 24th most abundant elements forming about 0.008% of the earth's crust, where it occurs in igneous rocks as a free metal or together with iron. Nickel is a heavy metal with broad industrial applications; more than half of global nickel production is used in stainless steel while electroplating accounts for 11% of total nickel processing. The wastewater generated from nickel processing still contains a substantial amount of nickel that should be removed before the final discharge to the environment.

Results & Discussion:

Nickel was not detected in the wastewater samples at Kattar Bund Disposal Station.

Impacts on Human Health:

Exposure to nickel may cause health problems including skin irritation, asthma, conjunctivitis, gastrointestinal distress, blood disorders, muscular pain, liver problems and neurological effects, such as giddiness, headache or temporary loss of sight. High exposure of nickel e.g. in workplace has been linked to cancer.

Sources of Nickel:

Although it is not harmful in low quantities, nickel is toxic to humans and animals when in high concentrations. Nickel can be present in wastewater as a result of human activities. Sources of nickel in wastewater include ship cruise effluents, battery production, industrial applications and the chemical industry

Removal Techniques:

Nickel ion can be removed from nickel-containing wastewater by several techniques:

- Chemical precipitation
- Ion floatation
- Ion exchange
- Adsorption
- Membrane filtration
- Electrochemical treatments

3.1.16 Iron

Iron (Fe) is a metal belong to first transition series with standard atomic weight 55.845. Iron reacts readily with oxygen and water to give brown to black hydrated iron oxides, commonly known as rust. Iron is most widely used of all the metal.

Result

The wastewater samples collected from Kattar Bund Disposal Station showed the highest value of Fe as1.46 mg/l and lowest value was0.67 mg/l. The graphical representation is as follows

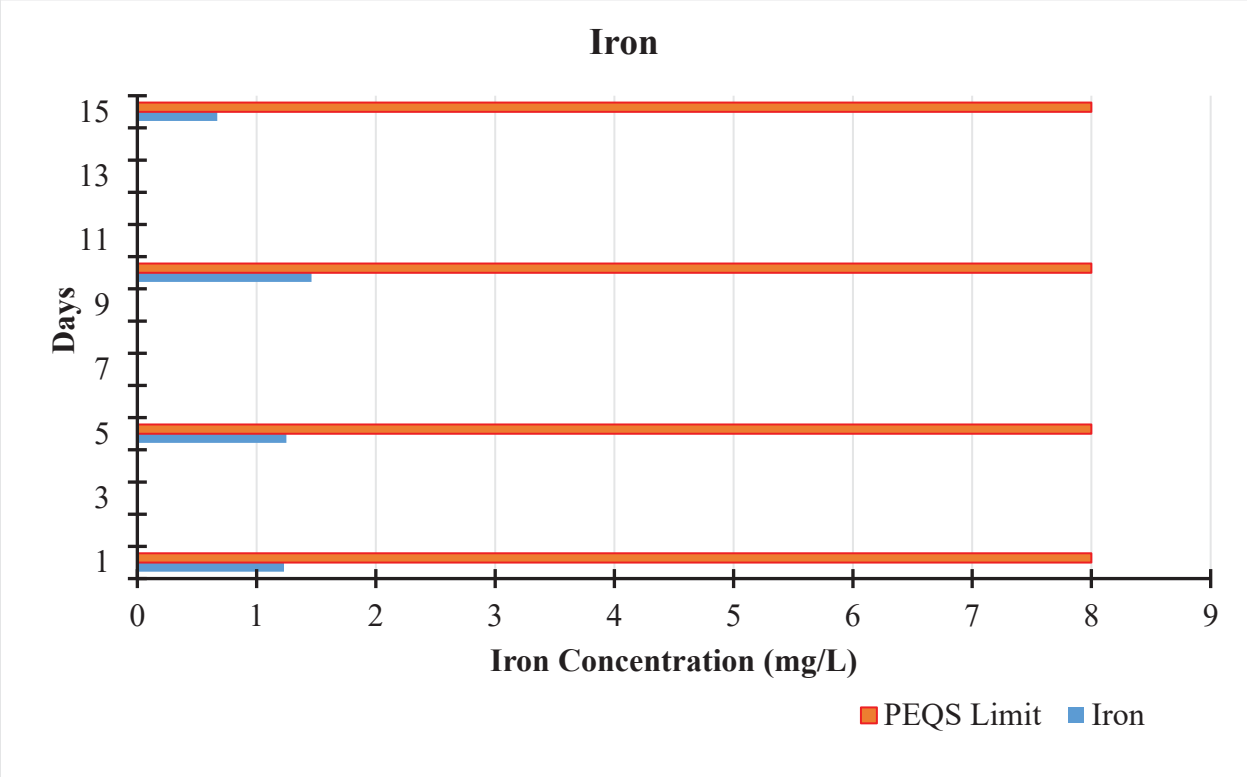


Figure 3-24 Temporal Analysis of Fe Concentration in Analyzed Samples

Potential Sources:

Sources of iron include wastewater treatment plants, waste water from laborites and volcanic ash, Dust, runoff of rain from the rocks and sediments, storm water, and industrial discharges.

Impacts of Iron:

Iron is likely safe for most people when it is taken in appropriate amount. But having lot of side effect such as hemochromatosis, stomach upset and pain, constipation or diarrhea, nausea, and vomiting. When effluent from wastewater treatment plants or runoff from rocks and soil sources, septic tanks or storm water enter the aquatic environment, they raise the iron level in water body. High levels of iron in water can have several noticeable effects like clouding and sediment, discoloration, staining, pipe buildup, dry and itchy skin. It is noticed that the presence of iron in water can promote the growth of bacteria like E. coli. The presence of the small ferric iron particles causes irritation of the gill tissues leading to gill damage and secondary bacterial and fungal infections. Iron acts like a catalyst in water and does promote the dissociation of oxygen molecules into free radicals.

Removal Techniques:

The ion exchange process works equally well for removing ferrous iron. Single-tank softener systems are also effective in removing the iron from the water. The Kinetico® Mach Super Kit cartridge filter can work in removing ferric iron from the water. To remove ultra-fine iron requires an Ultra-filtration system. Many other methods are also used to remove the iron from water like Shock Chlorination, Chemical Oxidization, Catalytic Filtration, Phosphate Treatment, Oxidizing filters, Water Softeners, Iron Removal Filter.

3.1.17 Total Toxic Metals

Total Toxic Heavy metals are found naturally in the earth. They become concentrated as a result of human caused activities and can enter plant and animal (including human) tissues via inhalation, diet, and manual handling.

Results & Discussion:

The wastewater samples collected from Kattar Bund Disposal Station showed the highest value as 0.042 mg/l and lowest value as 0.02 mg/l. Overall graphical representation is shown below in figure 3-24:

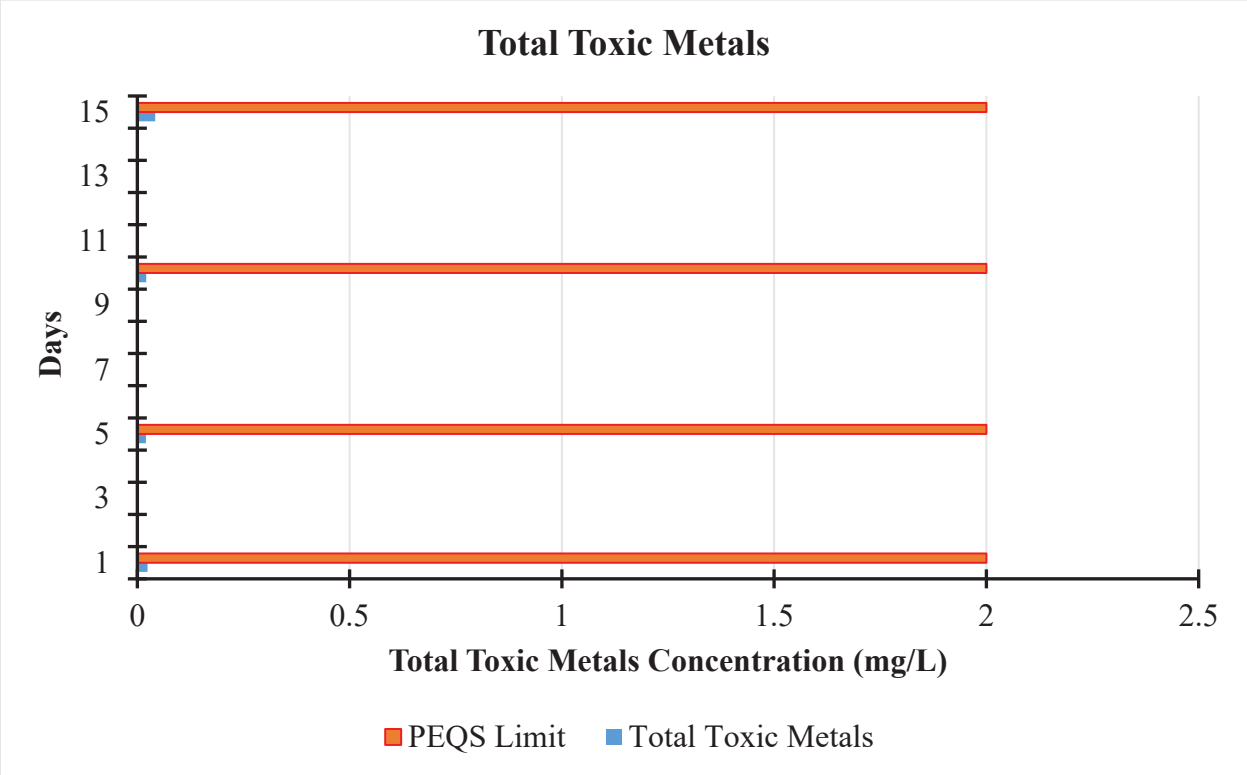


Figure 3-25 Temporal Analysis of Total Toxic Metals Concentration in Analyzed Samples

Impacts:

Heavy metals do bio accumulate in living organisms and the human body through various processes causing adverse effects. In the human body, these heavy metals are transported and compartmentalized into body cells and tissues binding to proteins, nucleic acids destroying these macromolecules and disrupting their cellular functions. It can affect the central nervous function leading to mental disorder, damage the blood constituents and may damage the lungs, liver, kidneys and other vital organs promoting several disease conditions

Potential Sources:

Although there are many sources of water contamination, industrialization and urbanization are two of the culprits for the increased level of heavy metal water contamination. Heavy metals are transported by runoff from industries, municipalities and urban areas

Remediation Technique:

Several methods have been used to remove heavy metals from contaminated water.

- Chemical precipitation,
- Ion exchange,
- Adsorption,
- Membrane filtration
- Reverse osmosis
- Solvent extraction,
- Electrochemical treatment.

3.1.18 Pesticides, Total Chlorine:

Pesticides, Selenium & Total Chlorine values were observed to be below Method Detection limit.

Conclusion

The composite sampling and analysis of wastewater at Kattar Bund Disposal station carried out during consecutive 15 days showed that it had significant organic pollution load. This was mainly observed due to the high concentrations of chemical and biological oxygen demand which correlated with high concentration of volatile suspended solids along with oil and grease / n Hexane extractable organic contaminants.

The decrease in organic pollution load was considered by determining concentrations of COD, BOD and suspended solids after primary settlement and it was observed that with the settling of large / heavy particles the decrease in COD & BOD was upto 50%. Hence proper settling and sedimentation techniques can be utilized in designing of wastewater treatment plant at the subject drain and play a major role in bringing the wastewater contaminants upto limits set in Punjab Environmental Quality Standards.

High concentrations of Total Nitrogen and phosphorous in the wastewater can be a cause of eutrophication but also act as valuable nutrients if biological treatment plant is utilized to treat the wastewater.

Due to mixing of grey water from nearby communities as well as housing societies, high concentration of indicatory microorganisms were observed i.e. Total & Faecal coliforms and E Coli. Mixing of this water with drinking sources or contamination of ground water can lead to spreading of infections and bacterial illnesses.

Annexure I

Original Reports of Wastewater Analysis

TEST REPORT

Report Number: PI-00190-22
Receiving Date: 08 Feb, 2022
Issue Date: 14 Feb, 2022

Customer	:	Jers Consultancy Pvt Ltd
Address	:	24-Civic Centre, Quaid-e-Azam Town, Township, Lahore (Pakistan)
Contact person	:	Mr. Mudasar Arbi
Contact details	:	0301 4283114
Email	:	/

Sample Information

Sample Description:	:	Composite Waste Water
Vendor Reference:	:	Day 01
Sample Collection Date:	:	(07-08) Feb, 2022
Sampling Method:	:	Composite Sampling
Sampling Duration:	:	24 Hours (12 pm, 07th Feb – 11 am, 8th Feb) 2022
Sample Collected by:	:	Numan Anwar & Hamid Sohail

For and on behalf of
Tti Testing Laboratories

Hamad Ahmad
Head Food and Water Lab

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Tel: (92-42) 111 786 001, Fax: (92-42) 3515 4555, URL: www.ttilabs.net

TEST REPORT

REPORT NUMBER: PI-00190-22

Test Results:

Composite Waste Water Analysis: Day 01

Sr.#	Parameter	Method	Unit	MDL	PEQS Limit	Results
1. A	Temperature @ lab	APHA 2550 B	°C	0.1	-	21
1. B	Temperature @Sampling (Average)	APHA 2550 B	°C	0.1	-	17
2. A	pH Value @ 25 °C	APHA 4500 H^+B	pH Unit	0.01	6-9	7.39
2. B	pH Value @ Sampling (Average)	APHA 4500 H^+B	pH Unit	0.01	6-9	7
3.	Density	ASTM-D4052-2018	kg/m^3	0.1	N.S	0.999
4.	Total Dissolved Solids (TDS)	APHA 2540 C	mg/L	5.0	3500	943
5.	Sulphate	APHA 4500-SO_4^{2-}E	mg/L	5.0	600	95
6.	Fluoride	APHA 4500 D	mg/L	0.02	10	0.3
7.	Total Phosphorous	APHA-4500P	mg/L	1.0	N.S	11.9
8.	Total Nitrogen (TKN)	APHA 4500 B	mg/L	0.01	N.S	24.7
9.	Total Chlorine	APHA 4500-Cl G	mg/L	0.01	1.0	N.D
10.	Cyanide	APHA 4500 CN E	mg/L	0.002	1.0	N.D
11.	Chloride	APHA 4500 Cl B	mg/L	1.0	1000	114
12.	Sulfide	APHA 4500-S^2 D	mg/L	0.002	1.0	1.26
13.	Oil & Grease	APHA 5520 B	mg/L	1.0	10	27
14.	Chemical Oxygen Demand (COD)	APHA 5220 D	mg/L	5.0	150	492
15.	Chemical Oxygen Demand (Primary Settled Sample)	APHA 5220 D	mg/L	5.0	150	263
16.	Biochemical Oxygen Demand (BOD_5)	APHA 5210 B	mg/L	10.0	80	212
17.	Biochemical Oxygen Demand (Primary Settled Sample)	APHA 5210 B	mg/L	10.0	80	113
18.	Phenolic Compounds	APHA 5530 C	mg/L	0.1	0.1	N.D
19.	Total suspended Solids (TSS)	APHA 2540 D	mg/L	1.0	200	160
20.	Total suspended Solids (Primary Settled Sample)	APHA 2540 D	mg/L	1.0	200	48

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Sr.#	Parameter	Method	Unit	MDL	PEQS Limit	Results
21.	Volatile Suspended Solids (VSS)	APHA 2540 E	mg/L	1.0	N.S	53
22.	Total Settle able Solids	APHA 2540 F	mg/L	1.0	N.S	0.7
23.	Arsenic (As)	APHA 3111 / 3120 B	mg/L	0.01	1.0	0.02
24.	Barium (Ba)	APHA 3111 / 3120 B	mg/L	0.1	1.5	N.D
25.	Boron (B)	APHA 3111 / 3120 B	mg/L	0.1	6.0	N.D
26.	Cadmium (Cd)	APHA 3111 / 3120 B	mg/L	0.003	0.1	N.D
27.	Chromium (Cr)	APHA 3111 / 3120 B	mg/L	0.01	1.0	0.018
28.	Copper (Cu)	APHA 3111 / 3120 B	mg/L	0.5	1.0	N.D
29.	Iron (Fe)	APHA 3111 / 3120 B	mg/L	0.1	8.0	1.23
30.	Lead (Pb)	APHA 3111 / 3120 B	mg/L	0.01	0.5	0.09
31.	Manganese (Mn)	APHA 3111 / 3120 B	mg/L	0.1	1.5	N.D
32.	Mercury (Hg)	APHA 3112B / 3120 B	mg/L	0.001	0.01	N.D
33.	Nickel (Ni)	APHA 3111 / 3120 B	mg/L	0.01	1.0	N.D
34.	Silver (Ag)	APHA 3111 / 3120 B	mg/L	0.01	1.0	N.D
35.	Selenium (Se)	APHA 3114B / 3120 B	mg/L	0.005	0.5	N.D
36.	Zinc (Zn)	APHA 3111 / 3120 B	mg/L	0.5	5.0	N.D
37.	Anionic Detergents	APHA 5540 C	mg/L	5.0	20	N.D
38.	Total Toxic Metals	Calculation Method	-	-	2.0	0.024
39.	Pesticides	USEPA – 8081	mg/L	0.1	0.15	N.D
40.	Total Coliform	ISO 9308-1	cfu/100mL	-	Absent	2.7×10^7
41.	Faecal Coliform	APHA 9221 E	cfu/100ml	-	Absent	2.1×10^5
42.	Faecal E. coli	ISO 9308-1	cfu/100mL	-	Absent	2.1×10^5

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TEST REPORT

REPORT NUMBER: PI-00190-22

Note:

PEQS	=	Punjab Environmental Quality Standards
MDL	=	Method Detection Limit
mg/L	=	milligram per liter
APHA	=	American Public Health Association
N.D	=	Not Detected
N.S	=	Not Specified
TNTC	=	Too Numerous to Count

- *Uncertainty of the parameters and laboratory conditions at the time of analysis can be provided as per client's requirement.*
- *The lab environmental conditions are maintained at 25±5C° and humidity at 50±20%.*
- *Other Terms and Conditions are mentioned overleaf.*

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TEST REPORT

Report Number: PI-00195-22
Receiving Date: 09 Feb, 2022
Issue Date: 14 Feb, 2022

Customer	:	Jers Consultancy Pvt Ltd
Address	:	24-Civic Centre, Quaid-e-Azam Town, Township, Lahore (Pakistan)
Contact person	:	Mr. Mudasar Arbi
Contact details	:	0301 4283114
Email	:	/

Sample Information

Sample Description:	:	Composite Waste Water
Vendor Reference:	:	Day 02
Sample Collection Date:	:	(08-09) Feb, 2022
Sampling Method:	:	Composite Sampling
Sampling Duration:	:	24 Hours (12 pm, 08th Feb – 11 am, 9th Feb) 2022
Sample Collected by:	:	Mr. Numan Anwar & Mr. Adeel

For and on behalf of
Tti Testing Laboratories

Hamad Ahmad
Head Food and Water Lab

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Tel: (92-42) 111 786 001, Fax: (92-42) 3515 4555, URL: www.ttilabs.net

TEST REPORT

REPORT NUMBER: PI-00195-22

Test Results:

Composite Waste Water Analysis: Day 02

Sr.#	Parameter	Method	Unit	MDL	PEQS Limit	Results
1. A	Temperature @ lab	APHA 2550 B	°C	0.1	-	21
1. B	Temperature @Sampling (Average)	APHA 2550 B	°C	0.1	-	16
2. A	pH Value @ 25 °C	APHA 4500 H^+B	pH Unit	0.01	6-9	7.7
2. B	pH Value @ Sampling (Average)	APHA 4500 H^+B	pH Unit	0.01	6-9	6.5
3.	Density	ASTM-D4052-2018	kg/m^3	0.1	N.S	0.998
4.	Total Dissolved Solids (TDS)	APHA 2540 C	mg/L	5.0	3500	1013
5.	Total Phosphorous	APHA-4500P	mg/L	1.0	N.S	12.4
6.	Total Nitrogen (TKN)	APHA 4500 B	mg/L	0.01	N.S	31.8
7.	Oil & Grease	APHA 5520 B	mg/L	1.0	10	17
8.	Chemical Oxygen Demand (COD)	APHA 5220 D	mg/L	5.0	150	310
9.	Chemical Oxygen Demand (Primary Settled Sample)	APHA 5220 D	mg/L	5.0	150	255
10.	Biochemical Oxygen Demand (BOD_5)	APHA 5210 B	mg/L	10.0	80	156
11.	Biochemical Oxygen Demand (Primary Settled Sample)	APHA 5210 B	mg/L	10.0	80	109
12.	Total suspended Solids (TSS)	APHA 2540 D	mg/L	1.0	200	166
13.	Total suspended Solids (Primary Settled Sample)	APHA 2540 D	mg/L	1.0	200	14
14.	Total Settle able Solids	APHA 2540 F	mg/L	1.0	N.S	0.9
15.	Total Coliform	ISO 9308-1	cfu/100mL	-	Absent	9.1×10^6
16.	Faecal Coliform	APHA 9221 E	cfu/100ml	-	Absent	8.7×10^5
17.	Faecal E. coli	ISO 9308-1	cfu/100mL	-	Absent	8.7×10^5

Note:

PEQS = Punjab Environmental Quality Standards
MDL = Method Detection Limit
mg/L = milligram per liter
APHA = American Public Health Association
N.D = Not Detected
N.S = Not Specified

- *Uncertainty of the parameters and laboratory conditions at the time of analysis can be provided as per client's requirement.*
- *The lab environmental conditions are maintained at 25±5C° and humidity at 50±20%.*
- *Other Terms and Conditions are mentioned overleaf.*

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TEST REPORT

Report Number: PI-00197-22
Receiving Date: 10 Feb, 2022
Issue Date: 15 Feb, 2022

Customer	:	Jers Consultancy Pvt Ltd
Address	:	24-Civic Centre, Quaid-e-Azam Town, Township, Lahore (Pakistan)
Contact person	:	Mr. Mudasar Arbi
Contact details	:	0301 4283114
Email	:	/

Sample Information

Sample Description:	:	Composite Waste Water
Vendor Reference:	:	Day 03
Sample Collection Date:	:	(09-10) Feb, 2022
Sampling Method:	:	Composite Sampling
Sampling Duration:	:	24 Hours (12 pm, 09th Feb – 11 am, 10th Feb) 2022
Sample Collected by:	:	Mr. Numan Anwar & Mr. Adeel

For and on behalf of
Tti Testing Laboratories

Hamad Ahmad
Head Food and Water Lab

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TEST REPORT

REPORT NUMBER: PI-00197-22

Test Results:

Composite Waste Water Analysis: Day 03

Sr.#	Parameter	Method	Unit	MDL	PEQS Limit	Results
1. A	Temperature @ lab	APHA 2550 B	°C	0.1	-	22
1. B	Temperature @Sampling (Average)	APHA 2550 B	°C	0.1	-	16.8
2. A	pH Value @ 25 °C	APHA 4500 H^+B	pH Unit	0.01	6-9	7.42
2. B	pH Value @ Sampling (Average)	APHA 4500 H^+B	pH Unit	0.01	6-9	6.9
3.	Density	ASTM-D4052-2018	kg/m^3	0.1	N.S	0.999
4.	Total Dissolved Solids (TDS)	APHA 2540 C	mg/L	5.0	3500	1009
5.	Total Phosphorous	APHA-4500P	mg/L	1.0	N.S	12.8
6.	Total Nitrogen (TKN)	APHA 4500 B	mg/L	0.01	N.S	28.4
7.	Oil & Grease	APHA 5520 B	mg/L	1.0	10	19
8.	Chemical Oxygen Demand (COD)	APHA 5220 D	mg/L	5.0	150	343
9.	Chemical Oxygen Demand (Primary Settled Sample)	APHA 5220 D	mg/L	5.0	150	170
10.	Biochemical Oxygen Demand (BOD_5)	APHA 5210 B	mg/L	10.0	80	195
11.	Biochemical Oxygen Demand (Primary Settled Sample)	APHA 5210 B	mg/L	10.0	80	146
12.	Total suspended Solids (TSS)	APHA 2540 D	mg/L	1.0	200	169
13.	Total suspended Solids (Primary Settled Sample)	APHA 2540 D	mg/L	1.0	200	62
14.	Total Settle able Solids	APHA 2540 F	mg/L	1.0	N.S	0.6
15.	Total Coliform	ISO 9308-1	cfu/100mL	-	Absent	1.6×10^7
16.	Faecal Coliform	APHA 9221 E	cfu/100ml	-	Absent	9.8×10^5
17.	Faecal E. coli	ISO 9308-1	cfu/100mL	-	Absent	9.8×10^5

Note:

PEQS = Punjab Environmental Quality Standards
MDL = Method Detection Limit
mg/L = milligram per liter
APHA = American Public Health Association
N.D = Not Detected
N.S = Not Specified

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TEST REPORT

Report Number: PI-00205-22
Receiving Date: 11 Feb, 2022
Issue Date: 16 Feb, 2022

Customer	:	Jers Consultancy Pvt Ltd
Address	:	24-Civic Centre, Quaid-e-Azam Town, Township, Lahore (Pakistan)
Contact person	:	Mr. Mudasar Arbi
Contact details	:	0301 4283114
Email	:	/

Sample Information

Sample Description:	:	Composite Waste Water
Vendor Reference:	:	Day 04
Sample Collection Date:	:	(10-11) Feb, 2022
Sampling Method:	:	Composite Sampling
Sampling Duration:	:	24 Hours (12 pm, 10th Feb – 11 am, 11th Feb) 2022
Sample Collected by:	:	Mr. Numan Anwar & Mr. Adeel

For and on behalf of
Tti Testing Laboratories

Hamad Ahmad
Head Food and Water Lab

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TEST REPORT

REPORT NUMBER: PI-00205-22

Test Results:

Composite Waste Water Analysis: Day 04

Sr.#	Parameter	Method	Unit	MDL	PEQS Limit	Results
1. A	Temperature @ lab	APHA 2550 B	°C	0.1	-	22
1. B	Temperature @Sampling (Average)	APHA 2550 B	°C	0.1	-	17
2. A	pH Value @ 25 °C	APHA 4500 H^+B	pH Unit	0.01	6-9	7.35
2. B	pH Value @ Sampling (Average)	APHA 4500 H^+B	pH Unit	0.01	6-9	7.6
3.	Density	ASTM-D4052-2018	kg/m^3	0.1	N.S	0.999
4.	Total Dissolved Solids (TDS)	APHA 2540 C	mg/L	5.0	3500	1059
5.	Total Phosphorous	APHA-4500P	mg/L	1.0	N.S	12
6.	Total Nitrogen (TKN)	APHA 4500 B	mg/L	0.01	N.S	30.2
7.	Oil & Grease	APHA 5520 B	mg/L	1.0	10	3
8.	Chemical Oxygen Demand (COD)	APHA 5220 D	mg/L	5.0	150	298
9.	Chemical Oxygen Demand (Primary Settled Sample)	APHA 5220 D	mg/L	5.0	150	150
10.	Biochemical Oxygen Demand (BOD_5)	APHA 5210 B	mg/L	10.0	80	161
11.	Biochemical Oxygen Demand (Primary Settled Sample)	APHA 5210 B	mg/L	10.0	80	92
12.	Total suspended Solids (TSS)	APHA 2540 D	mg/L	1.0	200	188
13.	Total suspended Solids (Primary Settled Sample)	APHA 2540 D	mg/L	1.0	200	16
14.	Total Settle able Solids	APHA 2540 F	mg/L	1.0	N.S	0.9
15.	Total Coliform	ISO 9308-1	cfu/100mL	-	Absent	5.1×10^6
16.	Faecal Coliform	APHA 9221 E	cfu/100ml	-	Absent	8.0×10^4
17.	Faecal E. coli	ISO 9308-1	cfu/100mL	-	Absent	8.0×10^4

Note:

PEQS = Punjab Environmental Quality Standards
MDL = Method Detection Limit
mg/L = milligram per liter
APHA = American Public Health Association
N.D = Not Detected
N.S = Not Specified

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TEST REPORT

Report Number: PI-00208-22
Receiving Date: 12 Feb, 2022
Issue Date: 17 Feb, 2022

Customer	:	Jers Consultancy Pvt Ltd
Address	:	24-Civic Centre, Quaid-e-Azam Town, Township, Lahore (Pakistan)
Contact person	:	Mr. Mudasar Arbi
Contact details	:	0301 4283114
Email	:	/

Sample Information

Sample Description:	:	Composite Waste Water
Vendor Reference:	:	Day 05
Sample Collection Date:	:	(11-12) Feb, 2022
Sampling Method:	:	Composite Sampling
Sampling Duration:	:	24 Hours (12 pm, 11th Feb – 11 am, 12th Feb) 2022
Sample Collected by:	:	Numan Anwar & Hamid Sohail

For and on behalf of
Tti Testing Laboratories

Hamad Ahmad
Head Food and Water Lab

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TEST REPORT

REPORT NUMBER: PI-00208-22

Test Results:

Composite Waste Water Analysis: Day 05

Sr.#	Parameter	Method	Unit	MDL	PEQS Limit	Results
1. A	Temperature @ lab	APHA 2550 B	°C	0.1	-	22
1. B	Temperature @Sampling (Average)	APHA 2550 B	°C	0.1	-	18
2. A	pH Value @ 25 °C	APHA 4500 H^+B	pH Unit	0.01	6-9	7.59
2. B	pH Value @ Sampling (Average)	APHA 4500 H^+B	pH Unit	0.01	6-9	7
3.	Density	ASTM-D4052-2018	kg/m^3	0.1	N.S	0.998
4.	Total Dissolved Solids (TDS)	APHA 2540 C	mg/L	5.0	3500	1025
5.	Sulphate	APHA 4500-SO_4^{2-}E	mg/L	5.0	600	121
6.	Fluoride	APHA 4500 D	mg/L	0.02	10	0.28
7.	Total Phosphorous	APHA-4500P	mg/L	1.0	N.S	3.75
8.	Total Nitrogen (TKN)	APHA 4500 B	mg/L	0.01	N.S	17.4
9.	Total Chlorine	APHA 4500-Cl G	mg/L	0.01	1.0	N.D
10.	Cyanide	APHA 4500 CN E	mg/L	0.002	1.0	N.D
11.	Chloride	APHA 4500 Cl B	mg/L	1.0	1000	155
12.	Sulfide	APHA 4500-S^2 D	mg/L	0.002	1.0	1.93
13.	Oil & Grease	APHA 5520 B	mg/L	1.0	10	09
14.	Chemical Oxygen Demand (COD)	APHA 5220 D	mg/L	5.0	150	376
15.	Chemical Oxygen Demand (Primary Settled Sample)	APHA 5220 D	mg/L	5.0	150	201
16.	Biochemical Oxygen Demand (BOD_5)	APHA 5210 B	mg/L	10.0	80	128
17.	Biochemical Oxygen Demand (Primary Settled Sample)	APHA 5210 B	mg/L	10.0	80	115
18.	Phenolic Compounds	APHA 5530 C	mg/L	0.1	0.1	N.D
19.	Total suspended Solids (TSS)	APHA 2540 D	mg/L	1.0	200	164
20.	Total suspended Solids (Primary Settled Sample)	APHA 2540 D	mg/L	1.0	200	34

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Sr.#	Parameter	Method	Unit	MDL	PEQS Limit	Results
21.	Volatile Suspended Solids (VSS)	APHA 2540 E	mg/L	1.0	N.S	66
22.	Total Settle able Solids	APHA 2540 F	mg/L	1.0	N.S	0.8
23.	Arsenic (As)	APHA 3111 / 3120 B	mg/L	0.01	1.0	0.02
24.	Barium (Ba)	APHA 3111 / 3120 B	mg/L	0.1	1.5	N.D
25.	Boron (B)	APHA 3111 / 3120 B	mg/L	0.1	6.0	N.D
26.	Cadmium (Cd)	APHA 3111 / 3120 B	mg/L	0.003	0.1	N.D
27.	Chromium (Cr)	APHA 3111 / 3120 B	mg/L	0.01	1.0	0.012
28.	Copper (Cu)	APHA 3111 / 3120 B	mg/L	0.5	1.0	N.D
29.	Iron (Fe)	APHA 3111 / 3120 B	mg/L	0.1	8.0	1.25
30.	Lead (Pb)	APHA 3111 / 3120 B	mg/L	0.01	0.5	0.056
31.	Manganese (Mn)	APHA 3111 / 3120 B	mg/L	0.1	1.5	N.D
32.	Mercury (Hg)	APHA 3112B / 3120 B	mg/L	0.001	0.01	N.D
33.	Nickel (Ni)	APHA 3111 / 3120 B	mg/L	0.01	1.0	N.D
34.	Silver (Ag)	APHA 3111 / 3120 B	mg/L	0.01	1.0	N.D
35.	Selenium (Se)	APHA 3114B / 3120 B	mg/L	0.005	0.5	N.D
36.	Zinc (Zn)	APHA 3111 / 3120 B	mg/L	0.5	5.0	N.D
37.	Anionic Detergents	APHA 5540 C	mg/L	5.0	20	N.D
38.	Total Toxic Metals	Calculation Method	-	-	2.0	0.02
39.	Pesticides	USEPA – 8081	mg/L	0.1	0.15	N.D
40.	Total Coliform	ISO 9308-1	cfu/100mL	-	Absent	4.7×10^6
41.	Faecal Coliform	APHA 9221 E	cfu/100ml	-	Absent	4.8×10^5
42.	Faecal E. coli	ISO 9308-1	cfu/100mL	-	Absent	4.8×10^5

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TEST REPORT

REPORT NUMBER: PI-00208-22

Note:

PEQS	=	Punjab Environmental Quality Standards
MDL	=	Method Detection Limit
mg/L	=	milligram per liter
APHA	=	American Public Health Association
N.D	=	Not Detected
N.S	=	Not Specified

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TEST REPORT

Report Number: PI-00212-22
Receiving Date: 13 Feb, 2022
Issue Date: 18 Feb, 2022

Customer	:	Jers Consultancy Pvt Ltd
Address	:	24-Civic Centre, Quaid-e-Azam Town, Township, Lahore (Pakistan)
Contact person	:	Mr. Mudasar Arbi
Contact details	:	0301 4283114
Email	:	/

Sample Information

Sample Description:	:	Composite Waste Water
Vendor Reference:	:	Day 06
Sample Collection Date:	:	(12-13) Feb, 2022
Sampling Method:	:	Composite Sampling
Sampling Duration:	:	24 Hours (12 pm, 12th Feb – 11 am, 13th Feb) 2022
Sample Collected by:	:	Mr. Numan Anwar & Mr. Adeel

For and on behalf of
Tti Testing Laboratories

Hamad Ahmad
Head Food and Water Lab

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TEST REPORT

REPORT NUMBER: PI-00212-22

Test Results:

Composite Waste Water Analysis: Day 06

Sr.#	Parameter	Method	Unit	MDL	PEQS Limit	Results
1. A	Temperature @ lab	APHA 2550 B	°C	0.1	-	22
1. B	Temperature @Sampling (Average)	APHA 2550 B	°C	0.1	-	16.9
2. A	pH Value @ 25 °C	APHA 4500 H^+B	pH Unit	0.01	6-9	7.75
2. B	pH Value @ Sampling (Average)	APHA 4500 H^+B	pH Unit	0.01	6-9	8
3.	Density	ASTM-D4052-2018	kg/m^3	0.1	N.S	0.998
4.	Total Dissolved Solids (TDS)	APHA 2540 C	mg/L	5.0	3500	810
5.	Total Phosphorous	APHA-4500P	mg/L	1.0	N.S	11.3
6.	Total Nitrogen (TKN)	APHA 4500 B	mg/L	0.01	N.S	28.6
7.	Oil & Grease	APHA 5520 B	mg/L	1.0	10	21
8.	Chemical Oxygen Demand (COD)	APHA 5220 D	mg/L	5.0	150	361
9.	Chemical Oxygen Demand (Primary Settled Sample)	APHA 5220 D	mg/L	5.0	150	230
10.	Biochemical Oxygen Demand (BOD_5)	APHA 5210 B	mg/L	10.0	80	187
11.	Biochemical Oxygen Demand (Primary Settled Sample)	APHA 5210 B	mg/L	10.0	80	129
12.	Total suspended Solids (TSS)	APHA 2540 D	mg/L	1.0	200	180
13.	Total suspended Solids (Primary Settled Sample)	APHA 2540 D	mg/L	1.0	200	24
14.	Total Settle able Solids	APHA 2540 F	mg/L	1.0	N.S	0.9
15.	Total Coliform	ISO 9308-1	cfu/100mL	-	Absent	9.7×10^6
16.	Faecal Coliform	APHA 9221 E	cfu/100ml	-	Absent	7.9×10^5
17.	Faecal E. coli	ISO 9308-1	cfu/100mL	-	Absent	7.9×10^5

Note:

PEQS = Punjab Environmental Quality Standards
MDL = Method Detection Limit
mg/L = milligram per liter
APHA = American Public Health Association
N.D = Not Detected
N.S = Not Specified

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TEST REPORT

Report Number: PI-00215-22
Receiving Date: 14 Feb, 2022
Issue Date: 19 Feb, 2022

Customer	:	Jers Consultancy Pvt Ltd
Address	:	24-Civic Centre, Quaid-e-Azam Town, Township, Lahore (Pakistan)
Contact person	:	Mr. Mudasar Arbi
Contact details	:	0301 4283114
Email	:	/

Sample Information

Sample Description:	:	Composite Waste Water
Vendor Reference:	:	Day 07
Sample Collection Date:	:	(13-14) Feb, 2022
Sampling Method:	:	Composite Sampling
Sampling Duration:	:	24 Hours (12 pm, 13th Feb – 11 am, 14th Feb) 2022
Sample Collected by:	:	Mr. Numan Anwar & Mr. Adeel

For and on behalf of
Tti Testing Laboratories

Hamad Ahmad
Head Food and Water Lab

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TEST REPORT

REPORT NUMBER: PI-00215-22

Test Results:

Composite Waste Water Analysis: Day 07

Sr.#	Parameter	Method	Unit	MDL	PEQS Limit	Results
1. A	Temperature @ lab	APHA 2550 B	°C	0.1	-	22
1. B	Temperature @Sampling (Average)	APHA 2550 B	°C	0.1	-	18.1
2. A	pH Value @ 25 °C	APHA 4500 H^+B	pH Unit	0.01	6-9	6.79
2. B	pH Value @ Sampling (Average)	APHA 4500 H^+B	pH Unit	0.01	6-9	6.7
3.	Density	ASTM-D4052-2018	kg/m^3	0.1	N.S	0.999
4.	Total Dissolved Solids (TDS)	APHA 2540 C	mg/L	5.0	3500	955
5.	Total Phosphorous	APHA-4500P	mg/L	1.0	N.S	13.2
6.	Total Nitrogen (TKN)	APHA 4500 B	mg/L	0.01	N.S	25.7
7.	Oil & Grease	APHA 5520 B	mg/L	1.0	10	28
8.	Chemical Oxygen Demand (COD)	APHA 5220 D	mg/L	5.0	150	678
9.	Chemical Oxygen Demand (Primary Settled Sample)	APHA 5220 D	mg/L	5.0	150	473
10.	Biochemical Oxygen Demand (BOD_5)	APHA 5210 B	mg/L	10.0	80	389
11.	Biochemical Oxygen Demand (Primary Settled Sample)	APHA 5210 B	mg/L	10.0	80	291
12.	Total suspended Solids (TSS)	APHA 2540 D	mg/L	1.0	200	260
13.	Total suspended Solids (Primary Settled Sample)	APHA 2540 D	mg/L	1.0	200	70
14.	Total Settle able Solids	APHA 2540 F	mg/L	1.0	N.S	0.7
15.	Total Coliform	ISO 9308-1	cfu/100mL	-	Absent	9.1×10^9
16.	Faecal Coliform	APHA 9221 E	cfu/100ml	-	Absent	9.2×10^7
17.	Faecal E. coli	ISO 9308-1	cfu/100mL	-	Absent	9.2×10^7

Note:

PEQS = Punjab Environmental Quality Standards
MDL = Method Detection Limit
mg/L = milligram per liter
APHA = American Public Health Association
N.D = Not Detected
N.S = Not Specified

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TEST REPORT

Report Number: PI-00231-22
Receiving Date: 15 Feb, 2022
Issue Date: 21 Feb, 2022

Customer	:	Jers Consultancy Pvt Ltd
Address	:	24-Civic Centre, Quaid-e-Azam Town, Township, Lahore (Pakistan)
Contact person	:	Mr. Mudasar Arbi
Contact details	:	0301 4283114
Email	:	/

Sample Information

Sample Description:	:	Composite Waste Water
Vendor Reference:	:	Day 08
Sample Collection Date:	:	(14-15) Feb, 2022
Sampling Method:	:	Composite Sampling
Sampling Duration:	:	24 Hours (12 pm, 14th Feb – 11 am, 15th Feb) 2022
Sample Collected by:	:	Mr. Numan Anwar & Mr. Adeel

For and on behalf of
Tti Testing Laboratories

Hamad Ahmad
Head Food and Water Lab

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TEST REPORT

REPORT NUMBER: PI-00231-22

Test Results:

Composite Waste Water Analysis: Day 08

Sr.#	Parameter	Method	Unit	MDL	PEQS Limit	Results
1. A	Temperature @ lab	APHA 2550 B	°C	0.1	-	22
1. B	Temperature @Sampling (Average)	APHA 2550 B	°C	0.1	-	20
2. A	pH Value @ 25 °C	APHA 4500 H^+B	pH Unit	0.01	6-9	7.85
2. B	pH Value @ Sampling (Average)	APHA 4500 H^+B	pH Unit	0.01	6-9	8.8
3.	Density	ASTM-D4052-2018	kg/m^3	0.1	N.S	0.998
4.	Total Dissolved Solids (TDS)	APHA 2540 C	mg/L	5.0	3500	1025
5.	Total Phosphorous	APHA-4500P	mg/L	1.0	N.S	13.3
6.	Total Nitrogen (TKN)	APHA 4500 B	mg/L	0.01	N.S	36.8
7.	Oil & Grease	APHA 5520 B	mg/L	1.0	10	19
8.	Chemical Oxygen Demand (COD)	APHA 5220 D	mg/L	5.0	150	324
9.	Chemical Oxygen Demand (Primary Settled Sample)	APHA 5220 D	mg/L	5.0	150	169
10.	Biochemical Oxygen Demand (BOD_5)	APHA 5210 B	mg/L	10.0	80	125
11.	Biochemical Oxygen Demand (Primary Settled Sample)	APHA 5210 B	mg/L	10.0	80	88
12.	Total suspended Solids (TSS)	APHA 2540 D	mg/L	1.0	200	190
13.	Total suspended Solids (Primary Settled Sample)	APHA 2540 D	mg/L	1.0	200	142
14.	Total Settle able Solids	APHA 2540 F	mg/L	1.0	N.S	0.4
15.	Total Coliform	ISO 9308-1	cfu/100mL	-	Absent	4.9×10^6
16.	Faecal Coliform	APHA 9221 E	cfu/100ml	-	Absent	8.4×10^5
17.	Faecal E. coli	ISO 9308-1	cfu/100mL	-	Absent	8.4×10^5

Note:

PEQS = Punjab Environmental Quality Standards
MDL = Method Detection Limit
mg/L = milligram per liter
APHA = American Public Health Association
N.D = Not Detected
N.S = Not Specified

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TEST REPORT

Report Number: PI-00234-22
Receiving Date: 16 Feb, 2022
Issue Date: 21 Feb, 2022

Customer	:	Jers Consultancy Pvt Ltd
Address	:	24-Civic Centre, Quaid-e-Azam Town, Township, Lahore (Pakistan)
Contact person	:	Mr. Mudasar Arbi
Contact details	:	0301 4283114
Email	:	/

Sample Information

Sample Description:	:	Composite Waste Water
Vendor Reference:	:	Day 09
Sample Collection Date:	:	(15-16) Feb, 2022
Sampling Method:	:	Composite Sampling
Sampling Duration:	:	24 Hours (12 pm, 15th Feb – 11 am, 16th Feb) 2022
Sample Collected by:	:	Mr. Numan Anwar & Mr. Adeel

For and on behalf of
Tti Testing Laboratories

Hamad Ahmad
Head Food and Water Lab

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TEST REPORT

REPORT NUMBER: PI-00234-22

Test Results:

Composite Waste Water Analysis: Day 09

Sr.#	Parameter	Method	Unit	MDL	PEQS Limit	Results
1. A	Temperature @ lab	APHA 2550 B	°C	0.1	-	22
1. B	Temperature @Sampling (Average)	APHA 2550 B	°C	0.1	-	22.6
2. A	pH Value @ 25 °C	APHA 4500 H^+B	pH Unit	0.01	6-9	7.9
2. B	pH Value @ Sampling (Average)	APHA 4500 H^+B	pH Unit	0.01	6-9	9
3.	Density	ASTM-D4052-2018	kg/m^3	0.1	N.S	0.999
4.	Total Dissolved Solids (TDS)	APHA 2540 C	mg/L	5.0	3500	879
5.	Total Phosphorous	APHA-4500P	mg/L	1.0	N.S	13
6.	Total Nitrogen (TKN)	APHA 4500 B	mg/L	0.01	N.S	34.1
7.	Oil & Grease	APHA 5520 B	mg/L	1.0	10	23
8.	Chemical Oxygen Demand (COD)	APHA 5220 D	mg/L	5.0	150	406
9.	Chemical Oxygen Demand (Primary Settled Sample)	APHA 5220 D	mg/L	5.0	150	172
10.	Biochemical Oxygen Demand (BOD_5)	APHA 5210 B	mg/L	10.0	80	296
11.	Biochemical Oxygen Demand (Primary Settled Sample)	APHA 5210 B	mg/L	10.0	80	84
12.	Total suspended Solids (TSS)	APHA 2540 D	mg/L	1.0	200	267
13.	Total suspended Solids (Primary Settled Sample)	APHA 2540 D	mg/L	1.0	200	37
14.	Total Settle able Solids	APHA 2540 F	mg/L	1.0	N.S	0.8
15.	Total Coliform	ISO 9308-1	cfu/100mL	-	Absent	6.3×10^9
16.	Faecal Coliform	APHA 9221 E	cfu/100ml	-	Absent	5.9×10^7
17.	Faecal E. coli	ISO 9308-1	cfu/100mL	-	Absent	5.9×10^7

Note:

PEQS = Punjab Environmental Quality Standards
MDL = Method Detection Limit
mg/L = milligram per liter
APHA = American Public Health Association
N.D = Not Detected
N.S = Not Specified

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TEST REPORT

Report Number: PI-00242-22
Receiving Date: 18 Feb, 2022
Issue Date: 23 Feb, 2022

Customer	:	Jers Consultancy Pvt Ltd
Address	:	24-Civic Centre, Quaid-e-Azam Town, Township, Lahore (Pakistan)
Contact person	:	Mr. Mudasar Arbi
Contact details	:	0301 4283114
Email	:	/

Sample Information

Sample Description:	:	Composite Waste Water
Vendor Reference:	:	Day 10
Sample Collection Date:	:	(16-17) Feb, 2022
Sampling Method:	:	Composite Sampling
Sampling Duration:	:	24 Hours (12 pm, 16th Feb – 11 am, 17th Feb) 2022
Sample Collected by:	:	Numan Anwar & Hamid Sohail

For and on behalf of
Tti Testing Laboratories

Hamad Ahmad
Head Food and Water Lab

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TEST REPORT

REPORT NUMBER: PI-00242-22

Test Results:

Composite Waste Water Analysis: Day 10

Sr.#	Parameter	Method	Unit	MDL	PEQS Limit	Results
1. A	Temperature @ lab	APHA 2550 B	°C	0.1	-	22
1. B	Temperature @Sampling (Average)	APHA 2550 B	°C	0.1	-	18.7
2. A	pH Value @ 25 °C	APHA 4500 H^+B	pH Unit	0.01	6-9	7.19
2. B	pH Value @ Sampling (Average)	APHA 4500 H^+B	pH Unit	0.01	6-9	7.3
3.	Density	ASTM-D4052-2018	kg/m^3	0.1	N.S	0.999
4.	Total Dissolved Solids (TDS)	APHA 2540 C	mg/L	5.0	3500	895
5.	Sulphate	APHA 4500-SO_4^{2-} E	mg/L	5.0	600	138
6.	Fluoride	APHA 4500 D	mg/L	0.02	10	0.34
7.	Total Phosphorous	APHA-4500P	mg/L	1.0	N.S	13.4
8.	Total Nitrogen (TKN)	APHA 4500 B	mg/L	0.01	N.S	29.5
9.	Total Chlorine	APHA 4500-Cl G	mg/L	0.01	1.0	N.D
10.	Cyanide	APHA 4500 CN E	mg/L	0.002	1.0	N.D
11.	Chloride	APHA 4500 Cl B	mg/L	1.0	1000	115
12.	Sulfide	APHA 4500-S^2 D	mg/L	0.002	1.0	1.297
13.	Oil & Grease	APHA 5520 B	mg/L	1.0	10	17
14.	Chemical Oxygen Demand (COD)	APHA 5220 D	mg/L	5.0	150	283
15.	Chemical Oxygen Demand (Primary Settled Sample)	APHA 5220 D	mg/L	5.0	150	260
16.	Biochemical Oxygen Demand (BOD_5)	APHA 5210 B	mg/L	10.0	80	189
17.	Biochemical Oxygen Demand (Primary Settled Sample)	APHA 5210 B	mg/L	10.0	80	147
18.	Phenolic Compounds	APHA 5530 C	mg/L	0.1	0.1	N.D
19.	Total suspended Solids (TSS)	APHA 2540 D	mg/L	1.0	200	120
20.	Total suspended Solids (Primary Settled Sample)	APHA 2540 D	mg/L	1.0	200	36

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Sr.#	Parameter	Method	Unit	MDL	PEQS Limit	Results
21.	Volatile Suspended Solids (VSS)	APHA 2540 E	mg/L	1.0	N.S	43
22.	Total Settle able Solids	APHA 2540 F	mg/L	1.0	N.S	0.6
23.	Arsenic (As)	APHA 3111 / 3120 B	mg/L	0.01	1.0	0.021
24.	Barium (Ba)	APHA 3111 / 3120 B	mg/L	0.1	1.5	N.D
25.	Boron (B)	APHA 3111 / 3120 B	mg/L	0.1	6.0	N.D
26.	Cadmium (Cd)	APHA 3111 / 3120 B	mg/L	0.003	0.1	N.D
27.	Chromium (Cr)	APHA 3111 / 3120 B	mg/L	0.01	1.0	N.D
28.	Copper (Cu)	APHA 3111 / 3120 B	mg/L	0.5	1.0	N.D
29.	Iron (Fe)	APHA 3111 / 3120 B	mg/L	0.1	8.0	1.46
30.	Lead (Pb)	APHA 3111 / 3120 B	mg/L	0.01	0.5	0.051
31.	Manganese (Mn)	APHA 3111 / 3120 B	mg/L	0.1	1.5	N.D
32.	Mercury (Hg)	APHA 3112B / 3120 B	mg/L	0.001	0.01	N.D
33.	Nickel (Ni)	APHA 3111 / 3120 B	mg/L	0.01	1.0	N.D
34.	Silver (Ag)	APHA 3111 / 3120 B	mg/L	0.01	1.0	N.D
35.	Selenium (Se)	APHA 3114B / 3120 B	mg/L	0.005	0.5	N.D
36.	Zinc (Zn)	APHA 3111 / 3120 B	mg/L	0.5	5.0	N.D
37.	Anionic Detergents	APHA 5540 C	mg/L	5.0	20	N.D
38.	Total Toxic Metals	Calculation Method	-	-	2.0	0.021
39.	Pesticides	USEPA – 8081	mg/L	0.1	0.15	N.D
40.	Total Coliform	ISO 9308-1	cfu/100mL	-	Absent	8.9×10^7
41.	Faecal Coliform	APHA 9221 E	cfu/100 mL	-	Absent	1.2×10^6
42.	Faecal E. coli	ISO 9308-1	cfu/100 mL	-	Absent	1.2×10^6

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TEST REPORT

REPORT NUMBER: PI-00242-22

Note:

PEQS	=	Punjab Environmental Quality Standards
MDL	=	Method Detection Limit
mg/L	=	milligram per liter
APHA	=	American Public Health Association
N.D	=	Not Detected
N.S	=	Not Specified

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TEST REPORT

Report Number: PI-00244-22
Receiving Date: 18 Feb, 2022
Issue Date: 23 Feb, 2022

Customer	:	Jers Consultancy Pvt Ltd
Address	:	24-Civic Centre, Quaid-e-Azam Town, Township, Lahore (Pakistan)
Contact person	:	Mr. Mudasar Arbi
Contact details	:	0301 4283114
Email	:	/

Sample Information

Sample Description:	:	Composite Waste Water
Vendor Reference:	:	Day 11
Sample Collection Date:	:	(17-18) Feb, 2022
Sampling Method:	:	Composite Sampling
Sampling Duration:	:	24 Hours (12 pm, 17th Feb – 11 am, 18th Feb) 2022
Sample Collected by:	:	Mr. Numan Anwar & Mr. Adeel

For and on behalf of
Tti Testing Laboratories

Hamad Ahmad
Head Food and Water Lab

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TEST REPORT

REPORT NUMBER: PI-00244-22

Test Results:

Composite Waste Water Analysis: Day 11

Sr.#	Parameter	Method	Unit	MDL	PEQS Limit	Results
1. A	Temperature @ lab	APHA 2550 B	°C	0.1	-	22
1. B	Temperature @Sampling (Average)	APHA 2550 B	°C	0.1	-	24
2. A	pH Value @ 25 °C	APHA 4500 H^+B	pH Unit	0.01	6-9	7.04
2. B	pH Value @ Sampling (Average)	APHA 4500 H^+B	pH Unit	0.01	6-9	9
3.	Density	ASTM-D4052-2018	kg/m^3	0.1	N.S	0.998
4.	Total Dissolved Solids (TDS)	APHA 2540 C	mg/L	5.0	3500	920
5.	Total Phosphorous	APHA-4500P	mg/L	1.0	N.S	11.8
6.	Total Nitrogen (TKN)	APHA 4500 B	mg/L	0.01	N.S	29.2
7.	Oil & Grease	APHA 5520 B	mg/L	1.0	10	12
8.	Chemical Oxygen Demand (COD)	APHA 5220 D	mg/L	5.0	150	302
9.	Chemical Oxygen Demand (Primary Settled Sample)	APHA 5220 D	mg/L	5.0	150	209
10.	Biochemical Oxygen Demand (BOD_5)	APHA 5210 B	mg/L	10.0	80	165
11.	Biochemical Oxygen Demand (Primary Settled Sample)	APHA 5210 B	mg/L	10.0	80	114
12.	Total suspended Solids (TSS)	APHA 2540 D	mg/L	1.0	200	126
13.	Total suspended Solids (Primary Settled Sample)	APHA 2540 D	mg/L	1.0	200	30
14.	Total Settle able Solids	APHA 2540 F	mg/L	1.0	N.S	0.7
15.	Total Coliform	ISO 9308-1	cfu/100mL	-	Absent	8.1×10^6
16.	Faecal Coliform	APHA 9221 E	cfu/100ml	-	Absent	1.9×10^5
17.	Faecal E. coli	ISO 9308-1	cfu/100mL	-	Absent	1.9×10^5

Note:

PEQS = Punjab Environmental Quality Standards
MDL = Method Detection Limit
mg/L = milligram per liter
APHA = American Public Health Association
N.D = Not Detected
N.S = Not Specified

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TEST REPORT

Report Number: PI-00247-22
Receiving Date: 19 Feb, 2022
Issue Date: 24 Feb, 2022

Customer	:	Jers Consultancy Pvt Ltd
Address	:	24-Civic Centre, Quaid-e-Azam Town, Township, Lahore (Pakistan)
Contact person	:	Mr. Mudasar Arbi
Contact details	:	0301 4283114
Email	:	/

Sample Information

Sample Description:	:	Composite Waste Water
Vendor Reference:	:	Day 12
Sample Collection Date:	:	(18-19) Feb, 2022
Sampling Method:	:	Composite Sampling
Sampling Duration:	:	24 Hours (12 pm, 18th Feb – 11 am, 19th Feb) 2022
Sample Collected by:	:	Mr. Numan Anwar & Mr. Adeel

For and on behalf of
Tti Testing Laboratories

Hamad Ahmad
Head Food and Water Lab

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TEST REPORT

REPORT NUMBER: PI-00247-22

Test Results:

Composite Waste Water Analysis: Day 12

Sr.#	Parameter	Method	Unit	MDL	PEQS Limit	Results
1. A	Temperature @ lab	APHA 2550 B	°C	0.1	-	23
1. B	Temperature @Sampling (Average)	APHA 2550 B	°C	0.1	-	25.6
2. A	pH Value @ 25 °C	APHA 4500 H^+B	pH Unit	0.01	6-9	7.52
2. B	pH Value @ Sampling (Average)	APHA 4500 H^+B	pH Unit	0.01	6-9	9.5
3.	Density	ASTM-D4052-2018	kg/m^3	0.1	N.S	0.999
4.	Total Dissolved Solids (TDS)	APHA 2540 C	mg/L	5.0	3500	995
5.	Total Phosphorous	APHA-4500P	mg/L	1.0	N.S	15
6.	Total Nitrogen (TKN)	APHA 4500 B	mg/L	0.01	N.S	31.6
7.	Oil & Grease	APHA 5520 B	mg/L	1.0	10	16
8.	Chemical Oxygen Demand (COD)	APHA 5220 D	mg/L	5.0	150	176
9.	Chemical Oxygen Demand (Primary Settled Sample)	APHA 5220 D	mg/L	5.0	150	131
10.	Biochemical Oxygen Demand (BOD_5)	APHA 5210 B	mg/L	10.0	80	103
11.	Biochemical Oxygen Demand (Primary Settled Sample)	APHA 5210 B	mg/L	10.0	80	87
12.	Total suspended Solids (TSS)	APHA 2540 D	mg/L	1.0	200	108
13.	Total suspended Solids (Primary Settled Sample)	APHA 2540 D	mg/L	1.0	200	50
14.	Total Settle able Solids	APHA 2540 F	mg/L	1.0	N.S	0.4
15.	Total Coliform	ISO 9308-1	cfu/100mL	-	Absent	5.9×10^5
16.	Faecal Coliform	APHA 9221 E	cfu/100ml	-	Absent	1.0×10^4
17.	Faecal E. coli	ISO 9308-1	cfu/100mL	-	Absent	1.0×10^4

Note:

PEQS = Punjab Environmental Quality Standards
MDL = Method Detection Limit
mg/L = milligram per liter
APHA = American Public Health Association
N.D = Not Detected
N.S = Not Specified

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TEST REPORT

Report Number: PI-00249-22
Receiving Date: 20 Feb, 2022
Issue Date: 25 Feb, 2022

Customer	:	Jers Consultancy Pvt Ltd
Address	:	24-Civic Centre, Quaid-e-Azam Town, Township, Lahore (Pakistan)
Contact person	:	Mr. Mudasar Arbi
Contact details	:	0301 4283114
Email	:	/

Sample Information

Sample Description:	:	Composite Waste Water
Vendor Reference:	:	Day 13
Sample Collection Date:	:	(19-20) Feb, 2022
Sampling Method:	:	Composite Sampling
Sampling Duration:	:	24 Hours (12 pm, 19th Feb – 11 am, 20th Feb) 2022
Sample Collected by:	:	Mr. Numan Anwar & Mr. Adeel

For and on behalf of
Tti Testing Laboratories

Hamad Ahmad
Head Food and Water Lab

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TEST REPORT

REPORT NUMBER: PI-00249-22

Test Results:

Composite Waste Water Analysis: Day 13

Sr.#	Parameter	Method	Unit	MDL	PEQS Limit	Results
1. A	Temperature @ lab	APHA 2550 B	°C	0.1	-	23
1. B	Temperature @Sampling (Average)	APHA 2550 B	°C	0.1	-	21
2. A	pH Value @ 25 °C	APHA 4500 H^+B	pH Unit	0.01	6-9	7.82
2. B	pH Value @ Sampling (Average)	APHA 4500 H^+B	pH Unit	0.01	6-9	7.9
3.	Density	ASTM-D4052-2018	kg/m^3	0.1	N.S	0.998
4.	Total Dissolved Solids (TDS)	APHA 2540 C	mg/L	5.0	3500	962
5.	Total Phosphorous	APHA-4500P	mg/L	1.0	N.S	12
6.	Total Nitrogen (TKN)	APHA 4500 B	mg/L	0.01	N.S	28.7
7.	Oil & Grease	APHA 5520 B	mg/L	1.0	10	18
8.	Chemical Oxygen Demand (COD)	APHA 5220 D	mg/L	5.0	150	463
9.	Chemical Oxygen Demand (Primary Settled Sample)	APHA 5220 D	mg/L	5.0	150	379
10.	Biochemical Oxygen Demand (BOD_5)	APHA 5210 B	mg/L	10.0	80	238
11.	Biochemical Oxygen Demand (Primary Settled Sample)	APHA 5210 B	mg/L	10.0	80	199
12.	Total suspended Solids (TSS)	APHA 2540 D	mg/L	1.0	200	142
13.	Total suspended Solids (Primary Settled Sample)	APHA 2540 D	mg/L	1.0	200	56
14.	Total Settle able Solids	APHA 2540 F	mg/L	1.0	N.S	0.5
15.	Total Coliform	ISO 9308-1	cfu/100mL	-	Absent	8.0×10^8
16.	Faecal Coliform	APHA 9221 E	cfu/100ml	-	Absent	2.1×10^7
17.	Faecal E. coli	ISO 9308-1	cfu/100mL	-	Absent	2.1×10^7

Note:

PEQS = Punjab Environmental Quality Standards
MDL = Method Detection Limit
mg/L = milligram per liter
APHA = American Public Health Association
N.D = Not Detected
N.S = Not Specified

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TEST REPORT

Report Number: PI-00264-22
Receiving Date: 21 Feb, 2022
Issue Date: 26 Feb, 2022

Customer	:	Jers Consultancy Pvt Ltd
Address	:	24-Civic Centre, Quaid-e-Azam Town, Township, Lahore (Pakistan)
Contact person	:	Mr. Mudasar Arbi
Contact details	:	0301 4283114
Email	:	/

Sample Information

Sample Description:	:	Composite Waste Water
Vendor Reference:	:	Day 14
Sample Collection Date:	:	(20-21) Feb, 2022
Sampling Method:	:	Composite Sampling
Sampling Duration:	:	24 Hours (12 pm, 20th Feb – 11 am, 21st Feb) 2022
Sample Collected by:	:	Mr. Numan Anwar & Mr. Adeel

For and on behalf of
Tti Testing Laboratories

Hamad Ahmad
Head Food and Water Lab

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TEST REPORT

REPORT NUMBER: PI-00264-22

Test Results:

Composite Waste Water Analysis: Day 14

Sr.#	Parameter	Method	Unit	MDL	PEQS Limit	Results
1. A	Temperature @ lab	APHA 2550 B	°C	0.1	-	23
1. B	Temperature @Sampling (Average)	APHA 2550 B	°C	0.1	-	26.3
2. A	pH Value @ 25 °C	APHA 4500 H^+B	pH Unit	0.01	6-9	7.92
2. B	pH Value @ Sampling (Average)	APHA 4500 H^+B	pH Unit	0.01	6-9	8.5
3.	Density	ASTM-D4052-2018	kg/m^3	0.1	N.S	0.998
4.	Total Dissolved Solids (TDS)	APHA 2540 C	mg/L	5.0	3500	865
5.	Total Phosphorous	APHA-4500P	mg/L	1.0	N.S	13.2
6.	Total Nitrogen (TKN)	APHA 4500 B	mg/L	0.01	N.S	23.5
7.	Oil & Grease	APHA 5520 B	mg/L	1.0	10	14
8.	Chemical Oxygen Demand (COD)	APHA 5220 D	mg/L	5.0	150	290
9.	Chemical Oxygen Demand (Primary Settled Sample)	APHA 5220 D	mg/L	5.0	150	203
10.	Biochemical Oxygen Demand (BOD_5)	APHA 5210 B	mg/L	10.0	80	139
11.	Biochemical Oxygen Demand (Primary Settled Sample)	APHA 5210 B	mg/L	10.0	80	108
12.	Total suspended Solids (TSS)	APHA 2540 D	mg/L	1.0	200	124
13.	Total suspended Solids (Primary Settled Sample)	APHA 2540 D	mg/L	1.0	200	58
14.	Total Settle able Solids	APHA 2540 F	mg/L	1.0	N.S	0.4
15.	Total Coliform	ISO 9308-1	cfu/100mL	-	Absent	9.0×10^6
16.	Faecal Coliform	APHA 9221 E	cfu/100ml	-	Absent	7.6×10^4
17.	Faecal E. coli	ISO 9308-1	cfu/100mL	-	Absent	7.6×10^4

Note:

PEQS = Punjab Environmental Quality Standards
MDL = Method Detection Limit
mg/L = milligram per liter
APHA = American Public Health Association
N.D = Not Detected
N.S = Not Specified

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TEST REPORT

Report Number: PI-00266-22
Receiving Date: 22 Feb, 2022
Issue Date: 28 Feb, 2022

Customer	:	Jers Consultancy Pvt Ltd
Address	:	24-Civic Centre, Quaid-e-Azam Town, Township, Lahore (Pakistan)
Contact person	:	Mr. Mudasar Arbi
Contact details	:	0301 4283114
Email	:	/

Sample Information

Sample Description:	:	Composite Waste Water
Vendor Reference:	:	Day 15
Sample Collection Date:	:	(21-22) Feb, 2022
Sampling Method:	:	Composite Sampling
Sampling Duration:	:	24 Hours (12 pm, 21st Feb – 11 am, 22nd Feb) 2022
Sample Collected by:	:	Numan Anwar & Hamid Sohail

For and on behalf of
Tti Testing Laboratories

Hamad Ahmad
Head Food and Water Lab

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TEST REPORT

REPORT NUMBER: PI-00266-22

Test Results:

Composite Waste Water Analysis: Day 15

Sr.#	Parameter	Method	Unit	MDL	PEQS Limit	Results
1. A	Temperature @ lab	APHA 2550 B	°C	0.1	-	22
1. B	Temperature @Sampling (Average)	APHA 2550 B	°C	0.1	-	28
2. A	pH Value @ 25 °C	APHA 4500 H^+B	pH Unit	0.01	6-9	7.19
2. B	pH Value @ Sampling (Average)	APHA 4500 H^+B	pH Unit	0.01	6-9	9.2
3.	Density	ASTM-D4052-2018	kg/m^3	0.1	N.S	0.999
4.	Total Dissolved Solids (TDS)	APHA 2540 C	mg/L	5.0	3500	899
5.	Sulphate	APHA 4500-SO_4^{2-}E	mg/L	5.0	600	134
6.	Fluoride	APHA 4500 D	mg/L	0.02	10	0.33
7.	Total Phosphorous	APHA-4500P	mg/L	1.0	N.S	3.55
8.	Total Nitrogen (TKN)	APHA 4500 B	mg/L	0.01	N.S	31.8
9.	Total Chlorine	APHA 4500-Cl G	mg/L	0.01	1.0	N.D
10.	Cyanide	APHA 4500 CN E	mg/L	0.002	1.0	N.D
11.	Chloride	APHA 4500 Cl B	mg/L	1.0	1000	107
12.	Sulfide	APHA 4500-S^2 D	mg/L	0.002	1.0	1.205
13.	Oil & Grease	APHA 5520 B	mg/L	1.0	10	19
14.	Chemical Oxygen Demand (COD)	APHA 5220 D	mg/L	5.0	150	282
15.	Chemical Oxygen Demand (Primary Settled Sample)	APHA 5220 D	mg/L	5.0	150	176
16.	Biochemical Oxygen Demand (BOD_5)	APHA 5210 B	mg/L	10.0	80	178
17.	Biochemical Oxygen Demand (Primary Settled Sample)	APHA 5210 B	mg/L	10.0	80	108
18.	Phenolic Compounds	APHA 5530 C	mg/L	0.1	0.1	N.D
19.	Total suspended Solids (TSS)	APHA 2540 D	mg/L	1.0	200	164
20.	Total suspended Solids (Primary Settled Sample)	APHA 2540 D	mg/L	1.0	200	96

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Sr.#	Parameter	Method	Unit	MDL	PEQS Limit	Results
21.	Volatile Suspended Solids (VSS)	APHA 2540 E	mg/L	1.0	N.S	59
22.	Total Settle able Solids	APHA 2540 F	mg/L	1.0	N.S	0.5
23.	Arsenic (As)	APHA 3111 / 3120 B	mg/L	0.01	1.0	0.024
24.	Barium (Ba)	APHA 3111 / 3120 B	mg/L	0.1	1.5	N.D
25.	Boron (B)	APHA 3111 / 3120 B	mg/L	0.1	6.0	N.D
26.	Cadmium (Cd)	APHA 3111 / 3120 B	mg/L	0.003	0.1	N.D
27.	Chromium (Cr)	APHA 3111 / 3120 B	mg/L	0.01	1.0	0.019
28.	Copper (Cu)	APHA 3111 / 3120 B	mg/L	0.5	1.0	N.D
29.	Iron (Fe)	APHA 3111 / 3120 B	mg/L	0.1	8.0	0.67
30.	Lead (Pb)	APHA 3111 / 3120 B	mg/L	0.01	0.5	0.05
31.	Manganese (Mn)	APHA 3111 / 3120 B	mg/L	0.1	1.5	N.D
32.	Mercury (Hg)	APHA 3112B / 3120 B	mg/L	0.001	0.01	N.D
33.	Nickel (Ni)	APHA 3111 / 3120 B	mg/L	0.01	1.0	N.D
34.	Silver (Ag)	APHA 3111 / 3120 B	mg/L	0.01	1.0	N.D
35.	Selenium (Se)	APHA 3114B / 3120 B	mg/L	0.005	0.5	N.D
36.	Zinc (Zn)	APHA 3111 / 3120 B	mg/L	0.5	5.0	N.D
37.	Anionic Detergents	APHA 5540 C	mg/L	5.0	20	N.D
38.	Total Toxic Metals	Calculation Method	-	-	2.0	0.042
39.	Pesticides	USEPA – 8081	mg/L	0.1	0.15	N.D
40.	Total Coliform	ISO 9308-1	cfu/100mL	-	Absent	8.0×10^7
41.	Faecal Coliform	APHA 9221 E	cfu/100ml	-	Absent	5.1×10^5
42.	Faecal E. coli	ISO 9308-1	cfu/100mL	-	Absent	5.1×10^5

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TEST REPORT

REPORT NUMBER: PI-00266-22

Note:

PEQS	=	Punjab Environmental Quality Standards
MDL	=	Method Detection Limit
mg/L	=	milligram per liter
APHA	=	American Public Health Association
N.D	=	Not Detected
N.S	=	Not Specified

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TEST REPORT

Report Number: PI-00275-22
Receiving Date: 22 Feb, 2022
Issue Date: 28 Feb, 2022

Customer	:	Jers Consultancy Pvt Ltd
Address	:	24-Civic Centre, Quaid-e-Azam Town, Township, Lahore (Pakistan)
Contact person	:	Mr. Mudasar Arbi
Contact details	:	0301 4283114
Email	:	/

Sample Information

Sample Description:	:	Composite Waste Water
Vendor Reference:	:	Drain Sample
Sample Collection Date:	:	(21-22) Feb, 2022
Sampling Method:	:	Composite Sampling
Sample Collected by:	:	Numan Anwar & Hamid Sohail

For and on behalf of
Tti Testing Laboratories

Hamad Ahmad
Head Food and Water Lab

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TEST REPORT

REPORT NUMBER: PI-00275-22

Test Results:

Composite Waste Water Analysis: Drain Sample

Sr.#	Parameter	Method	Unit	MDL	PEQS Limit	Results
1. A	Temperature @ lab	APHA 2550 B	°C	0.1	-	22
1. B	Temperature @Sampling (Average)	APHA 2550 B	°C	0.1	-	27
2. A	pH Value @ 25 °C	APHA 4500 H^+B	pH Unit	0.01	6-9	7.12
2. B	pH Value @ Sampling (Average)	APHA 4500 H^+B	pH Unit	0.01	6-9	8
3.	Density	ASTM-D4052-2018	kg/m^3	0.1	N.S	0.998
4.	Total Dissolved Solids (TDS)	APHA 2540 C	mg/L	5.0	3500	1989
5.	Sulphate	APHA 4500-SO_4^{2-}E	mg/L	5.0	600	180
6.	Fluoride	APHA 4500 D	mg/L	0.02	10	N.D
7.	Total Phosphorous	APHA-4500P	mg/L	1.0	N.S	1.85
8.	Total Nitrogen (TKN)	APHA 4500 B	mg/L	0.01	N.S	24.3
9.	Total Chlorine	APHA 4500-Cl G	mg/L	0.01	1.0	N.D
10.	Cyanide	APHA 4500 CN E	mg/L	0.002	1.0	N.D
11.	Chloride	APHA 4500 Cl B	mg/L	1.0	1000	630
12.	Sulfide	APHA 4500-S^2 D	mg/L	0.002	1.0	0.09
13.	Oil & Grease	APHA 5520 B	mg/L	1.0	10	11
14.	Chemical Oxygen Demand (COD)	APHA 5220 D	mg/L	5.0	150	263
15.	Chemical Oxygen Demand (Primary Settled Sample)	APHA 5220 D	mg/L	5.0	150	259
16.	Biochemical Oxygen Demand (BOD_5)	APHA 5210 B	mg/L	10.0	80	186
17.	Biochemical Oxygen Demand (Primary Settled Sample)	APHA 5210 B	mg/L	10.0	80	173
18.	Phenolic Compounds	APHA 5530 C	mg/L	0.1	0.1	N.D
19.	Total suspended Solids (TSS)	APHA 2540 D	mg/L	1.0	200	218
20.	Total suspended Solids (Primary Settled Sample)	APHA 2540 D	mg/L	1.0	200	54

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Sr.#	Parameter	Method	Unit	MDL	PEQS Limit	Results
21.	Volatile Suspended Solids (VSS)	APHA 2540 E	mg/L	1.0	N.S	43
22.	Total Settle able Solids	APHA 2540 F	mg/L	1.0	N.S	0.5
23.	Arsenic (As)	APHA 3111 / 3120 B	mg/L	0.01	1.0	0.042
24.	Barium (Ba)	APHA 3111 / 3120 B	mg/L	0.1	1.5	N.D
25.	Boron (B)	APHA 3111 / 3120 B	mg/L	0.1	6.0	N.D
26.	Cadmium (Cd)	APHA 3111 / 3120 B	mg/L	0.003	0.1	N.D
27.	Chromium (Cr)	APHA 3111 / 3120 B	mg/L	0.01	1.0	0.025
28.	Copper (Cu)	APHA 3111 / 3120 B	mg/L	0.5	1.0	N.D
29.	Iron (Fe)	APHA 3111 / 3120 B	mg/L	0.1	8.0	1.2
30.	Lead (Pb)	APHA 3111 / 3120 B	mg/L	0.01	0.5	0.03
31.	Manganese (Mn)	APHA 3111 / 3120 B	mg/L	0.1	1.5	N.D
32.	Mercury (Hg)	APHA 3112B / 3120 B	mg/L	0.001	0.01	N.D
33.	Nickel (Ni)	APHA 3111 / 3120 B	mg/L	0.01	1.0	N.D
34.	Silver (Ag)	APHA 3111 / 3120 B	mg/L	0.01	1.0	N.D
35.	Selenium (Se)	APHA 3114B / 3120 B	mg/L	0.005	0.5	N.D
36.	Zinc (Zn)	APHA 3111 / 3120 B	mg/L	0.5	5.0	N.D
37.	Anionic Detergents	APHA 5540 C	mg/L	5.0	20	N.D
38.	Total Toxic Metals	Calculation Method	-	-	2.0	0.097
39.	Pesticides	USEPA – 8081	mg/L	0.1	0.15	N.D
40.	Total Coliform	ISO 9308-1	cfu/100mL	-	Absent	5.6×10^7
41.	Faecal Coliform	APHA 9221 E	cfu/100ml	-	Absent	4.0×10^5
42.	Faecal E. coli	ISO 9308-1	cfu/100mL	-	Absent	4.0×10^5

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Note:

PEQS	=	Punjab Environmental Quality Standards
MDL	=	Method Detection Limit
mg/L	=	milligram per liter
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N.S	=	Not Specified

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CHEMICAL ANALYSIS TEST REPORT (GROUND WATER)

Reference Number: ESPAK/0255P/23/DW/2540/00620 **Date:** 23/05/2023
Name of Industry / Client: JERS Consultancy (Pvt) Limited
Address: 24-Civic Center Street, Township Commercial Area Lahore
Validation Officer: Muhammad Nadeem, Research Officer
Nature of Sample: Ground Water from Bore
Date Sample Received: 17/05/2023 **Grab / Composite:** Grab
Date of Sample Collection: 16/05/2023
Sample Collected / Sent By: Muhammad Zubair, Analyst (Field), ESPAK
Date of Completion of Analysis: 23/05/2023

S. No	Parameters	Limit Values (DW-PEQS)	Concentration	Method / Equipment Used	Remarks
1	Total Coliforms	----	ND	SMWW 9221 B	---
2	Fecal Coliform Bacteria	Must not be detectable in any 100mL sample	ND	SMWW 9221 F	Within Limits
3	E. Coli	Must not be detectable in any 100mL Sample	ND	SMWW 9221 F	Within Limits
4	Residual Chlorine	0.2-0.5 mg/L	ND	SMWW 4500-Cl B	---
5	Total Hardness as $CaCO_3$*	<500 mg/L	232 mg/L	SMWW 2340C	Within Limits
6	Chloride (as Cl^-)*	<250 mg/L	37 mg/L	SMWW 4500Cl^-B	Within Limits
7	pH*	6.5-8.5	8.1	SMWW 4500H*B	Within Limits
8	Turbidity	<5 NTU	0.8 NTU	SMWW 2130B	Within Limits
9	Total Dissolved Solids (TDS)*	<1000 mg/L	446 mg/L	SMWW 2540C	Within Limits
10	Color	≤15 TCU	ND	SMWW 2120 C	Within Limits
11	Nitrate (NO_3^-)	≤50 mg/L	ND	SMWW 4500NO_3^-B	Within Limits
12	Nitrite (NO_2^-)	≤3 mg/L	ND	SMWW 4500NO_2^-B	Within Limits
13	Taste	Non Objectionable / Acceptable	Acceptable	Organoleptic	Within Limits
14	Odor	Non Objectionable / Acceptable	Acceptable	Organoleptic	Within Limits
15	Phenolic Compounds (as Phenols)	NGVS	ND	SMWW 5530 C	---
16	Cyanide (CN^-)	≤0.05 mg/L	ND	SMWW 4500 CN^- F	Within Limits
17	Fluoride (F^-)*	≤1.5 mg/L	0.2 mg/L	U.S. EPA 9214	Within Limits
18	Chromium (Cr)	≤0.05 mg/L	ND	U.S. EPA-200.7	Within Limits
19	Copper (Cu)	2.0 mg/L	ND	U.S. EPA-200.7	Within Limits
20	Lead (Pb)	≤0.05 mg/L	ND	U.S. EPA-200.7	Within Limits
21	Manganese (Mn)	≤0.5 mg/L	0.1 mg/L	U.S. EPA-200.7	Within Limits
22	Mercury (Hg)	≤0.001 mg/L	ND	U.S. EPA-200.7	Within Limits

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CHEMICAL ANALYSIS TEST REPORT (GROUND WATER)

Reference Number: ESPAK/0255P/23/DW/2540/00620 **Date:** 23/05/2023

Name of Industry / Client: JERS Consultancy (Pvt) Limited

S. No	Parameters	Limit Values (DW-PEQS)	Concentration	Method / Equipment Used	Remarks
23	Nickel (Ni)	≤0.02 mg/L	ND	U.S. EPA-200.7	Within Limits
24	Boron (B)	0.3 mg/L	ND	U.S. EPA-200.7	Within Limits
25	Cadmium (Cd)	0.01 mg/L	ND	U.S. EPA-200.7	Within Limits
26	Selenium (Se)	0.01 mg/L	ND	U.S. EPA-200.7	Within Limits
27	Barium (Ba)	0.7 mg/L	0.1 mg/L	U.S. EPA-200.7	Within Limits
28	Zinc (Zn)	5.0 mg/L	ND	U.S. EPA-200.7	Within Limits
29	Aluminum (Al)	≤0.2 mg/L	ND	U.S. EPA-200.7	Within Limits
30	Antimony (Sb)	≤0.005 mg/L	ND	U.S. EPA-200.7	Within Limits
31	Arsenic (As)	≤0.05 mg/L	ND	U.S. EPA-200.7	Within Limits

PEQS: Punjab Environmental Quality Standards for Drinking Water, 2016
SMWW: Standard Methods for the Examination of Water and WasteWater 23rd Edition, American Public Health Association, American Water Works Association, Water Environment Federation USA (2017)

- Laboratory tests and measurements were carried out at 25 ± 2 °C and 50 ± 10 % Relative Humidity conditions unless stated otherwise.
- Uncertainty of Measurement (UoM) data will be provided on request, where available. The statement of conformity, if provided in the report, is based on the decision rule of simple acceptance or rejection with equal shared risk due to measurement uncertainty.

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- **The report data is not intended to be used legally by the client.**
- **Only parameters marked with asterisk (*) are ISO 17025:2017 accredited.**

1. **Sample Analyzed By:** Waqas Ahmad (Analyst (ICP-AES)); Ghulam Mustafa (Analyst (Chemical)); M.Shahid (Analyst (Chemical)); Ayesha Javaid (Analyst (Chemical)); Khizra Bano (Analyst(Microbiology))
2. **Name of Chief Analyst with Seal:** Muhammad Arfan
3. **Signature of Incharge of the Environmental Laboratory:**

Name: Imran Malik
General Manager
Date: 23/05/2023

---------- End of Report ----------

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CHEMICAL ANALYSIS TEST REPORT (AMBIENT AIR)

Reference Number: ESPAK/0255P/23/AA/2541/00235 **Date:** 18/05/2023

Name of Industry/Client: JERS Consultancy (Pvt) Limited

Address: 24-Civic Center Street, Township Commercial Area Lahore

Validation Officer: Muhammad Nadeem, Research Officer

Nature of Sample: Ambient Air

Monitoring Location: Near Thokar Niaz Baig, Lahore (GPS: 31.472981°N 74.209574°E)

Date of Sample Collection: 16/05/2023

Grab / Composite: Continuous- 24 Hours

Sample Collected/Sent By: Muhammad Zubair, Analyst (Field), ESPAK

Date of Completion of Analysis: 17/05/2023

S. No	Parameters	Limit Values (PEQS-24Hours)	Concentration	Method / Equipment Used	Remarks
1	Carbon Monoxide (CO)	5 mg/m³ (8 Hours)	4.5 mg/m³	Non Dispersive Infrared Absorption (NDIR)	Within Prescribed Limits
2	Sulfur Dioxide (SO_2)	120 µg/m³	15.4 µg/m³	UV Fluorescence (UVF)	Within Prescribed Limits
3	Ozone (O_3)	130 µg/m³ (1 Hour)	22.6 µg/m³	Non Dispersive UV Absorption	Within Prescribed Limits
4	Oxides of Nitrogen as NO	40 µg/m³	18.3 µg/m³	Chemiluminescence Detection	Within Prescribed Limits
5	Oxides of Nitrogen as NO_2	80 µg/m³	29.6 µg/m³	Chemiluminescence Detection	Within Prescribed Limits
6	Particulate Matter $PM_{2.5}$	35 µg/m³	25.3 µg/m³	Particulate Sensor	Within Prescribed Limits
7	Particulate Matter PM_{10}	150 µg/m³	123 µg/m³	Particulate Sensor	Within Prescribed Limits
8	Suspended Particulate Matter (SPM)	500 µg/m³	264.0 µg/m³	High Volume Sampler (HVS)	Within Prescribed Limits

PEQS: Punjab Environmental Quality Standards for Ambient Air, 2016

Uncertainty of Measurement (UoM) data will be provided on request, where available. The statement of conformity, if provided in the report, is based on the decision rule of simple acceptance or rejection with equal shared risk due to measurement uncertainty.

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1. **Sample Analyzed By:** Muhammad Zubair, Analyst (Field)
2. **Name of Chief Analyst with Seal:** Muhammad Arfan
3. **Signature of Incharge of the Environmental Laboratory:**

Name: Imran Malik
General Manager
Date: 18/05/2023

---------- End of Report ----------

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NOISE MONITORING REPORT

Reference Number: ESPAK/0255P/23/N/2542/00272 **Date:** 18/05/2023

Name of Industry/Client: JERS Consultancy (Pvt) Limited

Address: 24-Civic Center Street, Township Commercial Area Lahore

Validation Officer: Muhammad Nadeem, Research Officer

Nature of Sample: Noise

Date of Sample Collection: 16/05/2023 **Grab / Composite:** Continuous-24 Hours

Sample Collected/Sent By: Muhammad Zubair, Analyst (Field), ESPAK

Date of Completion of Analysis: 17/05/2023

Method/Equipment Used: Sound Level Meter

S. No	Measurement Point	Limit Values (PEQS)	Noise Level in dB(A) Leq	Remarks
1	Near Thokar Niaz Baig, Lahore (GPS: 31.472981°N 74.209574°E) - Day time	65 dB(A)	56 dB(A)	Within Prescribed Limits
2	Near Thokar Niaz Baig, Lahore (GPS: 31.472981°N 74.209574°E)- Night time	55 dB(A)	55 dB(A)	Within Prescribed Limits

PEQS: Punjab Environmental Quality Standards for Noise in Commercial Area, 2016 Day Time Hours (6:00 am to 10:00 pm) Night Time Hours (10:00 pm to 6:00 am)

• Uncertainty of Measurement (UoM) data will be provided on request, where available. The statement of conformity, if provided in the report, is based on the decision rule of simple acceptance or rejection with equal shared risk due to measurement uncertainty.

Note:

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1. **Sample Analyzed By:** Muhammad Zubair, Analyst (Field)
2. **Name of Chief Analyst with Seal:** Muhammad Arfan
3. **Signature of Incharge of the Environmental Laboratory:**

Name: Imran Malik
General Manager
Date: 18/05/2023

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Client Name	JERS Counsultancy (pvt.) Ltd
Monitoring Address	Near Tohker Niaz Baig, Lahore
Cooridantes	31.472981, 74.209574
Parameter	Ambient Air + Noise + Weather
Equipment Used	Environnement S.A + Noise Level Meter + Weather Station
Sampling interval	60 minutes
Sampling duration	24 hours
Monitoring Date	16-May

Date - Time	CO	SO_2	O_3	NO	NO_2	$PM_{2.5}$	PM_{10}	TSP	Noise	Temp.	RH	Wind Speed	Wind Direction
	mg/m^3	ug/m^3	ug/m^3	ug/m^3	ug/m^3	ug/m^3	ug/m^3	ug/m^3	dB	°C	%	m/s	
16/05/2023 11:32	5.4	16.7	22.6	18.0	30.8	26.2	136		59.0	29	50	1.8	NW
16/05/2023 12:32	3.3	12.2		17.7	30.3	28.1	117		53.0	27	54	1.6	NW
16/05/2023 13:32	4.9	15.3		19.2	28.4	24.6	126		56.0	25	56	1.5	NW
16/05/2023 14:32	4.6	17.4		18.9	29.8	26.2	128		57.0	23	58	1.4	NW
16/05/2023 15:32	3.5	16.4		17.4	29.9	24.8	132		53.0	23	58	1.5	W
16/05/2023 16:32	4.7	17.6		18.5	31.4	27.6	128.0		55.0	20	61	1.4	W
16/05/2023 17:32	4.3	16.9		18.1	29.5	25.6	130		79.0	20	61	1.3	W
16/05/2023 18:32	5.4	16.2		19.2	30.9	22.6	98.7		52.0	19	62	1.2	W
16/05/2023 19:32		12.3		18.8	31.8	22.0	117		55.0	19	62	1.2	N
16/05/2023 20:32		17.4		17.9	30.6	20.0	108		52.0	19	62	1.2	NE
16/05/2023 21:32		17.0		17.7	28.9	21.5	100		48.0	18	63	1.3	NE
16/05/2023 22:32		12.9		19.1	30.8	23.1	108		53.0	18	63	0.9	NE
16/05/2023 23:32		12.7		17.1	29.5	27.0	112	264	53.0	18	63	0.9	NE
17/05/2023 0:32		17.9		18.6	31.6	28.3	124		56.0	19	62	0.9	NE
17/05/2023 1:32		17.2		18.3	29.0	25.5	127		55.0	21	60	0.8	NE
17/05/2023 2:32		14.3		19.8	31.1	21.0	109		61.0	23	58	1.1	SE
17/05/2023 3:32		17.4		18.4	29.2	25.3	119		52.0	25	54	1.2	SE
17/05/2023 4:32		13.6		19.4	28.7	24.9	126		52.0	27	56	1.4	SE
17/05/2023 5:32		17.6		18.0	30.8	27.0	132		56.0	29	54	1.2	SE
17/05/2023 6:32		14.8		19.6	31.4	26.0	127		49.0	30	52	1.1	SE
17/05/2023 7:32		16.9		19.2	30.9	28.0	136		54.0	30	52	1.1	SE
17/05/2023 8:32		14.0		17.3	28.3	28.0	132		70.0	31	50	1.2	S
17/05/2023 9:32		10.1		16.6	23.3	26.0	134		58.0	31	50	1.2	S
17/05/2023 10:32		14.4		15.5	22.4	27.6	136		53.0	31	50	1.3	S

Average	4.5	15.4	22.6	18.3	29.6	25.3	123	264	56.5
Maximum	5.4	17.9	22.6	19.8	31.8	28.3	136	264	79.0
Minimum	3.3	10.1	22.6	15.5	22.4	20.0	98.7	264.0	48.0

CO First 8 Hours	4.5
Noise Day Hours	56
Noise Night Hours	55

Monitored By:	Muhammad Zubair, Field Officer

ENVIRONMENTAL PROTECTION AGENCY
GOVERNMENT OF THE PUNJAB
National Hockey Stadium, Gate No. 08
Gaddafi Stadium Complex, Lahore

Validation # 56-A

Dated: 19-05-2023

Validation for Stack & Ambient Monitoring / Sampling

	Emission Monitoring under CTM-34 or OTM-39			
Facility Name & Address Phone	JERS Consultancy (Pvt) Ltd	No of Stacks /Sampling Point	AA	01
Industry Category				
Analyzer Model & Make	Environment S.A			
Average stack emission Values of CO, NOx (in mg/nM3)				
Excess Air / Excess Oxygen (%age):-				
Analyzer exposed for Ramp-Up phase to the sample gas for 5 minutes		Yes	NO	NA
Analyzer flow rate and EC temperature monitored during calibration and testing		Yes	No	NA
Test Data Phase of sample gas recorded with 15 second interval		Yes	No	NA
All key requirements to ensure QA/QC complied for said EPA approved Method		Yes	No	NA
Particulate Matter (PM) Monitoring / Sampling under USEPA Method 5 / 17				
Model & Make of Iso-kinetic PM Assembly				
The PM sampling train is complete as per Method 5 & 17		Yes	No	NA
Leak Test performed prior to sampling		Yes	No	NA
Field data Sheet for PM Sampling filled during PM sampling		Yes	No	NA
Data for determining of "K" factor & DGM "Y" Factor filled during sampling		Yes	No	NA
All method key requirements during sampling were compiled to ensure QA/QC		Yes	No	NA
Filter of Particulate matter is suitable for metal Testing		Yes	No	NA
SOx sampling as per Method 8 (Thorin Indicator Method)				
The right absorbent solution are available for SOx Sampling		Yes	No	NA
The equipment is capable to maintain flow rate @ 2.0LPM or as per method 8 requirement		Yes	No	NA
Sampling for SOx is performed as per method		Yes	No	NA
Ambient Air Quality Monitoring by Automatic Monitors for CO, O3, SO2, NOx, PM2.5 & PM10				
In case of continuous monitoring at a site, One Point QC Check Single analyzer & zero/span check is performed every 14 days.		Yes	No	NA
The CE of NOx analyzer is ensured to be maintained within 96% - 104.1%		Yes	No	NA
Zero/span check is performed prior to starting ambient monitoring		Yes	No	NA
All key requirements for Critical & Operational Criteria for ambient air monitoring by automatic monitors were compiled during monitoring		Yes	No	NA
The measuring techniques of monitors comply PEQS		Yes	No	NA
Ambient Air Sampling of SPM, PM10, Pb by High Volume Sampler				
In case of Sampling for SPM through samplers, the flow rate of sampler complies PEQS (1.1m3/min).		Yes	No	NA
Calibration of Sampler performed prior to sampling		Yes	No	NA
Vehicular Emissions & Noise Measurement				
Sampling of Vehicle emissions and noise measurement have been performed as per method and SOPs		Yes	No	NA

Remarks (if Any):- Valid Subject to Compliance of conditions of certificate.

Dated 16-05-2023

Signature

Research Officer
Environment Protection Agency
Punjab Lahore

Signature

M. Zubair
Asst. Analyst

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GOVERNMENT OF THE PUNJAB
National Hockey Stadium, Gate No. 08
Gaddafi Stadium Complex, Lahore

Validation 56-B Dated 19-05-23

Validation for Wastewater & Drinking Water

Project / Unit Name with Address and contact details	JERS Consultancy (Pvt.) Ltd
Sampling Point	Bore
Validation No	
Name of Private Lab	ESPAK

Waste Water (WW) Treatment Facility: Primary / Secondary / Tertiary / NA

Drinking Water (W) Treatment Facility: Chemical / RO / NA

Total WW collected Sample .....

Total Collected Drinking water samples.....

Sample Tag for testing parameter is assigned on sample container	Yes	NO	NA
Sample is preserved properly for each testing parameter	Yes	NO	NA
Sample size is adequate for testing the target parameters	Yes	NO	NA
Wastewater Flow Measurement performed to ensure sample representativeness	Yes	NO	NA

No. of Waste Water outlets	Waste Water Flow m^3/hr from each outlet (Optional)	Water intake m^3/hr (Optional)	Water Mass balance complied during sampling (Optional) Yes / No	Sample Type: Ground Water (Grab / Composite)

Parameter	Matrix W	Matrix WW	Container	Sample Size	Preservation	Yes	NO	NA
Coliform, Total or Fecal	✓	—	Sterile Container	100 mL	Refrigerate 6 C	✓		
Coliform, Total or Fecal, Chlorinated Water	✓	—	Sterile Container	100 mL	0.008% Thiosulphate & cooled 6 C	✓		
Color, Turbidity	✓	—	P,G	500 mL	Cool 6 C	✓		
Hardness, Total	✓	—	P,G	500ml	HNO3 to pH<2	✓		
Nitrogen, Nitrate + Nitrite , Phenolic Compounds, Oil & Grease, COD, NH3	✓	—	P,G	2000 mL	H2SO4 to pH < 2, Cool 6C	✓		
Metals, General	✓	—	P,G Rinsed 1:1 HNO3	500 mL	HNO3 to pH < 2	✓		
Cyanide, Total		—	P,G	500 mL	NaOH to pH > 12, Cool 6C	✓		
Pesticides, General		—	Glass	1 Liter	Cool 6 C			

Field Parameters*		pH meter, Model Make	Measurement Method	Calibrated in Field Yes / NO	Measured value
Field parameter					
pH					
Temp					
Cl					

Signature

Research Officer
Environment Protection Agency
Punjab Lahore

Dated: 12-05-2023

Signature

M. Zubair
Lab. Analyst

ESPAK

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Annexure-V

Public Consultation Proformae

Public Consultation Performa
Jers Consultancy Pvt Ltd

Name Of the Interviewer: Tashfeen Date: 03-05-2023

Location: canal view

1. Name of Respondents: Amoos
2. CNIC No/ Mobile No: 0320 468 6584
3. Gender a) Male ✓ b) Female
4. Age: 25 year
5. Education: Bachelor
6. Address: canal view
7. Marital Status: a) Married b) Unmarried ✓ c) Divorced/Widowed/separated
8. Occupation Status:
   1) Govt servient: _____
   2) Private job: ✓
   3) Business: _____
   4) Farming: _____
   5) Labor: _____
   6) Retired: _____
   7) Any Other (specific): _____
9. Average Monthly Income: 30000
10. Are you aware of the WWTP project at Kattar Bund Road
    a. YES: _____
    b. No: ✓

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Public Consultation Performa
Jers Consultancy Pvt Ltd

11. In your opinion what may be the possible positive and negative impacts of the projects during construction and operation Phase

i. Construction Phase
(positive Impacts) :

employment

Construction Phase
(Negative Impacts):

dust issues

ii. Operation Phase
(Positive Impacts):

Sewerage issues will be solved and water will be reused for agri Purpose

(Negative Impacts) :

-

12. Any other Suggestions:

-

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Public Consultation Performa
Jers Consultancy Pvt Ltd

Name Of the Interviewer: Tashfeen Date: 05-05-2023

Location: canal view

1. Name of Respondents: Nazeer Ahmed
2. CNIC No/ Mobile No: 03214354166
3. Gender a) Male ✓ b) Female
4. Age: 64 year
5. Education: F.Sc
6. Address: Canal view Society
7. Marital Status: a) Married ✓ b) Unmarried c) Divorced/Widowed/separated
8. Occupation Status:
   1) Govt servient: _____
   2) Private job: Manger Administrative
   3) Business: _____
   4) Farming: _____
   5) Labor: _____
   6) Retired: _____
   7) Any Other (specific): _____
9. Average Monthly Income: 60000
10. Are you aware of the WWTP project at Kattar Bund Road
    a. YES: _____
    b. No: ✓

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Jers Consultancy Pvt Ltd

11. In your opinion what may be the possible positive and negative impacts of the projects during construction and operation Phase

i. Construction Phase
(positive Impacts) :

employment

Construction Phase
(Negative Impacts):

–

ii. Operation Phase
(Positive Impacts):

Sewerage and wastewater will be reused for agri purpose

(Negative Impacts) :

12. Any other Suggestions:

✓

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Name Of the Interviewer: Tashfeen Date: 05-05-2023

Location: Niaz Baig

1. Name of Respondents: Ameer Ali
2. CNIC No/ Mobile No: 0303-8086988
3. Gender ✓ a) Male b) Female
4. Age: 41 year
5. Education: ~~Ma~~ Middle
6. Address: Niaz Baig
7. Marital Status: ✓ a) Married b) Unmarried c) Divorced/Widowed/separated
8. Occupation Status:
   1) Govt servient: _____
   2) Private job: ✓
   3) Business: _____
   4) Farming: _____
   5) Labor: _____
   6) Retired: _____
   7) Any Other (specific): _____
9. Average Monthly Income: 30000
10. Are you aware of the WWTP project at Kattar Bund Road
    a. YES: _____
    b. No: ✓

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Jers Consultancy Pvt Ltd

11. In your opinion what may be the possible positive and negative Impacts of the projects during construction and operation Phase

i. Construction Phase
(positive Impacts) :

employment

Construction Phase
(Negative Impacts):

dust

ii. Operation Phase
(Positive Impacts):

sewerage issues will be solved

(Negative Impacts) :

-

12. Any other Suggestions:

Roads should be built again

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Name Of the Interviewer: Tashfeen Date: 05-05-2023

Location: Niaz Baig

1. Name of Respondents: Haji Tarap
2. CNIC No/ Mobile No: 0303-4304348
3. Gender a) Male ✓ b) Female
4. Age: 62 years
5. Education: —
6. Address: Niaz Baig
7. Marital Status: a) Married ✓ b) Unmarried c) Divorced/Widowed/separated
8. Occupation Status:
   1) Govt servient: _____
   2) Private job: _____
   3) Business: _____
   4) Farming: ✓
   5) Labor: _____
   6) Retired: _____
   7) Any Other (specific): _____
9. Average Monthly Income: 45000
10. Are you aware of the WWTP project at Kattar Bund Road
    a. YES: _____
    b. No: ✓

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11. In your opinion what may be the possible positive and negative Impacts of the projects during construction and operation Phase

i. Construction Phase
(positive Impacts) :

empelopment

Construction Phase
(Negative Impacts):

-

ii. Operation Phase
(Positive Impacts):

sewerage issues will be solved

(Negative Impacts) :

-

12. Any other Suggestions:

Road network should be given

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Jers Consultancy Pvt Ltd

Name Of the Interviewer: Tashfeen Date: 05-05-2023

Location: Munir Garden

1. Name of Respondents: Wasim Abbas
2. CNIC No/ Mobile No: 35404-6455051-7
3. Gender a) ✓ Male b) Female
4. Age: 25 year
5. Education: Middle
6. Address: Munir garder
7. Marital Status: a) ✓ Married b) Unmarried c) Divorced/Widowed/separated
8. Occupation Status:
   1) Govt servient: _____
   2) Private job: ~~Shop~~
   3) Business: shop
   4) Farming: _____
   5) Labor: _____
   6) Retired: _____
   7) Any Other (specific): _____
9. Average Monthly Income: 30000
10. Are you aware of the WWTP project at Kattar Bund Road
    a. YES: _____
    b. No: ✓

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11. In your opinion what may be the possible positive and negative impacts of the projects during construction and operation Phase

i. Construction Phase
(positive Impacts) :

employment opportunity.

Construction Phase
(Negative Impacts):

dust

ii. Operation Phase
(Positive Impacts):

Sewerage issues will be solved

(Negative Impacts) :

—

12. Any other Suggestions:

gas should be provided

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Name Of the Interviewer: Tashfeen Date: 05-05-2023

Location: Munir Garden Thober

1. Name of Respondents: Shehbaz Ali
2. CNIC No/ Mobile No: -
3. Gender a) Male ✓ b) Female
4. Age: 35 year
5. Education: Primary
6. Address: Munir garden Thober
7. Marital Status: a) Married ✓ b) Unmarried c) Divorced/Widowed/separated
8. Occupation Status:
    1) Govt servient: _____
    2) Private job: shop
    3) Business: _____
    4) Farming: _____
    5) Labor: _____
    6) Retired: _____
    7) Any Other (specific): _____
9. Average Monthly Income: 30000
10. Are you aware of the WWTP project at Kattar Bund Road
    a. YES: _____
    b. No: ✓

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11. **In your opinion what may be the possible positive and negative impacts of the projects during construction and operation Phase**

i. **Construction Phase**
(positive Impacts) :

empelogment oppertunity

Construction Phase
(Negative Impacts):

ii. **Operation Phase**
(Positive Impacts):

seweraj issues will be solved

(Negative Impacts) :

12. **Any other Suggestions:**

Gas should be provided

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Name Of the Interviewer: Tashfeen Date: 05-05-2023

Location: Kattar Bund Road

1. Name of Respondents: Rizwan
2. CNIC No/ Mobile No: 0323-4570436
3. Gender ✓ a) Male b) Female
4. Age: 33
5. Education: graduation
6. Address: Shop on Kattar Bund Road
7. Marital Status: ✓ a) Married b) Unmarried c) Divorced/Widowed/separated
8. Occupation Status:
    1) Govt servient: _____
    2) Private job: _____
    3) Business: ✓
    4) Farming: _____
    5) Labor: _____
    6) Retired: _____
    7) Any Other (specific): _____
9. Average Monthly Income: 50000
10. Are you aware of the WWTP project at Kattar Bund Road
    a. YES: _____
    b. No: ✓

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11. **In your opinion what may be the possible positive and negative impacts of the projects during construction and operation Phase**

i. **Construction Phase**
(positive Impacts) :

empelogment

Construction Phase
(Negative Impacts):

Trolley Trector movements, restriction to shop, restriction to business

ii. **Operation Phase**
(Positive Impacts):

sewerage issues will be solved

(Negative Impacts) :

12. ***Any other Suggestions:***

Roads should ~~will~~ be built again

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Name Of the Interviewer: Tashfeen Date: 05-05-2023

Location: Thoher Niaz Baig

1. Name of Respondents: Ali Hamza
2. CNIC No/ Mobile No: 0327-4113505
3. Gender a) ✓Male b) Female
4. Age: 19 year
5. Education: Matric
6. Address: Thoher Niaz Baig
7. Marital Status: a) Married b) ✓Unmarried c) Divorced/Widowed/separated
8. Occupation Status:
   1) Govt servient: _____
   2) Private job: ✓
   3) Business: _____
   4) Farming: _____
   5) Labor: _____
   6) Retired: _____
   7) Any Other (specific): _____
9. Average Monthly Income: 25000
10. Are you aware of the WWTP project at Kattar Bund Road
    a. YES: _____
    b. No: ✓

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11. In your opinion what may be the possible positive and negative impacts of the projects during construction and operation Phase

i. Construction Phase
(positive Impacts) :

employment opportunities

Construction Phase
(Negative Impacts):

dust issues, movement restriction

ii. Operation Phase
(Positive Impacts):

several issues will be solved

(Negative Impacts) :

—

12. Any other Suggestions:

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Name Of the Interviewer: Tashfeen Date: 05-05-2023

Location: Thober Niaz Baig

1. Name of Respondents: Afzaal
2. CNIC No/ Mobile No: 0302-4685109
3. Gender a) Male ✓ b) Female
4. Age: 17 Year
5. Education: Matric
6. Address: Thober Niaz Baig
7. Marital Status: a) Married b) Unmarried ✓ c) Divorced/Widowed/separated
8. Occupation Status:
    1) Govt servient: _____
    2) Private job: _____
    3) Business: ✓
    4) Farming: _____
    5) Labor: _____
    6) Retired: _____
    7) Any Other (specific): _____
9. Average Monthly Income: 50000
10. Are you aware of the WWTP project at Kattar Bund Road
    a. YES: _____
    b. No: ✓

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11. In your opinion what may be the possible positive and negative impacts of the projects during construction and operation Phase

i. **Construction Phase**
(positive Impacts) :

employment opportunity,

Construction Phase
(Negative Impacts):

dust issues, already sewerage line damage

ii. **Operation Phase**
(Positive Impacts):

sewerage issues will be solved

(Negative Impacts) :

–

12. Any other Suggestions:

–

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Name Of the Interviewer: Tashfeen Date: 05-05-2023

Location: Thober Niaz Baig

1. Name of Respondents: Shafiq
2. CNIC No/ Mobile No: 0306-4944057
3. Gender ✓ a) Male b) Female
4. Age: 40 years
5. Education: middle
6. Address: Thober Niaz Baig
7. Marital Status: ✓ a) Married b) Unmarried c) Divorced/Widowed/separated
8. Occupation Status:
    1) Govt servient: _____
    2) Private job: _____
    3) Business: ✓
    4) Farming: _____
    5) Labor: _____
    6) Retired: _____
    7) Any Other (specific): _____
9. Average Monthly Income: 50000
10. Are you aware of the WWTP project at Kattar Bund Road
    a. YES: _____
    b. No: ✓

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11. In your opinion what may be the possible positive and negative impacts of the projects during construction and operation Phase

i. **Construction Phase**
(positive Impacts) :

employment opportunity

Construction Phase
(Negative Impacts):

dust, restriction to movement

ii. **Operation Phase**
(Positive Impacts):

sewerage issues will be solved

(Negative Impacts) :

—

12. *Any other Suggestions:*

✓

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Name Of the Interviewer: Tashfeen Date: 05-05-2023

Location: Thober Niaz Baig

1. Name of Respondents: Majid Ali
2. CNIC No/ Mobile No: 0303- 4555549
3. Gender a) Male ✓ b) Female
4. Age: 24 year
5. Education: Primary
6. Address: Thober Niaz Baig
7. Marital Status: a) Married b) Unmarried ✓ c) Divorced/Widowed/separated
8. Occupation Status:
   1) Govt servient: _____
   2) Private job: _____
   3) Business: _____
   4) Farming: _____
   5) Labor: _____
   6) Retired: _____
   7) Any Other (specific): Richshaw driver
9. Average Monthly Income: 35000
10. Are you aware of the WWTP project at Kattar Bund Road
    a. YES: _____
    b. No: ✓

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11. In your opinion what may be the possible positive and negative impacts of the projects during construction and operation Phase

i. Construction Phase
(positive Impacts) :

employment

Construction Phase
(Negative Impacts):

dust, restriction to movement

ii. Operation Phase
(Positive Impacts):

sewerage issues will be solved

(Negative Impacts) :

—

12. Any other Suggestions:

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Name Of the Interviewer: Tashfeen Date: 05-05-2023

Location: Kattar Bund road

1. Name of Respondents: Taqi Abbas
2. CNIC No/ Mobile No: 0321-8131208
3. Gender ✓ a) Male b) Female
4. Age: 36 year
5. Education: Middle
6. Address: Kattar Bund Shop
7. Marital Status: ✓ a) Married b) Unmarried c) Divorced/Widowed/separated
8. Occupation Status:
   1) Govt servient: _____
   2) Private job: ✓
   3) Business: _____
   4) Farming: _____
   5) Labor: _____
   6) Retired: _____
   7) Any Other (specific): _____
9. Average Monthly Income: 50000
10. Are you aware of the WWTP project at Kattar Bund Road
    a. YES: _____
    b. No: ✓

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11. **In your opinion what may be the possible positive and negative impacts of the projects during construction and operation Phase**

i. **Construction Phase**
(positive Impacts) :

employment

Construction Phase
(Negative Impacts):

restriction to business, restriction to movement

ii. **Operation Phase**
(Positive Impacts):

sewerage issues will be solved

(Negative Impacts) :

-

12. ***Any other Suggestions:***

Roads should be built again

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Name Of the Interviewer: Tashfeen Date: 05-05-2023

Location: Kattar Bund Road

1. Name of Respondents: Zahoor Ahmed
2. CNIC No/ Mobile No: 1230 1 - 7521532
3. Gender a) Male ✓ b) Female
4. Age: 40 year
5. Education: Primary
6. Address: Kattar Bund Shop
7. Marital Status: a) Married ✓ b) Unmarried c) Divorced/Widowed/separated
8. Occupation Status:
   1) Govt servient: _____
   2) Private job: _____
   3) Business: shop
   4) Farming: _____
   5) Labor: _____
   6) Retired: _____
   7) Any Other (specific): _____
9. Average Monthly Income: 50000
10. Are you aware of the WWTP project at Kattar Bund Road
    a. YES: _____
    b. No: ✓

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11. **In your opinion what may be the possible positive and negative impacts of the projects during construction and operation Phase**

i. **Construction Phase**
(positive Impacts) :

empelayment

Construction Phase
(Negative Impacts):

restriction to business, restriction to business

ii. **Operation Phase**
(Positive Impacts):

sewerage issues will be solved

(Negative Impacts) :

—

12. ***Any other Suggestions:***

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Name Of the Interviewer: Tashfeen Date: 05-05-2023

Location: Kattar Bund Road

1. Name of Respondents: Shaban
2. CNIC No/ Mobile No: 0300-4646707
3. Gender a) Male ✓ b) Female
4. Age: 43 years
5. Education: Matric
6. Address: Kattar Bund's Shop
7. Marital Status: a) Married ✓ b) Unmarried c) Divorced/Widowed/separated
8. Occupation Status:
   1) Govt servient: _____
   2) Private job: Shop
   3) Business: _____
   4) Farming: _____
   5) Labor: _____
   6) Retired: _____
   7) Any Other (specific): _____
9. Average Monthly Income: ~35000
10. Are you aware of the WWTP project at Kattar Bund Road
    a. YES: _____
    b. No: ✓

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11. **In your opinion what may be the possible positive and negative impacts of the projects during construction and operation Phase**

i. **Construction Phase**
(positive Impacts) :

empelayment

Construction Phase
(Negative Impacts):

Restriction to business, Restriction to movement

ii. **Operation Phase**
(Positive Impacts):

sewerage issues will be solved

(Negative Impacts) :

12. **Any other Suggestions:**

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Name Of the Interviewer: Tashfeen Date: 05-05-2023

Location: Kattar Bund Road

1. Name of Respondents: Adil
2. CNIC No/ Mobile No: 0305 - 6410004
3. Gender a) Male ✓ b) Female
4. Age: 30 year
5. Education: Matric
6. Address: Shop on Kattar Bund road
7. Marital Status: a) Married ✓ b) Unmarried c) Divorced/Widowed/separated
8. Occupation Status:
   1) Govt servient: _____
   2) Private job: Shop
   3) Business: _____
   4) Farming: _____
   5) Labor: _____
   6) Retired: _____
   7) Any Other (specific): _____
9. Average Monthly Income: 100000
10. Are you aware of the WWTP project at Kattar Bund Road
    a. YES: _____
    b. No: ✓

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11. **In your opinion what may be the possible positive and negative impacts of the projects during construction and operation Phase**

i. **Construction Phase**
(positive Impacts) :

empelogment

Construction Phase
(Negative Impacts):

Restriction to buisness, Restriction to movement

ii. **Operation Phase**
(Positive Impacts):

Sewerage issues will be solved

(Negative Impacts) :

-

12. ***Any other Suggestions:***

Roads should be built again

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Name Of the Interviewer: Tashfeen Date: 05-05-2023

Location: Kattar Bund Road

1. Name of Respondents: M Umar
2. CNIC No/ Mobile No: 0309 4233943
3. Gender a) Male ✓ b) Female
4. Age: 21 year
5. Education: Matric
6. Address: Shop on Kattar Bund road
7. Marital Status: a) Married b) Unmarried ✓ c) Divorced/Widowed/separated
8. Occupation Status:
    1) Govt servient: _____
    2) Private job: shop
    3) Business: _____
    4) Farming: _____
    5) Labor: _____
    6) Retired: _____
    7) Any Other (specific): _____
9. Average Monthly Income: 60000
10. Are you aware of the WWTP project at Kattar Bund Road
    a. YES: _____
    b. No: ✓

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11. In your opinion what may be the possible positive and negative impacts of the projects during construction and operation Phase

i. Construction Phase
(positive Impacts) :

empelopment

Construction Phase
(Negative Impacts):

restriction to busines and movement

ii. Operation Phase
(Positive Impacts):

Sewerage issues will be solved

(Negative Impacts) :

—

12. Any other Suggestions:

roads should be built again

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Name Of the Interviewer: Tashfeen Date: 05-05-2023

Location: Kattan Bund Shop

1. Name of Respondents: Nadeem
2. CNIC No/ Mobile No: 0300 - 9426230
3. Gender ✓ a) Male b) Female
4. Age: 54
5. Education: F.A
6. Address: Shop on Kattan Bund
7. Marital Status: ✓ a) Married b) Unmarried c) Divorced/Widowed/separated
8. Occupation Status:
    1) Govt servient: _____
    2) Private job: Shop
    3) Business: _____
    4) Farming: _____
    5) Labor: _____
    6) Retired: _____
    7) Any Other (specific): _____
9. Average Monthly Income: 50000
10. Are you aware of the WWTP project at Kattar Bund Road
    a. YES: _____
    b. No: ✓

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11. **In your opinion what may be the possible positive and negative impacts of the projects during construction and operation Phase**

i. **Construction Phase**
(positive Impacts) :

empeloyment opperturity

Construction Phase
(Negative Impacts):

restriction to movemant and
buiness , demage to shop

ii. **Operation Phase**
(Positive Impacts):

seweraje issues will be
solved

(Negative Impacts) :

12. **Any other Suggestions:**

Roads should be built

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Name Of the Interviewer: Tashfeen Date: 05-05-2023

Location: 8 Kattar Bund road

1. Name of Respondents: M. Tariq
2. CNIC No/ Mobile No: 0333 - 4321 371
3. Gender a) Male ✓ b) Female
4. Age: 42
5. Education: Middle
6. Address: Kattar Bund Road
7. Marital Status: a) Married ✓ b) Unmarried c) Divorced/Widowed/separated
8. Occupation Status:
    1) Govt servient: _____
    2) Private job: shop
    3) Business: _____
    4) Farming: _____
    5) Labor: _____
    6) Retired: _____
    7) Any Other (specific): _____
9. Average Monthly Income: 50002
10. Are you aware of the WWTP project at Kattar Bund Road
    a. YES: _____
    b. No: ✓

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11. **In your opinion what may be the possible positive and negative impacts of the projects during construction and operation Phase**

i. **Construction Phase**
(positive Impacts) :

employment opportunity

Construction Phase
(Negative Impacts):

~~red~~ demage to shop or Property, dust, restriction to business

ii. **Operation Phase**
(Positive Impacts):

Sewerage issue will be solved

(Negative Impacts) :

12. **Any other Suggestions:**

Roads should be built again

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Name Of the Interviewer: Tashfeen Date: 05-05-2023

Location: Kattar Bund Road

1. Name of Respondents: M. Thanjir
2. CNIC No/ Mobile No: 0301 4739106
3. Gender a) Male ✓ b) Female
4. Age: 42 Year
5. Education: Primary
6. Address: Shop on Kattar Bund
7. Marital Status: a) Married ✓ b) Unmarried c) Divorced/Widowed/separated
8. Occupation Status:
   1) Govt servient: _____
   2) Private job: Shop
   3) Business: _____
   4) Farming: _____
   5) Labor: _____
   6) Retired: _____
   7) Any Other (specific): _____
9. Average Monthly Income: 43000
10. Are you aware of the WWTP project at Kattar Bund Road
    a. YES: _____
    b. No: ✓

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11. In your opinion what may be the possible positive and negative impacts of the projects during construction and operation Phase

i. Construction Phase
(positive Impacts) :

employment opportunity

Construction Phase
(Negative Impacts):

dust , movement restriction

ii. Operation Phase
(Positive Impacts):

Sewerage issues will be solved

(Negative Impacts) :

-

12. Any other Suggestions:

Roads should be built again

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Name Of the Interviewer: Tashfeen Date: 05-05-2023

Location: Kattar Bund Road

1. Name of Respondents: Jamshaid
2. CNIC No/ Mobile No: 0300-4334781
3. Gender a) Male ✓ b) Female
4. Age: 45 yeas
5. Education: Matric
6. Address: shop on Kattar Bund road
7. Marital Status: a) Married ✓ b) Unmarried c) Divorced/Widowed/separated
8. Occupation Status:
   1) Govt servient: _____
   2) Private job: shop
   3) Business: _____
   4) Farming: _____
   5) Labor: _____
   6) Retired: _____
   7) Any Other (specific): _____
9. Average Monthly Income: 40000
10. Are you aware of the WWTP project at Kattar Bund Road
    a. YES: _____
    b. No: ✓

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11. **In your opinion what may be the possible positive and negative impacts of the projects during construction and operation Phase**

i. **Construction Phase**
(positive Impacts) :

employment opportunity.

Construction Phase
(Negative Impacts):

dust, restriction and demage to business and shop

ii. **Operation Phase**
(Positive Impacts):

Sewerage issues will be solved

(Negative Impacts) :

12. **Any other Suggestions:**

Roads should be built again

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Name Of the Interviewer: Tashfeen Date: 05-05-2023

Location: Kattar Bund Road

1. Name of Respondents: Adnan
2. CNIC No/ Mobile No: 0333 4753847
3. Gender ✓ a) Male b) Female
4. Age: 40
5. Education: Matric
6. Address: Shop on Kattar Bund
7. Marital Status: ✓ a) Married b) Unmarried c) Divorced/Widowed/separated
8. Occupation Status:
    1) Govt servient: _____
    2) Private job: Shop
    3) Business: _____
    4) Farming: _____
    5) Labor: _____
    6) Retired: _____
    7) Any Other (specific): _____
9. Average Monthly Income: 47000
10. Are you aware of the WWTP project at Kattar Bund Road
    a. YES: ✓
    b. No: _____

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11. In your opinion what may be the possible positive and negative impacts of the projects during construction and operation Phase

i. **Construction Phase**
(positive Impacts) :

employment opportunity

Construction Phase
(Negative Impacts):

dust, demage to shop

ii. **Operation Phase**
(Positive Impacts):

Sewerage issues will be solved

(Negative Impacts) :

12. *Any other Suggestions:*

Roads should be built

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Name Of the Interviewer: Tashfeen Date: 04-05-2023

Location: Shah Pur Kanjra

1. Name of Respondents: Sajid Ali
2. CNIC No/ Mobile No: 0324-7272830
3. Gender ✓ a) Male b) Female
4. Age: 30 year
5. Education: Matric
6. Address: Shah Pur Kaanjra
7. Marital Status: ✓ a) Married b) Unmarried c) Divorced/Widowed/separated
8. Occupation Status:
   1) Govt servient: _____
   2) Private job: _____
   3) Business: ✓
   4) Farming: _____
   5) Labor: _____
   6) Retired: _____
   7) Any Other (specific): _____
9. Average Monthly Income: 50000
10. Are you aware of the WWTP project at Kattar Bund Road
    a. YES: ✓
    b. No: _____

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11. In your opinion what may be the possible positive and negative impacts of the projects during construction and operation Phase

i. **Construction Phase**
(positive Impacts) :

empelogment

Construction Phase
(Negative Impacts):

dust issue, restriction to movement

ii. **Operation Phase**
(Positive Impacts):

Sewerage system will be upgraded

(Negative Impacts) :

- - - -

12. Any other Suggestions:

Road issues, empelogment opportunities

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Name Of the Interviewer: Tashfeen Date: 04-05-2023

Location: Shah Pur Kaanjra

1. Name of Respondents: M Naveed
2. CNIC No/ Mobile No: 0300 - 1591213
3. Gender a) Male ✓ b) Female
4. Age: 36 years
5. Education: —
6. Address: Shah Pur Kaanjra
7. Marital Status: (a) Married b) Unmarried c) Divorced/Widowed/separated
8. Occupation Status:
   1) Govt servient: _____
   2) Private job: _____
   3) Business: ✓
   4) Farming: _____
   5) Labor: _____
   6) Retired: _____
   7) Any Other (specific): _____
9. Average Monthly Income: 35000
10. Are you aware of the WWTP project at Kattar Bund Road
    a. YES: _____
    b. No: ✓

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11. **In your opinion what may be the possible positive and negative impacts of the projects during construction and operation Phase**

i. **Construction Phase**
(positive Impacts) :

empelogment opportunities should be given to local

Construction Phase
(Negative Impacts):

dust , movement restriction

ii. **Operation Phase**
(Positive Impacts):

sewerage system

(Negative Impacts) :

12. **Any other Suggestions:**

road should be made

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Name Of the Interviewer: Tashfeen Date: 04-05-2023

Location: Shah Pur Kaanjra

1. Name of Respondents: Zaman Ali
2. CNIC No/ Mobile No: 0307-4226360
3. Gender a) Male ✓ b) Female
4. Age: 30 years
5. Education: Middle
6. Address: Shah Pur Kaanjra
7. Marital Status: a) Married ✓ b) Unmarried c) Divorced/Widowed/separated
8. Occupation Status:
   1) Govt servient: _____
   2) Private job: _____
   3) Business: ✓
   4) Farming: _____
   5) Labor: _____
   6) Retired: _____
   7) Any Other (specific): _____
9. Average Monthly Income: 40000
10. Are you aware of the WWTP project at Kattar Bund Road
    a. YES: _____
    b. No: ✓

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11. **In your opinion what may be the possible positive and negative impacts of the projects during construction and operation Phase**

i. **Construction Phase**
(positive Impacts) :

empelogment opportunities

Construction Phase
(Negative Impacts):

dust issue, Pedesterian movement restriction

ii. **Operation Phase**
(Positive Impacts):

Sewerage issued will be solved

(Negative Impacts) :

- —

12. **Any other Suggestions:**

roads should be build

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Name Of the Interviewer: Tashfeen Date: 04-05-2023

Location: Shah pur Kanjra

1. Name of Respondents: Abdul Shaboor
2. CNIC No/ Mobile No: 0300 8000 591
3. Gender ✓ a) Male b) Female
4. Age: 42 years
5. Education: Middle
6. Address: Shah pur Kanjra
7. Marital Status: (a) Married b) Unmarried c) Divorced/Widowed/separated
8. Occupation Status:
   1) Govt servient: _____
   2) Private job: _____
   3) Business: _____
   4) Farming: _____
   5) Labor: _____
   6) Retired: _____
   7) Any Other (specific): driver
9. Average Monthly Income: 33000
10. Are you aware of the WWTP project at Kattar Bund Road
    a. YES: _____
    b. No: ✓

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Jers Consultancy Pvt Ltd

11. **In your opinion what may be the possible positive and negative impacts of the projects during construction and operation Phase**

i. **Construction Phase**
(positive Impacts) :

employment opportunity

Construction Phase
(Negative Impacts):

dust, obstruction in the movement

ii. **Operation Phase**
(Positive Impacts):

sewerage issues will be solved

(Negative Impacts) :

—

12. ***Any other Suggestions:***

roads should be made

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Jers Consultancy Pvt Ltd

Name Of the Interviewer: Tashfeen Date: 04-05-2023

Location: Shah Pur

1. Name of Respondents: ~~Anwar~~ Iqbal
2. CNIC No/ Mobile No: 0303 - 0743039
3. Gender a) Male ✓ b) Female
4. Age: 19 year
5. Education: Matric
6. Address: shah pur Kanjra
7. Marital Status: a) Married (b) Unmarried c) Divorced/Widowed/separated
8. Occupation Status:
   1) Govt servient: _____
   2) Private job: ✓
   3) Business: _____
   4) Farming: _____
   5) Labor: _____
   6) Retired: _____
   7) Any Other (specific): _____
9. Average Monthly Income: 25000
10. Are you aware of the WWTP project at Kattar Bund Road
    a. YES: _____
    b. No: ✓

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Jers Consultancy Pvt Ltd

11. In your opinion what may be the possible positive and negative impacts of the projects during construction and operation Phase

i. Construction Phase
(positive Impacts) :

empolayment opperturnity

Construction Phase
(Negative Impacts):

dust , movement restriction

ii. Operation Phase
(Positive Impacts):

Sewerage issues will be solved

(Negative Impacts) :

- - -

12. Any other Suggestions:

Roads should be built alongside

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Public Consultation Performa
Jers Consultancy Pvt Ltd

Name Of the Interviewer: Tashfeen Date: 04-05-2023

Location: Shah Pur Kanjra

1. Name of Respondents: Samran
2. CNIC No/ Mobile No: 0303 - 4190621
3. Gender a) Male ✓ b) Female
4. Age: 28 years
5. Education: Primary
6. Address: Shah Pur Kanjra
7. Marital Status: a) Married ✓ b) Unmarried c) Divorced/Widowed/separated
8. Occupation Status:
   1) Govt servient: _____
   2) Private job: _____
   3) Business: _____
   4) Farming: ✓
   5) Labor: _____
   6) Retired: _____
   7) Any Other (specific): _____
9. Average Monthly Income: 50000
10. Are you aware of the WWTP project at Kattar Bund Road
    a. YES: _____
    b. No: ✓

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Jers Consultancy Pvt Ltd

11. In your opinion what may be the possible positive and negative impacts of the projects during construction and operation Phase

i. Construction Phase
(positive Impacts) :

empelogment opperturnity

Construction Phase
(Negative Impacts):

dust , vehicle movement restriction

ii. Operation Phase
(Positive Impacts):

Sewerage issues will be solved

(Negative Impacts) :

- - -

12. Any other Suggestions:

roads should be built

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Jers Consultancy Pvt Ltd

Name Of the Interviewer: Tashfeen Date: 04-05-2023

Location: eden garden

1. Name of Respondents: M- Saeed
2. CNIC No/ Mobile No: Home -
3. Gender a) Male ✓ b) Female
4. Age: 74
5. Education: -
6. Address: eden garden
7. Marital Status: a) Married ✓ b) Unmarried c) Divorced/Widowed/separated
8. Occupation Status:
    1) Govt servient: _____
    2) Private job: _____
    3) Business: _____
    4) Farming: _____
    5) Labor: _____
    6) Retired: ✓
    7) Any Other (specific): _____
9. Average Monthly Income: ✓
10. Are you aware of the WWTP project at Kattar Bund Road
    a. YES: 30000
    b. No: ✓

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11. **In your opinion what may be the possible positive and negative impacts of the projects during construction and operation Phase**

i. **Construction Phase**
(positive Impacts) :

employment opportunity

Construction Phase
(Negative Impacts):

dust issues ;

ii. **Operation Phase**
(Positive Impacts):

Sewerage issues will be solved

(Negative Impacts) :

odour issues

12. **Any other Suggestions:**

green belt should be made along WWTP

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Jers Consultancy Pvt Ltd

Name Of the Interviewer: Tashfeen Date: 04-05-2023

Location: Eden garden society

1. Name of Respondents: Aftab Tassadur
2. CNIC No/ Mobile No: 0322-4630050
3. Gender a) Male ✓ b) Female
4. Age: 61
5. Education: Master
6. Address: Eden garden
7. Marital Status: (a) Married b) Unmarried c) Divorced/Widowed/separated
8. Occupation Status:
   1) Govt servient: _____
   2) Private job: _____
   3) Business: _____
   4) Farming: _____
   5) Labor: _____
   6) Retired: ✓
   7) Any Other (specific): _____
9. Average Monthly Income: 100000
10. Are you aware of the WWTP project at Kattar Bund Road
    a. YES: ✓
    b. No: _____

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11. **In your opinion what may be the possible positive and negative impacts of the projects during construction and operation Phase**

i. **Construction Phase**
(positive Impacts) :

empelopment opperturnity

Construction Phase
(Negative Impacts):

dust issues, movement restriction

ii. **Operation Phase**
(Positive Impacts):

odour, accessibility of local residents

(Negative Impacts) :

odour, accessibility

12. **Any other Suggestions:**

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Name Of the Interviewer: Tashfeen Date: 04-05-2023

Location: Francis town

1. Name of Respondents: Liaquat Majeeh
2. CNIC No/ Mobile No: 35202-4695932-5
3. Gender ✓ a) Male b) Female
4. Age: 47 years
5. Education: —
6. Address: Francis town
7. Marital Status: ✓ a) Married b) Unmarried c) Divorced/Widowed/separated
8. Occupation Status:
   1) Govt servient: _____
   2) Private job: ✓
   3) Business: _____
   4) Farming: _____
   5) Labor: _____
   6) Retired: _____
   7) Any Other (specific): _____
9. Average Monthly Income: 20000
10. Are you aware of the WWTP project at Kattar Bund Road
    a. YES: _____
    b. No: ✓

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Jers Consultancy Pvt Ltd

11. In your opinion what may be the possible positive and negative impacts of the projects during construction and operation Phase

i. Construction Phase
(positive Impacts) :

empelogment opportunity

Construction Phase
(Negative Impacts):

dust issues

ii. Operation Phase
(Positive Impacts):

Sewerage issues will be solved

(Negative Impacts) :

12. Any other Suggestions:

gas supply should be Provided

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Jers Consultancy Pvt Ltd

Name Of the Interviewer: Tashfeen Date: 04-05-2023

Location: Francis town

1. Name of Respondents: Zulqarnain
2. CNIC No/ Mobile No: 0304- 4523705 ✓
3. Gender a) Male b) Female
4. Age: 26 Years
5. Education: -
6. Address: Francis town
7. Marital Status: ✓a) Married b) Unmarried c) Divorced/Widowed/separated
8. Occupation Status:
    1) Govt servient: _____
    2) Private job: _____
    3) Business: _____
    4) Farming: ✓
    5) Labor: _____
    6) Retired: _____
    7) Any Other (specific): _____
9. Average Monthly Income: 40000
10. Are you aware of the WWTP project at Kattar Bund Road
    a. YES: _____
    b. No: ✓

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11. **In your opinion what may be the possible positive and negative impacts of the projects during construction and operation Phase**

i. **Construction Phase**
(positive Impacts) :

employment opportunity,

Construction Phase
(Negative Impacts):

dust issues, Movement restriction

ii. **Operation Phase**
(Positive Impacts):

Sewerage issue will be solved

(Negative Impacts) :

12. **Any other Suggestions:**

gas supply should be Provided

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Name Of the Interviewer: Tashfeen Date: 04.05.23

Location: Francis town

1. Name of Respondents: Qasim
2. CNIC No/ Mobile No: 0324-4084223
3. Gender ✓ a) Male b) Female
4. Age: 45 years
5. Education: Middle
6. Address: Francis town
7. Marital Status: ✓ a) Married b) Unmarried c) Divorced/Widowed/separated
8. Occupation Status:
   1) Govt servient: _____
   2) Private job: ✓
   3) Business: _____
   4) Farming: _____
   5) Labor: _____
   6) Retired: _____
   7) Any Other (specific): _____
9. Average Monthly Income: 25000
10. Are you aware of the WWTP project at Kattar Bund Road
    a. YES: _____
    b. No: ✓

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Jers Consultancy Pvt Ltd

11. In your opinion what may be the possible positive and negative impacts of the projects during construction and operation Phase

i. Construction Phase
(positive Impacts) :

employment and business opportunity.

Construction Phase
(Negative Impacts):

dust issues, movement restriction

ii. Operation Phase
(Positive Impacts):

Sewerage issues will be solved.

(Negative Impacts) :

12. Any other Suggestions:

Gas supply should be provided

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Name Of the Interviewer: Tashfeen

Location: Francis town

Date: 04-05-2023

1. Name of Respondents: Zaheer Raheel
2. CNIC No/ Mobile No: 0309-1469163
3. Gender
   a) Male ✓ b) Female
4. Age: 25 years
5. Education: —
6. Address: Francis town
7. Marital Status: a) Married ✓ b) Unmarried c) Divorced/Widowed/separated
8. Occupation Status:
   1) Govt servient: _____
   2) Private job: ✓
   3) Business: _____
   4) Farming: _____
   5) Labor: _____
   6) Retired: _____
   7) Any Other (specific): _____
9. Average Monthly Income: 23000
10. Are you aware of the WWTP project at Kattar Bund Road
    a. YES: _____
    b. No: ✓

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Jers Consultancy Pvt Ltd

11. In your opinion what may be the possible positive and negative impacts of the projects during construction and operation Phase

i. Construction Phase
(positive Impacts) :

employment and business opportunity

Construction Phase
(Negative Impacts):

Movements restriction

ii. Operation Phase
(Positive Impacts):

Sewerage issues will be solved.

(Negative Impacts) :

12. Any other Suggestions:

Gas supply should be given

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Name Of the Interviewer: Tashfeen Date: 04-05-2023

Location: Francis town

1. Name of Respondents: Shaukat Maseeh
2. CNIC No/ Mobile No: 0324-4084223
3. Gender ✓ a) Male b) Female
4. Age: 42 years
5. Education: -
6. Address: Francis town
7. Marital Status: ✓ a) Married b) Unmarried c) Divorced/Widowed/separated
8. Occupation Status:
    1) Govt servient: _____
    2) Private job: _____
    3) Business: _____
    4) Farming: _____
    5) Labor: ✓
    6) Retired: _____
    7) Any Other (specific): _____
9. Average Monthly Income: 20000
10. Are you aware of the WWTP project at Kattar Bund Road
    a. YES: _____
    b. No: ✓

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Jers Consultancy Pvt Ltd

11. In your opinion what may be the possible positive and negative impacts of the projects during construction and operation Phase

i. Construction Phase
(positive Impacts) :

employment opportunity

Construction Phase
(Negative Impacts):

Dust issues, Movement restriction

ii. Operation Phase
(Positive Impacts):

sewerage issues will be solved

(Negative Impacts) :

12. Any other Suggestions:

Gas should be provided, electricity ~~issu~~ bill issues

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Name Of the Interviewer: Tashfeen Abbas Date: 04-05-2023

Location: Francis town

1. Name of Respondents: Nasir
2. CNIC No/ Mobile No: 0307 5230283
3. Gender a) Male ✓ b) Female
4. Age: 34 years
5. Education: —
6. Address: Francis town
7. Marital Status: a) Married ✓ b) Unmarried c) Divorced/Widowed/separated
8. Occupation Status:
    1) Govt servient: _____
    2) Private job: ✓
    3) Business: _____
    4) Farming: _____
    5) Labor: _____
    6) Retired: _____
    7) Any Other (specific): _____
9. Average Monthly Income: 20000
10. Are you aware of the WWTP project at Kattar Bund Road
    a. YES: _____
    b. No: ✓

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11. In your opinion what may be the possible positive and negative impacts of the projects during construction and operation Phase

i. Construction Phase
(positive Impacts) :

employment opPertunity

Construction Phase
(Negative Impacts):

D. movemant restriction

ii. Operation Phase
(Positive Impacts):

sewerage issues will be solve

(Negative Impacts) :

- - -

12. Any other Suggestions:

gas supply -

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Name Of the Interviewer: Tashfeen Date: 04-05-2023

Location: Gopi Rai

1. Name of Respondents: Sarfaraj
2. CNIC No/ Mobile No: 0305-4602624
3. Gender a) Male ✓ b) Female
4. Age: 23 years
5. Education: FSC
6. Address: Gopi rai
7. Marital Status: a) Married (b) Unmarried c) Divorced/Widowed/separated
8. Occupation Status:
    1) Govt servient: _____
    2) Private job: _____
    3) Business: ✓
    4) Farming: _____
    5) Labor: _____
    6) Retired: _____
    7) Any Other (specific): _____
9. Average Monthly Income: 40000
10. Are you aware of the WWTP project at Kattar Bund Road
    a. YES: _____
    b. No: ✓

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Jers Consultancy Pvt Ltd

11. In your opinion what may be the possible positive and negative impacts of the projects during construction and operation Phase

i. Construction Phase
(positive Impacts) :

employment opportunity

Construction Phase
(Negative Impacts):

dust issue, movement restriction

ii. Operation Phase
(Positive Impacts):

sewerage issues will be solved

(Negative Impacts) :

odor

12. Any other Suggestions:

graveyard boundary wall construction

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Jers Consultancy Pvt Ltd

Name Of the Interviewer: Tashfeen Date: 04-05-2023

Location: Gopi Rai

1. Name of Respondents: Rehmat Ali
2. CNIC No/ Mobile No: 35202-2655834-1
3. Gender a) Male ✓ b) Female
4. Age: 63 year
5. Education: –
6. Address: Gopi village
7. Marital Status: a) Married ✓ b) Unmarried c) Divorced/Widowed/separated
8. Occupation Status:
    1) Govt servient: _____
    2) Private job: _____
    3) Business: _____
    4) Farming: ✓
    5) Labor: _____
    6) Retired: _____
    7) Any Other (specific): _____
9. Average Monthly Income: 40000
10. Are you aware of the WWTP project at Kattar Bund Road
    a. YES: _____
    b. No: ✓

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11. In your opinion what may be the possible positive and negative impacts of the projects during construction and operation Phase

    i. Construction Phase
    (positive Impacts) :

    employment opportunity

    Construction Phase
    (Negative Impacts):

    dust issues, Movement restriction

    ii. Operation Phase
    (Positive Impacts):

    Seweraye issues will be solved

    (Negative Impacts) :

    -

12. Any other Suggestions:

    graveyard boundary should be build

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Name Of the Interviewer: Tashfeen Date: 04-05-2023

Location: Gopi Rai village

1. Name of Respondents: Mudasar
2. CNIC No/ Mobile No: 0301 1460825
3. Gender a) Male ✓ b) Female
4. Age: 25 year
5. Education: Matric
6. Address: Gopi village
7. Marital Status: a) Married (b) Unmarried ✓ c) Divorced/Widowed/separated
8. Occupation Status:
   1) Govt servient: _____
   2) Private job: _____
   3) Business: ✓
   4) Farming: _____
   5) Labor: _____
   6) Retired: _____
   7) Any Other (specific): _____
9. Average Monthly Income: 45000
10. Are you aware of the WWTP project at Kattar Bund Road
    a. YES: _____
    b. No: ✓

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Jers Consultancy Pvt Ltd

11. In your opinion what may be the possible positive and negative impacts of the projects during construction and operation Phase

i. Construction Phase
(positive Impacts) :

employment opportunity

Construction Phase
(Negative Impacts):

dust issues

ii. Operation Phase
(Positive Impacts):

Sewerage issues will be solved

(Negative Impacts) :

12. Any other Suggestions:

Graveyard boundary should be built

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Name Of the Interviewer: Tashfeen

Date: 04-05-2023

Location: Gopi village

1. Name of Respondents: M. Iqbal
2. CNIC No/ Mobile No: 0301-4456921
3. Gender a) Male ✓ b) Female
4. Age: 50 years
5. Education: illiterate
6. Address: Gopi village
7. Marital Status: a) Married ✓ b) Unmarried c) Divorced/Widowed/separated
8. Occupation Status:
   1) Govt servient: _____
   2) Private job: _____
   3) Business: _____
   4) Farming: ✓
   5) Labor: _____
   6) Retired: _____
   7) Any Other (specific): _____
9. Average Monthly Income: 55000
10. Are you aware of the WWTP project at Kattar Bund Road
    a. YES: _____
    b. No: ✓

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11. In your opinion what may be the possible positive and negative impacts of the projects during construction and operation Phase

i. Construction Phase
(positive Impacts) :

employment,

Construction Phase
(Negative Impacts):

dust

ii. Operation Phase
(Positive Impacts):

Sewerage issues

(Negative Impacts) :

12. Any other Suggestions:

roads should also be build

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Name Of the Interviewer: Tashfeen Date: 04-05-2023

Location: Gopi Rai village

1. Name of Respondents: M. AKram
2. CNIC No/ Mobile No: 0322-4337543
3. Gender a) Male ✓ b) Female
4. Age: 37
5. Education: FA
6. Address: Gopi village
7. Marital Status: a) Married ✓ b) Unmarried c) Divorced/Widowed/separated
8. Occupation Status:
    1) Govt servient: _____
    2) Private job: _____
    3) Business: ✓
    4) Farming: _____
    5) Labor: _____
    6) Retired: _____
    7) Any Other (specific): _____
9. Average Monthly Income: 60000
10. Are you aware of the WWTP project at Kattar Bund Road
    a. YES: _____
    b. No: ✓

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11. In your opinion what may be the possible positive and negative impacts of the projects during construction and operation Phase

i. Construction Phase
(positive Impacts) :

employment

Construction Phase
(Negative Impacts):

dust illness

ii. Operation Phase
(Positive Impacts):

Sewerage issues will be solved

(Negative Impacts) :

12. Any other Suggestions:

Sewerage system of village should also be built

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Name Of the Interviewer: Tashfeen Date: 04-05-2023

Location: Gopi Rai village

1. Name of Respondents: Gulzar hussain
2. CNIC No/ Mobile No: 0305-4859282
3. Gender a) Male ✓ b) Female
4. Age: 42 years
5. Education: illiterate
6. Address: Gopi Rai village
7. Marital Status: a) Married ✓ b) Unmarried c) Divorced/Widowed/separated
8. Occupation Status:
    1) Govt servient: _____
    2) Private job: _____
    3) Business: _____
    4) Farming: _____
    5) Labor: ✓
    6) Retired: _____
    7) Any Other (specific): _____
9. Average Monthly Income: 30000
10. Are you aware of the WWTP project at Kattar Bund Road
    a. YES: _____
    b. No: ✓

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11. In your opinion what may be the possible positive and negative impacts of the projects during construction and operation Phase

i. Construction Phase
(positive Impacts) :

employment opportunities -

Construction Phase
(Negative Impacts):

dust issues - Movement restriction

ii. Operation Phase
(Positive Impacts):

Sewerage issues will be solved

(Negative Impacts) :

-

12. Any other Suggestions:

School - Graveyard boundary wall should be build

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Jers Consultancy Pvt Ltd

Name Of the Interviewer: Tashfeen Date: 04-05-2023

Location: Gopi village

1. Name of Respondents: Akhtar Ali
2. CNIC No/ Mobile No: 0322-4749625
3. Gender a) Male ✓ b) Female
4. Age: 40 year
5. Education: Matric
6. Address: Gopi Rai village
7. Marital Status: a) Married ✓ b) Unmarried c) Divorced/Widowed/separated
8. Occupation Status:
    1) Govt servient: _____
    2) Private job: _____
    3) Business: _____
    4) Farming: ✓ _____
    5) Labor: _____
    6) Retired: _____
    7) Any Other (specific): _____
9. Average Monthly Income: 48000
10. Are you aware of the WWTP project at Kattar Bund Road
    a. YES: _____
    b. No: ✓ _____

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11. In your opinion what may be the possible positive and negative impacts of the projects during construction and operation Phase

    i. Construction Phase
    (positive Impacts) :

    employment opPertunities.

    Construction Phase
    (Negative Impacts):

    dust iMues, movement restriction

    ii. Operation Phase
    (Positive Impacts):

    sewerage iMue will be
    Solved

    (Negative Impacts) :

    —

12. Any other Suggestions:

    School, college, hospital
    graveyard boundary should be baild.

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Name Of the Interviewer: Tashfeen Date: 04-05-2023

Location: Gopi village

1. Name of Respondents: Bagh deen
2. CNIC No/ Mobile No: 0304-9680012
3. Gender a) Male ✓ b) Female
4. Age: 40 years
5. Education: illiterate
6. Address: Gopi Rai village
7. Marital Status: a) Married ✓ b) Unmarried c) Divorced/Widowed/separated
8. Occupation Status:
    1) Govt servient: _____
    2) Private job: _____
    3) Business: _____
    4) Farming: ✓
    5) Labor: _____
    6) Retired: _____
    7) Any Other (specific): _____
9. Average Monthly Income: 52 000
10. Are you aware of the WWTP project at Kattar Bund Road
    a. YES: _____
    b. No: ✓

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11. In your opinion what may be the possible positive and negative impacts of the projects during construction and operation Phase

i. Construction Phase
(positive Impacts) :

employment opperturitiel

Construction Phase
(Negative Impacts):

dust issues, movement restriction

ii. Operation Phase
(Positive Impacts):

sewerage issues will be solved

(Negative Impacts) :

-

12. Any other Suggestions:

School, colleges, graveyard boundary hospital should also built

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Name Of the Interviewer: Tashfeen Date: 04-05-2023

Location: Gopi Rai village

1. Name of Respondents: Munawar Hussain
2. CNIC No/ Mobile No: 0357-42 10 618
3. Gender a) Male ✓ b) Female
4. Age: 62 years
5. Education: Primary
6. Address: Gopi rai village
7. Marital Status: a) Married ✓ b) Unmarried c) Divorced/Widowed/separated
8. Occupation Status:
    1) Govt servient: _____
    2) Private job: _____
    3) Business: _____
    4) Farming: ✓ _____
    5) Labor: _____
    6) Retired: _____
    7) Any Other (specific): _____
9. Average Monthly Income: 48000
10. Are you aware of the WWTP project at Kattar Bund Road
    a. YES: _____
    b. No: ✓ _____

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11. In your opinion what may be the possible positive and negative impacts of the projects during construction and operation Phase

i. Construction Phase
(positive Impacts) :

employment opportunities

Construction Phase
(Negative Impacts):

dust issues ,

ii. Operation Phase
(Positive Impacts):

sewerage issues will be solved

(Negative Impacts) :

12. Any other Suggestions:

School , hospital , water supply graveyard should also be build

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Name Of the Interviewer: Tashfeen Date: 04-05-2023

Location: Gopi village

1. Name of Respondents: Iftikhar Ali
2. CNIC No/ Mobile No: 0307 - 4369883
3. Gender a) Male ✓ b) Female
4. Age: 50 year
5. Education: -
6. Address: Gopi Rai village
7. Marital Status: a) Married ✓ b) Unmarried c) Divorced/Widowed/separated
8. Occupation Status:
    1) Govt servient: _____
    2) Private job: _____
    3) Business: _____
    4) Farming: ✓
    5) Labor: _____
    6) Retired: _____
    7) Any Other (specific): _____
9. Average Monthly Income: 46000
10. Are you aware of the WWTP project at Kattar Bund Road
    a. YES: _____
    b. No: ✓

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11. In your opinion what may be the possible positive and negative impacts of the projects during construction and operation Phase

i. Construction Phase
(positive Impacts) :

employment opportunities

Construction Phase
(Negative Impacts):

dust issues, Restriction movements

ii. Operation Phase
(Positive Impacts):

Sewerage issues will be solved

(Negative Impacts) :

12. Any other Suggestions:

school, hospital, graveyard boundary wall should also be build

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Jers Consultancy Pvt Ltd

Name Of the Interviewer: Tashfeen Date: 04-05-2023

Location: Gopi Rai Village

1. Name of Respondents: Faqeer hussain
2. CNIC No/ Mobile No: 0326-4010362
3. Gender a) Male ✓ b) Female
4. Age: 60 years
5. Education: illiterate
6. Address: Gopi Rai village
7. Marital Status: a) Married ✓ b) Unmarried c) Divorced/Widowed/separated
8. Occupation Status:
    1) Govt servient: _____
    2) Private job: _____
    3) Business: _____
    4) Farming: ✓
    5) Labor: _____
    6) Retired: _____
    7) Any Other (specific): _____
9. Average Monthly Income: 45000
10. Are you aware of the WWTP project at Kattar Bund Road
    a. YES: _____
    b. No: ✓

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Public Consultation Performa
Jers Consultancy Pvt Ltd

11. In your opinion what may be the possible positive and negative impacts of the projects during construction and operation Phase

i. Construction Phase
(positive Impacts) :

employment opperturnities

Construction Phase
(Negative Impacts):

dust issues, Movements restriction

ii. Operation Phase
(Positive Impacts):

Sewerage issues will be solved

(Negative Impacts) :

—

12. Any other Suggestions:

Hospital should be build in village

CamScanner

Public Consultation Performa
Jers Consultancy Pvt Ltd

Name Of the Interviewer: Tashfeen Date: 04-05-2023

Location: Gopi village

1. Name of Respondents: Sarfraz
2. CNIC No/ Mobile No: 0321-3698970
3. Gender a) Male ✓ b) Female
4. Age: 34 years
5. Education: F.A
6. Address: Gopi Rai village
7. Marital Status: a) Married ✓ b) Unmarried c) Divorced/Widowed/separated
8. Occupation Status:
    1) Govt servient: _____
    2) Private job: _____
    3) Business: _____
    4) Farming: ✓
    5) Labor: _____
    6) Retired: _____
    7) Any Other (specific): _____
9. Average Monthly Income: 60000
10. Are you aware of the WWTP project at Kattar Bund Road
    a. YES: _____
    b. No: ✓

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Public Consultation Performa
Jers Consultancy Pvt Ltd

11. In your opinion what may be the possible positive and negative impacts of the projects during construction and operation Phase

i. Construction Phase
(positive Impacts) :

employment

Construction Phase
(Negative Impacts):

dust issues, ~~employ~~ Movement restriction

ii. Operation Phase
(Positive Impacts):

sewerage issues will be solved

(Negative Impacts) :

12. Any other Suggestions:

water supply Filtration plant Projects, High School should be given

CamScanner

Public Consultation Performa
Jers Consultancy Pvt Ltd

Name Of the Interviewer: Tashfeen Date: 04-05-2023

Location: Gopi village

1. Name of Respondents: Shubat Ali
2. CNIC No/ Mobile No: 0302-4021906
3. Gender ✓ a) Male b) Female
4. Age: 50 years
5. Education: FA
6. Address: Gopi village
7. Marital Status: ✓ a) Married b) Unmarried c) Divorced/Widowed/separated
8. Occupation Status:
    1) Govt servient: ✓
    2) Private job: _____
    3) Business: _____
    4) Farming: _____
    5) Labor: _____
    6) Retired: _____
    7) Any Other (specific): _____
9. Average Monthly Income: 45000
10. Are you aware of the WWTP project at Kattar Bund Road
    a. YES: _____
    b. No: ✓

CamScanner

Public Consultation Performa
Jers Consultancy Pvt Ltd

11. In your opinion what may be the possible positive and negative impacts of the projects during construction and operation Phase

i. Construction Phase
(positive Impacts) :

employment opportunities

Construction Phase
(Negative Impacts):

dust illue , movement restriction

ii. Operation Phase
(Positive Impacts):

Sewerage illues will be solved

(Negative Impacts) :

12. Any other Suggestions:

School , college , hospital should be build

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Public Consultation Performa
Jers Consultancy Pvt Ltd

Name Of the Interviewer: Tashfeen Date: 04-05-2025

Location: Gopi village

1. Name of Respondents: Riasat Ali
2. CNIC No/ Mobile No: 0323-8803977
3. Gender a) Male ✓ b) Female
4. Age: 32 years
5. Education: FA
6. Address: Gopi village
7. Marital Status: a) Married ✓ b) Unmarried c) Divorced/Widowed/separated
8. Occupation Status:
    1) Govt servient: _____
    2) Private job: _____
    3) Business: ✓
    4) Farming: _____
    5) Labor: _____
    6) Retired: _____
    7) Any Other (specific): _____
9. Average Monthly Income: 58000
10. Are you aware of the WWTP project at Kattar Bund Road
    a. YES: _____
    b. No: ✓

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Public Consultation Performa
Jers Consultancy Pvt Ltd

11. In your opinion what may be the possible positive and negative impacts of the projects during construction and operation Phase

i. Construction Phase
(positive Impacts) :

employment ,

Construction Phase
(Negative Impacts):

Movement restriction , dust

ii. Operation Phase
(Positive Impacts):

Sewerage issues will be solved

(Negative Impacts) :

12. Any other Suggestions:

graveyard boundar wall should be build

CamScanner

Public Consultation Performa
Jers Consultancy Pvt Ltd

Name Of the Interviewer: Tashfeen Date: 04-05-2025

Location: Gopi village

1. Name of Respondents: Mohsin
2. CNIC No/ Mobile No: 0322 - 4791275
3. Gender a) Male ✓ b) Female
4. Age: 24 years
5. Education: Matric
6. Address: Gopi village
7. Marital Status: a) Married b) Unmarried ✓ c) Divorced/Widowed/separated
8. Occupation Status:
    1) Govt servient: _____
    2) Private job: _____
    3) Business: _____
    4) Farming: ✓
    5) Labor: _____
    6) Retired: _____
    7) Any Other (specific): _____
9. Average Monthly Income: 42000
10. Are you aware of the WWTP project at Kattar Bund Road
    a. YES: _____
    b. No: ✓

CamScanner

Public Consultation Performa
Jers Consultancy Pvt Ltd

11. In your opinion what may be the possible positive and negative impacts of the projects during construction and operation Phase

i. Construction Phase
(positive Impacts) :

employment opPestunities

Construction Phase
(Negative Impacts):

dust issues

ii. Operation Phase
(Positive Impacts):

sewerage ~~will~~ will be ~~built~~ disposed

(Negative Impacts) :

12. Any other Suggestions:

roads or graveyard walls

CamScanner

Public Consultation Performa
Jers Consultancy Pvt Ltd

Name Of the Interviewer: Tashfeen Date: 04-05-2023

Location: Gopi village

1. Name of Respondents: Karamat Ali
2. CNIC No/ Mobile No: 0307-7076304
3. Gender ✓ a) Male b) Female
4. Age: 50 years
5. Education: illiterate
6. Address: Gopi village
7. Marital Status: ✓ a) Married b) Unmarried c) Divorced/Widowed/separated
8. Occupation Status:
    1) Govt servient: _____
    2) Private job: _____
    3) Business: _____
    4) Farming: ✓
    5) Labor: _____
    6) Retired: _____
    7) Any Other (specific): _____
9. Average Monthly Income: 48000
10. Are you aware of the WWTP project at Kattar Bund Road
    a. YES: _____
    b. No: ✓

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Public Consultation Performa
Jers Consultancy Pvt Ltd

11. In your opinion what may be the possible positive and negative impacts of the projects during construction and operation Phase

i. Construction Phase
(positive Impacts) :

employment

Construction Phase
(Negative Impacts):

dust issues, road blockage, movement restriction

ii. Operation Phase
(Positive Impacts):

sewerage issues will be solved

(Negative Impacts) :

12. Any other Suggestions:

Graveyard boundary wall

CamScanner

Public Consultation Performa
Jers Consultancy Pvt Ltd

Name Of the Interviewer: Tashfeen Date: 04-05-2023

Location: Gopi village

1. Name of Respondents: Majid Ali
2. CNIC No/ Mobile No: 0302-9422819
3. Gender a) Male ✓ b) Female
4. Age: 29 years
5. Education: illiterate
6. Address: Gopi village
7. Marital Status: a) Married ✓ b) Unmarried c) Divorced/Widowed/separated
8. Occupation Status:
    1) Govt servient: _____
    2) Private job: _____
    3) Business: _____
    4) Farming: ✓
    5) Labor: _____
    6) Retired: _____
    7) Any Other (specific): _____
9. Average Monthly Income: 43000
10. Are you aware of the WWTP project at Kattar Bund Road
    a. YES: _____
    b. No: ✓

CamScanner

Public Consultation Performa
Jers Consultancy Pvt Ltd

11. In your opinion what may be the possible positive and negative impacts of the projects during construction and operation Phase

    i. Construction Phase
    (positive Impacts) :

    employment

    Construction Phase
    (Negative Impacts):

    dust , Movement restriction

    ii. Operation Phase
    (Positive Impacts):

    sewerage issues will be solved

    (Negative Impacts) :

12. Any other Suggestions:

    graveyard Boundary wall

CamScanner

Public Consultation Performa
Jers Consultancy Pvt Ltd

Name Of the Interviewer: Tashfeen Date: 04-05-2023

Location: Gopi village

1. Name of Respondents: Kashif
2. CNIC No/ Mobile No: 0308 - 8530942
3. Gender ✓ a) Male b) Female
4. Age: 20 years
5. Education: illitesate
6. Address: Gopi village
7. Marital Status: ✓ a) Married b) Unmarried c) Divorced/Widowed/separated
8. Occupation Status:
    1) Govt servient: _____
    2) Private job: _____
    3) Business: _____
    4) Farming: ✓
    5) Labor: _____
    6) Retired: _____
    7) Any Other (specific): _____
9. Average Monthly Income: 38000
10. Are you aware of the WWTP project at Kattar Bund Road
    a. YES: _____
    b. No: ✓

CamScanner

Public Consultation Performa
Jers Consultancy Pvt Ltd

11. In your opinion what may be the possible positive and negative impacts of the projects during construction and operation Phase

    i. Construction Phase
    (positive Impacts) :

    employment opperturities

    Construction Phase
    (Negative Impacts):

    dust issues

    ii. Operation Phase
    (Positive Impacts):

    sewerage issues will be solved

    (Negative Impacts) :

12. Any other Suggestions:

    Roads issues will be solved

CamScanner

Public Consultation Performa
Jers Consultancy Pvt Ltd

Name Of the Interviewer: Tashfeen Date: 04-05-2023

Location: Gopi village

1. Name of Respondents: Babar Ali
2. CNIC No/ Mobile No: ~
3. Gender a) Male ✓ b) Female
4. Age: 20 years
5. Education: Primary
6. Address: Gopi village
7. Marital Status: a) Married b) Unmarried ✓ c) Divorced/Widowed/separated
8. Occupation Status:
   1) Govt servient: _____
   2) Private job: _____
   3) Business: _____
   4) Farming: ✓
   5) Labor: _____
   6) Retired: _____
   7) Any Other (specific): _____
9. Average Monthly Income: 45000
10. Are you aware of the WWTP project at Kattar Bund Road
    a. YES: _____
    b. No: ✓

CamScanner

Public Consultation Performa
Jers Consultancy Pvt Ltd

11. In your opinion what may be the possible positive and negative impacts of the projects during construction and operation Phase

i. Construction Phase
(positive Impacts) :

employment ,

Construction Phase
(Negative Impacts):

dust , Path blockage

ii. Operation Phase
(Positive Impacts):

Sewerage issues will be solved

(Negative Impacts) :

12. Any other Suggestions:

Roads should be built

CamScanner

Public Consultation Performa
Jers Consultancy Pvt Ltd

Name Of the Interviewer: Tashfeen Date: 04-05-2023

Location: Near escape channel

1. Name of Respondents: Irfan
2. CNIC No/ Mobile No: -
3. Gender (a) Male b) Female
4. Age: 25
5. Education: illiterate
6. Address: Shah Pur Kanjra
7. Marital Status: (a) Married b) Unmarried c) Divorced/Widowed/separated
8. Occupation Status:
    1) Govt servient: _____
    2) Private job: _____
    3) Business: _____
    4) Farming: ✓
    5) Labor: _____
    6) Retired: _____
    7) Any Other (specific): _____
9. Average Monthly Income: 50000
10. Are you aware of the WWTP project at Kattar Bund Road
    a. YES: _____
    b. No: ✓

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Public Consultation Performa
Jers Consultancy Pvt Ltd

11. In your opinion what may be the possible positive and negative impacts of the projects during construction and operation Phase

i. Construction Phase
(positive Impacts) :

employment

Construction Phase
(Negative Impacts):

dust issues.

ii. Operation Phase
(Positive Impacts):

Sewerage issues will be solved

(Negative Impacts) :

12. Any other Suggestions:

roads should be built or Paved.

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Public Consultation Performa
Jers Consultancy Pvt Ltd

Name Of the Interviewer: Tashfeen
Location: Kattar Bund road
Date: 04-05-2023

1. Name of Respondents: Yas Muhammad
2. CNIC No/ Mobile No: 35202 - 5607889 - 1
3. Gender ✓ a) Male b) Female
4. Age: 72 year
5. Education: illiterate
6. Address: Gopi village
7. Marital Status: ✓ a) Married b) Unmarried c) Divorced/Widowed/separated
8. Occupation Status:
   1) Govt servient: _____
   2) Private job: _____
   3) Business: _____
   4) Farming: ✓
   5) Labor: _____
   6) Retired: _____
   7) Any Other (specific): _____
9. Average Monthly Income: 33000
10. Are you aware of the WWTP project at Kattar Bund Road
    a. YES: _____
    b. No: ✓

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Public Consultation Performa
Jers Consultancy Pvt Ltd

11. In your opinion what may be the possible positive and negative impacts of the projects during construction and operation Phase

i. Construction Phase
(positive Impacts) :

employment opportunities

Construction Phase
(Negative Impacts):

dust issue, vehicle movement
road blockage

ii. Operation Phase
(Positive Impacts):

Sewerage issues will be
solved

(Negative Impacts) :

12. Any other Suggestions:

Roads should be built

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Public Consultation Performa
Jers Consultancy Pvt Ltd

Name Of the Interviewer: ~~M. Adnan~~ TashPeen Date: 04-05-2023

Location: Kattar Bund Road

1. Name of Respondents: M. Adnan
2. CNIC No/ Mobile No: 0302-9650402
3. Gender a) Male ✓ b) Female
4. Age: 22
5. Education: Matric
6. Address: Gopi village
7. Marital Status: a) Married b) Unmarried ✓ c) Divorced/Widowed/separated
8. Occupation Status:
   1) Govt servient: _____
   2) Private job: _____
   3) Business: _____
   4) Farming: _____
   5) Labor: _____
   6) Retired: _____
   7) Any Other (specific): Trolley driver
9. Average Monthly Income: 35000
10. Are you aware of the WWTP project at Kattar Bund Road
    a. YES: _____
    b. No: ✓

CamScanner

Public Consultation Performa
Jers Consultancy Pvt Ltd

11. In your opinion what may be the possible positive and negative impacts of the projects during construction and operation Phase

i. Construction Phase
(positive Impacts) :

Local employment

Construction Phase
(Negative Impacts):

Road blockage

ii. Operation Phase
(Positive Impacts):

Sewarage issues will be solved

(Negative Impacts) :

12. Any other Suggestions:

Roads should also be build

CamScanner

Public Consultation Performa
Jers Consultancy Pvt Ltd

Name Of the Interviewer: Tashfeen Date: 04-05-2023

Location: Kattar Bund Road Gopi village

1. Name of Respondents: Waqas
2. CNIC No/ Mobile No: 0321-9645724
3. Gender a) Male ✓ b) Female
4. Age: 32
5. Education: Primary
6. Address: Gopi village
7. Marital Status: a) Married ✓ b) Unmarried c) Divorced/Widowed/separated
8. Occupation Status:
   1) Govt servient: _____
   2) Private job: _____
   3) Business: _____
   4) Farming: _____
   5) Labor: _____
   6) Retired: _____
   7) Any Other (specific): ~~Rickshaw~~ driver
9. Average Monthly Income: 30000
10. Are you aware of the WWTP project at Kattar Bund Road
    a. YES: _____
    b. No: ✓

CamScanner

11. In your opinion what may be the possible positive and negative impacts of the projects during construction and operation Phase

i. Construction Phase
(positive Impacts) :

Construction Phase
(Negative Impacts):

dust , Path blockage , Privacy issue

ii. Operation Phase
(Positive Impacts):

Sewerage issues will be solved .

(Negative Impacts) :

12. Any other Suggestions:

Road should be built

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Public Consultation Performa
Jers Consultancy Pvt Ltd

Name Of the Interviewer: Tashfeen Abbas Date: 04-05-2023

Location: _____

1. Name of Respondents: M - Usman
2. CNIC No/ Mobile No: 0300 - 4623985
3. Gender a) Male ✓ b) Female
4. Age: 37
5. Education: Middle
6. Address: Kattar Bund road
7. Marital Status: a) Married ✓ b) Unmarried c) Divorced/Widowed/separated
8. Occupation Status:
    1) Govt servient: _____
    2) Private job: ✓
    3) Business: _____
    4) Farming: _____
    5) Labor: _____
    6) Retired: _____
    7) Any Other (specific): _____
9. Average Monthly Income: 90000
10. Are you aware of the WWTP project at Kattar Bund Road
    a. YES: _____
    b. No: ✓

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11. In your opinion what may be the possible positive and negative impacts of the projects during construction and operation Phase

i. Construction Phase
(positive Impacts) :

Construction Phase
(Negative Impacts):

Dust, Path blockage

ii. Operation Phase
(Positive Impacts):

Sewerage issues will be solved.

(Negative Impacts) :

12. Any other Suggestions:

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Public Consultation Performa
Jers Consultancy Pvt Ltd

Name Of the Interviewer: Tashfeen Abbasi Date: 04-05-2023

Location: Near disposal station

1. Name of Respondents: Zeeshan shafiq
2. CNIC No/ Mobile No: 0302 - 1497662
3. Gender a) Male ✓ b) Female
4. Age: 40 years
5. Education: Matric
6. Address: Mustafa town
7. Marital Status: (a) Married b) Unmarried c) Divorced/Widowed/separated
8. Occupation Status:
   1) Govt servient: ✓
   2) Private job: _____
   3) Business: _____
   4) Farming: _____
   5) Labor: _____
   6) Retired: _____
   7) Any Other (specific): _____
9. Average Monthly Income: 40000
10. Are you aware of the WWTP project at Kattar Bund Road
    a. YES: ✓
    b. No: _____

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11. In your opinion what may be the possible positive and negative impacts of the projects during construction and operation Phase

i. Construction Phase
(positive Impacts) :

employment

Construction Phase
(Negative Impacts):

Pathway blockage -

ii. Operation Phase
(Positive Impacts):

water conservation, Sewerage issues will be solved

(Negative Impacts) :

-

12. Any other Suggestions:

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Annexure-VI

Pictorial Assessment

Existing Conditions on site













Niaz Baig Area









Niaz Baig Sewer Survey


31.47458705N 74.24122907E
81° E
Sarai
Lahore
Punjab
Altitude:194.8m
Speed:0.0km/h
Index number: 42
Mar 14, 2022 11:29:02 AM




31.48122411N 74.23564013E
96° E
Gulshan Town
Lahore
Punjab
Altitude:168.0m
Speed:0.0km/h
Index number: 31
Mar 11, 2022 11:40:13 AM



Meetings with Stakeholders and Public Consultations















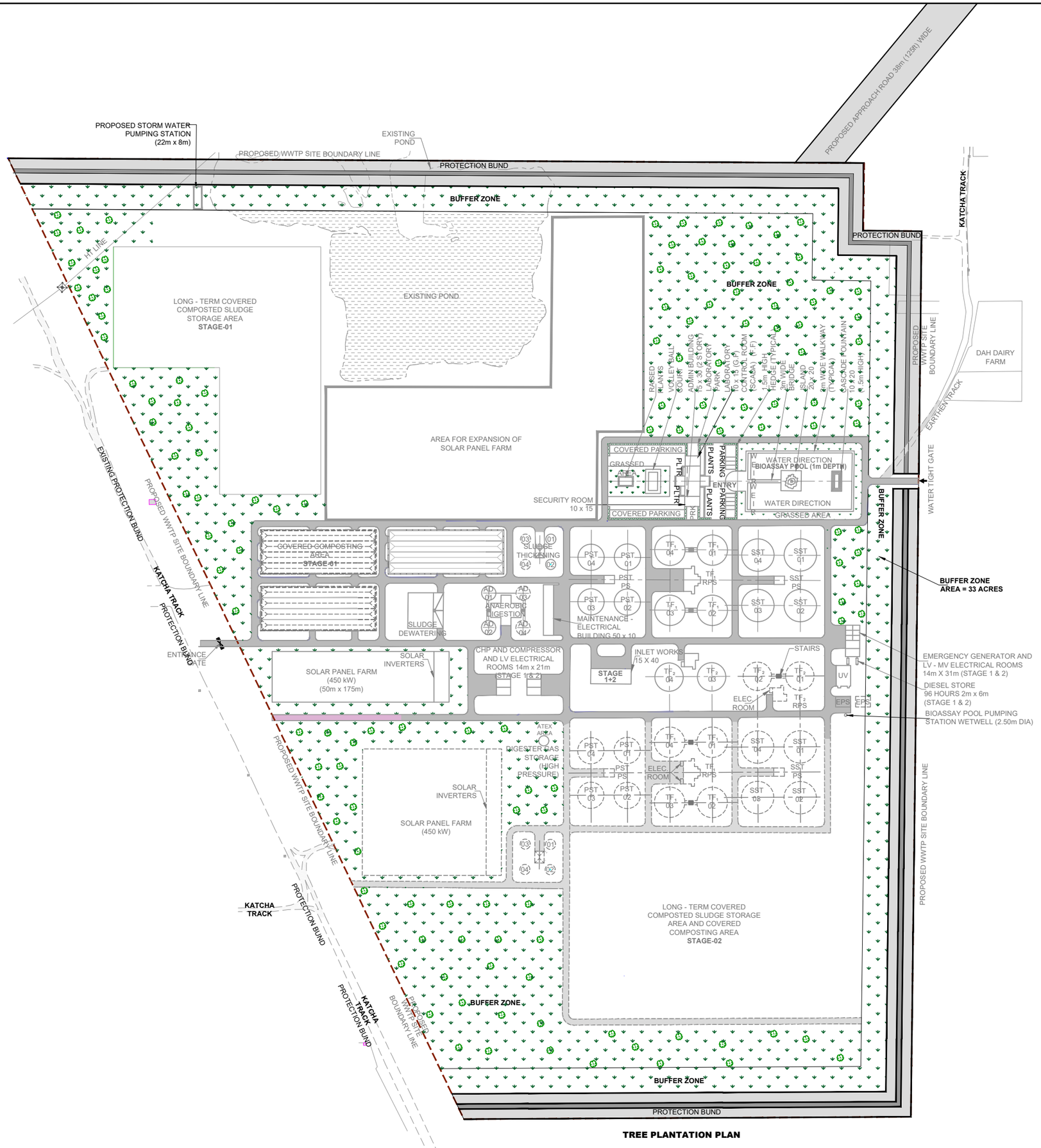

GPS Map Camera
Lahore, Punjab, Pakistan
F6FC+4WQ, Gopi Rai, Lahore, Punjab, Pakistan
Lat 31.47274°
Long 74.221456°
04/05/23 12:31 PM GMT +05:00
Google


GPS Map Camera
Lahore, Punjab, Pakistan
F6GG+HCF, Katar Bund Rd, Gopi Rai, Lahore, Punjab
54000, Pakistan
Lat 31.476009°
Long 74.226078°
04/05/23 11:07 AM GMT +05:00
Google


GPS Map Camera
Lahore, Punjab, Pakistan
F6CR+R45, Sarai, Lahore, Punjab, Pakistan
Lat 31.472088°
Long 74.240313°
05/05/23 10:39 AM GMT +05:00
Google

Annexure-VII

Tree Plantation Plan



TREE PLANTATION PLAN

Annexure-VIII

Fire Safety Plan

Emergency Response Plan and Fire Detection System

An Emergency Response Plans for floods, earthquakes, and manmade disasters must be developed by WASA, 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.

Fire Alarms

The electrical rooms and the control centre shall be monitored with respect to fire detection. For this, the respective rooms shall be equipped with smoke detectors. If the fire detector is activated, a signal is transmitted by the telephone selection device and the Internet. At the exits, manual fire detectors shall be utilized. For local alarm, an acoustic signal transmitter within the buildings is triggered during fire alarm.



Annexure-IX

- NOC for discharge of Effluent from Kattar Bund WWTP in Lahore Branch Canal from Department of Irrigation

- NOC from RUDA on WASA notified WWTP land

Government of The Punjab
IRRIGATION DEPARTMENT
Office of the Executive Engineer
Lahore Division CBDC, Lahore
Opposite Royal Palm, Canal Bank
Mustafabad Dharamapura, Lahore
Phone No. 042-99250194 Fax No. 042-99250263
E-mail:- xenlahore_canal@yahoo.com

To

Director (Planning And Design), WASA,
Lahore,

No. 1618/169 WA Dated 19/04/2023

Subject: **NOC FOR DISCHARGE OF EFFLUENT FROM KATTAR BUND WWTP IN LAHORE BRANCH CANAL.**

Ref: Dy. Managing Director (Engg), WASA letter No. DMD/216 dated 12.04.2023

As per meeting of undersigned held on 25.03.2023 with WASA officials and consultant Danish, it was decided that the proposal of storm water of design capacity of almost 80Cs will be discharge from proposed WWTP into the escape channel through existing Kattar bund disposal station after enhancement and concrete lining of escape channel. Another meeting of undersigned was held on 18.04.2023 with WASA officials, it was informed that WASA will incorporate the component of enhancement capacity of escape channel in the project/PC-I. The proposal to dispose off treated effluent into the Lahore Branch Canal is seems to be feasible subject to fulfill the departmental specifications.

In view of above, conditionally NOC is hereby granted in favour of Managing Director (Engg), WASA LDA Lahore in the public interest under the following terms & conditions.

1. WASA Lahore has proposed that storm water of design capacity of about 80 cusec will be bypassed from the proposed WWTP by discharging the storm water into the escape channel through existing Kattar bund disposal station. WASA shall include the enhancement of the capacity of the Escape channel to accommodate the storm water flow under the proposed project.

   The inlet structure for treated water from WWTP Kattar Bund is proposed to be constructed with gated system in the right of way irrigation Department at RD 314+000 of Lahore Branch Canal with 20 cusec discharge capacity.

3. WASA Lahore is responsible to provide gated system for operation of treated effluent at RD:314+000 Lahore Branch canal as well as at RD:0+020 of Escape Channel.
4. The gated system will be repaired and maintained by the WASA Lahore.
5. The gated system will be operated and controlled by the Irrigation Department.
6. WASA shall abide by all applicable rules and procedures timely notified and informed by the Irrigation Department.
7. WASA will execute the said work on its own expenses.
8. Work shall be executed in the presence as well as supervision of concerned officials, of Irrigation Department.
9. WASA is responsible of any mishap occurred at site and shall make good all such damages

10. Any blockage in Irrigation channel at any time, irrigation Department will stop water troughing into Canal and will use alternate source.
11. Route plan and Structure plan should be discussed before implementation with Irrigation Department.
12. An undertaking should be provided at the stage of granting conditional as well as original NOC separately.
13. Discharge in escape channel is subject to enhancement of design as well as payment of Rs:35000/- per Cusec annually as per policy of the Irrigation Department.
14. During Canal Closure, disposing of effluent discharge will be totally stopped by the WASA
15. Due to breach of Canal or any emergency with canal, disposing of effluent discharge will be totally stopped by the Irrigation for a stipulated period.
16. Department reserves the right to cancel the NOC at any stage and re-occupy the ROW at any time for its convenience / for the purpose of planned utilization of ROW / in the public interest, after serving fifteen (15) days notice to the concerned agency.
17. The sponsor shall be responsible for any damages to the canal occurred during execution of work or subsequently and shall make good all such damages.
18. The subsequent maintenance and safety for the work shall rest with the sponsor.
19. WASA shall be responsible for re-location / demolition at its own cost, if so required by the Irrigation Department at any stage.
20. The WASA will execute an agreement with the undersigned for implementation of afore-mentioned terms and condition on judicial stamp paper worth of Rs 100/- before commencement of work.

This is for your kind information.

Executive Engineer,
Lahore Division CBDC,
Lahore.

C.C.
Sub Divisional Officer, Lahore Canal Sub Division Lahore for information.

RAVI URBAN DEVELOPMENT AUTHORITY

Housing Urban Development & Public Health Engineering Department
Government of the Punjab

No. RUDA/CEO/GEN/01-23
Dated: February 15, 2023

The Managing Director,
Water and Sanitation Agency,
Lahore.

SUBJECT: **CONSTRUCTION OF WASTE WATER TREATMENT PLANT (SOUTH) AT KATTAR BUND ROAD, LAHORE**

Dear Sir,

With reference to the subject cited above and WP No. 42025/2022, it is stated that Water and Sanitation Agency, Lahore (WASA) is currently in process of acquisition of land for the wastewater treatment plant cited above. There is no denying the fact under the current environmental, economic and social challenges, construction of waste water treatment plants is unavoidable. In a recent study conducted by the World Bank, (From Waste to Resource, 2020) it has been concluded that "Wastewater can be treated to various qualities to satisfy demand from different sectors, including industry and agriculture. It can be used to maintain the environmental flow, or even reused as drinking water. Wastewater treatment is one solution to the water scarcity issue, and also to the problem of water security, freeing water resources for other uses or for preservation".

2. The cited project is being financed by Danida Sustainable Infrastructure Finance (DSIF) and as such is a major opportunity to accomplish this most important milestone. Therefore, the Ravi Urban Development Authority (RUDA) has no objection upon the continuance and culmination of proceedings for land acquisition by WASA upon land notified by WASA through notification dated 15-06-2019. It shall be presumed that the afore referred land acquisition proceedings by WASA are being conducted with the consent and on behalf of RUDA, for all legal purposes.

3. This is being issued by the approval of the Authority.

Yours Sincerely,

Chief Executive Officer
Ravi Urban Development Authority