ENVIRONMENTAL MANAGEMENT FRAMEWORK

Karachi Water and Sewerage Services Improvement Project (KWSSIP)

Karachi Water and Sewerage Board

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ABBREVIATIONS

µg/m^3	Microgram per Cubic Meter
AERC	Applied Economic Research Centre
BOD_5	Biochemical Oxygen Demand (for 5 day)
BOT	Build Operate Transfer
CBOs	Community Based Organizations
CCMR	Community Complaints Management Register
CCP	Climate Change Policy
CDM	Clean Development Mechanism
CETP	Combined Effluent Treatment Plant
CO	Carbon Monoxide
CO_2	Carbon Dioxide
COD	Chemical Oxygen Demand
CPEMP	Construction Phase Environmental Management Plan
dBA	A Weighted Decibels
EA	Environmental Assessment
ED	Executive Director
EIA	Environmental Impact Assessment
EMF	Environmental Management Framework
EMP	Environmental Management Plan
EPA	Environmental Protection Agency
ESC	Environment and Social Cell
FGDs	Focused Group Discussions
FI	Financial Intermediary
GDP	Gross Domestic Product
GEF	Global Environmental Facility
GHG	Greenhouse Gas
GIS	Geographical Information System
GRC	Grievance Redress Cell
GRM	Grievance Redress Mechanism
GRR	Grievance Redress Report
HC	Hydrocarbon
HR	Human Resource
IBRD	International Bank for Reconstruction and Development
IDA	International Development Association
IEE	Initial Environmental Examination
IEPS	Initial Executive Project Summary
IFI	International Financing Institution
Km	Kilometer
km^2	Square Kilometer
KMC	Karachi Metropolitan Corporation
KSDP	Karachi Strategic Development Plan
KWSB	Karachi Water and Sewerage Board
KWSSIP	Karachi Water Supply and Sewerage Improvement Project
M	Meter

MDGs	Millennium Development Goals
MG	Million Gallon
MGD	Million Gallons per Day
Mm	Millimeter
MP	Mitigation Plan
NEQS	National Environmental Quality Standards
NGOs	Non-Governmental Organizations
NOC	No Objection Certificate
NOx	Oxides of Nitrogen
NRW	Non-Revenue Water
O&M	Operation and Maintenance
^{o}C	Degree Celsius
OED	Operations Evaluation Department
OP	Operational Policy
PCR	Project Completion Report
PCRs	Physical Cultural Resources
PDOs	Project Development Objectives
PGA	Peak Ground Acceleration
PKR	Pak Rupee
PM_{10}	Particulate Matter of 10 micrometer Diameter Particle Size
$PM_{2.5}$	Particulate Matter of 2.5 micrometer Diameter Particle Size
PMU	Project Management Unit
PPIAF	The Public Private Infrastructure Advisory Facility
PPP	Public Private Partnership
PR	President's Report
PSHA	Probabilistic Seismic Hazard Assessment
RED	Regional Environmental Division
REDD	Reducing Emissions from Deforestation and Forest Degradation
RO	Reverse Osmosis
SAR	Staff Appraisal Report
SDS	Safety Data Sheet
SEPA	Sindh Environmental Protection Agency
SEQS	Sindh Environmental Quality Standards
SME	Small and Medium Enterprise
SPDB	Sindh Planning and Development Board
STC	Short Term Consultant
TDS	Total Dissolved Solids
TM	Task Manager
TMP	Traffic Management Plan
TORs	Terms of References
TPP	Tree Plantation Plan
TPV	Third Party Validation
TSP	Total Suspended Particulates
US EPA	United States Environmental Protection Agency
WASH	Water, Sanitation and Hygiene
WHO	World Health Organization

EXECUTIVE SUMMARY

Background

Karachi is Pakistan's main seaport and international trade hub and contributes about 15 percent to the national GDP. The population of Karachi is at least 16 million.[1] The city is the capital of Sindh province. Karachi is administered by the Karachi Municipal Council (KMC) headed by an elected Mayor, with the provincial government retaining a strong role and fiscal predominance. Unclear roles, overlapping functions, and poor coordination among various agencies responsible for city governance and management have worsened the city's problems. Many migrants have settled in informal settlements (Katchi Abadies). It is estimated that currently about 50 percent of the population of Karachi are living in Katchi Abadies. Katchi Abadies are frequently serviced through illegal connections to the 'Karachi Water and Sewerage Board (KWSB) network or by water tankers. Water supply service level in Katchi Abadies is much below the already low general service level in the city and thus poses a particularly severe health risk to their population.

Nearly three million Karachiites lack access to piped water[2], but even those formally connected are confronted with inadequate, irregular and inequitable water services. Brackish groundwater limits the use of alternatives such as household wells; instead, inefficient and expensive "private water tankers form the major source of domestic water supply". Lack of metering of domestic customers, an inefficient tariff structure, an outdated database to calculate tariffs, and poor billing and collection efficiency have led to a large gap between receipts and expenditures. The city's current water demand is estimated at 1,200 million gallons per day (mgd), with the present shortfall of water relative to this demand estimated at 550 mgd.[3]

More than 6 million Karachiites have no access to public sewerage service. Those without access predominantly discharge sewage through the storm water system, natural drains or informal sewer pipes directly into the environment, rivers and ultimately the sea. Onsite solutions (pit latrines, septic tanks) are relatively rare and used by less than three percent of the population.[4] Even those with nominal access to public sewers do not receive acceptable services. The city is particularly vulnerable to more extreme heat, precipitation, flooding and sea level rise due to climate change[5]. Improving the water and sewer system will be critical to successfully adapt to these risks.

The World Bank is providing support to Karachi for the improvement of water and sewerage services and the governance through Karachi Water and Sewerage Services Improvement Project (KWSSIP). The proposed Project builds on analytical work and consultations that the Bank has carried out over the past two years on the status of the water and sewerage services in Karachi. Recent analysis and projections carried out in the context of project preparations indicated that, with committed implementation of the right reforms, KWSB could experience a turn-around in the short to medium term. The scope of the assessment also covers service delivery to K*atchi Abadies*.

The Project: Karachi Water and Sewerage Services Improvement Project (KWSSIP)

This project is conceived as part of a long-term program comprised of four Series of Projects 1 to 4 (SOP 1-4). This project is the first Series of Projects (SOP-1). The long-term program is designed to address the dramatic water and sanitation service gaps in the rapidly growing megacity of Karachi**.** The SOP-1 will provide strategic coherence and a long-term financial framework for the ambitious infrastructure expansions and utility reform program pursued by KWSB. The SOP-1 signals commitment and continuity for the reform process, while staggered projects will incentivize performance to allow the client to access successive financing rounds. Compared to a single project, the SOP 1-4 arrangement will also provide more opportunity for learning and adaptation between projects, an important characteristic for a complex program in a politically challenging environment. Finally, SOP 1-4 has been critical to attract long-term co-financing from

[1] Initial results from the 2017 census initially suggested a population of 14.9 million, but this was contested by the Government of Sindh, citing estimates as high as 23 million (see e.g. https://tribune.com.pk/story/1494020/mqm-p-rejects-fake-census-results). A higher census figure of 16 million is now commonly cited (see e.g. World Bank Group, *Transforming Karachi into a Livable and Competitive Megacity - A City Diagnostic*; Washington DC, 2018)

[2] Data from PSML 2014-15 combined with 2017 census data.

[3] Ibid. p.46; Relative to WHO standards;

[4] Pakistan Social and Living Standards measurement Survey, 2015

[5] See Hijioka, Y., et al.; Part B: Regional Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, pp. 1327-1370.; and: Hasan, A, Pervaiz, A and Raza, M. 2017. Drivers of climate change vulnerability at different scales in Karachi. IIED Working Paper. IIED, London; and Anwar, F.; Karachi City Climate Change Adaptation Strategy –A Roadmap; April 2012; Shehri-Citizens for a Better Environment;

the Asian Infrastructure Investment Bank (AIIB).

The SOP-1 will focus on reform, maintenance and rehabilitation, but no major investments in new infrastructure. Rehabilitation activities will be selected during implementation in line with the evolving reform agenda and as the identification of priority sites is finalized. Reform efforts will be aligned with the KWSB Commitment of Cooperation (CoC) roadmap signed between Bank and KWSB, and initiate improvements to service delivery standards, KWSB's institutional structure, the utility's financial viability and greater involvement of the private sector. SOP-1 would also be used to prepare designs and safeguard documents for future investments in line with an environmental category B classification.

Project's Development Objectives (PDOs)
The Project Development Objective is to improve access to safe water services in the project area and to increase KWSB's financial and operational performance.

Components of the Project
The SOP-1 will invest US$100 million, of which US$ 40million from IBRD, in infrastructure rehabilitation, capacity building to raise operational performance and improvements to the enabling environment. The project activities of SOP-1 will be grouped into three components.

Component 1 will finance both capacity building and reform measures to improve the enabling environment.

Component 2 will undertake selected infrastructure investments.

Component 3 will fund project management and associated studies.

Environmental Management Framework (EMF)
KWSSIP SOP 1 triggers the World Bank Environment and Social Safeguard policies, and consistent with the requirements of Environmental Assessment OP4.01 has been assessedas Category-B project. Accordingly, as the project investments to be financed in the project have not been selected and or finalized at the time the Bank appraised the project, an Environmental Management Framework (EMF)[6] has been prepared by KWSB. The purpose of the EMF is to establish principles, rules, guidelines and procedures to ensure compliance of environmental safeguard requirements of the national laws and World Bank's safeguard policies for those project investments that are not yet defined and/or whose locations are unknown at the time the Bank appraises the project. In-line with Category B project requirements, the EMF sets out the policies, strategies, procedures and institutional requirements to screen the activities when their locations are identified and/or defined, the environmental documents required for these activities and the approval and clearance procedures to be followed. KWSB will use this EMF during designing, construction and operational phases of the project components to ensure safeguard compliance and mitigate environmental impacts at all the stages of the project as per the environmental management plan provided in the framework.
KWSB has prepared this EMF by using primary and secondary information collected through literature review, reconnaissance survey, institutional and community stakeholder consultations, and consultation workshop. This framework will be followed by KWSB, once the individual sub-projects are identified during project implementation and their location, technical and engineering details are available. EMF also provides the stakeholder engagement and involvement guidelines throughout the project life cycle and mechanism to disclose project information to them, and redress the grievances of the affected communities.

Environmental Baseline
Karachi is located just above the tropical zone on the coast of the Arabian Sea at 24º45" to 25º15" north, and 66º37" to 67º37" east at about 20 m above sea level (airport weather station). Karachi is bounded by Hub-River (Balochistan Province) on West, Badin District on East, Dadu District on North and Arabian Sea on South. The climate of the Karachi can be characterized by dry, hot and humid conditions and in general terms it is moderate, sunny and humid. There is a minor seasonal intervention of a mild winter from mid-December to mid-February followed by a long hot and humid summer extending from April to September, with monsoon rains from July to mid- September. The level of precipitation is low for most of the year. The

[6] An instrument that examines the issues and impacts associated when a project consists of a program and/or series of sub-projects, and the impacts cannot be determined until the program or sub-project details have been identified. ESMF sets out the principles, rules, guidelines and procedures to assess the environment and social impacts. It contains measures and plans to reduce, mitigate and/or offset adverse impacts and enhance positive impacts, provision for estimating and budgeting the costs of such measures, and information on the agency or agencies responsible for addressing project impacts.

humidity levels usually remain high from March to November, while very low in winter as the wind direction in winter is North Easterly.

Climate of Karachi is semi-arid and rainfall is low and highly variable. Torrential rains and heavy rainfall mostly occur in the month of June under the effect of tropical storms. Torrential and heavy rains rarely affect coastal areas but cause flooding within the city. Karachi is located in a moderate earthquake zone.

Karachi covers an area of approximately 3,600 km^2, comprised largely of flat or rolling plains, with hills on the western and northern boundaries of the urban sprawl. The city represents quite a variety of habitats such as the sea coast, islands, sand dunes, swamps, semi-arid regions, cultivated fields, dry stream beds, sandy plains, hillocks.

Indus River and Hub Dam on Hub River are the two major sources of surface water for Karachi. Karachi obtains its drinking water from the Indus River about 120 km to the east and the Hub River about 56 km in the west. Groundwater resources in the Karachi area are limited. The aquifers close to the coastal belt are mostly saline and unusable for domestic purposes. Aquifers near the Hub River are well developed and serve as sources of water for agriculture and domestic use.

Over the last three decades, Karachi consistently lagged behind in the maintenance and expansion of water supply system, bulk conveyance system, and distribution network as compared to the city demands due to high population growth rate (4 to 5% per annum), low capacity of institutions, and low level of financing. The consequence is the rationing of water supply currently in practice in most of the areas of the city. Water is supplied only once in every two or three days and for the duration of two to three hours at a time.

At present, four major drainage systems are serving Karachi city: the Lyari, the Malir, the Budnai, and small streams referred to collectively as the coastal basin. The Malir River Basin and the Lyari River Basin contribute about 80% of the surface runoff from the city. Thus, the natural drainage system of Karachi city is comprised of mainly the tributaries of the Malir and Lyari Rivers.

Most of the wastewater from industries does not comply with the Sindh Environmental Quality Standards (SEQS) and result in considerable environmental pollution and degradation. The main sources for pollution in coastal waters are indiscriminate discharges of untreated industrial and domestic effluent, shipping traffic, mechanized fishing fleet and oil terminals at Karachi harbor.

World Health Organization (WHO) included Karachi amongst the top 20 polluted cities of the world with respect to outdoor ambient air pollution levels measured as PM_{10} and $PM_{2.5}$. Annual mean concentrations of PM_{10} and $PM_{2.5}$ in Karachi are 273 $\mu g/m^3$ and 117 $\mu g/m^3$, respectively.[7]

Malir River and its adjoining sites in the east are densely populated with wide variety of vegetation in the form of natural foliage consists of: bushes, shrubs, trees including agricultural products such as crops, vegetables and fruits. No endangered fauna exists in the eastern boundaries section. Fauna of the area is comprised of: some avian fauna, sparrows of diversity genera, crows, cuckoos, and wild and domesticated pigeons.

Population of Karachi is exposed to the health risks linked to high air, water and solid waste pollution levels. Large proportion of the city's population lives in Katchi Abadies. In Katchi Abadies the infrastructure is dilapidated and access to basic services is very low.

The Pakistan Social & Living Standards Measurement Survey of 2014-15 showed a 76% literacy rate for the urban areas of Sindh. The literacy rate for Karachi is 82%. The overall literacy rate for urban areas in Pakistan was 76% (Literacy for population above 10 year and older).

Regulatory Review

This section documents three sets of laws, policies and strategies i.e. national, provincial, and World Bank Safeguard Policies.

National Laws, Policies and Strategies

[7] WHO, "Public Health, Environmental and Social Determinants of Health: Ambient (Outdoor) Air Pollution in Cities Database 2014.

The national laws, policies and strategies relevant for the environmental safeguard of the project activities are: Climate Change Policy of Pakistan 2012, Pakistan Climate Change Act, 2016, The Canal and Drainage Act 1873, Pakistan Penal Code, and The Antiquities Act 1975.

Provincial Policies, Strategies, and Laws

The provincial policies, strategies, and laws relevant for the environmental safeguard of the project activities are: Sindh Strategy for Sustainable Development, 2007, Sindh Sanitation Policy 2017, Sindh Drinking Water Policy 2017, Karachi Strategic Development Plan 2020, Karachi Water and Sewerage Board Act, 1996, Sindh Environmental Protection Act 2014, Sindh Environmental Protection Agency (Review of IEE and EIA Assessment) Regulations, 2014, The Sindh Local Government Act 2013, and The Sindh Wildlife Protection Ordinance, 1972.

World Bank Safeguard Policies

KWSSIP Component 1 and 2 trigger the World Bank safeguard policies including Environmental Assessment OP 4.01, Physical Cultural Resources OP 4.11, Safety of Dams OP 4.37, and Projects on International Water Ways OP 7.50. In Component 3, environmental safeguard documents for SOP-2 will be prepared (and reviewed and disclosed) under the new World Bank Environmental and Social Framework (ESF) in accordance with ESF standards and procedures. Environmental and Social Standards (ESS) to be considered while preparing safeguard documents for SOP-2 will include ESS-1: Assessment and Management of Environmental and Social Risks and Impacts, ESS-2: Labor and Working Conditions, ESS-3: Resource Efficiency and Pollution Prevention, ESS-4: Community Health and Safety, ESS-8: Cultural Heritage, and ESS-10: Stakeholder Engagement and Information Disclosure

Project investments that would be assigned an EA category A under OP4.01 and preparatory studies for investments that will be financed in future projects that would be assessed as High risk under ESS1 will NOT be eligible for financing under this project.

Furthermore, an Environmental Audit and corresponding Management Action Plan will also be required for TP1 and TP3 waste water treatment plants before any rehabilitation works start, and rehabilitation works will only be implemented if these two wastewater treatment plants meet relevant standards and if they don't cause any long term or irreversible environmental impacts.

Potential Environmental Impacts and Mitigation Measures

As stated above that KWSSIP comes under EA category project. Sub-projects that would have major, widespread and intense environmental impacts will be excluded from the project and will not be eligible for financing. KWSSIP will finance sub-project investments in Component 2 that may still have significant impacts but will not be wide spread, and therefore, l can be avoided through re-location of activities or in their design, or otherwise reduced to acceptable levels or reversed through the application of effective mitigation measures. The impacts of sub-projects are expected to occur during the construction activities, and lesser extent during their operations and maintenance activities. Most of the environmental impacts will be temporary and manageable, and in all cases mitigations exist for each and every impact. Potential impacts may include: i) loss of top soil, air pollution, soil erosion, and disturbance to aesthetic of the area due to clearing of the land for campsites and for construction activities, ii) chances of disturbance to natural habitats and biodiversity, iii) chances of disturbance to Physical Cultural Resources (PCRs) at the project sites, iv) air pollution resulting in poor visibility, disturbance to vegetation, property damages, soil contamination and health implications on workers and nearby communities due to dust emissions and stack emission of generators and vehicular emissions, v) soil and water contamination, odor, health implications (due to breeding of mosquitos and flies), and nuisance due to improper treatment and disposal of sanitary wastewater from construction camps, vi) nuisance, health implications on workers and communities (due to breeding of mosquitos and flies), if solid waste is not disposed and treated properly, vii) soil contamination due to improper disposal of hazardous solid waste and improper placement of oily parts, rags, chemicals, and lubricants, viii) nuisance, health implications on workers and nearby communities, disturbance to biodiversity due to noise from the construction activities, machineries and vehicles, ix) safety hazards for workers and communities, x) traffic congestion at or around construction sites due to construction activities, xi) odor, nuisance, soil/water contamination and outbreak of diseases due to improper management of spoil material and diversion of black water from sewerage project rehabilitation .

The operational phase impacts arising from rehabilitation of water supply and sewerage system subprojects include i) soil and water contamination due to leakages in the sewers, ii) odor and outbreak of diseases due to leakages, and damaging of sewers and malfunctioning of disposal pumps, iii) water borne diseases

(if water is not properly treated), iv) shortage of water supply, v) water contamination due to damaging pipelines, vi) health implications on workers and nearby communities and loss of biodiversity due to noise, ,vii) soil contamination due to chemicals spillage and leakages, viii) soil contamination due to storage of oily parts and rags on unpaved floors, spillage and leakage of chemicals/lubricants/fuel on soil and improper disposal of sludge, and ix) stress on energy resources due to energy use during operational phase.

The proposed mitigation measures during construction activities include i) campsite management, ii) avoidance of clearing vegetation and restoration of the site by planting trees/crops, iii) protection of natural habitats, iv) protection of Physical Cultural Resources (PCRs), v) suppression of dust emission, vi) control of stack and vehicular emissions, vii) safe disposal of sanitary wastewater, viii) safe disposal of domestic solid waste, ix) safe disposal of hazardous and construction waste, x) soil pollution control, xi) noise abatement measures, xii) protection of workers from health and safety hazards, xiii) protection of communities from accidents and safety hazards, xiii) traffic management and xiv) restoration of campsites, xv) management of spoil material and black water diversion.

The proposed mitigation measures during operational phase of the water supply and sewerage system operations include i) maintenance of sewerage system and disposal pumps, ii) ensuring proper functioning of water treatment facilities, iii) maintenance of water supply pipelines and pumping facilities, iv) noise abatement measures at project sites, v) soil pollution control, vi) protection of workers from health and safety hazards, vii) protection of community's health, viii) landscaping to improve aesthetic of the sites, ix) energy auditing and implementing energy efficiency measures at water turbines and disposal pumps.

Stakeholder Consultations

KWSB recognizes the importance of early and continuing engagement and meaningful consultation with stakeholders. KWSB will engage the stakeholders, including communities, groups, or individuals affected by proposed projects, and other interested parties, through information disclosure, consultation, and informed participation in a manner proportionate to the risks and impacts on affected communities. At this point in time, the details about the project/subprojects and their exact locations are not known, therefore, it is not possible to engage communities and carry out the consultation for those projects which are unknown. KWSB organized a consultation workshop with the stakeholder institutions to share the draft EMF and finalize the EMF in the lights of the recommendations made by the participants. Major participants of the workshop included representatives of Karachi Metropolitan Corporation, six District Municipal Corporations, NGOs, Community Based Organizations (CBOs), Asian Infrastructure Improvement Bank (AIIB) etc. After the project locations are identified and details are available for each component of the project, Focused Group Discussions (FGDs) will be carried out by KWSB with the directly affected stakeholders.

Community representatives reported that communities were facing poor environmental conditions with very low level of water supply and sanitation services. Communities living along the main drains and rivers are facing serious environmental issues and generally public health is at low level. Most of the representatives of the communities reported that water supply was intermittent, erratic, and contaminated. During rainy reasons, most of the area was flooded by rain and sewerage water that led to serious health issues and inconvenience to the communities.

In line with the environmental assessment requirements of International Bank for Reconstruction and Development (IBRD) or International Development Association (IDA) financing, KWSB will consult project affected groups and local nongovernmental organizations (NGOs) about the project's environmental impacts, and committed to incorporate their opinions, concerns, and ideas in the design and construction of the sub-projects.

Institutional Arrangement and Environmental Assessment of KWSSIP

KWSB will establish the Project Implementation Unit (PIU) for the implementation of KWSSIP. An Environmental and Social Cell (ESC) staffed by a qualified environmental and social specialists will be established under PIU. ESC will take care of the environmental and social safeguard requirements of the project components. The ESC will be the custodian of the EMF at the overall project level. The main function of the ESC will be to support KWSB to ensure the compliance of the EMF during the implementation of eligible sub-projects in line with SEPA 2014 and the World Bank safeguards operational policies.

Under World Bank's Operational Policy 4.01 (Environmental Assessment), the bank requires Environmental Assessment (EA) of projects proposed for Bank financing to help ensure that these are environmentally sound and sustainable, and thus to improve decision making. First step of the environmental assessment

is the screening. Two levels of screening will be conducted. Firstly, KWSB will conduct Environmental screening with the assistance of the ESC, and propose sub-projects. This screening of the sub projects will be carried out at the time of identification and aligned with the local planning process and cycle of the KWSB and the World Bank Safeguards policies. The environmental screening of each proposed sub-project will be carried out to determine the appropriate extent and type of EA required. Secondly, KWSB screening exercise will be evaluated by the World Bank to ensure that the KWSB screening complies with the World Bank Safeguard policies. The Bank classifies the proposed project into one of four categories of A, B, C and FI, depending on the type, location, sensitivity, and scale of the project and the nature and magnitude of its potential environmental impacts. After the screening process and classification of the category of the project, the type and extent of the EA required will be decided and executed. Based on the eligible sub-projects under KWSSIP, it is assessed that in most of the cases preparation of ESMP will be required. However, it is possible that some investments would also require ESIA's. The ESC will assist KWSB to prepare the ESIA's and or ESMPs, as required.

The Sindh Environmental Protection Agency Review of the IEE and EIA Regulations, 2014 categorizes development projects into three schedules, according to their anticipated potential environmental impact for the preparation of Environmental Impact Assessment (EIA), Initial Environmental Examination (IEE), and Screening and checklists as per the schedule. For the rehabilitation of water supply and sewerage subprojects in low income communities, SEPA does not require any environmental assessment whereas these are under category B subprojects for World Bank which will require limited EIA in the form of IEE, Environmental and Social Management Plan (ESMP) etc. The priority sewer network rehabilitation subprojects will be of Schedule II and category B under SEPA and World Bank respectively.

So, to summarize, all investments eligible for financing would need to be EA risk rated either B or C, consistent with OP4.01 and will therefore require either (i) ESIA with their corresponding ESMPs or (ii) ESMPs only. Lastly, Environmental Audit and management action plan will also be required for TP1 and TP3 waste water treatment plants.

Grievance Redress Mechanism

KWSB will respond to the concerns and grievances of project affected parties related to the environmental and social performance of the project in a timely manner. For this purpose, KWSB will implement a Grievance Redress Mechanism (GRM). The KWSB will establish a GRM to facilitate the resolution of community complaints and grievances. Under this mechanism, a Grievance Redress Cell (GRC) will be established in the PIU. One GRM focal person at each construction sites will be designated during construction phase. This person will be directly accessible to the community for the registration of complaints and their resolution. The established GRM will be communicated to the public and particularly the affected communities through print and electronic media, and during public consultations and community engagement events. This cell will maintain a Community Complaints Management Register (CCMR), at the site, for registering complaints and grievances. All written and oral grievances will be recorded in the Register. For operational phase GRM, the respective Engineers and Plant Managers of the utilities and plants respectively will be responsible for maintaining community complaints in the CCMR and their resolution. Android based GRM Application (GRM App) will also be established and launched to make GRM effective, easy and accessible to everybody for lodging complaints.

Budget

The tentative budget under different cost head is proposed. Total estimated budget for the compliance of environmental safeguard requirements is about Rs. 101.6 million.

1.0 INTRODUCTION

This chapter provides background of the project and its components to be financed by the World Bank, profile of the proponent and the Environmental Management Framework (EMF) for these projects.

1.1 Background

Karachi is the the largest city and economic motor of Pakistan. According to the recently released provisional 2017 National Census, the population of Karachi is at least 16 million.[8] Karachi is Pakistan's main seaport and international trade hub and contributes about 15 percent to the national GDP. The city is the capital of Sindh province. Karachi is administered by the Karachi Municipal Council (KMC) headed by an elected Mayor, with the provincial government retaining a strong role and fiscal predominance. According to a recent City Diagnostic by the World Bank, the city's governance structure is marked by numerous challenges:

> *"Unclear roles, overlapping functions, and poor coordination among various agencies responsible for city governance and management have worsened the city's problems. Municipal and city development functions are highly fragmented, with roughly 20 agencies across federal, provincial, and local levels. The provincial government retains substantial control over various city services and functions. Local governments are in an extremely weak financial position, leaving precious little for much-needed maintenance or development of infrastructure."*[9]

Since the independence of Pakistan, the city of Karachi has seen a continued influx of people due to better economic opportunities, which has made it one of the ten largest cities in the world. Many migrants have settled in informal settlements (Katchi Abadis). It is estimated that currently about 50 percent of the population of Karachi are living in Katchi Abadis. Katchi Abadis are frequently serviced through illegal connections to the Karachi Water and Sewerage Board (KWSB) network or by water tankers. Their water supply service level is much below the already low general service level in the city and thus poses a particularly severe health risk to their population.

Karachi's water supply services are falling far short of the expanding city's needs. Nearly three million Karachiites lack access to piped water[10], but even those formally connected are confronted with inadequate, irregular and inequitable water services. Availability often ranges "from two hours every two days to four hours per day at very low pressure", with rationing particularly widespread in informal settlements which face "severe shortages of water".[11] Brackish groundwater limits the use of alternatives such as household wells; instead, inefficient and expensive "private water tankers form the major source of domestic water supply". The city's current water demand is estimated at 1,200 million gallons per day (mgd), with the present shortfall of water relative to this demand estimated at 550 mgd.[12]

More than 6 million Karachiites have no access to public sewerage service. Those without access predominantly discharge sewage through the storm water system, natural drains or informal sewer pipes directly into the environment, rivers and ultimately the sea. Onsite solutions

[8] Initial results from the 2017 census initially suggested a population of 14.9 million, but this was contested by the Government of Sindh, citing estimates as high as 23 million (see e.g. https://tribune.com.pk/story/1494020/mqm-p-rejects-fake-census-results). A higher census figure of 16 million is now commonly cited (see e.g. World Bank Group, *Transforming Karachi into a Livable and Competitive Megacity - A City Diagnostic*; Washington DC, 2018)

[9] World Bank, Transforming Karachi into a Livable and Competitive Megacity – A City Diagnostic and Transformation Strategy, Washington DC, 2018;
[10] Data from PSML 2014-15 combined with 2017 census data.
[11] World Bank, Transforming Karachi into a Livable and Competitive Megacity – A City Diagnostic and Transformation Strategy, Washington DC, 2018; p.46;
[12] Ibid. p.46; Relative to WHO standards;

(pit latrines, septic tanks) are relatively rare and used by less than three percent of the population.[13] Even those with nominal access to public sewers do not receive acceptable services. The city's sewage treatment facilities are dilapidated and not working properly due to "complex challenges of inadequate sewer trunk mains, malfunctioning pumping facilities, and a lack of wastewater treatment capacity. The amount of raw sewage discharged into the sea each day is estimated to be 475 million gallons.[14] The failure to provide basic water and sewerage services in Karachi is a frequent source of public discontent and has prompted an intervention of the Supreme Court of Pakistan which issued directives aimed at improving services. For both the Federal Government and the Government of Sindh, improving water and sanitation services in Karachi is a high priority.

The consequences of the persistent water supply and sanitation services shortfalls for Karachi's population are dramatic. As the Supreme Court noted in 2017, "the residents as well as all visitors to the City" are exposed "to avoidable water-borne diseases. It is estimated that four-fifths of all illnesses are caused by water-borne diseases, many of which result in fatalities."[15] As was highlighted in a recent study, the limited access to and high cost of water are particularly acute problems for the poor and "for women, who are often the sole caretakers of the household and children" and must frequently "revert to carrying dirty and contaminated water from a well or from a river or canal that ends up endangering the lives of their families" or "buy water from private tankers, despite unsure availability and the water's exorbitant cost, which is onerous given meager household incomes."[16]

The risks of drinking water supply and sewerage service shortfalls in Karachi are aggravated by climate change: The city is particularly vulnerable to more extreme heat, precipitation, flooding and sea level rise due to climate change[17]. Improving the water and sewer system will be critical to successfully adapt to these risks. For example dealing with heat waves, such as the one experienced in 2015, requires sufficient and continuous availability of drinking water; functioning sewer systems and treatment capacity are important to deal with the impact of increased urban floods and to prevent contamination of the urban environment through sewer overflows. Likewise, sea level rise is likely to further reduce the quality of groundwater sources and thus increase reliance on the public piped system.

The Karachi Water & Sewerage Board (KWSB) is responsible for water and sewer services. The present service gaps arise from KWSB's operational challenges, chronic under-investment and a weak enabling environment. KWSB has not had significant capital investment for more than a decade even though a 2008 master plan estimated investment needs of over US$ 2.5 billion to achieve universal access to safe and affordable drinking water by 2030. The last investment project financed by an international financing institution (IFI) dates to the mid-1990s. KWSB's existing infrastructure is worn out and operating far below its rated capacity.

KWSB's technical challenges are exacerbated by its low operational performance. Lack of metering of domestic customers, an inefficient tariff structure, an outdated database to calculate tariffs, and poor billing and collection efficiency have led to a large gap between receipts and expenditures. In 2015-16, total receipts covered barely 50 percent of the utility's operational expenditures.[18] A conservative estimate of non-revenue water (NRW) from physical and

[13] Pakistan Social and Living Standards measurement Survey, 2015
[14] World Bank, Transforming Karachi into a Livable and Competitive Megacity – A City Diagnostic and Transformation Strategy, Washington DC, 2018; p.48;
[15] Supreme Court of Pakistan; Order – Constitutional Petition No. 38 of 2016; Full text at: http://www.supremecourt.gov.pk/web/page.asp?id=2443 [9/23/2018]
[16] World Bank, Transforming Karachi into a Livable and Competitive Megacity – A City Diagnostic and Transformation Strategy, Washington DC, 2018; p.47;
[17] See Hijioka, Y., et al.; Part B: Regional Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, pp. 1327-1370.; and: Hasan, A, Pervaiz, A and Raza, M. 2017. Drivers of climate change vulnerability at different scales in Karachi. IIED Working Paper. IIED, London; and Anwar, F.; Karachi City Climate Change Adaptation Strategy –A Roadmap; April 2012; Shehri-Citizens for a Better Environment;
[18] KWSB Financial Reform Roadmap, 2016;

commercial losses is around 55 percent.[19] Outstanding debts of KWSB to Karachi Electric alone amount to US$ 320 million, and financial losses are estimated at over US$ 5 million per month. A particular problem is non-payment of water bills. The total outstanding arrears are estimated at US$460 million (US$179 million for retail and US$281 million for bulk) and continue to accumulate. Government institutions and utilities are among the largest defaulters, owing the equivalent of US$350 million to KWSB. Given these financial pressures, KWSB has not been able to carry out preventative maintenance, focusing only on emergency repairs, thus aggravating the deterioration of assets over time.

The under-performance of KWSB has been aggravated by a complex, inefficient institutional framework. After passing through various phases of institutional change, the utility was made a GoS-controlled entity through the KWSB Act of 1996.[20] The composition of the KWSB Board of Directors is dominated by GoS officers. The city is represented by the Mayor of Karachi and a Chairperson from one of Karachi's six District Municipal Corporations (DMC). These arrangements restrict KWSB's operational autonomy, limit direct inputs by stakeholders (e.g. consumers) and constrain KWSB's ability to pursue a turnaround strategy decisively. Utilities in other large cities in the world are either fully aligned with municipal governments or operate as autonomous public utilities.

The Government of Sindh (GoS) and KWSB are committed to reforms and have already undertaken significant initial reform efforts. An exemplary step has been the reform of the tanker-truck business which supplies more than 10 percent of the population of Karachi with water.[21] Under pressure from civil society and the Supreme Court, in 2016-17 the GoS empowered KWSB to close down all illegal water hydrants (more than 100) which were supplying water to the tankers, either from illegal connections to KWSB's water network or from unsafe groundwater sources. KWSB put in place six legal water hydrants in the city, the operation of which it outsourced. Tankers using these hydrants require a KWSB license to be served, and must prominently display KWSB's phone number and water tariffs. The installation of meters and outsourcing have drastically increased the hydrant revenues, which was a major achievement against strong financial interests from groups outside KWSB (commonly referred to as the "tanker mafia"). The revenues from hydrants have increased from PKR 79 million in FY15 to PKR 356 million in FY17; preliminary data for FY18 shows a further increase to PKR 658 million. These water hydrants were outsourced through a procedure of auction by a KWSB-led broad-based procurement committee comprised of representatives from other departments and the District Administration. Moreover, KWSB took further steps to improve the service by establishing a centralized Tanker Request Center and launching a mobile application (called OTS KW&SB) to make it possible to order a tanker by mobile phone. The tanker reform was a significant step and illustrates the present political will to improve KWSB's performance.

KWSB has also commenced reforms in financial and customer management, non-revenue water reduction and services to the poor. As a result, revenue collection has increased by 32 percent from FY 16 to FY 18 without changes to the tariffs. This has enabled KWSB to increase expenditures for urgently needed maintenance and operations. In February 2019, KWSB also created and staffed units dedicated to non-revenue water reduction (NRW Cell) and to improving services and revenue collection in informal settlements (Katchi Abadi Cell).

To build on these successes, the GoS has agreed on a Commitment of Cooperation (CoC) with KWSB and the World Bank which outlines a reform roadmap in line with the objectives of the proposed Series of Projects. The CoC's vision is to transform KWSB into a modern,

[19] Ibid.

[20] KWSB was established in 1981, with the mandate of production, transmission and distribution, cost recovery of potable water, management of the sewerage system, development of schemes to cover services short falls, and collection of revenues. But in 1983, the Government of Sindh promulgated the Sindh Local Government (amendment) Ordinance (February 1983) institutionally bringing KWSB under the umbrella of Karachi Metropolitan Corporation (KMC). In 1996, a new Act called the Karachi Water & Sewerage Board Act 1996 was adopted.

[21] Pakistan Social and Living Standards Survey 2014-15;

efficient utility accountable to its customers and capable of providing safely managed water and sanitation services across Karachi while recovering its costs and raising private finance by 2030. The CoC outlines concrete objectives with specific timelines, including far-reaching changes to improve KWSB's operational autonomy, such as an amendment to the KWSB Act, as well as measures such as improved service rules, independent auditing of KWSB's finances, an increase in female staff and specific targets for service continuity and non-revenue water reduction.

The project will be instrumental in supporting this reform program and enabling complementary infrastructure investments. The first project in the proposed Series of Projects (SOP-1) will focus on reform and rehabilitation, strategically complementing reform measures (e.g. improving metering and billing to reduce commercial revenue losses) with strategic infrastructure investments (e.g. network repairs to reduce technical losses). SOP-1 will include concrete measures to increase resilience against climate change related risks by improving water and sewer service quality, which will be reinforced and deepened in subsequent projects

The World Bank is providing support to Karachi for the improvement of water and sewerage services and the governance through Karachi Water and Sewerage Services Improvement Project (KWSSIP). The proposed Project builds on analytical work and consultations that the Bank has carried out over the past two years on the status of the water and sewerage services in Karachi. Recent analysis and projections carried out in the context of project preparations indicated that, with committed implementation of the right reforms, KWSB could experience a turn-around in the short to medium term. The scope of the assessment also covers service delivery to K*atchi Abadis* (informal settlements).

1.2 The Proponent: Karachi Water and Sewerage Board (KWSB)

The proponent of the project is the 'Karachi Water and Sewerage Board (KWSB)'. KWSB was established in 1981. It is a service-based consumer-oriented organization responsible for production, transmission and distribution, cost recovery of potable water to the citizen of Karachi, managing sewerage system within the city to ensure hygienic environment, development of scheme to cover short falls in services and collection of revenues for sustained economic viability[22].. Later in 1983, Government of Sindh supported the establishment of KWSB by promulgating the Sindh Local Government (amendment) Ordinance of February 1983 leading to creation of KWSB within Karachi Metropolitan Corporation (KMC). In the year 1996, a new Act called the Karachi Water & Sewerage Board Act 1996 was enacted, which served to separate KWSB from KMC and placed them under the Government of Sindh as an autonomous body. Karachi Water & Sewerage Board is the biggest water & wastewater utility of the Country. Water is being supplied to Karachi from a distantly located water source through bulk conveyance system comprising of a complex network of canals, conduits, siphons, multi-stage pumping and filtration.

1.3 The Project: Karachi Water and Sewerage Services Improvement Project (KWSSIP)

The project is conceived as the first of a proposed Series of Projects (SOP) that forms a long-term program to address the dramatic water and sanitation service gaps in the rapidly growing megacity of Karachi. The SOP will provide strategic coherence and a long-term financial framework for the ambitious infrastructure expansions and utility reform program pursued by KWSB. The SOP signals commitment and continuity for the reform process, while staggered projects will incentivize performance to allow the client to access successive financing rounds. Compared to a single project, the SOP will also provide more opportunity for learning and adaptation between projects, an important characteristic for a complex program in a politically

[22] www.ksb.gos.pk

challenging environment. Finally, the ambitious SOP has been critical to attract long-term co-financing from the Asian Infrastructure Investment Bank (AIIB).

The **first project** (SOP-1) will focus on reform, maintenance and rehabilitation, but no major investments in new infrastructure. Rehabilitation activities will be selected during implementation in line with the evolving reform agenda and as the identification of priority sites is finalized. Reform efforts will be aligned with the CoC roadmap, and initiate improvements to service delivery standards, KWSB's institutional structure, the utility's financial viability and greater involvement of the private sector. SOP-1 would also be used to prepare designs and safeguard documents for future investments in line with an environmental category B classification.

1.3.1 Components of the Project

The first project will invest US$100 million, of which US$ 40million from IBRD, in infrastructure rehabilitation, capacity building to raise operational performance and improvements to the enabling environment. The project activities of SOP-1 will be grouped into three components.

Component 1 will finance both capacity building and reform measures to improve the enabling environment.

Component 2 will undertake selected rehabilitation of infrastructure investments.

Component 3 will fund project management and associated studies.

1.4 Environmental Management Framework (EMF)

KWSSIP triggers the World Bank Environment Assessment OP 4.01 and consistent with the requirements of OP4.01, this project has been assigned an EA risk category of B, thereby ensuring investments that would be assigned an EA category of A will Not be eligible for financing. Accordingly, EMF is required to ensure the compliance with environmental safeguard requirements in line with the national laws and World Bank's safeguard policies for those project activities that are not yet defined and/or whose locations are unknown at the time the Bank appraises the project.

EMF is an instrument that examines the issues and impacts associated when a project consists of a program and/or series of sub-projects, and the impacts cannot be determined until the program or sub-project details have been identified. The EMF sets out the principles, rules, guidelines and procedures to assess the environmental impacts. It contains measures and plans to reduce, mitigate and/or offset adverse impacts and enhance positive impacts, provisions for estimating and budgeting the costs of such measures, and information on the agency or agencies responsible for addressing project impacts.

The purpose of the EMF is to ensure environmental safeguards compliance and mitigate environmental impacts at all the stages of the project and sub-projects as per the environmental management plan provided in this framework. EMF will be used during designing, construction and operational phases of the project components.

EMF has been prepared based on primary and secondary information. Most of the information was collected from literature, reconnaissance survey, and consultations with community and institutional stakeholders. This framework will be followed once the sub-projects are identified and their details are available. This framework establishes the requirements and procedures for the stakeholder engagement and involvement throughout the project life cycle and mechanism to disclose project information to them and redress the grievances of the affected community.

1.4.1 Objective and Scope of EMF

The main objective of the document is to provide a framework for the environmental assessment and mitigation of potential environmental risks and impacts of the proposed project components on surrounding environment and communities. The framework outlines approaches for management of safeguards issues and impacts that are common to these project aspects such as (but not restricted to) waste management, grievance redress mechanism, monitoring and evaluation, etc.

Adequate information has been included in the EMF about the area in which subprojects are expected to be sited, including any potential environmental vulnerabilities of the area; and on the potential impacts that may occur and mitigation measures that might be expected to be used.

1.4.2 Structure of EMF

The EMF consists of ten chapters. The brief of each chapter is given below:

	Executive Summary	*Provides summary of the EMF contents and key findings.*
1	**Introduction**	*Background of the project and their brief description, information of the proponents, introduction of the EMF, its objective and structure, and study team.*
2	**Project Description**	*Detailed description of project and its components*
3	**Environmental Baseline**	*Description of environmental baseline of the entire project area.*
4	**Regulatory Review**	*Brief description of the national, provincial and World Bank laws, policies, strategies, guidelines, codes and procedures for the categorization, screening, environmental assessment and compliance of the proposed project/subprojects. This chapter establishes that how the various requirements have been or will be complied with during the planning and implementation stages of the subprojects.*
5	**Potential Environmental Impacts and Mitigation Measures**	*Description of potential generic environmental risks and impacts (direct, indirect/induced and cumulative) to be caused by the project's construction and operation phases on surrounding environment and community. Description of mitigation measures as per mitigation hierarchy (avoidance, minimization or reduction, mitigation, compensate/offset).*
6	**Stakeholder Consultation**	*Describes the objective, process, and outcome of the stakeholder consultations carried out during the EMF preparation.*

7	**Environmental Management Framework (EMF)**	*Description of institutional arrangements for the implementation of EMF and environmental management of the project and sub-projects.*
8	**Grievance Redress Mechanism**	*Description of the Grievance Redress Mechanism to be adopted by the proponent to facilitate resolution of any community complaints and grievances about the project's environmental performance, in line with the requirements of* World Bank.
9	**Budget**	*Estimated budget for executing the EMF, monitoring cost etc.*

2.0 PROJECT DESCRIPTION

This chapter describes detail of the components of the project 'Karachi Water and Sewerage Services Improvement Project (KWSSIP)'.

2.1 Project's Development Objective (PDO)

The Project Development Objective is to improve access to safe water services in the project area and to increase KWSB's financial and operational performance.

2.2 Description of Project Components

The description of the project components is given below:

2.2.1 Component 1: Operational & Enabling Environment Reform (US$7 million of which IBRD US$2.8million)

To build capacity and raise operational performance, as well as to prepare and implement planned enabling environment reforms, this component will support an array of measures including on:

i. *Revenue Management, Customer Care and Communication:* Improving customer management is a critical objective both to provide better, more accountable services to the population of Karachi and to increase revenue streams and thus KWSB's sustainability.

   The initial focus of revenue enhancement measures will not be water tariffs, but lower hanging fruits. As most KWSB revenues comes from bulk customers, generally either unmetered or inaccurately metered, improving metering and enforcing bulk customer bill collection will be the first priority. Similarly, domestic connections are unmetered and tariffs are based on largely outdated building descriptions. Updating KWSB customer data using a customer identification survey (and subsequent updating) is expected to significantly increase revenue giving the pace of urban densification. Additional revenue increases will come from upgrades to the metering and billing systems, and from a reintroduction of pre-existing but suspended wastewater tariffs. Beyond these quick-wins, the project will study water tariffs to guide the introduction of universal domestic metering with volumetric tariffs (under future projects) and the design of an effective communication strategy. Beyond revenue enhancement, KWSB will seek matching improvements in customer service by creating six new customer service centers. These will not only have staff from the Complaints Cell but also staff from the revenue and operational departments. Staff will be trained in customer engagement and a modern GRM will be developed, implementing and monitored. The citizen report card process will be revived, and a communications strategy developed. A water conversation strategy addressing different consumer groups will be developed and integrated into the communication strategy.

ii. *Non-revenue Water (NRW) Reduction Program:* A key aspect of improving operational performance and financial sustainability will be the reduction of non-revenue water. The project will develop a systematic non-revenue water reduction program, including the design and establishment of district meter areas, improvements in leak detection and repair, and a program for maintenance of meters installed under the project. These measures, in combination with network rehabilitation works and commercial revenue enhancement, are expected to significantly reduce commercial and technical losses. Lower NRW losses will

reduce the abstraction of groundwater, thereby reducing the pace of saltwater intrusion in the coastal aquifer. Reduction in physical losses will also improve energy efficiency and reduce greenhouse gas emissions.

iii. *Institutional Reforms and Human Resources:* The project will provide technical assistance and training to KWSB on human resource management, including on gender equality. HR systems (software and hardware) will be upgraded, staff training will be provided, and an institutional reform program (including drafting amendments to the KWSB Act) will be developed and implemented. Amendments to the Act are expected to include (a) the right of the MD/CEO to recruit staff without interference from the KWSB Board of Directors or the Government, (b) changing the service rules following principles of diversity, accountability and transparency, (c) establishing tariff setting rules based on affordability and O&M cost recovery, and (d) allowing the KWSB Board of Directors to approve tariffs at its sole discretion based on the new tariff setting rules and public consultations. Improving cost recovery will enable KWSB to better maintain its infrastructure, thereby contributing to service reliability and increasing the resilience of its customers to droughts and floods.

iv. *Social Sector Policy and* Katchi Abadi *Program:* The project will support the informal settlements unit of KWSB to implement infrastructure investments in at least three katchi abadis during SOP-1, and ensure that lessons learnt are translated into a subsequent broader informal settlement program. This program will include resources to support KWSB cooperation with local NGOs and community-based entrepreneurs, and to support addressing concerns of vulnerable customer groups (e.g. identifying the water contamination trail from main network outside Katchi Abadis to inhouse storage and water quality improvement/coping mechanisms, education and awareness campaign, assessment of informal water operators, a Gender Action Plan). Katchi abadis will be integrated into the existing KWSB GIS system by mapping service levels, demographics and infrastructure. Collectively these measures will improve the climate resilience of katchi adabis, which are particularly vulnerable to heat waves (which increase demand for water) and flooding (which has a larger impact if floodwater is contaminated by untreated wastewater).

v. *Other Capacity Building Priorities – Asset Management, Financial Management, Industrial Discharge Monitoring:* The project will finance additional capacity building including the design and implementation of an asset management program and improvements to the existing GIS. These are critical for the sustainable management of KWSB. The project will support improvements in financial management at KWSB and support improved monitoring of industrial discharges into the sewerage and storm water system, thereby reducing the contamination of water bodies. A survey of the condition of priority sewers will be conducted to guide rehabilitation designs.

2.2.2 Component 2: Infrastructure Investments (US$77 million of which IBRD US$30.8million)

Infrastructure interventions will be selected during implementation according to criteria that ensure relevance to project objectives and compliance with relevant environmental and social operational Bank policies, while flexibly aligning investments to the evolving reform agenda. This will reinforce the impact of capacity building and institutional reforms, and lay the foundation for scaling-up capital investments in subsequent projects. Priority areas for investments include:

i. *Water Network Rehabilitation:* To reinforce the non-revenue water and revenue management reforms of Component 1, priority areas of the network with be rehabilitated, focusing on reducing major leaks and installing district and customer meters. Leakage reduction will reduce the energy footprint of water supplied to consumers. Modern meters with data loggers for large bulk customers will be installed, and KWSB equipped with KWSB meter-reading

devices. Reducing NRW losses and introducing consumption metering will increase the supply of water and promote the conservation of water, thereby making Karachi's residents more resilient to water shortages. Additional chlorination facilities will be established to improve water quality.

ii. *Sewer Network Rehabilitations:* The project will invest in priority sewerage rehabilitation to restore network integrity in critical areas, and to reduce sewage leakage and flooding. These investments will be in the wastewater collection areas of the two wastewater treatment plants currently being rehabilitated (TP1 and TP3). As noted above, a well-functioning sewerage system reduces the impact of floods—not only by reducing the contamination of water bodies, but also by lowering the probability of infrastructure, existing water sources, and local communities from becoming overwhelmed by a flood carrying untreated wastewater. New fuel-efficient sewage suction and jetting trucks will modernize the KWSB fleet and reduce sewer clogging. These investments will reduce health risks for Karachi residents. The new suction and jetting trucks are also expected to have improved fuel efficiency standards relative to the existing fleet.

iii. *Rehabilitation of Safe Water Supplies in Katchi Abadis :* The project will improve water supply and sanitation in three Katchi Abadis. KWSB will rehabilitate and formalize existing infrastructure and test different technical approaches to improving quality of access, including water ATMs, installation of metered house connections, and improved bulk water supply. Institutional options will be developed, including full or partial outsourcing of operations to CBOs, NGOs, or private entities. These efforts will be supported by intensive stakeholder consultation and outreach. Subsequent projects will scale-up these investments based on lessons learned. More reliable WASH services will increase the targeted settlements' resilience to heatwaves, water shortages and floods.

iv. *Improving Energy Efficiency:* To reinforce the impact of the asset management improvement program, the project will reduce the energy consumption of KWSB pumping stations and water treatment plants, and thus reduce current high energy costs and KWSB's carbon footprint.

v. Other capital investments will be considered as Component 1 reforms evolve, screened by the established criteria.

2.2.3 Component 3: Project Management and Studies (US$16 million of which IBRD US$6.4 million)

This component will support the costs of managing the project and preparing aspects of the proposed subsequent projects, taking into account the expected impacts of climate change in the studies to be conducted. This will include direct project management costs of KWSB, updating of KWSB's Masterplan, Feasibility Studies, Tender Documents, Safeguard Documents and Supervision costs for this project as well as other critical studies such as an energy audit, a review of private participation options and a rapid groundwater protection assessment. In addition, this component will support the institutional strengthening of KWSB including strengthening the social and environmental management capacity of KWSB. This component will also finance the preparation of Feasibility Studies, Tender- and Safeguard Documents for investments in future projects of the proposed series, as long as they are not rated environmental category A under OP4.01 or High under ESS1.

The selection criteria for investments will ensure that investment will not be prepared for or take place in areas where the standards and conditions of the Bank's operational policy on involuntary resettlement (OP 4.12) cannot be ensured. OP 4.12 requires, among other stipulations, compensation and (if applicable) rehabilitation of affected people including persons without land title, squatters, vendors, hawkers etc. For infrastructure investments, the ESF will apply to subsequent phases of this SOP, but not to this project.

Table 1 provides investment plan of the project.

Table 1: Investment Plan

Project Components		Investment (US$ million)
Component 1 - Reform in Karachi Water and Sewerage Board		***7.0***
1	*Institutional Reforms and Capacity Building in HR*	
1a	Design and Provide Technical Assistance and Training to KWSB	0.5
1b	Design and Implementation of an HR Reform Program	0.2
1c	Upgrading of HR System including Software & Hardware	0.5
2	*Communication Strategy and Capacity Building in Development*	
2a	Design and Implementation of a Communication Program	0.2
2b	Develop and Implement Customer Relation Strategy including Training and Construction of 6 Service Centers	0.8
3	*GIS and Capacity Building in Asset Management*	
3a	Implementation of a GIS System	1.0
3b	Design and Implementation of an Asset Management Program	0.4
4	*Revenue Improvement and Customer Care*	
4a	Conduct Customer Identification and Tariff Basis Survey	0.5
4b	Improve Billing and Collection System including Tariff Study	0.25
5	*NRW Reduction and Metering Best Practices*	
5a	Design and Implementation of a NRW Control Program	1.4
5b	Design and Implementation of a Meter Maintenance Program	0.25
6	*Social Sector Policy and Informal Settlements (Katchi Abadis)*	
6a	Strategy for and Strengthening of the Katchi Abadis Cell and NGOs/CBOs Working in Katchi Abadis	0.4
6b	Implementation Support for the Gender Action Plan	0.1
7	*Sewerage Improvement Program*	
7a	Monitoring of Industrial Discharge into the Sewerage and Storm Water System	0.1
7b	Drafting of Indirect (Industrial) Discharge Regulations into the Sewerage	0.1
7c	Priority Sewer Lines Condition Survey and Rehabilitation Design (including Trenchless)	0.2
8	*Study on Financial Management Best Practices*	0.1
Component 2 - Securing Sustainable Water Supply & Sewerage		***77.0***

1	Rehabilitating Water Supply and/or Sewerage in Three Low Income Communities	5.0
2	Priority Sewer Network Rehabilitation	22.0
3	Priority Water Network Rehabilitation including Meters & DMAs to Reduce NRW	20.0
4	Reducing Energy Consumption	20.0
5	Sewage Suction and Jetting Trucks	10.0
Component 3 - Project Management & Studies		***16.0***
1	Preparing Specific Safeguard Documents for Project 2	1.5
2	Contract Management Consultant	1.5
3	Feasibility & Tender Documents for SOP-1	3.5
4	Conduct Energy Audit	0.5
5	PPP Options Study for NRW Reduction	0.5
6	Options Study and/or Transaction Advice for PPP Operation and Investment for Desalination and/or Wastewater Reuse	0.5
7	Rapid Groundwater Protection Assessment	0.5
8	Updating of KWSB's Master Plan	4.0
9	Feasibility & Tender Documents for Project 2	1.5
10	Project Management Cost for KWSB	2.0
Total Project 1 (SOP-1)		**100.0**

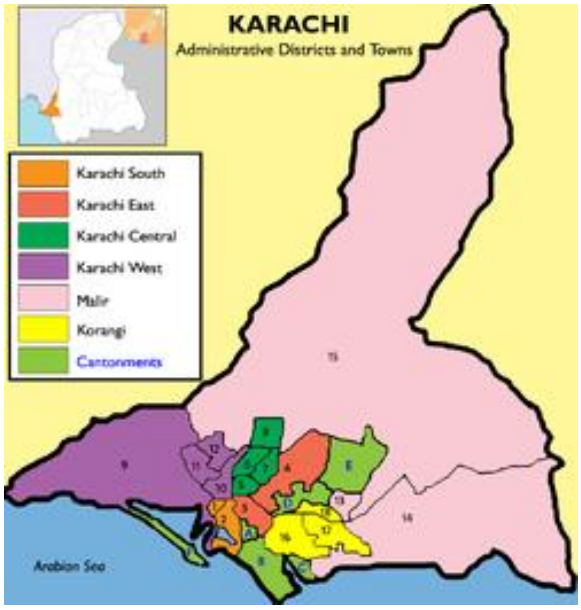
3.0 ENVIRONMENTAL BASELINE

This chapter describes the environmental baseline of the entire area for the proposed project/subprojects including physical, biological, socioeconomic conditions and cultural aspects relevant to KWSSIP.

3.1 Physical Environment

The map of the Karachi is presented in Figure 1.

Figure 1: Map of Karachi



3.1.1 Climate

Karachi is located just above the tropical zone on the coast of the Arabian Sea at 24º45" to 25º15" north, and 66º37" to 67º37" east at about 20 m above sea level (airport weather station). Karachi is bounded by Hub-River (Balochistan Province) on west, Badin District on east, Dadu District on north and Arabian Sea on south. The climate of the Karachi can be characterized by dry, hot and humid conditions and in general terms it is moderate, sunny and humid. There is a minor seasonal intervention of a mild winter from mid-December to mid-February followed by a long hot and humid summer extending from April to September, with monsoon rains from July to mid-September. The level of precipitation is low for most of the year. The humidity levels usually remain high from March to November, while very low in winter as the wind direction in winter is northeasterly.

3.1.2 Temperature

Table 2 and Figure 2 show the maximum, minimum and average monthly temperatures of the Karachi for the recent years (2016-2019). The maximum temperature range is 25 – 37 ºC. The average temperature range is 21 - 33 ºC. The minimum monthly temperature range is 18 – 30 ºC.

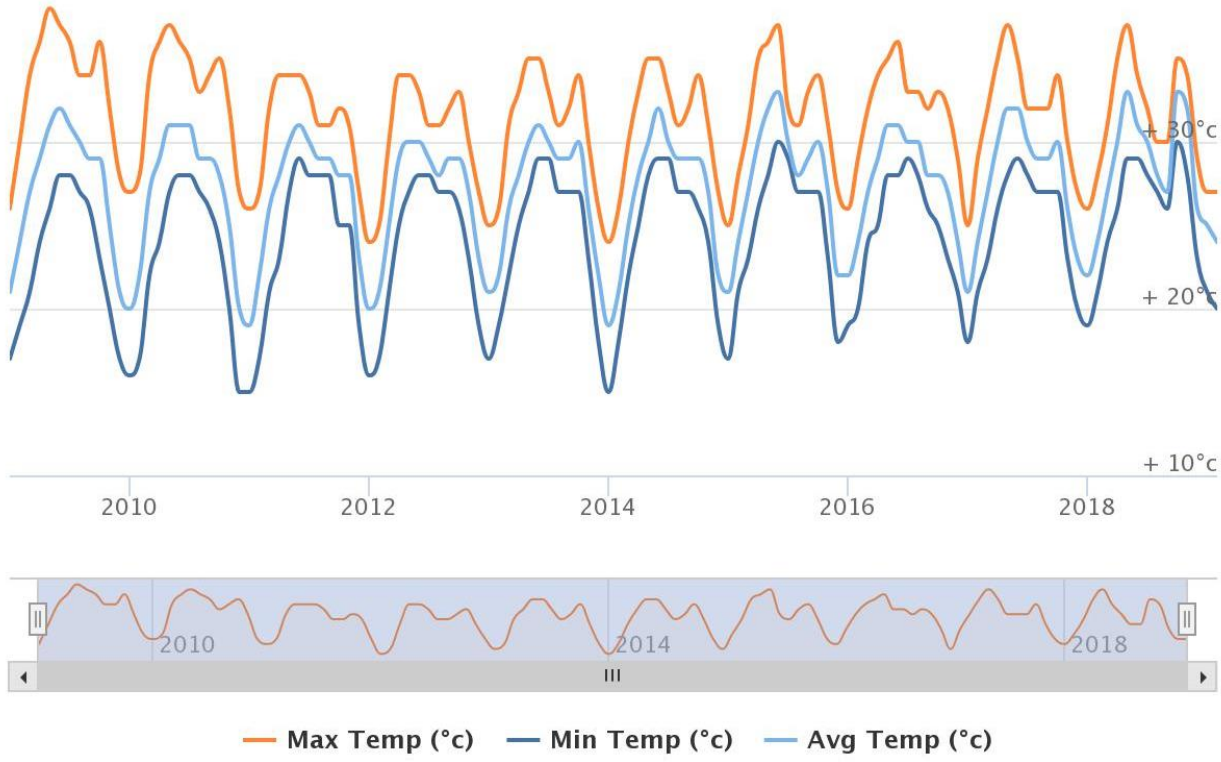
April to November are the hot months whereas cold months are December to March.

Table 2: Maximum, Minimum and Average Temperature (Karachi)

Year	Month's Temperature C°											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2016												
Max	26	29	32	34	35	36	33	33	32	33	32	29
Avg	22	24	27	29	31	31	30	30	28	28	27	24
Min	19	20	24	25	28	28	29	28	26	25	23	21
2017												
Max	25	29	32	35	37	35	32	32	32	34	30	27
Avg	21	24	27	30	32	32	30	29	29	30	26	23
Min	18	21	23	26	28	29	28	27	27	27	23	20
2018												
Max	26	28	31	35	37	34	32	30	30	35	34	29
Avg	22	24	27	30	33	31	30	28	27	33	32	26
Min	19	21	24	26	29	29	28	27	26	30	28	23
2019												
Max	27	27	-	-	-	-	-	-	-	-	-	-
Avg	25	24	-	-	-	-	-	-	-	-	-	-
Min	21	20	-	-	-	-	-	-	-	-	-	-

Source: Extract from Temperature Graph (World Weather Online)

Figure 2: Maximum, Minimum and Average Temperature (Karachi)



Source: World Weather Online (https://www.worldweatheronline.com/karachi-weather-history/sindh/pk.aspx)

3.1.3 Rainfall

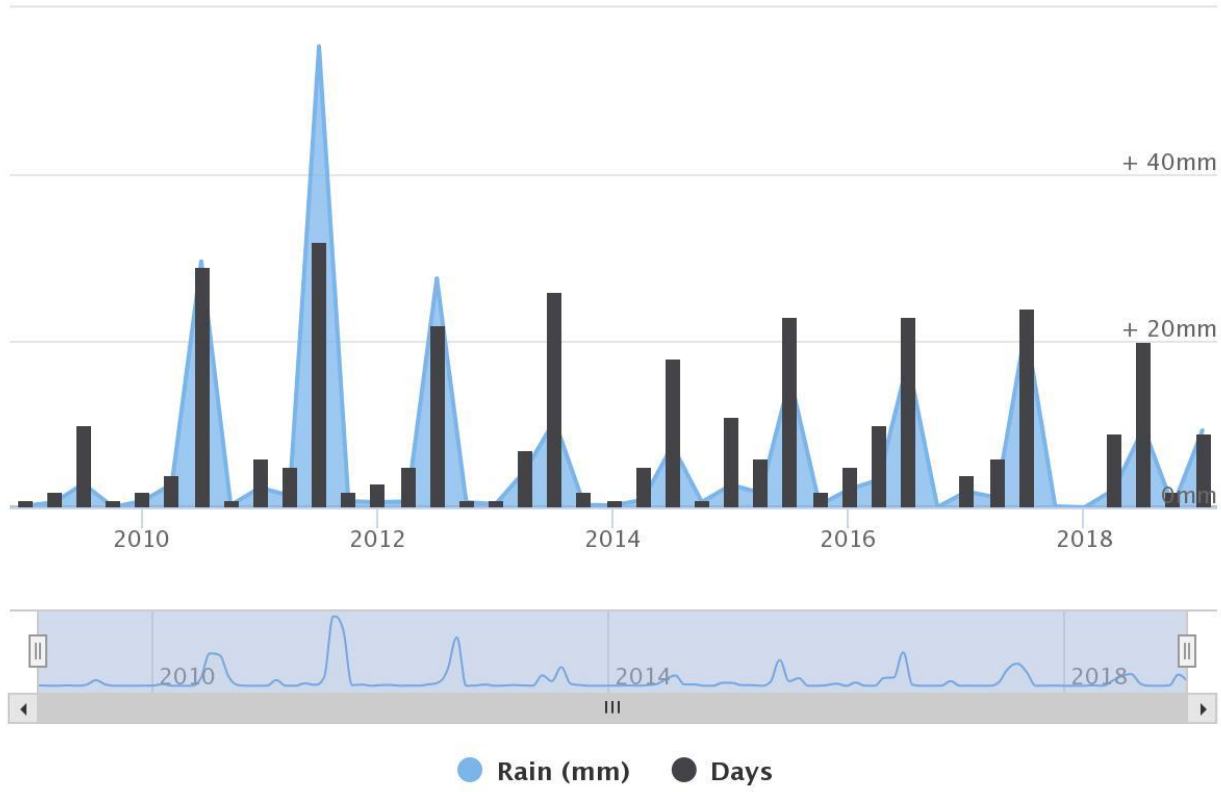
As this region falls in the semi-arid climatic zone, the rainfall in Karachi is extremely low and erratic. Table 3 and Figure 3 show the average monthly rainfall data of Karachi.

Table 3: Average Rainfall of Karachi (mm)

Year	Month's Average Rainfall (mm)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2016	2.63	0.0	3.9	0.11	0.09	9.71	10.23	41.09	1.2	0.01	0.0	0.1
2017	5.61	0.03	0.1	0.01	0.06	3.47	20.4	27.17	16.92	0.0	0.14	0.22
2018	0.01	0.0	0.04	0.53	0.0	5.92	11.86	14.31	2.53	0.0	0.0	0.4
2019	13.7	4.8	-	-	-	-	-	-	-	-	-	-

Source: Extract from Rainfall Graph (World Weather Online)

Figure 3: Monthly Average Rainfall (mm) and Number of Rainy Days of Karachi



Source: World Weather Online (https://www.worldweatheronline.com/karachi-weather-history/sindh/pk.aspx)

3.1.4 Humidity

Despite arid conditions, humidity is relatively high throughout the year. Table 4 and Figure 4 present detail of the average monthly humidity of Karachi.

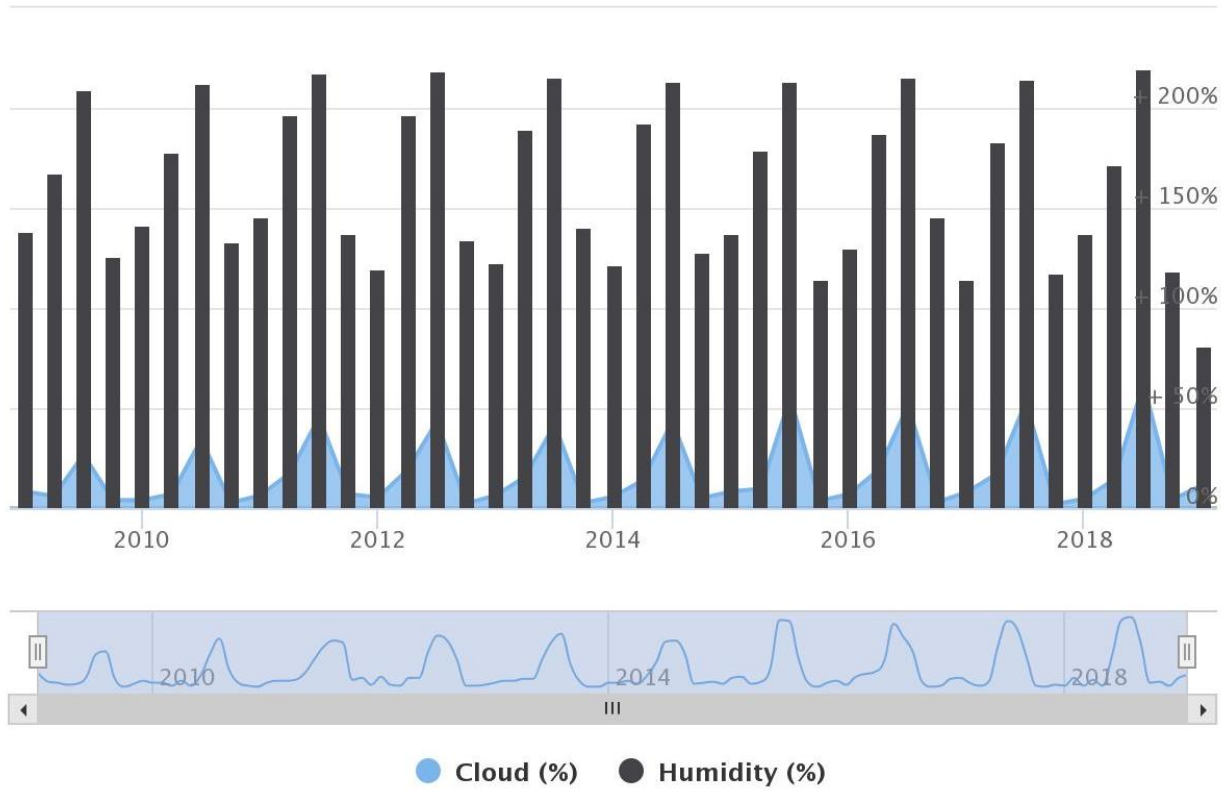
Table 4: Average Humidity (%) of Karachi (mm)

Year	Month's Average Humidity (%)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2016	48	33	49	54	66	67	72	73	71	63	39	44
2017	37	29	49	52	63	68	74	72	69	55	38	25
2018	42	45	50	51	52	69	73	75	72	47	37	35
2019	42	39	-	-	-	-	-	-	-	-	-	-

Source: Extract from Humidity Graph (World Weather Online)

Figure 4: Average Humidity and Clouds (%) of Karachi



Source: World Weather Online (https://www.worldweatheronline.com/karachi-weather-history/sindh/pk.aspx)

3.1.5 Wind

Karachi weather is considered pleasant and is famous for its breeze from the sea. The onshore winds from the Arabian Sea contribute to humid conditions. The wind speed has highest velocities during the summer months, when the direction is south-west to west. During winter, the wind blows from north to northeast, shifting southwest to west in the evening hours. The wind usually carries sand and salt resulting in severe wind erosion and corrosion. Tropical cyclones are formed in the Arabian Sea in the pre-monsoon season, mostly in the month of June. Table 5 and Figure 5 show the maximum and average monthly wind speed of Karachi. Figure 6 shows the wind rose for Karachi

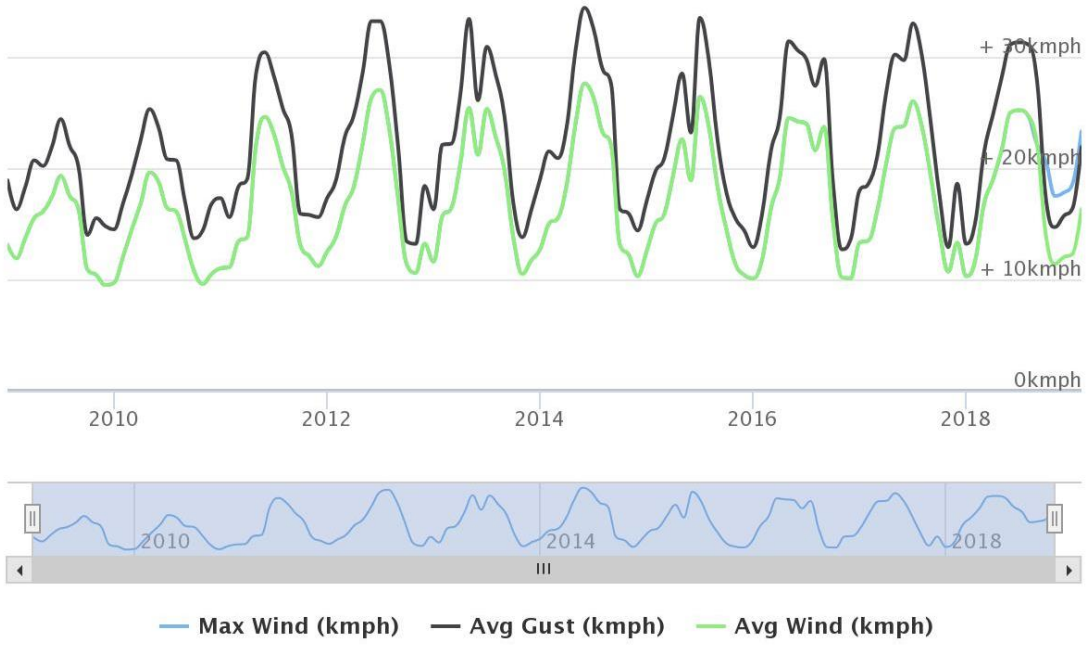
Table 5: Maximum and Average Wind Speed (kmph) of Karachi

Year	Month's Wind Speed (kmph)											
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
2016												
Max	10.1	11,7	16.3	19.1	24.5	24.2	24	21.6	23.7	15.3	10.2	10.1

Avg	10.1	11.7	16.3	19.1	24.5	24.2	24	21.6	23.7	15.3	10.2	10.1
2017												
Max	13.3	13.5	16.2	20.4	23.6	23.8	26	23.8	19.4	14.4	10.7	13.3
Avg	13.3	13.5	16.2	20.4	23.6	23.8	26	23.8	19.4	14.4	10.7	13.3
2018												
Max	10.3	11.6	16.7	18.9	21.6	25	25.2	24.7	22.1	20.6	17.5	17.8
Avg	10.3	11.6	16.7	18.9	21.6	25	25.2	24.7	22.1	13.9	11.4	12
2019												
Max	18.6	23.3	-	-	-	-	-	-	-	-	-	-
Avg	12.3	16.3	-	-	-	-	-	-	-	-	-	-

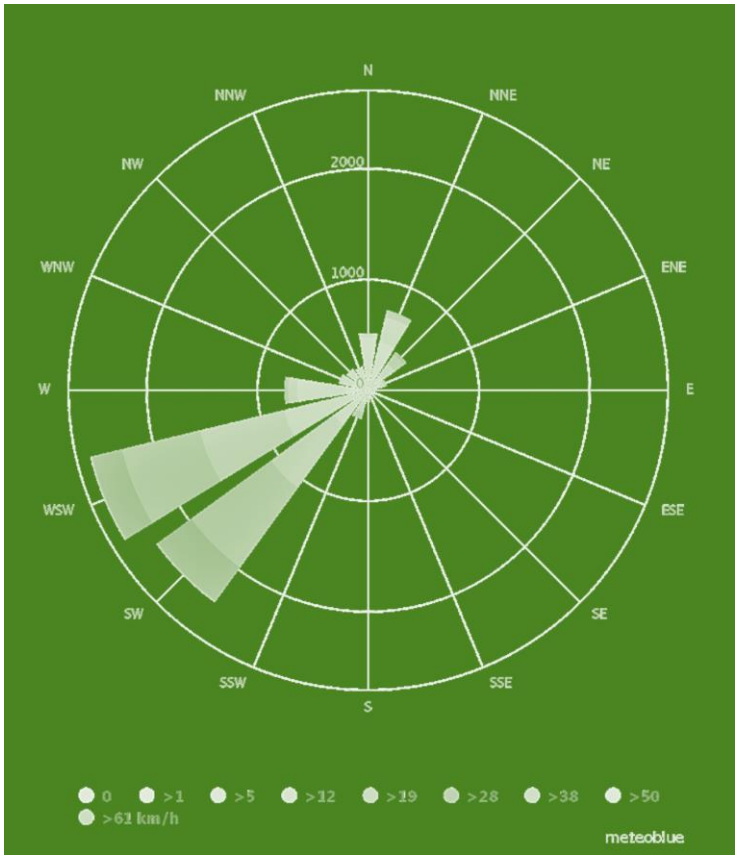
Source: Extract from Wind Graph (World Weather Online)

Figure 5: Monthly Average and Maximum Wind Speed and Gust (kmph) of Karachi



Source: World Weather Online (https://www.worldweatheronline.com/karachi-weather-history/sindh/pk.aspx)

Figure6: Wind Rose of Karachi



Source: Pakistan Meteorological Department

3.1.6 Topography

Karachi is located in the south of Sindh, on the coast of the Arabian Sea. It covers an area of approximately 3,600 km^2, comprised largely of flat or rolling plains, with hills on the western and northern boundaries. The city represents quite a variety of habitats such as the sea coast, islands, sand dunes, swamps, semi-arid regions, cultivated fields, dry stream beds, sandy plains, and hillocks. The hills in Karachi are the off-shoots of the Kirthar Range. All these hills are devoid of vegetation and have wide intervening plains, dry river beds and water channels.

Classified according to physiographic features, Karachi City District can be divided into three broad categories: Hilly Region (Mountain Highland), Alluvial Plain (Piedmont Plain) and Coastal Areas (Valley Floor). The greatest height of the region is 76 m that gradually decreases to 1.5 m above mean sea level along the coastline. The Karachi Harbor is a sheltered bay to the south-west of the city, protected from storms by the Sandspit Beach, the Manora Island and the Oyster Rocks.

The Arabian Sea beach lines the southern coastline of Karachi. Dense mangroves and creeks of the Indus delta can be found towards the south east side of the city. Towards the west and the north is Cape Monze, an area marked with projecting sea cliffs and rocky sandstone promontories.

Karachi is the part of major synclinorium stretching from Ranpathani River in the east to Cape Monze in the west, Mehar and Mole Jabal (Mountains) in the north. Within the synclinorium, a number of structures such as Pipri, Gulistan-e-Jauhar, Pir Mango and Cape Monze are exposed. The presence of concealed structures under the Malir River valley, Gadap and Maripur plains can fairly be deduced. Rock aggregates, sand, limestone and clay are some of the potentials for gainful utilization. Gulistan-e-Jauhar, member of the Gaj formation, offers groundwater potential

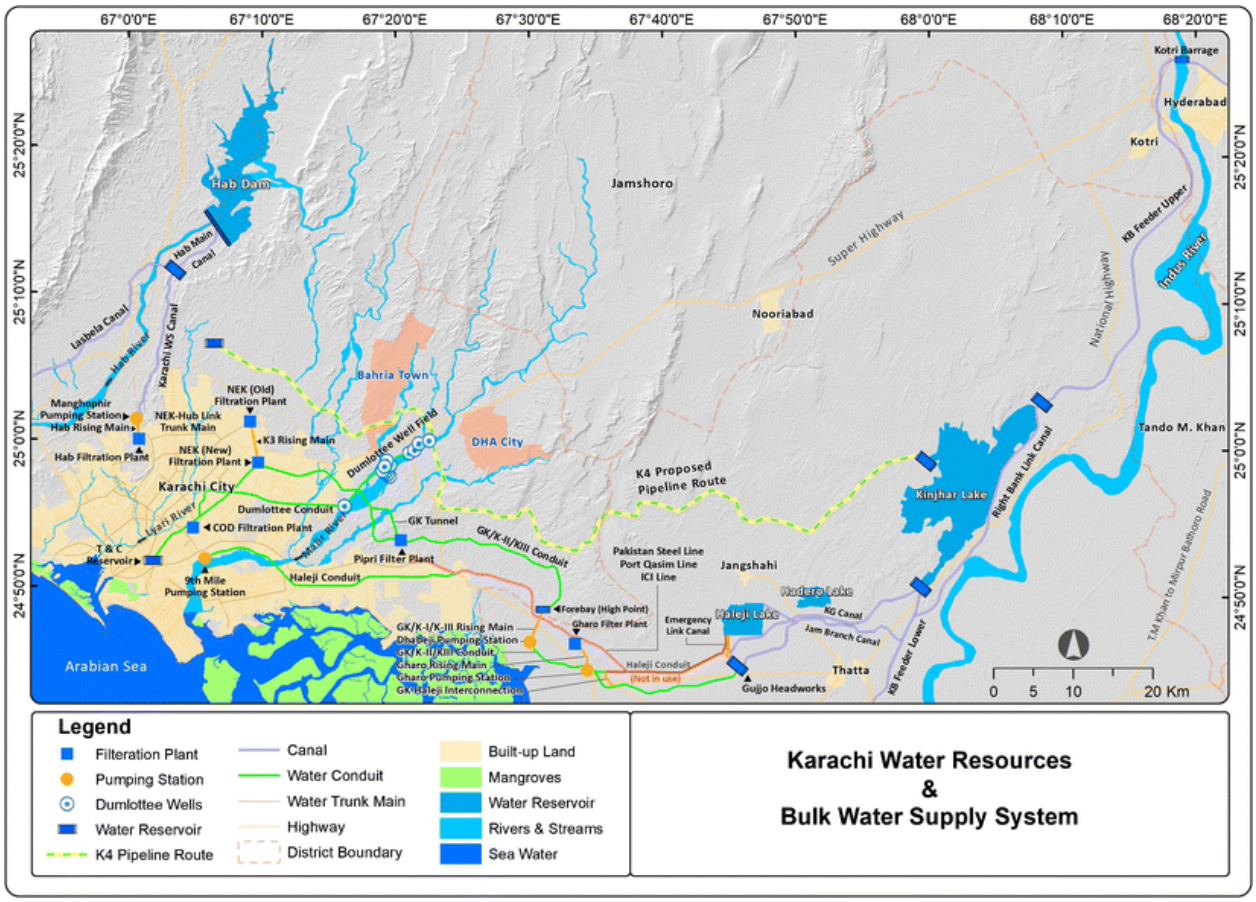
for limited use. The area is underlain by rocks of sedimentary origin ranging in age from Eocene to Recent[23].

The vacant land accounts for only 7% of all land and housing is the biggest user of land (with about 37% of the total), while roads and open spaces are also significant. Most of the developed areas are concentrated in the inner ring towns of Saddar, Jamshed, Lyari, Liaquatabad, Gulshan-e-Iqbal and Gulberg. These towns contain the diverse mix of land uses and include most of the governmental and regional-scale industrial and commercial activities[24].

3.1.7 Water Resources

The map of water resources and bulk water supply system for Karachi is shown in Figure 7.

Figure 7: Water Resources & Bulk Water Supply System of Karachi



The description of the water resources of Karachi is as under:

a) Surface Water

Indus River and Hub Dam on Hub River are the two major sources of surface water for Karachi.

1) Indus River

[23] Geological Survey, Preparatory Survey (II) on Karachi Circular Railway Revival Project, Final Report, JICA, 2013
[24] Karachi Strategic Development Plan 2020

The Indus River, the main source of water for Karachi, is severely constrained by dry season demand, but has abundant wet season discharges. Except during the summer flood season, very little water escapes to the sea. Water from the Indus River is distributed over the Sindh Province through three barrage systems, namely, Guddu, Sukkur and Kotri. Urban and industrial water for Karachi is taken from the Kotri Barrage and discharged through the Kalri Baghar Feeder Upper (KB Feeder Upper) to Kinjhar Lake. Kotri Barrage is the lowest barrage on the River Indus. Kinjhar Lake is a natural reservoir, the storage of which has been increased by constructing nearly 20 km of embankments having a maximum height of 9 m. The lake has a catchment area of 910 km. The supply from the River Indus comes via canals from Kinjhar, Haleji, Gharo and through conduits to the Dhabeji pumping station. The water is then distributed via conduits and distribution mains.

2) Hub Dam

The Hub Dam is a multi-purpose dam (municipal, industrial and irrigation purposes) constructed on the Hub River approximately 56 km to the north-west of Karachi city. The catchment area of the dam extends across two provinces namely Sindh and Balochistan, covering a total area of 8,730 square km. There has been an agreement between the two provinces that, at the Regulator located at the end of the Hub Main Canal, 63.3% of the total flow from the dam will be diverted to the Karachi Water Supply Canal (Sindh) while 36.7% to the Lasbela Canal (Balochistan).

b) Groundwater

Ground water resources in Karachi are limited. Small amount of groundwater is extracted for private use in the Karachi area. The aquifers close to the coastal belt are mostly saline and unusable for domestic purposes. Aquifers near the Hub River are well developed and serve as sources of water for agriculture and domestic use. The aquifers are estimated to lie at depths of 50-100 m.

Dumlottee Well Field, located on the banks of Malir River in the Dumlottee area about 30 km to the northeast of the city supplies water for few months after the rainy season. The system is almost dry in the rest of the year.

1) Groundwater Recharge Sources

Five possible water-sources are contributing to the groundwater recharge in Karachi. The first possible source is the rainfall. As the city of Karachi suffers from deficit of precipitation (only rainfall), the contribution to shallow groundwater storage from rain is very little. However, rainfall in the hinterlands and other areas surrounding Karachi may significantly contribute to the groundwater flow-system. The spring water discharges into Malir River and Layari River and the municipal/industrial waste effluents added to these rivers are also contributing to groundwater storage. Seawater intrusion along Karachi coast is another possible source.

During the past several years, a number of pumping wells has been installed to meet requirements for the irrigation-water supply (to serve vegetable and fruits cultivation, dairy and poultry) and drinking-water supply for Karachi. Excessive pumping of groundwater and continuous lowering of water-table is likely to result in intrusion of seawater into the Malir Basin under natural seepage conditions and under artificially induced conditions of recharge of saline seawater in the coastal aquifer(s) of Karachi.[25]

[25] Geological Survey, Preparatory Survey (II) on Karachi Circular Railway Revival Project, Final Report, JICA, 2013

2) Groundwater Quality[26]

Physico-chemical data of shallow groundwater (depth less than 30 meters) shows that the shallow wells, located in the vicinity of coast and in the proximity of polluted rivers, have relatively higher values of electrical conductivity, salinity and population of coliform bacteria. The shallow groundwater is moderately saline, representing electrical conductivity values in the range of 1.1 to 1.9 mS/cm and salinity in the range of 1 ppt. The pH of shallow groundwater varies from mildly acidic (~6.3) to mildly alkaline values (~7.9). Areas with quite poor sanitary conditions have relatively low values of pH (~6.3 to 6.8). Shallow groundwater below 20 meters is slightly reducing. The dissolved oxygen is in the range of 1.5 to 7.9 mg/l. Turbidity of shallow groundwater varies between 3.6 NTU and 95 NTU. The concentration of HCO_3 - (356 – 514 ppm, n=4), Cl- (82 - 169 ppm, n=4) and $SO4^{-2}$ (38-117 ppm, n=4) in shallow groundwater is very reasonable.

In general, deep groundwater is mostly saline and has high electrical conductivity (range: 1.9-19.1 mS/cm) and salinity (range: 1.7-7.4 ppt), as compared to shallow groundwater. Based on hydro-chemical data of water samples collected from pumping wells, it is assumed that the shallow mixed deep groundwater discharged by large-scale pumping wells mainly represents the deep groundwater from confined aquifer.

The hydro-chemical and stable isotope results indicate that the confined aquifer hosts a mixture of rainwater from hinterlands and surrounding regions around coastal Karachi, as well as sea trapped water / seawater, through intrusion under natural infiltration conditions or under induced recharge conditions.

c) Water Supply System

About 33% of the total water supply is without filtration. From filtration plants and reservoirs, water is supplied through the water trunk mains and distribution pipelines. The detail of the water filtration plants is given is Table 6.

Table 6: Detail of Filtration Plants in Karachi

Location	Gharo		COD		Pipri			NEK Old	NEK New	Hub
Number of Plants	1	2	1	2	1	2	3	1	1	1
Year of Construction	1943	1953	1962	1971	1971	1978	2006	1978	1998	2006
Rated Capacity MGD	10	10	70	45	25	25	50	25	100	80

Source: KWSB

A total of 139 distribution pumping stations are being operated and managed by the KWSB. Some of the consumers install individual small suction pumps and suck water from distribution pipes forcibly. This is the one of reasons of serious water supply situation which makes low water pressure and water shortage, and also problems of water quality aggravation such as sewerage contamination caused by negative pressure in the pipes. Consumers pay water tariff on the basis of plot size hence they pay no attention to any wastage. Awareness for the usage and storage of water is very less in many parts of Karachi. In order to complement the supply to water starved areas and to attend acute

[26] Information in this section is taken from: Geological Survey, Preparatory Survey (II) on Karachi Circular Railway Revival Project, Final Report, JICA, 2013

and chronic water shortages, Water Hydrants are operating in Karachi outsourced by KW&SB, which are providing water through tankers on specified / regulated rates to the citizens.

3.1.8 Sewerage System

Four drainage systems are said to encompass Karachi city, the Lyari, the Malir, the Budnai, and small streams referred to collectively as the coastal basin. The Malir River Basin and the Lyari River Basin contribute about 80% of the surface runoff from the city. Thus, the natural drainage system of Karachi city includes mainly the tributaries of the Malir and Lyari Rivers. While these are perennial streams, in stream flow is intermittent, and fresh water inflow depends on rainfall and runoff; both rivers also intercept discharges from sewer lines and outfalls and carry sewage to the sea from all parts of the city. The Budnai Basin and the Coastal Basin are minor basins. The Malir River flows from the east towards the south and center, and the Lyari River stretches from north of the city to the southwest ending in the Arabian Sea.

Drainage channels collect surface runoff through hundreds of small/large side channels and lined nullahs (drains) that serve as important components of the drainage network. These are generally dry built channels and streambeds that flow into the main rivers described above. Whenever a heavy rain takes place, the huge amount of runoff that course through these channels may cause the rivers to overflow their banks and spread over adjacent floodplains. In any event, the drainage network of the city is severely stressed due to increased runoff from paved surfaces, and encroachment on drainage channels.

The Lyari River is an ephemeral stream having a substantial catchment area starting from as far back as the Badra range of hills, some 100 km north of the city. Its catchment covers an area of 700 km^2, out of which, approximately 150 km^2 is in the metropolitan area. The river is the main contributor to an estimated amount of 200 MGD of sewage that enters the Arabian Sea. A large number of industries including leather tanning units, pharmaceuticals, petrochemicals, refineries, chemical, textile, paper and pulp, engineering works and thermal power stations, located along the river, regularly discharge their untreated industrial waste, including the waste flows from the SITE industrial estate in Orangi that flows via the Orangi Nullah to the Lyari and thence to the ocean.

Malir River is shorter with a smaller drainage area. It is ephemeral and is constituted from two major tributaries, the Mol and Khadeji, as well as some minor tributaries. Khadeji is a perennial stream that originates at Khadeji falls and gains flow as it travels across the Malir Basin. The Malir and Khadeji River basins include dry hill torrents and flow depends upon precipitation during rains. Once the Malir enters urban space, it receives large amounts of industrial effluent from the Korangi industrial area, and discharges into the sea.

The wastewater quality of Malir and Lyari rivers is given in Table 7.

Table 7: Wastewater Quality of Malir and Lyari Rivers

Parameters (mg/l) except pH	Malir	Lyari (Mean Values)
Ph	7.41 - 8.45	7.49
Temperature ^oC	32 – 33	27
Total Dissolved Solids (TDS)	1,478 – 33,820	2,361
Biochemical Oxygen Demand (BOD)	180 – 320	343
Chemical Oxygen Demand (COD)	506 – 1,413	552
Zinc	0.6 – 1.39	0.32

Lead	2.19 – 6.77	0.23
Cadmium	1.71 – 2.6	0.12

Source: Physico-Chemical Profile of Malir River and Chinna Creek (Sadia Tariq et al.), Impact of Orangi Nala Industrial Effluents on Sewage Water of Lyari River, Karachi, Pakistan (Yasmin Nergis et al.)

The existing coverage of the sewerage system is only about 30% for the Karachi. The existing sewerage system has a number of problems. These include low sewage flows received at existing sewage treatment plants, resulting from the inadequate provisions of sewer trunk mains and the malfunctioning of pumping facilities, deterioration of water quality in rivers and canals, and clogging of waterways caused by damping of massive rubbish. The detail of the sewage treatment plants is given in Table 8.

As per KSDP 2020, more than 380 MGD wastewater is discharged daily. Only about 90 MGD is treated at existing wastewater treatment plants. According to KWSB sources, almost 441.32 MGD raw sewage gets into the sea without required level of treatment from Karachi via 11 drains. Existing sewerage facilities for sewage collection and its treatment are far from sufficient in quantity to serve the large population of Karachi city. Additional sewage collection system including branch sewers, trunk sewers and pumping stations need to be constructed to improve living environment of the citizen. In the same manner, existing sewage treatment plants need to be extended and new plant(s) has to be implemented to treat all the generated sewage to improve water qualities of public water bodies, especially of Arabian Sea.

Table 8: Summary of Sewage Treatment Plants of Karachi

	TP-1 (SITE)	TP-2 (Mahmoodabad)	TP-3 (Mauripur)
Drainage Area	F.B. Area, Liaquatabad, Nazimabad & North Nazimabad, Part of Orangi Town, Pak Colony etc.	Old City Areas, Clifton Societies, Mahmoodabad, Part of Azam Basti, Dada Bhai, Sadder, Malir	Old Lyari, Garden East and West, Gulshan-e-Iqbal, PIB Colony, Soldier Bazar, Baldia, Nazimabad, North Karachi
Site Area	120 acres (48.6 ha)	120 acres (48.6 ha)	545 acres (221 ha)
Year of Construction	1960/1995 (rehabilitated)	1960/1996 (rehabilitated)	1998
Treatment Process	Trickling Filter Process	Trickling Filter Process	Anaerobic + Facultative Pond
Capacity (MGD)	51	46	54
Present Flow Rate (MGD)	25	24	30-35
Effluent Quality	BOD 80.8 mg/l SS 76.4 mg/l	BOD 100 mg/l	BOD 75 mg/l SS 69 mg/l

Source: KWSB

a) Industrial Wastewater Pollution

Emission of untreated effluent from industries that do not meet the Sindh Environmental Quality Standards (SEQS) result in considerable environmental pollution and degradation. Untreated wastewater from most of the polluting industries does not comply with the SEQS. There are about 24 large and small industrial complexes in the province. The industrial estates of Karachi, namely Sindh Industrial Trading Estate (SITE), Landhi

Industrial Trading Estate (LITE), Korangi Industrial Area (KIA), and West Wharf Industrial Area, among others, discharge effluents mainly into the Lyari and Malir rivers, which, passing through mangroves of Korangi Creek, finally drain into the Arabian Sea. SITE represents about 50% of the industrial discharges into sea.

Many of the above mentioned industrial estates intend to or are in the process of establishing large scale effluent treatment plants. The larger industrial zones include SITE (north), Landhi Industrial Estate (east), Korangi Industrial Area (south), Hub (west, between Karachi and Gadani, technically outside Karachi). The other fast growing industrial areas include Port Qasim Industrial Area, North Karachi Industrial Area, FB Industrial Area, SITE Superhighway etc., besides a number of industrial units operating in residential areas. Due to paucity of land, capital and technical resources, very few industrial units have installed individual wastewater treatment plants. Therefore, almost all of the industrial effluent goes into the sea practically untreated.

The major sources of pollution in coastal waters are: indiscriminate discharges of untreated industrial and domestic effluent, shipping traffic, mechanized fishing fleet and oil terminals at Karachi harbor. An estimated 90,000 tons of oily discharge is pumped out within port limits annually. Currently, almost 100% of the country's shipping cargo is handled at the two ports of Karachi. Eight heavy metals (As, Cd, Co, Cr, Cu, Hg, Ni, Pb, Zn) have been found to be accumulating in coastal fauna.

Untreated wastewater is one of the major source of surface and groundwater contamination. Most of wastewater discharges from municipal and industrial sources do not meet the Sindh Environmental Quality Standards (SEQS). This indiscriminate discharges of untreated wastewater results in considerable environmental pollution and degradation. Major infectious diseases outbreaks were sourced by the contamination of fresh water resources. Most sewage flows into the nullahs and rivers which run as open sewers through the built-up area, causing highly obnoxious, insanitary conditions with serious health risks and unpleasant environment for the residents of adjoining neighborhoods.

There are numerous katchi abadies along most of the sewage channels where poor segments of society live. These are vulnerable to being exposed to water borne diseases, especially children. Besides causing health impacts, sewage overflow also damages already dilapidated infrastructure of Karachi, particularly roads.

The heavy metal accumulation (especially Pb) in seafood is linked to anemia, kidney failure and brain damage in humans. Mangroves and other ecological assets of the coast of Karachi are under serious threats due to exposure to the seawater contamination. Coastal ecological areas especially mangroves are habitats to invertebrate fish, shrimps, crabs, birds and reptiles.

3.1.9 Flooding

Climate of Karachi is semi-arid and rainfall is low and highly variable. Torrential rains and heavy rainfall mostly occur in the month of June under the effect of tropical storms. Torrential and heavy rains rarely affect coastal areas but cause flooding within the city.

As the result of a tropical storm (6 June 2010) Karachi received 130 mm rain within a day which caused huge surface runoff. The heavy monsoon rain mostly occurs in July and August and is the main cause of flooding in the city. However, its reoccurrence is estimated to occur at between

about 3 to 5-year intervals. Flood affected areas of the city and areas susceptible to flooding include the old city areas such as Kharadar, Mithadar, Bunder Road, Ram-swami and Arambagh.

3.1.10 Seismology

Karachi is located in a moderate earthquake zone. Pakistan falls into three seismic zones. Zone-III is the most severe and Zone-I the least. The Karachi Building Control Authority has placed Karachi in Zone-II. Based on the actual events, past observations of fault movement and other geological activities, Karachi is situated in a region where moderate earthquakes may occur of magnitude 5.0 to 6.0 equivalent to intensity between VII and VIII on Modified Mercallis Scale (M).

The seismic zoning for Karachi was revised after the 2005 earthquake. Probabilistic Seismic Hazard Assessment (PSHA) carried out for revision of seismic provisions of the Building Code of Pakistan shows that Karachi falls in Zone 2B. The Zone 2B has Peak Ground Acceleration (PGA) in the range of 0.16 g to 0.24 g for a return period of 475 years and is considered to be at 'Moderate' risk of a major earthquake event.

3.1.11 Ambient Air Quality

World Health Organization (WHO) included Karachi amongst the top 20 polluted cities of the world with respect to outdoor ambient air pollution levels measured as PM_{10} and $PM_{2.5}$. Annual mean concentrations of PM_{10} and $PM_{2.5}$ in Karachi are 273 µg/m^3 and 117 µg/m^3, respectively.[27] WHO revised standard for safe concentration levels for PM_{10} is 20 µg/m^3 and for $PM_{2.5}$ is 10 µg/m^3. In Karachi, PM_{10} concentration level is about 14 times and $PM_{2.5}$ concentration level is about 12 times higher than the WHO standards. Highest level of $PM_{2.5}$ concentration happens during November to February due to reduced wind speed. During this period, $PM_{2.5}$ concentrations reach in the range of 120–180 µg/m^3 (12-18 times the WHO standards). In 2007, Encyclopedia of Earth, ranked Karachi as the most polluted city in terms of Total Suspended Particulates (TSP), and fourth most polluted mega city according to the multi-pollutant index ranking.[28] In Karachi, the concentration levels of carbon monoxide (CO), oxides of nitrogen (NO_x), and sulfur dioxide (SO_2) are within the permissible limits established by US EPA. The concentrations of hydrocarbons (HC) are higher than the permissible limits (0.25-2.8 as compared to 0.24 permissible limits).[29] Higher level of air pollution has resulted in substantial increase in respiratory tract infection. Major contributors towards air pollution in Karachi are vehicular traffic, industry and ambient dust.

3.2 Biological Environment

3.2.1 Flora

Karachi can be divided into following four sections with respect to flora and fauna of the area:

- Eastern Boundaries
- Southern Boundaries
- Northern Boundaries
- Western Boundaries

Eastern Boundaries: Malir River and its adjoining sites in the east are densely populated with wide variety of vegetation in the form of natural foliage consisting diversity bushes, shrubs, trees including agricultural products such as crops, vegetables and fruits. This section is extended from Memon Goth till Shah Faisal Korangi vicinities besides Malir River. The wild Kekar, Neem and Oak trees are also found here.

[27] WHO, "Public Health, Environmental and Social Determinants of Health: Ambient (Outdoor) Air Pollution in Cities Database 2014".
[28] Gurjar Bhola R., "Air Quality in Megacities", The Encyclopedia of Earth", September 2014
[21] ibid 191

Southern Boundaries: Southern boundaries of Karachi city are surrounded by rocky and barren mountains which are very hot in summer and are grown mostly by diversity vegetation characteristic of Sindh region including bushes, shrubs, and wild Kekar trees. Most vegetation are shade less trees which are selectively consumed by domesticated animals such as goats etc. At some areas, commercial vegetables are also grown but large areas are unproductive.

Northern Boundaries: Northern boundaries of Karachi city are surrounded by High Seas of Indian Ocean which starts from Bin Qasim area up to Manora, Keamari and consisting large variety of Mangrove vegetation in the coastal corridor. Mangroves are natural vegetation located usually besides shoreline in closed seas and are significant sanctuaries and breeding places for wide variety of aquatic organisms.

Mangroves are under stress due to industrialization, decreased freshwater discharges, and urban sprawl. Major functions of mangroves are: protection of inland areas from the effects of climatic stress, breeding and spawning of marine fisheries, and livelihood to the coastal communities. Major issue is the depletion in mangrove cover, which is going down both in quantity and quality. The industrial units propping up along the coast, especially in the Port Qasim Industrial Area, often cut sizable numbers of mangroves. However, very low real effort is visible in alternative and compensatory plantation of mangroves, as promised by proponents during environmental approval process. Furthermore, with declining quality and quantity of fish catch, the fisher-folk is opting to other means of livelihood, thereby reducing their traditional economic reliance on mangroves. This results in cutting of mangroves by the local communities as well, especially during fuel shortage.

Western Boundaries: Western boundaries of Karachi city are surrounded also by High Seas of Indian ocean as well as stationery sea water referred to as closed sea. It is virtually consist of West Wharf and nearby coastal areas including Hawksbay and Mauripur sections. Most of this region is consist of large variety of Mangrove vegetation in the coastal corridor.

Ecological risk of high order has been induced by land clearance and removal of natural vegetation from the plains during the urban sprawl to make room for agriculture and urbanization. These zones include extensive flat alluvial plains, covered by relatively similar vegetation, mostly small trees and dwarf shrubs. Tall, clump-forming desert grasses are common. Signs of extensive drought damages done by land clearing activities are apparent and hence the natural vegetation that has survived in these areas has adapted to harsh conditions.

3.2.2 Fauna

Eastern Boundaries: No endangered fauna exist in this section, however, some avian fauna, sparrows of diversity genera, crows, cuckoos, and wild and domesticated pigeons exist. Among creeping fauna, snakes of few types also exist.

Southern Boundaries: The soil is sandy and rocky in appearance grown by wild Kekar trees and bushes having no valuable significance except cattle grazing for domesticated animals such as goats and cows. Snakes of some variety are encountered. There is no characteristic avian fauna except Collard Dove and Wild pigeon is reported. No significant faunal regime exists in this region.

Northern and Western Boundaries: The high and closed seas of Karachi in the northern and western corridors are enriched with large variation of aquatic organisms in the form of large variety of fishes, shrimps, prawns, lobsters, crabs, turtles etc. Sea snakes are also encountered in closed sea sections. Among avian fauna Egret, Seagulls, and White Storks are most common species. Migratory faunal regimes are encountered in winter in closed sea sections or in isolated islands that mainly consisting of Flying Ducks, Pelicans and Flamingos.

The impoverished as well as degraded environment resulting from non-availability of surface as well as groundwater and discharge of untreated wastewater into Lyari and Malir Rivers has irreversibly reduced the biodiversity of the indigenous as well as introduced vegetation and hence it offers very little chance for the survival/growth of fauna in Karachi.

Water availability is the main constraint for the distribution of many animal species. Large wild mammals are virtually absent in the areas within Karachi. There are a number of characteristic bird species that have adapted to the agricultural environment in the outskirts and suburban areas. These include Indian Roller, Common Mynah, Pigeon, and House Sparrow.

4.0 REGULATORY REVIEW

This chapter briefly describes the national, provincial and World Bank laws, policies, strategies, guidelines, codes and procedures for the categorization, screening, environmental assessment and environmental compliance of the proposed project/subprojects. This chapter stipulates that how the various requirements need to be complied during the planning and implementation stages of the subprojects.

4.1 National Laws, Policies and Strategies

This section briefly describes different policies and strategies, and laws of the Government of Pakistan relevant for the proposed projects mentioned in the previous chapters.

4.1.1 Climate Change Policy of Pakistan 2012

Climate Change Policy (CCP) establishes that urban areas in Pakistan are already affected by short-term climate changes. In the long term, it is predicted that urban areas located in the irrigated plains and coastal areas will be significantly affected by climate changes. It is predicted that due to climate changes, changes in hydrological cycle (intensive and erratic monsoon rains, flash floods, increased availability of water due to increased melting of glaciers in the short term;, and decrease in water availability in the long term due to decrease in glacier flows) and increase in temperature will affect urban areas. 50 cyclonic storms developed in the northern Arabia Sea during 1946-2004. Four storms hit the coast of Karachi resulted in heavy downpours, flash-floods, and loss of life and property.

CCP predicts that due to climate change, extreme weather events such as heat and cold waves, heavy or too little precipitation, and strong winds will occur more frequently and will cause health impacts in urban areas, for example, diarrheal diseases because of insufficient clean water availability for drinking and personal hygiene. It is predicted that vector-borne diseases such as malaria and dengue fever may increase. Similarly, extreme weather events will express themselves in the form of natural disasters such as floods, droughts, landslides, and urban flooding. It is assessed that Karachi will be exposed to the above mentioned climate change impacts.

CCP recommends the following actions: develop city-specific strategic plans, prepare and enforce legislation for water resource management in industry and domestic sectors with special focus on groundwater, adopt water efficiency measures and technologies, adopt rain harvesting measures, avoid excessive groundwater pumping, reuse wastewater after treatment, take flood protection measures, assess the health vulnerabilities of communities and build their capacities, develop proper disaster management system, redesign and upgrade drainage capacity of cities, strengthen early warning systems, develop enabling mechanisms for the adoption of climate change adaptations and mitigation measures; and conduct awareness campaigns to underscore the importance of conservation and sustainable use of water resources. At present, most of these adaptations are not in practice in Karachi.

CCP recommends the following measures relevant to KWSSIP:

Cities should update town planning design principles for lowering carbon footprints, ensure proper land use planning and encourage vertical instead of horizontal expansion, install wastewater treatment plants, segregate solid waste at source, develop municipal infrastructure in the periphery of urban areas, and conduct hazard mapping and zoning of areas before construction.

Generally, the implementation of CCP is nominal due to limited interprovincial coordination; low capacity of provincial departments, and city authorities; and low level of budgetary allocation for climate smart city development.

4.1.2 Pakistan Climate Change Act 2016

The Prime Minister established Pakistan Climate Change Council which coordinates and supervises the enforcement of the provisions of the Act, monitor implementation of the international agreements relating to climate change, approve and monitor implementation of comprehensive adaptation and mitigation policies, strategies, plans, programs, projects and other measures formulated by the authority to meet Pakistan's international obligations, monitor the implementation of National Adaptation Plan and its constituent provincial and local adaptation action plans, approves guidelines for the protection and conservation of renewable and non-renewable resources, species, habitats and biodiversity adversely affected or threatened by climate change.

The Minister In-charge of the Federal Government shall establish the Pakistan Climate Change Authority to exercise the powers and perform the functions under the Act. The functions of the authority shall be to formulate comprehensive adaptation and mitigation policies, plans, programs, projects and measures designed to address the effects of climate change, establish institutional and policy mechanism for implementation of Federal and provincial adaptation and mitigation policies, plans, programs, projects and measures, prepare suitable adaptation and mitigation projects for submission to international and local institutions for funding, including Clean Development Mechanism (CDM), Global Environmental Facility (GEF), Green Climate Fund and Adaptation Fund, prepare National Adaptation Plan and its constituents provincial and local adaptation plans, carry out Technology Need Assessment and prepare Climate Change Technology Action Plan in accordance with international best practices, prepare projects for funding under the Reducing Emissions from Deforestation and Forest Degradation (REDD) Mechanism, prepare guidelines for the protection and conservation of renewable and non-renewable resources, species, habitats and biodiversity which are adversely affected or threatened by climate change, advise Government regarding appropriate legislative, policy and implementation measures and actions relating to disaster preparedness, capacity building, institutional strengthening and awareness raising in relevant sectors affected by climate change, advise the Government regarding implementation of international conventions, design, establish and maintain a national registry and database on greenhouse gas emissions etc.

4.1.3 The Canal and Drainage Act 1873

The Canal and Drainage Act 1873 (CDA) focuses on construction and maintenance of drainage channels and defines powers to prohibit obstruction or order their removal. It briefly addresses issues relating to environmental pollution. Section 70(5) of the CDA clearly states that no one is allowed to "corrupt or foul the water of any canal so as to render it less fit for the purposes for which it is ordinarily used." In addition, Section 73 of the CDA gives power to arrest without warrant or to be taken before the magistrate a person who has willfully damaged or obstructed the canal or "rendered it less useful."

4.1.4 Pakistan Penal Code

The Penal Code discusses offences where public or private properties and/or human lives are affected due to intentional or accidental misconduct of an individual or body of people. The Code defines the penalties for violations concerning pollution of air, water bodies and land. In the context of this program, the Penal Code can provide a basis for the infrastructure projects to coordinate activities with the local authorities to ensure that construction and operation activities do not become a cause of public nuisance or inconvenience.

4.1.5 The Antiquities Act, 1975

This Act defines how to repeal and reenact the law relating to the preservation and protection of antiquities. The federal government may, by notification in the official Gazette, declare any antiquity to be a protected antiquity for the purposes of this Act. A contravention of any provision

of this Act or the rules shall, where no punishment has been specification provided, be punishable with rigorous imprisonment for a term which may extend to six months or with a fine which may extend to PKR 5,000, or with both.

4.1.6 National Water Policy 2018

The objective of the National Water Policy is to take cognizance of the emerging water crisis and provide an overall policy framework and guidelines for a comprehensive plan of action. This policy is a national framework within which the provinces can develop their master plans for sustainable development and management of water resources.

Following objectives of National Water Policy, among others, address environmental concerns and are related with KWSSIP:

- Promoting sustainable consumption and production patterns throughout the water sector from exploitation to utilization
- Augmentation of the available water resources of the country through judicious and equitable utilization via reservoirs, conservation and efficient use
- Promoting behavioral change to reduce wastage of water by raising public awareness through media campaigns and incorporating water conservation lessons in syllabi/curricula at primary, secondary and tertiary levels
- Treatment and possible reuse of waste water - domestic, agricultural and industrial
- Promoting appropriate technologies for rain water harvesting in rural as well as urban areas
- Regulating groundwater withdrawals for curbing over-abstraction and promoting aquifer recharge
- Climate change impact assessment and adaptation for sustainable water resources development and management
- Improving availability, reliability and quality of fresh water resources to meet critical municipal, agricultural, energy, security and environmental needs
- Improving urban water management by increasing system efficiency and reducing non-revenue water through adequate investments to address drinking water demand, sewage disposal, handling of wastewater and industrial effluents
- Restoring and maintaining the health of the environment and water related eco systems
- Flood management to mitigate floods and minimize their damages
- Strengthening and Capacity building of water sector institutions

Following policy measures address environmental concerns:

Comprehensive Regulatory Framework

The Federal government must play a leading role in facilitating regulations to ensure the efficient and sustainable utilization of ground water, industrial uses, and waste water management. Food security, water security and energy security being inextricably linked, so the regulatory framework

must address all the associated issues comprehensively, including ground water contamination, waste treatment, and open defecation (WASH).

Planning Principles

- Efficiency and conservation will be promoted at all levels
- Environmental Sustainability must be ensured

Conservation of Water

The Water Conservation Plans shall include: Conservation of Water: re-use and recycling of municipal and industrial waste water effluent after appropriate treatment at source adoption of rainwater harvesting technology

Industry

The Water Policy accordingly classifies Industry as an important user of water, and the provision of its water needs shall be facilitated. A study shall be undertaken for enactment of legislation to formally allow and define the use of water abstraction licenses and water rates for industrial use.

Industry shall be required to carry out in-house treatment of their wastewater before transfer to municipal sewer as per NEQ standards and the "Polluter Pays" principle shall be strictly enforced. Existing rules shall be strengthened for effective monitoring/control of pollution as per international standards. The standards of effluent disposal shall be strictly enforced.

Demand Management

It is recognized that fresh water, being a finite resource, cannot fulfill unlimited demand of numerous users. Demand Management of various uses shall, therefore, be accorded high priority.

Demand Management Plans shall be prepared for all uses, specifying measurable targets, and shall be rigidly enforced.

Water use efficiency in all sectors shall be vigorously pursued, and towards this end all avenues like professional, administrative, legal, technologies transfer and research application coupled with appropriate economic and financial incentives shall be explored.

Under National Water Policy, National Water Council is proposed whose responsibility would be to implement the policy measures through different water related public sector organizations.

4.2 Provincial Policies and Strategies, and Laws

This section briefly describes different laws, policies and strategies of the Sindh province for the environmental compliance of proposed projects mentioned in the previous chapters.

4.2.1 Sindh Strategy for Sustainable Development, 2007

The Sindh Strategy for Sustainable Development (SSSD) proposed a ten-year sustainable development agenda for Sindh. The main focus of SSSD is to promote the sustainable use of natural resources. It targets to reduce poverty and enhance social development through the participation of the people of Sindh.

Planning and Development Department Government of Sindh is responsible for the overall coordination of SSSD. The SSSD recommends that the rehabilitation and extension of water

supply and sanitation networks, effective water and wastewater quality monitoring and treatment to comply with SEQS, improved coordination among stakeholders (public agencies, private sector, and residents) for the effective management of air pollution, consultation based infrastructure planning and development with main focus on minimizing traffic and pollution hazards, and conducting environmental impact assessment of all the major projects. In addition, the SEPA should be strengthened for effective monitoring of pollution, especially in the case of industries.

SSSD recommends for the sustainable development and environmentally complying operations of industries: incentive mechanisms for reducing pollution; awareness raising of industrialists and stakeholders; promote cleaner production; enforce pollution charges as per SEPA 2014; prepare baseline of all industrial estates and sites to establish the pollution levels, waste disposal practices, air emissions, generation of hazardous waste for the preparation of environmental management plans for complying SEPA 2014; preparation of EIAs for all industrial development and infrastructure projects.

4.2.2 Sindh Sanitation Policy 2017

The vision of the policy is to provide the population of Sindh the better sanitation service and to make sure that the entire population of Sindh has access to a safely managed sanitation service and sanitary environment that is also nutrition sensitive and hygienic.

The key targets of the policy are to eradicate open defecation from Sindh province by 2025, while 70% villages of 13 high priority districts achieve the status of open defecation free by 2020, 100% households in Sindh have access to and use sanitary latrines by 2025, while 70% of rural households in high priority districts will achieve this by 2020, to strengthen and implement liquid waste with sewer lanes and covered/improved drains with 85% coverage of urban areas and 60% coverage in rural areas, to create and develop wastewater treatment mechanisms to cover 75% of urban areas and 40% rural areas by 2025, to implement integrated solid waste management with 100% coverage in urban areas and 60% in rural areas by 2025.

The policy is built upon thirteen principles including i) alignment with the goals and targets of the Sindh Development Goals (SDGs) for sanitation, ii) adherence to the pursuit of total sanitation as outlined in Pakistan Approach to Total Sanitation (PATS), within the province, iii) safely managed sanitation services for all persons in Sindh province, iv) prioritize the areas that pose the greatest risk to human health namely hygiene awareness and excreta disposal, v) recognizing that inadequate and unsafe water supply and sanitation as major cause of diarrhea and nutritional deficiency in children, vi) increase access to high quality nutrition sensitive services, including access to water, sanitation facilities and hygiene, vii) integrating key hygiene actions (safe drinking water, hand washing with soap, safe disposal of excreta, and food hygiene) and essential components in all nutrition programs, viii) promoting community led approaches to strengthen the demand for safely managed improved sanitary conditions, ix) identification and marketing of affordable (in terms of designs as well as availability of water) and cost effective technical solutions, x) ensuring the sustainability of the services by mobilizing and engaging existing structures, xi) envision of component sharing model in the National Sanitation Policy, xii) the role of women as an integral component of behavioral change communication strategies and project planning, implementing and monitoring, xiii) establishing and maintaining an independent monitoring and evaluation system to track progress.

4.2.3 Sindh Drinking Water Policy 2017

The vision of the policy is to provide safely managed drinking water whose supply is adequate, well maintained and sustainable and to enhance public awareness about health, nutrition and hygiene related to safe drinking water.

The main principles of the policy are mainly based upon access to safely managed drinking water to every citizen, water allocation for drinking purpose as the priority over other uses, removing the existing disparities in coverage of safe drinking water and addressing the needs of the poor on priority basis, recognizing the cause of diarrhea and nutritional deficiency in children due to inadequate and unsafe water supply and sanitation, increase the access to high quality nutrition sensitive services (including access to water, sanitation facilities and hygiene), integration of key hygiene actions (safe drinking water, hand washing with soap, safe disposal of excreta, food hygiene) as essential components in all nutrition programs, realizing the fact that access and availability of safe drinking water affects all aspects of life of a citizen, ensure women participation in planning, implementation, monitoring and operation and maintenance of water supply systems, delegation of responsibilities and resources to local authorities for the provision of safe water supply, development of supportive policy framework to encourage alternative options through stakeholders, promotion of execution of component sharing model for government programs and projects to ensure financial sustainability and development and use of low cost technologies in water and sanitation.

The overall goal of the policy is to improve the quality of life of people of Sindh by reducing morbidity and mortality caused by water borne diseases through provision of safely managed and potable drinking water to the entire population that is located on premises, available when needed, and free from contamination, affordable and of sufficient quantity, and in a way that is efficient, equitable and sustainable.

The specific objectives address mainly the introduction of legislative measures to create enabling environment, involvement of community in the water supply systems, development of district level drinking water availability plans, enhance the coverage of the safely managed drinking water in the province, development of criteria for installation of new drinking water supply schemes, standardized service delivery models for both urban, and rural drinking water supply schemes to improve efficiency and mechanisms for reuse, recycle and recharge of wastewater for other municipal and productive uses, ensuring the compliance of all the drinking water supply schemes and municipal discharges with the environmental quality standards, installation of water treatment plants at existing drinking water supply schemes, development of water safety plans for all drinking water supply systems, develop and sustain regular drinking water quality monitoring and surveillance and remedial action, increase public awareness about water related diseases, nutrition and hygiene, ensuring drinking water supply projects to be nutrition sensitive, institutionalize Water, Sanitation & Hygiene (WASH) in school and institute adaptation measures and disaster risk reduction and mitigation strategies to minimize the impact of climate events on drinking water supply systems.

4.2.4 Karachi Strategic Development Plan 2020

The vision of Karachi Strategic Development Plan 2020 (KSDP) is to *"transforming Karachi into a world class city and attractive economic center with a decent life for Karachiites"*. The objectives of KSDP-2020 are: (a) design future growth of Karachi based on its strengths and potential; (b) sustainable growth by integrating various development activities under holistic vision; (c) identification of social, economic, environment, and urban infrastructure issues; (d) development of strategic framework for city development; and (e) establish collaborative institutional arrangement with the participation of stakeholders and citizens.

Implementation of the KSDP-2020 is provided a legal coverage under Section 40 of the Sindh Local Government Ordinance 2001 (SLGO). SLGO makes it mandatory for all the development agencies in Karachi to follow the plan for planned and coordinated development of Karachi. KSDP proposes the establishment of new industrial parks or zones. KSDP recognizes that higher level of air pollution persists in the city due to automobile and industrial emissions, open burning of solid waste, and other domestic and commercial emissions. Hazardous industrial waste is burned in substandard incinerators resulting hazardous emissions.

KSDP recommends renewal and maintenance of current buildup areas rather than spatial expansion.

4.2.5 The Karachi Water and Sewerage Board Act, 1996 (KWSB Act)

Under KWSB Act 1996, board was established for supply of water and disposal of sewerage in the Karachi Division.

Powers and Functions of the Board: The Board shall i) sanction the fees and levy for water connections, water supply to tankers and sewerage connections and collect the charges, ii) reduce, suspend or disconnect the water supply and impose surcharges, if dues are not paid within the due time, iii) make regulations with the approval of the Government, iv) undertake construction improvement, maintenance and operation of water works and sewerage works, v) assess the position of water supply from time to time and regulate water supply, vi) review the existing schemes or prepare new schemes relating to water works and sewerage work and undertake execution with the approval of Government, vii) regulate, control or inspect water connection, sewer lines and service lines, viii) produce and supply of potable water, ix) place, maintain aqueducts, conduits, sewers etc.

Supply of Water and Execution of Schemes: The Board shall i) be responsible for the bulk production of potable water and its distribution, ii) ensure that the water supplied by it is duly filtered, treated and tested and is fit for human consumption, iii) arrange retail distribution of water within its jurisdiction excluding the areas receiving water supply through constituent Bodies, iv) supply water to any person or authority in the area or areas notified under this Act (subject to availability), v) continue to make bulk water supply to the constituent Bodies (Karachi Port Trust, Cantonment Board of Karachi, Sindh Industrial & Trading Estate, Karachi Pakistan Steel Mills, Defense Service or any other body or organization notified by Government) at such rates and subject to such terms and conditions as may be determined by the Board, vi) continue to execute the Hub Dam Water Supply Stage I and Phase-IV of the Greater Karachi Bulk Water Supply Stage I and Sewerage Disposal Projects, vii) have right to place and maintain aqueducts, conduits and lines of mains, drains, sewers or pipes, over, under, along or across any immovable property without acquiring such property, and to enter on such property for the purpose of examining, repairing, altering or removing any aqueducts, conduits or lines of mains, sewers or pipes.

4.2.6 Sindh Environmental Protection Act 2014 (SEPA 2014)

SEPA 2014 is the overriding environmental legislation in the province of Sindh. SEPA 2014, Section 35 states that the provisions of this Act shall have effect notwithstanding anything inconsistent therewith contained in any other law in force for the time being.

After the 18th Constitutional Amendment, environmental management has been delegated to the provincial governments. The environmental management of the province is mainly governed under the SEPA 2014, which is a replica of the Pakistan Environmental Protection Act of 1997 with some amendments. The law is comprehensive and provides the basic framework for environmental management of the province. The main focus of the law is on sustainable development, protection, conservation, rehabilitation, and improvement of environment. It instructs the provincial government to establish the Sindh Environmental Protection Council. Under the law, Environmental Impact Assessment/Initial Environmental Examination (EIA/IEE) is essentially required for all the projects before commencing any construction activity. It prohibits specified discharges and emissions. Sindh Environmental Quality Standards are an essential part of the law. The SEPA empowers the provincial government to issue notices and to enforce the Act for the protection of the environment.

SEPA 2014 has established the Sindh Environmental Quality Standards (SEQS). These are discharge standards and are applicable at the point of discharges of emissions. SEQS are relevant for wastewater treatment plants and landfills activities. SEPA 2014 states that noncompliance with SEQS and not paying pollution charges will invoke implementation of punitive sections of the Environmental Protection Order and penalties to every noncomplying person, corporate body, Government agency, local authority, or local councils. Cases challenged by the parties will be settled by the Environmental Magistrates and Tribunals, and if required, the cases can also be appealed in the higher courts. Standards for the following types of effluent and emissions are specified in the SEQS and may be relevant to the specified projects:

1) Municipal and liquid industrial effluent parameters (32) for discharge to inland waters, sewage treatment facilities, and the sea

2) Industrial gaseous emissions (16) into the atmosphere

3) Motor and vehicle exhaust and noise (3 to 5)

4) Ambient air quality (9)

5) Drinking water quality (33)

6) Noise standards for residential, commercial, industrial, and silence zones

SEPA 2014 instructs the proponents of projects to conduct and submit IEE or EIA study according to the size and impacts of the subprojects of the project. In the context of the KWSSIP SOP-1, IEEs will not be required for the rehabilitation of water supply and sanitation subprojects. KWSSIP SOP-1 will not finance any sub-project for which EIA/IEE will be required. Most of the sub-projects will be either small or rehabilitation projects. SEPA 2014 does not demand environmental assessment of rehabilitation projects.

a) Sindh Environmental Protection Agency (Review of IEE and EIA Assessment) Regulations, 2014

This document sets out the key procedural requirements for conducting an IEE and EIA. The document lists the responsibilities of proponents and duties of responsible authorities and provides schedules of proposals for determining whether the project requires IEE, EIA or screening under Schedules I, II, and III respectively and lays down the procedures for Environmental Approval and for filing the case with the SEPA to receive the NOC.

The Regulations also provide the necessary details on the preparation, submission, and review of IEEs and EIAs.

In the case of wastewater discharges in the canal system and use of wastewater for irrigation purposes, Section 11 of SEPA 2014 establishes that “no person shall discharge or emit or allow the discharge or emission of any effluent or waste in excess of SEQS” and “if the water is conforming SEQS, it can be used for irrigation purposes, otherwise not.”

4.2.7 The Sindh Local Government Act 2013

Under the Sindh Local Government Act 2013 (SLGA), Chapter VI, land use planning; implementation of building by-laws; management of environmental and health hazards; food adulteration; provision and maintenance of water supply schemes and public sources of drinking water; and mobilization of communities for the upgrade of local infrastructure (transportation, landscaping, and removal of encroachments) are the responsibilities of municipal corporations/committees.

Under Chapter VI, the district council is responsible for the overall welfare of the population (health and safety); improvement and maintenance of district main transportation routes including removal of encroachments and other local infrastructure (such as open spaces, graveyards, public open spaces); assistance to relevant authorities in the provision of relief services in the case of natural calamities (fire, flood, hailstorm, earthquake, and epidemic); control over land use and spatial planning (including agriculture, industry, commerce, residential, and so on); and enforcement of municipal laws.

Under the second and fourth Schedules, both municipal committees and union councils are responsible for the management of dangerous and offensive articles and their trade.

Under the Sixth Schedule Part-I and Part-II of the Act, it is an offence and the Local Government (LG) can take the offender to court for discharging of chemicals in any drain, public watercourse, and public land that is likely to cause public health hazards; industry and commercial concerns disposing affluent in the water supply and sewerage system; adulteration of eatables and drinkables items; cultivation of agriculture produce or crop by irrigating with sewer water or any such liquid; and dumping of solid waste and refuse in a place other than a landfill or dumping site, establishing a brick kiln, lime kiln, charcoal kiln, or pottery within such distance of the residential area as may be specified by the Council, dyeing or tanning skins within such distance of any commercial or residential areas as may be specified by the local government, and damaging or polluting physical environment, inside or outside private or public premises, in a manner to endanger public health.

4.2.8 The Sindh Wildlife Protection Ordinance, 1972

The ordinance requires the protection of wildlife species declared as protected and game animals. Ordinance declares certain areas as national parks and game reserves where hunting and spoiling of its natural landscape and environment is prohibited.

4.3 World Bank Safeguard Policies

KWSSIP SOP-1 triggers the following World Bank safeguard policies for Component 1 and 2:

- Environmental Assessment OP 4.01
- Physical Cultural Resources OP 4.11
- Safety of Dams OP 4.37
- Projects on International Water Ways OP 7.50

Under Component 3, environmental safeguard documents for SOP-2 will be prepared (and reviewed and disclosed) under the new World Bank Environmental and Social Framework (ESF) in accordance with ESF standards and procedures. Following Environmental and Social Standards (ESS) will be applied to the prepared safeguard documents for SOP-2:

- ESS-1: Assessment and Management of Environmental and Social Risks and Impacts
- ESS-2: Labor and Working Conditions
- ESS-3: Resource Efficiency and Pollution Prevention
- ESS-4: Community Health and Safety
- ESS-8: Cultural Heritage
- ESS-10: Stakeholder Engagement and Information Disclosure

4.3.1 Environmental Assessment OP 4.01

This policy requires environmental assessment (EA) of projects proposed for World Bank financing to help ensure that these are environmentally sound and sustainable, and thus to improve decision making. The EA is a process whose breadth, depth, and type of analysis depend

on the nature, scale, and potential environmental impact of the proposed project. EA evaluates a project's potential environmental risks and impacts in its area of influence; examines project alternatives; identifies ways of improving project selection, siting, planning, design, and implementation by preventing, minimizing, mitigating, or compensating for adverse environmental impacts and enhancing positive impacts; and includes the process of mitigating and managing adverse environmental impacts throughout project implementation. The Bank favors preventive measures over mitigatory or compensatory measures, whenever feasible.

The EA takes into account the natural environment (air, water, and land); human health and safety; social aspects (including physical cultural resources) and trans-boundary and global environmental aspects. EA considers natural and social aspects in an integrated way. It also takes into account the variations in project and country conditions; the findings of country environmental studies; national environmental action plans; the country's overall policy framework, national legislation, and institutional capabilities related to the environment and social aspects; and obligations of the country, pertaining to project activities, under relevant international environmental treaties and agreements. The EA is initiated as early as possible in project processing and is integrated closely with the economic, financial, institutional, social, and technical analyses of a proposed project.

As per the policy, the Bank undertakes environmental screening of each proposed project to determine the appropriate extent and type of the environmental assessment. The Bank classifies the proposed projects into one of four categories of A, B, C and FI depending on the type, location, sensitivity, and scale of the project and the nature and magnitude of its potential environmental impacts. Consistent with the requirements of OP 4.01, the proposed KWSSIP project has been assigned an EA category of B.

4.3.2 Physical Cultural Resources OP 4.11

This policy addresses physical cultural resources, which are defined as movable or immovable objects, sites, structures, groups of structures, and natural features and landscapes that have archaeological, paleontological, historical, architectural, religious, aesthetic, or other cultural significance. Physical cultural resources may be located in urban or rural settings, and may be above or below ground, or under water. Their cultural interest may be at the local, provincial or national level, or within the international community.

Physical cultural resources are important as sources of valuable scientific and historical information, as assets for economic and social development, and as integral parts of a people's cultural identity and practices. The Bank assists countries to avoid or mitigate adverse impacts on physical cultural resources from development projects that it finances. The impacts on physical cultural resources resulting from project activities, including mitigating measures, may not contravene either the borrower's national legislation, or its obligations under relevant international environmental treaties and agreements.

The borrower addresses impacts on physical cultural resources in projects proposed for Bank financing, as an integral part of the environmental assessment process.

4.3.3 Safety of Dams OP 4.37

The Bank's Policy on Dam Safety is triggered as Karachi's only reliable water source is Kotri Barrage at the Indus River. For the life of any dam, the owner (national or local government) is responsible for ensuring that appropriate measures are taken and sufficient resources provided for the safety of the dam, irrespective of its funding sources or construction status. Because there are serious consequences if a dam does not function properly or fails, the Bank is concerned about the safety of new dams it finances and existing dams on which a Bank-financed project is directly dependent.

The Bank may finance the following types of projects that do not include a new dam but will rely on the performance of an existing dam or a dam under construction (DUC): power stations or water supply systems that draw directly from a reservoir controlled by an existing dam or a DUC; diversion dams or hydraulic structures downstream from an existing dam or a DUC, where failure of the upstream dam could cause extensive damage to or failure of the new Bank-funded structure; and irrigation or water supply projects that will depend on the storage and operation of an existing dam or a DUC for their supply of water and could not function if the dam failed. Projects in this category also include operations that require increases in the capacity of an existing dam, or changes in the characteristics of the impounded materials, where failure of the existing dam could cause extensive damage to or failure of the Bank-funded facilities.

4.3.4 Projects on International Water Ways OP 7.50

The Bank's policy on Projects on International Waterways is applicable to the project as the activities will involve the use of water from the Indus River which is shared between Pakistan, India and China. This policy applies to the types of international waterways such as (a) any river, canal, lake, or similar body of water that forms a boundary between, or any river or body of surface water that flows through, two or more states, whether Bank members or not; (b) any tributary or other body of surface water that is a component of any waterway described in (a) above; and (c) any bay, gulf, strait, or channel bounded by two or more states or, if within one state, recognized as a necessary channel of communication between the open sea and other states and any river flowing into such waters.

This policy applies to the types of projects such as (a) hydroelectric, irrigation, flood control, navigation, drainage, water and sewerage, industrial, and similar projects that involve the use or potential pollution of international waterways; and (b) detailed design and engineering studies of projects, to be carried out by the Bank as executing agency or in any other capacity.

Projects on international waterways may affect relations between the Bank and its borrowers and between states (whether members of the Bank or not). The Bank recognizes that the cooperation and goodwill of riparians is essential for the efficient use and protection of the waterway. Therefore, it attaches great importance to riparians' making appropriate agreements or arrangements for these purposes for the entire waterway or any part thereof. The Bank stands ready to assist riparians in achieving this end. In cases where differences remain unresolved between the state proposing the project (beneficiary state) and the other riparians, prior to financing the project the Bank normally urges the beneficiary state to offer to negotiate in good faith with the other riparians to reach appropriate agreements or arrangements.

4.3.5 ESS-1: Assessment and Management of Environmental and Social Risks and Impacts

This standard sets out the Borrower's responsibilities for assessing, managing and monitoring environmental and social risks and impacts associated with each stage of a project supported by the Bank through Investment Project Financing, in order to achieve environmental and social outcomes consistent with the Environmental and Social Standards (ESSs).

4.3.6 ESS-2: Labor and Working Conditions

This standard recognizes the importance of employment creation and income generation in the pursuit of poverty reduction and inclusive economic growth. Borrowers can promote sound worker-management relationships and enhance the development benefits of a project by treating workers in the project fairly and providing safe and healthy working conditions.

4.3.7 ESS-3: Resource Efficiency and Pollution Prevention

The objective of this standard is to i) promote the sustainable use of resources, including energy, water and raw materials, ii) avoid or minimize adverse impacts on human health and the environment by avoiding or minimizing pollution from project activities, iii) avoid or minimize project-related emissions of short and long-lived climate pollutants, iv) avoid or minimize generation of hazardous and non-hazardous waste, and v) minimize and manage the risks and impacts associated with pesticide use.

4.3.8 ESS-4: Community Health and Safety

This standard recognizes that project activities, equipment, and infrastructure can increase community exposure to risks and impacts. In addition, communities that are already subjected to impacts from climate change may also experience an acceleration or intensification of impacts due to project activities.

4.3.9 ESS-8: Cultural Heritage

This standard recognizes that cultural heritage provides continuity in tangible and intangible forms between the past, present and future. People identify with cultural heritage as a reflection and expression of their constantly evolving values, beliefs, knowledge and traditions. Cultural heritage, in its many manifestations, is important as a source of valuable scientific and historical information, as an economic and social asset for development, and as an integral part of people's cultural identity and practice. This standard sets out measures designed to protect cultural heritage throughout the project life cycle.

4.3.10 ESS-10: Stakeholder Engagement and Information Disclosure

This standard recognizes the importance of open and transparent engagement between the Borrower and project stakeholders as an essential element of good international practice. Effective stakeholder engagement can improve the environmental and social sustainability of projects, enhance project acceptance, and make a significant contribution to successful project design and implementation.

5.0 POTENTIAL ENVIRONMENTAL IMPACTS & MITIGATION MEASURES

This chapter describes potential generic environmental risks and impacts (direct, indirect/induced and cumulative) to be caused by the SOP 1: Component 2 construction and operation phases on surrounding environment and communities. It also describes mitigation measures as per mitigation hierarchy (avoidance, minimization or reduction, mitigation, compensate/offset). Sub-projects that would have major widespread and intense environmental impacts will be excluded from the project and will not be eligible for financing. Therefore, the proposed KWSSIP SOP 1 will finance sub-projects and activities in Component 2 that may still have significant impacts but will not be wide spread, and therefore, can either be avoided through re-location of activities or in their design, or otherwise reduced to acceptable levels or reversed through the application of effective mitigation measures. These impacts are expected to arise during the construction activities, and a lesser extent during operations and maintenance phases.

5.1 Project Activities

Table 10 describes type of project and associated activities which could result into potential environmental risks and impacts.

Table 10: Project Activities

#	Project	Activities
1	i) Rehabilitation of sewerage in three low income communities ii) Priority sewer network rehabilitation	i) Laying new pipelines a) Clearing of the area (cutting of tress, bushes, crops etc.) b) Removal of spoil material (sludge) c) Excavation d) Bedding e) Laying of pipelines f) Joining/welding g) Backfilling ii) Repair and maintenance of old pipelines a) Temporary rechanneling and diversion of black water to create dry spaces for rehabilitation work b) Excavation c) Removal of pipelines d) Laying of pipelines e) Joining/welding f) Backfilling g) Road Restoration by the respective agency
2	i) Rehabilitation of water supply in three low income communities ii) Priority water network rehabilitation	i) Laying new pipelines a) Clearing of the area (cutting of tress, bushes, crops etc.) b) Excavation c) Bedding d) Laying of pipelines d) Joining/welding e) Backfilling ii) Repair and maintenance of old pipelines a) Excavation b) Removal of pipelines c) Laying of pipelines d) Joining/welding

		e) Backfilling

5.2 Potential Environmental Impacts

Table 11 presents environmental aspects and potential impacts of the project activities.

Table 11: Environmental Aspects and Potential Impacts

#	Project	Activities	Environmental Aspects	Potential Environmental Impacts
1	i) Rehabilitation of sewerage in three low income communities ii) Priority sewer network rehabilitation	i) Laying new pipelines a) Clearing of the area (cutting of tress, bushes, crops etc.) b) Removal of spoil material (sludge) c) Excavation d) Bedding e) Laying the pipelines f) Joining/welding g) Backfilling ii) Repair and maintenance of old pipelines a) Temporary rechanneling and diversion of black water to create dry spaces for rehabilitation work b) Excavation c) Removal of pipelines d) Laying the pipelines e) Joining/welding f) Backfilling g) Road restoration by the respective agency	**Construction Phase** <u>Vegetation</u> loss of trees, plants, crops etc. due to clearing of land for camp sites, laying pipelines and building infrastructure <u>Natural Habitats</u> Disturbance to natural habitats (terrestrial, freshwater, or marine geographical unit or airway that supports assemblages of living organisms and their interactions with the nonliving environment.) <u>Physical Cultural Resources (PCRs)</u> Presence of PCRs at the project sites <u>Air Quality</u> i) Fugitive emission of dust (SPM, PM_{10}, $PM_{2.5}$) from excavation and vehicular movement ii) Stack emissions from generators iii) Vehicular emission iv) emission from welding activities <u>Wastewater</u> i) Generation of sanitary wastewater from construction camps <u>Solid Waste</u> i) Generation of domestic solid waste from construction camps	**Construction Phase** <u>Vegetation</u> Removal of top soil, air pollution, soil erosion, disturbance to aesthetic of the area <u>Natural Habitats</u> Disturbance to natural habitats and biodiversity <u>Physical Cultural Resources (PCRs)</u> Damage to PCRs at the project sites <u>Air</u> Air pollution resulting in poor visibility, disturbance to vegetation, property damages, soil contamination and health implications on workers and nearby community <u>Wastewater</u> Soil and water contamination, odor, health implications (due to breeding of mosquitos and flies), and nuisance due to improper treatment and disposal of sanitary wastewater from construction camps <u>Solid Waste</u> i) Nuisance, health implications on workers and community (due to breeding of mosquitos and flies) (if not disposed/treated properly)

#	Project	Activities	Environmental Aspects	Potential Environmental Impacts
			ii) Generation of empty chemical, paint, lubrication/grease, and fuel containers iii) dismantled pipelines iv) Generation of excavation material, debris etc. v) Generation of spoil material (sludge) from drains/sewers <u>Soil</u> i) Spillage and leakage of chemicals, fuel, lubricant on soil ii) storage of oily parts and rags on unpaved floors <u>Noise</u> Noise from construction machinery, generators, construction activities and vehicular movement <u>Safety</u> i) Safety concerns of workers ii) Safety concerns for the nearby community/passersby Temporary Rechanneling/Diversion of Black Water **Operation Phase** i) Leakages in the sewers ii) Damaging of sewers iii) Clogging of sewers	ii) Soil contamination due to improper disposal of hazardous solid waste iii) Chances of soil contamination, outbreak of diseases, odor, nuisance due to generation and dumping of spoil material (sludge), <u>Soil</u> Soil contamination <u>Noise</u> Nuisance, health implications on workers and nearby community, loss of biodiversity <u>Safety</u> Safety hazards for workers and community Traffic congestion and access restrictions at or around construction sites due to construction activities <u>Rechanneling of Black Water</u> <u>Chances of soil pollution, water contamination, odor, outbreak of diseases, nuisance at areas where black water is diverted.</u> **Operation Phase** i) Soil and water contamination due to leakages in the sewers ii) Odor and outbreak of diseases due to leakages, and damaging of sewers and malfunctioning of disposal pumps iii) The gases from manholes and interceptors can affect the workers,

#	Project	Activities	Environmental Aspects	Potential Environmental Impacts
			iv) Overflowing sewage due to malfunctioning of disposal pumps v) Release of aerosols and odors (H2S, NH3, amino acid and mercaptan) from manholes and the interceptor line when the dredging and repair are carried out	who dredge manholes without preventive measures
2	i) Rehabilitation of water supply in three low income communities ii) Priority water network rehabilitation	i) Laying new pipelines a) Clearing of the area (cutting of tress, bushes, crops etc.) b) Excavation c) Bedding d) Laying the pipelines d) Joining/welding e) Backfilling ii) Repair and maintenance of old pipelines a) Excavation b) Removal of pipelines c) Laying the pipelines d) Joining/welding e) Backfilling	**Construction Phase** As above **Operation Phase** i) Improper functioning of water treatment facilities (chlorination, filtration etc.) ii) Leakages in water supply pipelines iii) Damages in water supply pipelines iv) Improper functioning of water pumps v) Energy inefficient operation of water supply pumps	**Construction Phase** As above **Operation Phase** i) Water borne diseases (if no proper treatment) ii) Shortage of water supply iii) Dater contamination due to damaging pipelines

5.3 Mitigation Measures

Following section describes details of the mitigation measures for the above identified potential environmental impacts in Table 11 for the construction and operation phases of the project activities.

5.3.1 Construction Phase Mitigation Measures

Following are the construction phase mitigation measures for all the project activities.

- Campsite management
- Avoidance of clearing vegetation and restoration of the site by planting trees/crops
- Protection of natural habitats
- Protection of Physical Cultural Resources (PCRs)
- Suppression of dust emission
- Control of stack and vehicular emissions
- Safe disposal of sanitary wastewater
- Safe disposal of domestic solid waste
- Safe disposal of hazardous and construction waste
- Soil pollution control
- Noise abatement
- Protection of workers from health and safety hazards
- Protection of community from accidents
- Traffic management
- Restoration of campsites
- Management of spoil material (sludge)
- Management of black water diversion

The main responsibilities for implementing mitigation measures during the construction phase rest with the contractors appointed to carry out the projects related to rehabilitation of water supply and sewerage. The KWSB will, however, be responsible for monitoring the implementation of mitigation measures by the contractors; therefore, KWSB will implement a system of internal checks to ensure that these actions are carried out to a satisfactory standard. In exceptional circumstances, if the contractors refuse to adhere to the requirements of the mitigation plan contained in the contract documents, then the KWSB may need to use their authority to call a halt to a particular construction activity.

To avoid any misunderstandings regarding who is responsible for any particular mitigation activities recommended for the construction phase, the Construction Phase Environmental Mitigation Plan (CPEMP) will be appended to the Bidding documents. This will ensure that contractors include in their bids the cost of any mitigation actions and also a reliable mechanism for enforcement. In fact, most of the recommended actions involve little or no capital investment, but they also depend on whether the contractor's management adopts a responsible attitude toward environmental protection, thereby ensuring that the construction activity is properly planned and that mitigation measures are properly implemented. The recommended mitigation actions for the construction phase are given under:

a) Campsite Management:

The location and development of the Contractor's facilities (this applies to all types of facilities, storage areas, workshops, and labor camps) will be approved by KWSB. Locations will be selected so that it does not interfere with the environment and social well-being of the surrounding communities in respect to noise, dust, vibration and other physical impacts. The

construction labor camps shall be located at least 500 m away from the nearest habitation The size of contractor‘s facilities are limited to absolute minimum to reduce unnecessary clearing of vegetation.

b) Avoidance of Clearing Vegetation and Restoration of the Site by Planting Trees/Crops

Where grading or excavation occurs within farmland, topsoil will be separated and stockpiled during the construction period. The topsoil stockpile will be secured with plastic. Following construction, the topsoil will be applied evenly to the site during the restoration process. The topsoil will be properly compacted and stabilized to prevent erosion and sediment transport.

During the design stage of the project and finalizing the project location and alignment for the pipe laying, it would be the priority to avoid those areas where there are chances of cutting of significant trees and clearing of vegetation/crops. In case if it is not possible to avoid, then the project site would be restored to its original as much as possible by planting trees, vegetation and crops at the cleared land. All works will be carried out in a fashion that ensures minimum damage or disruption to the flora. The contractor will be responsible for the restoration of the site and KWSB will ensure restoration as per the requirements.

c) Protection of Natural habitats:

During site selection and finalization of pipelines and sewers alignment, the protection of the natural habitats will be the high priority area. The natural habitats are defined as a terrestrial, freshwater, or marine geographical unit or airway that supports assemblages of living organisms and their interactions with the nonliving environment. Alternatives will be considered for site selection and pipelines and sewer alignments, in case of presence of natural habitats at the project areas to protect them at best.

During environmental assessment, surveys will be conducted for rare plants and priority or endemic wildlife species prior to civil work activities at all the sites. If any rare plants or sensitive wildlife species occur at the construction sites, the sensitive resource will be fenced, and no activities will be allowed within 15 meters (50 feet) of the resource.

Prior to construction activities during the nesting season, a qualified biologist will survey potentially suitable nesting habitat for priority species birds. If active nests are identified, a qualified biologist will monitor the nesting birds’ responses to the loudest level of construction noise for an appropriate duration. If the nesting birds show signs of disturbance that could result in nest failure, all work activities that disturb the birds will be temporarily halted and visual and acoustic barriers will be erected between the nesting location and work areas. Installation of any visual and acoustic barriers will be overseen and approved by the qualified biologist.

d) Protection of Physical Cultural Resources (PCRs):

All necessary and adequate care will be taken to minimize impact on cultural properties which include cultural sites and remains, places of worship including mosques, churches, etc., graveyards, monuments and any other important structures as identified during design and all properties / sites / remains notified. No work will spill over to these properties, premises and precincts. The design options for cultural property relocation and enhancement will be prepared. All conservation and protection measures will be taken up as per design.

During earth excavation, if any property is unearthed and seems to be culturally significant or likely to have archaeological significance, the same will be intimated to the KWSB. Work will

be suspended until further orders from the KWSB. The Archaeological Department will be intimated of the chance find and the KWSB will carry out a join inspection with the department. Actions as appropriate will be intimated to the Contractor along with the probable date for resuming the work. The contractor workers will be sensitized and fully informed about the importance of PCRs before the commencement of the work as their negligence during excavation and construction activities could damage these resources. All fossils, coins, articles of value of antiquity and structures and other remains or things of geological or archaeological interest discovered on the site shall be the property of the Government, and will be dealt with as per provisions of the relevant legislation.

e) Suppression of Dust Emission:

Regular water sprinkling will be the responsibility of the contractor at the dust generation points, during construction activities. The water will be also sprinkled at vehicular and machinery movement routes to avoid dust spreading to the nearby community. In addition, the provision of dust masks and ensuring their use by the workers will also be the responsibility of the contractor under CPEMP.

f) Control of Stack and Vehicular Emissions:

The stack emissions from generators, if used as standby source of power supply and vehicular/machinery movement at the site can affect the ambient air quality at project site. It will be the responsibility of the contractor to use well maintained generators and vehicles/machines to keep ambient air quality within the desired level. The contractor will be obliged to provide fitness certificate/maintenance records of the generators, vehicles and machines before deploying them at the construction sites.

g) Safe Disposal of Sanitary Wastewater:

Generally proper disposal of sanitary wastewater is not practiced during construction at construction camps. It will be the responsibility of the contractor to dispose sanitary wastewater in a nearby drain after passing it through septic tanks. The contractor can also plan to include temporary septic tanks for the construction team.

h) Safe Disposal of Domestic Solid Waste:

Improper disposal of domestic solid waste from construction camps leads to air, water and soil pollution in case if it is burnt, thrown in the surface water drains or on open land. The solid waste dumping site becomes breeding place for mosquitos and flies which could be the source of outbreak of diseases. The construction contractors will implement a Waste Management Plan (mentioned in CPEMP). At a minimum, the plan will address the sources of waste; waste minimization, reuse, and recycling opportunities; and waste collection, storage, and disposal procedures. The Waste Management Plan would distinguish between solid and liquid waste, as applicable, and include procedures for addressing waste that may be hazardous to health and the environment. In addition, the Waste Management Plan will address the following:

- All food waste will be contained in covered bins and disposed of on a frequent basis to avoid attracting wildlife.
- Trash bins will be accessible at all locations where waste is generated.
- The project area will be kept clean and free of litter and no litter will be allowed to disperse to the surrounding area.
- Solid waste will be removed from the site and transported to a municipal landfill or disposal site.
- Waste will not be dumped or buried in unauthorized areas or burned.

- Human waste associated with the worker camp and latrines will be properly contained and disposed of.

The construction contractors will ensure all workers receive training on proper disposal of all waste prior to working on the project site.

i) Safe Disposal of Hazardous and Construction Waste

During construction activities different types of hazardous solid waste including empty containers of paint, lubricants, grease, fuel etc. oil filters, oily rags and construction waste are generated. The hazardous waste will be properly collected and stored at impervious surface under shade. This waste will be handed over to the authorized waste collectors so that these could be disposed of properly. The construction contractors will implement the Hazardous Solid Waste Management Plan (mentioned in CPEMP). The Hazardous Solid Waste Management will identify proper management procedures for all hazardous materials and wastes that may be encountered during construction, including handling, labeling, transporting, and storing procedures. In addition, the plan will address the following:

- Non-toxic and biodegradable produces will be used whenever possible.
- Hazardous materials will be transported and stored in appropriate containers with clearly visible labels. Hazardous materials will be stored at least 100 feet from any down gradient drainage or within secondary containment capable of containing its entire volume.
- Storm water flows will be directed away from hazardous material storage areas.
- Equipment and work areas will be regularly inspected for signs of leaks and spills. Spill containment and cleanup kits will be available wherever hazardous materials are being used or stored. Any incidental spills or leaks will be contained and cleaned up as soon as it is safe to do so. Any contaminated soil will be collected and disposed of in an appropriate land fill.
- Equipment refueling and maintenance will be limited to designated areas at least 30 meters (100 feet) from any down gradient drainage.

All workers will receive training on proper handling and storage of hazardous materials, as well as spill response and cleanup procedures, prior to working on the project site.

The debris produced during construction would preferably be dumped at nearby depressions rather than being thrown away and left unattended. Leftover material would not be dumped into storm water drains or watercourses, because such practices can clog these man-made and natural drainage systems and cause many other problems for the residents.

j) Soil Pollution Control

Soil pollution will be controlled by taking following measures:

- Storage of fuel, paint, and oil containers, oil filters, oily parts and oily rags on impervious floor under shade or storing of fuel and lubricants on a sand flooring of at least 6 inch thick, done on brick edge flooring lined with polyethylene sheet
- Placement of fuel containers under containment and proper decantation arrangement to avoid its spillage and leakage on floor
- Presence of spill kit to remove spills from the floor
- Avoidance of washing the contaminated floors rather dry cleaning the spills from the floor with saw dust and rags
- Location of fuel storage and refilling areas at least 500 m from all cross drainage structures and important water bodies

k) Noise Abatement

To minimize noise impacts on workers and nearby communities, the following measures will be taken:

- Carrying out regular inspection and maintenance of the construction vehicles and equipment
- Replacement of worn and noise producing parts of construction machinery in a timely manner
- In case of severe noise, using sound barriers to avoid the dispersion of sound waves into the nearby community
- Workers will use noise protection equipment when working in a noisy area.
- The noise level of 85 dBA for 8 hour working for the workers is considered safe. The contractors would ensure keeping noise levels within safe limits. In case of higher noise levels (more than 85 dBA), the workers will be rotated. The workers at higher noise level areas will not be allowed to work for more than two to three hours and shifted to calm places for rest of the hours
- Vehicular and machineries will not be allowed to operate at project site at night
- Noisy machines and vehicles will not be allowed to be used at the project site (noise level should not be more than 85 dBA at 7.5 m distance)

l) Protection of Workers from Health and Safety Hazards

The contractor will comply with all the precautions as required for the safety of the workforce as per the national/provincial and World Bank requirements. Contractor will ensure that all operators of heavy or dangerous machinery are properly trained/certified, and also insured. The contractor will supply all necessary safety appliances such as safety goggles, helmets, masks, safety shoes etc., to the workers and staff. The contractor will comply with all regulation regarding safe scaffolding, ladders, working platforms, gangway, stairwells, excavations, trenches and safe means of entry and egress. Workers, who are engaged in welding works, would be provided with welder's protective eye-shields. Medical facilities will be provided to the labor at the construction camp. Suitable transport will be provided to take injured or ill person(s) to the nearest approachable hospital. First Aid Box will be provided at every construction campsite and under the charge of a responsible person who will always be readily available during working hours. The contractor will be responsible for providing safe drinking water and for implementing appropriate sanitation conditions, and for supplying hygienic food and a sewerage system for the construction team at the site.

The risk of fires will be evaluated for each project site based on the activities that would occur, environmental conditions, and presence of ignitable or combustible materials in the area. If the activities pose a risk of igniting a wildfire, appropriate fire prevention and response equipment will be available at each active site such as shovels, axes, fire extinguishers, and dedicated water tanks. All workers will be trained on proper fire prevention and response procedures prior to working on the site. Any smoking on site will be restricted to barren areas away from ignitable or combustible material. Smoking waste will be fully extinguished and disposed of appropriately.

m) Protection of Community from Accidents

The construction activities, particularly the excavation, will not be carried out during rainy season to avoid any accident. The excavated areas will be properly cordoned off, and warning

and safety signs will be posted at accident prone areas to warn the passersby the potential danger at the construction site. The traffic will be diverted well before the construction area as per the traffic management plan. The construction contractors will install temporary signs and fences around all unsafe areas to prevent members of the public from entering the areas. If installing fences is not feasible, the area will be clearly identified as unsafe with signs and flagging.

n) Traffic Management

At all times, the Contractor will provide safe and convenient passage for vehicles, pedestrians and livestock. The contractor will comply the Traffic Management Plans (TMP) as provided in CPEMP. The traffic control plans will contain details of temporary diversions at different locations. Temporary diversion for road traffic will be constructed with the approval of the KWSB.

Special consideration will be given in the preparation of the traffic control plan to the safety of pedestrians and workers at night. The temporary traffic detours in settlement areas will be kept free of dust by frequent application of water. The contractor will take all necessary measures for the safety of traffic during construction work and provide, erect and maintain such barricades, including signs, markings, flags, lights and flagmen as may be required for the information and protection of traffic approaching or passing through the construction site. All signs, barricades, pavement markings will be as per road specification.

Informational signs will be posted where lane and road closures could substantially disrupt traffic circulation at least 7 days prior to the closure. Proper traffic controls will be in place during closures to minimize impacts on traffic circulation and for traffic safety. Appropriate safety precautions will be taken when transporting large equipment on public roadways.

o) Restoration of Campsites

After the completion of construction activities at each site, all construction camp facilities will be dismantled and removed from the site. The site will be restored to a condition in no way inferior to the condition prior to commencement of the works. Various activities to be carried out for site rehabilitation include:

- Oil and fuel contaminated soil will be removed and transported and buried in waste disposal areas.
- Soak pits, septic tanks will be covered and effectively sealed off.
- Debris (rejected material) will be disposed of suitably.
- Underground water tank in a barren/non-agricultural land will be covered. However, in an agricultural land, the tank will be removed.
- If the construction camp site is on an agricultural land, the top soil will be preserved and good earth will be spread back for a minimum 30 cm for faster rejuvenation of the land.
- In cases, where the construction camps site is located on a private land holding, the contractor will still have to restore the campsite as per this specification. The rehabilitation will be mandatory and will be include in the agreement with the landowner by the contractor. Also, the contractor would have to obtain a certificate for satisfaction from the landowner.

p) Management of Spoil Material

At some of the sewerage system rehabilitation projects, it might require to remove spoil material (sludge) from channels/sewers. This sludge will contain harmful components such as pathogenic organisms, organic compounds, heavy metals, and excess phosphorus and

nitrogen. If the removed sludge is kept unattended then it can pose environmental impacts at the site due to odor, nuisance, outbreak of diseases, and soil contamination. The contractor will take measures to collect the sludge and dispose at appropriate dumping site immediately. During collection of sludge, care will be taken to clean the place thoroughly.

q) Management of Black Water Diversion

At some of the sewerage system rehabilitation projects, it might require to re-channelize or divert the flow of black water temporarily to get dry place for laying sewers etc. The contractor will take all the precautionary measures while diverting the dirty water to avoid soil contamination, odor, nuisance, outbreak of diseases for the nearby community. The care will be taken that these channels should not pass close to the water supply infrastructure. The temporary channels will be paved and covered to avoid seepage to underground water resources, soil contamination and spreading of pathogens to the surrounding.

5.3.2 Operational Phase Mitigation Measures

Following are the operational phase mitigation measures for all the project activities.

- Maintenance of sewerage system and disposal pumps
- Maintenance of water supply pipelines and pumping facilities
- Noise abatement at project sites
- Soil pollution control
- Protection of workers from health and safety hazards
- Protection of community health
- Implementation of energy efficiency measures at water and wastewater pumps
- Landscaping to improve aesthetic of the sites

a) Maintenance of Sewerage System and Disposal Pumps

Lack of maintenance of sewerage system causes many environmental impacts such as contamination of soil and water resources, outbreak of diseases, odor and nuisance areas where sewage spills over and remains stagnant for longer periods. The malfunctioning of disposal pumps also results in the same situation. Clogged drains will also create flood situation in the city during rainy season.

KWSB staff will look after the proper functioning of the sewerage system and disposal pumps throughout the project lifecycle. For such system, KWSB will equip with proper trained workforce and requisite machinery with the support of vigilant governance system. KWSB will arrange standby disposal pumps and generator system to cope with all sort of emergency situation. Regular maintenance and upkeep of these pumps and generator system will be under strict operation and maintenance regime.

b) Maintenance of Water Supply Pipelines and Pumping Facilities

Lack of proper maintenance of water supply pipelines may result into contamination of water supply due to the intrusion of sewage in it. The contaminated water resources will cause water borne diseases. The malfunctioning of tube wells and water pumps will also be the cause of shortage of water supply. KWSB staff will look after the proper functioning of the water supply pipelines and pumping facilities throughout the project lifecycle. For creating this capacity, KWSB will equip itself with proper trained workforce and requisite machinery and will establish a vigilant governance system. In addition, an inventory of standby pumps and generator system to cope with all sort of emergency situation will be developed. Water supply pipelines,

pumps, and generators will be regularly maintained under strict operation and maintenance regime.

c) Noise Abatement at Project Sites:

Noise will be generated at following project locations during operational phase:

- Tube wells and water pumps
- Generators (water treatment, disposal station and water supply facilities)

Most of the above-mentioned facilities will remain enclosed and their noise impact will be restricted to the facilities only and will not disturb the nearby community. However, during designing of these facilities, noise aspect will be considered and all the noise producing equipment (pumps, turbines, generators etc.) will be built under enclosure to attenuate the noise impact to surrounding.

To minimize noise impacts on workers, working at noise prone areas, the following measures will be taken:

- Carrying out regular inspection and maintenance of the equipment
- Replacement of worn and noise producing parts of the equipment in a timely manner
- In case of severe noise, using sound barriers to avoid the dispersion of sound waves into the nearby community
- Workers will use noise protection equipment when working in a noisy area.
- The noise level of 85 dBA for 8 hours working for the workers is considered safe. The management will ensure keeping noise levels within safe limits. In case of higher noise levels (more than 85 dBA), the workers will be rotated. The workers at higher noise level areas will not be allowed to work for more than two to three hours and will be shifted to calm places for the remaining hours.

d) Soil Pollution Control

The improper handling and storage of chemicals, fuel, lubricant, oily solid waste etc. at water and disposal stations will lead to soil pollution. Soil pollution will be controlled by taking following measures:

- Storage of fuel, paint, and oil containers, oil filters, oily parts and oily rags on impervious floor under shade or storing of fuel and lubricants on a sand flooring of at least 6-inch-thick, done on brick edge flooring lined with polyethylene sheet
- Placement of fuel containers and liquid chemicals under containment and proper decantation arrangement to avoid its spillage and leakage on floor
- Presence of spill kit to remove spills from the floor
- Avoidance of washing the contaminated floors rather dry cleaning the spills from the floor with saw dust and rags
- Location of fuel storage and refilling areas at least 500 m from all cross-drainage structures and important water bodies

e) Protection of Workers from Health and Safety Hazards

The management of the projects (water and wastewater pumping stations) will comply with all the precautions as required for the safety of the workforce as per the national and World Bank requirements.

The Plant Manager/Engineer will ensure that all operators of heavy or dangerous machinery are properly trained/certified, and also insured. The Plant Manager/Engineer will supply all necessary safety appliances such as safety goggles, helmets, masks, safety shoes etc., to the workers and staff. Workers, who are engaged in welding works, will be provided with welder's protective eye-shields. Maintenance activities will be carried out by taking strict safety measures. The hazardous material and chemicals will be handled as per the instruction of the specific Safety Data Sheet (SDS).

Medical facilities will be provided to all the workers at the working locations. Suitable transport will be provided to take injured or ill person(s) to the nearest approachable hospital. The first aid box will be provided at every facility and under the charge of a responsible person who shall always be readily available during working hours. The workers handling chlorine will use appropriate PPE.

f) Protection of Community Health

Community health can be affected due to noise and odor from the water and wastewater pumping stations and improper disposal of sludge. Noise control measures have already been mentioned above. The trees will be planted at the periphery of the disposal pumping stations and drains so that odor and noise could be attenuated due to the tree cover. The waste sludge from the sewerage system will be properly collected, stored and disposed at designated places. The transportation vehicles will be covered from the top to avoid any nuisance while passing through the residential areas.

There is also the potential for fly, mosquito or insect breeding at the sewerage system sludge dumping site. There will be regular anti-mosquito and insecticide spray at temporary sludge dumping sites to address the mosquito and insect problem.

g) Implementation of Energy Efficiency Measures at Plants and Pumps

Energy inefficient operation of water pumps and disposal pumps will be another environmental concern which could have environmental impacts in terms of resource depletion and consequent air emission issues. The energy audits will be compulsory during operational phases and implementation of the energy efficiency measures will be the responsibility of the project management.

h) Landscaping to Improve Aesthetic of the Sites

The aesthetic of the sites such as disposal stations and drains will be improved by landscaping. The green spaces will be developed at these sites to create their positive image among nearby community.

6.0 STAKEHOLDER CONSULTATION

This chapter describes the objective, process, and outcome of the stakeholder consultations carried out before or during the preparation of Environmental Management Framework (EMF).

6.1 Requirement of Stakeholder Consultation

It is one of the essential requirement of International Bank for Reconstruction and Development (IBRD) or International Development Association (IDA) financing, during the environmental assessment process, KWSB should consult project affected groups and local nongovernmental organizations (NGOs) about the project's environmental aspects and take their views into account. KWSB recognizes the importance of early and continuing engagement and meaningful consultation with stakeholders. KWSB will engage the stakeholders, including communities, groups, or individuals affected by proposed projects, and with other interested parties, through information disclosure, consultation, and informed participation in a manner proportionate to the risks to and impacts on affected communities. The Bank will also participate in consultation activities to understand the concerns of affected people, and how such concerns will be addressed by the KWSB in project design and mitigation measures. The Bank will monitor, as part of its due diligence, the implementation of consultation and stakeholder engagement by the KWSB.

Citizen engagement will take place through the implementation of the Stakeholder Participation and Community Engagement Framework and the introduction of an effective GRM. A Stakeholder Participation and Community Engagement Framework has been prepared as part of the SMF. The stakeholder engagement guidelines ensure meaningful consultation and participation, at various stages of the project with all stakeholders who are directly or indirectly involved in the project including project-affected people, marginalized/vulnerable beneficiary groups, civil society organizations, and government representatives. The community engagement framework is guided by six principles: communication, inclusivity, transparency and accountability, continuous improvement, resources, and engaging partners. The approach includes the development of guidelines/policies on community participation, institutionalization of community participation, undertaking Citizens Satisfaction Surveys, and training of personnel involved in public/community engagement. In line with the CoC reform roadmap, KWSB will aim to improve its responsiveness to customers. This will involve not only the construction of new customer service centers, but the review of present Grievance Redress systems and procedures and introduction of improvements, possibly including a new GRM software to better receive, track and respond to all complaints.

6.2 Process of Stakeholder Consultation

KWSB will undertake a process of meaningful consultation in a manner that provides stakeholders with opportunities to express their views on project risks, impacts, and mitigation measures, and allows the KWSB to consider and respond to them. Meaningful consultation will be carried out on an ongoing basis as the nature of issues, impacts and opportunities evolves. Meaningful consultation is a two-way process, that:

a) Begins early in the project planning process to gather initial views on the project proposal and inform project design;

b) Encourages stakeholder feedback, particularly as a way of informing project design and engagement by stakeholders in the identification and mitigation of environmental and social risks and impacts; Continues on an ongoing basis, as risks and impacts arise;

c) Is based on the prior disclosure and dissemination of relevant, transparent, objective, meaningful and easily accessible information in a timeframe that enables meaningful consultations with stakeholders in a culturally appropriate format, in relevant local language(s) and is understandable to stakeholders;

d) Considers and responds to feedback;

e) Supports active and inclusive engagement with project-affected parties;

f) Is free of external manipulation, interference, coercion, discrimination, and intimidation; and

g) Is documented and disclosed by KWSB

6.3 Identification of Stakeholders

Stakeholder" refers to individuals or groups who:

- are affected or likely to be affected by the project (*project-affected parties*); and

- may have an interest in the project (*other interested parties*)

For KWSSIP, the relevant stakeholders include affected communities (which are directly or indirectly affected by the project activities, KWSB staff, the representatives of Karachi Metropolitan Corporation, six District Municipal Corporations, NGOs, Community Based Organizations (CBOs), civil society, Local Government Departments, Sindh Environmental Protection Agency (SEPA) staff.

6.4 Environmental Management Framework (EMF) Consultation and Disclosure

The consultation is required with the stakeholders regarding the potential environmental risks and impacts of the proposed project/subprojects as part of the EMF document before or during its preparation. At this point in time, the details about the project/subprojects and their exact locations are not known, therefore, it is not possible to engage communities and carry out the consultation for those projects which are unknown. However, KWSB conducted a consultation workshop with the community and institutional stakeholders on March 22, 2019 to share the draft EMF and finalize the EMF in the lights of the recommendations made by the participants. Major participants of the workshop were the representatives of Karachi Metropolitan Corporation, six District Municipal Corporations, NGOs, Consultants, Asian Infrastructure Investment Bank (AIIB), Community Based Organizations (CBOs) etc. Proceedings of the consultation workshop are attached as Annexure-1. KWSB is committed that after the project locations will be identified and details will be available for each component of the project, Focused Group Discussions (FGDs) will be carried out with the directly affected stakeholders.

These FGDs will provide complete details of the project activities to the concerned stakeholder and get their relevant feedback, concerns and suggestions to be considered in the planning for

offsetting environmental risks and impacts in the EMF. The EMF will be finalized in the light of these stakeholder consultations.

6.5 Proceedings of the Stakeholder Consultations

Preliminary stakeholder consultations were carried out during field visits prior to the preparation of EMF with Districts managements and a few community representatives. The summary of the consultations is as under:

Districts management informed that they were involved mostly in rehabilitation of infrastructure activities, IEEs/EIAs for such activities were not required by SEPA. Accordingly, no environmental assessment exercises were conducted in the past. Consequently, environmental assessment and monitoring capacities are non-existent at the districts management level.

Community representatives reported that communities were facing poor environmental conditions with very low level of water supply and sanitation services. Communities living along the main drains and rivers are facing serious environmental issues and generally public health is at low level. Most of the representatives of the communities reported that water supply was intermittent, erratic, and contaminated. During rainy reasons, most of the area was flooded by rain and sewerage water that led to serious health issues and inconvenience to the communities.

7.0 ENVIRONMENTAL MANAGEMENT FRAMEWORK

This chapter describes institutional arrangements for environmental management, screening methodology for the projects, generic mitigation plan, monitoring framework, and capacity building of stakeholders involved in environmental assessment, monitoring and management.

7.1 Institutional Arrangement

The institutional arrangement for the environmental and social assessment of KWSSIP project is presented in Figure 8.

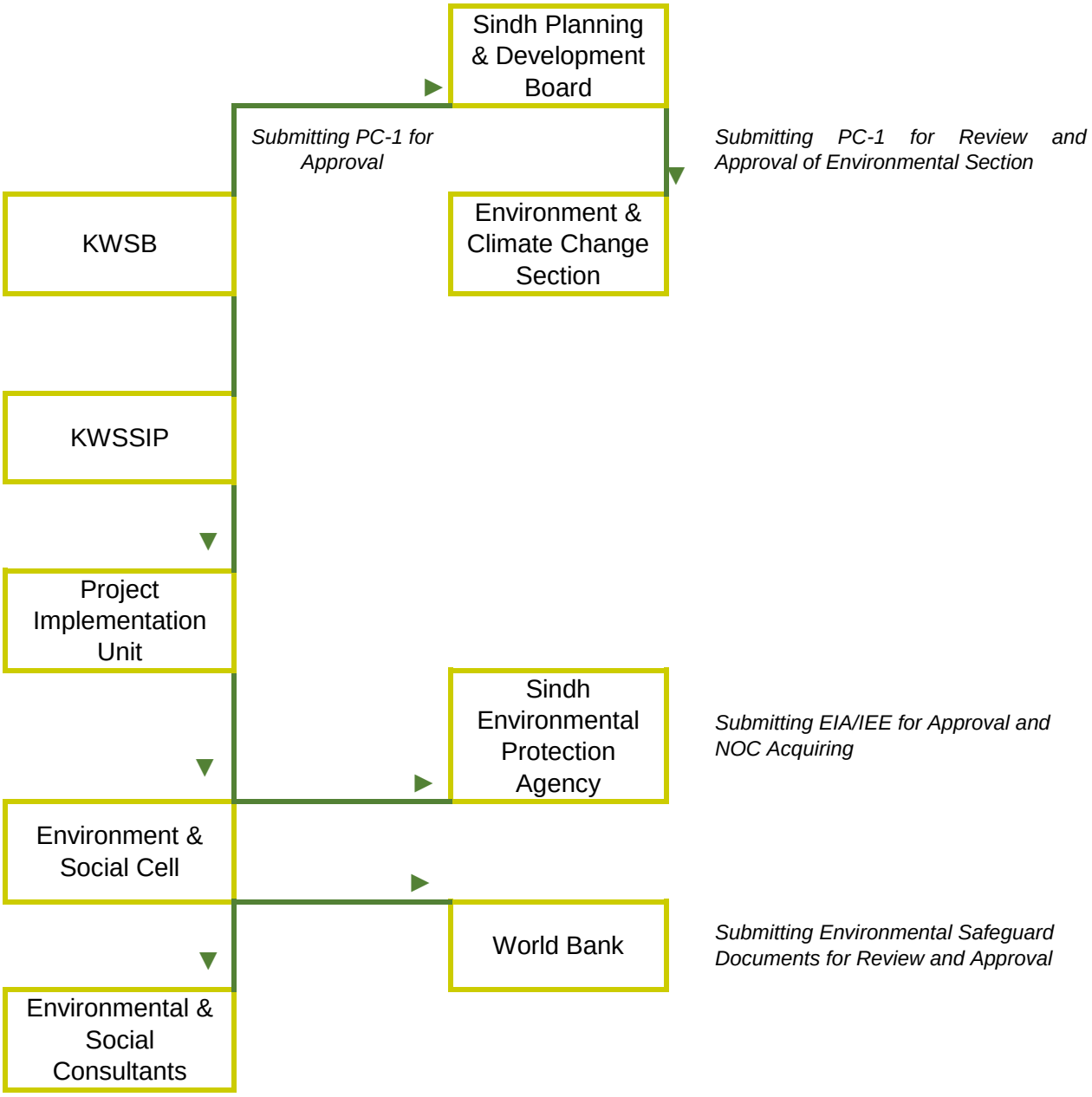
KWSB will be responsible for the compliance of environmental safeguard requirements of the KWSSIP components. The PC-1 of the project components, including environmental compliance requirements, will be prepared by KWSB and submitted to Sindh Planning and Development Board (SPDB) for approval and subsequent stages of the project. The Environmental and Climate Section of SPDB will review and approve the environmental requirements of the PC-1.

The project activities at KWSB will be monitored and managed by the Project Implementation Unit (PIU), to be established specifically for KWSSIP. The PIU will consist of two departments. One will be dedicated to implement the reform program (component 1 and the studies under component 3), and other will be in charge of developing and implementing the capital investments (component 2). The Environmental and Social Cell (ESC) staffed by qualified environmental and social specialist will be established under PIU. ESC will be custodian of EMF. ESC will support KWSB to ensure the EMF, SEPA 2014, and World Bank operational policies compliance of the eligible sub-projects, when these are identified. The ESC will have the liberty to outsource environmental and social compliance requirements to different consultants and specialists. The consultants will facilitate ESC in preparing environmental assessment, monitoring and compliance documents.

7.2 World Bank Environmental Review Project Cycle

Environmental review begins with screening at the time of project identification. The screening mechanism is attached in Annexure 2 of this EMF and will be applied to all investments propsoed for financing. Scoping and preparation of the Environmental Assessment (EA) occur in tandem with or as integral parts of the prefeasibility and feasibility studies. The final EA is sent to the Bank by KWSB prior to appraisal. If the EA is satisfactory and acceptable to KWSB and the Bank, it forms the basis for the decision of Regional Environmental Division (RED) on environmental clearance and the environmental condition to be negotiated with KWSB, some or all of which are incorporated into the loan agreement. The EA may be adequate for the purposes of appraisal, but the Bank review may reveal needs for additional analyses before clearance can be given and negotiations undertaken. Supervision includes monitoring the project's environmental performance and compliance with relevant conditions agreed on between the Bank and KWSB. After implementation is complete, the Project Completion Report (PCR) includes evaluation of both the impacts that actually occurred and the effectiveness of mitigation measures. The Operations Evaluation Department (OED) again audits selected projects possibly some years after the PCR.

Figure8: Institutional Arrangement for Environmental Assessment of KWSSIP



7.3 Environmental Screening

Under World Bank's Operational Policy 4.01 (Environmental Assessment), the bank requires Environmental Assessment (EA) of projects proposed for Bank financing to help ensure that these are environmentally sound and sustainable, and thus to improve decision making. First step of the environmental assessment is the screening.

Two levels of environmental screening will be conducted. Firstly, the KWSB as subprojects owners, with advice and assistance of ESC will conduct the screening of proposed sub-projects in line with the World Bank Safeguard policies, SEPA 2014 requirements and the screening mechanism in Annexure 2 of this EMF. All sub project investments identified for financing will require a prior review and No- Objection from the Bank before they can proceed for financing. All

An essential part of screening is to identify which aspects of a project are not environmentally significant and which therefore can prudently be dropped from further consideration. Its purpose is to ensure that the appropriate amount of attention is devoted to the environmental aspects of the proposed project from the very outset of the project cycle, to identify as much as possible the key environmental issues, and to determine the type of environmental analysis which is needed so that those issues, and others which may arise, can be addressed effectively in project planning, design, and appraisal.

Screening is carried out at the time of identification and aligned with the local planning process and cycle of the KWSB. The environmental screening of each proposed project will be carried out to determine the appropriate extent and type of EA required. The Bank classifies the proposed project into following one of four categories, depending on the type, location, sensitivity, and scale of the project and the nature and magnitude of its potential environmental impacts, and so designated in the Initial Executive Project Summary (IEPS).

Category A: A proposed project is classified as Category A if it is likely to have significant adverse environmental impacts that are sensitive, diverse, or unprecedented. These impacts may affect an area broader than the sites or facilities subject to physical works. EA for a Category A project examines the project's potential negative and positive environmental impacts, compares them with those of feasible alternatives (including the "without project" situation), and recommends any measures needed to prevent, minimize, mitigate, or compensate for adverse impacts and improve environmental performance. For a Category A project, the borrower is responsible for preparing a report, normally an EIA (or a suitably comprehensive regional or sectoral EA). Category A project investments will be Not be eligible for financing.

Category B: A proposed project is classified as Category B, if its potential adverse environmental impacts, on human populations or environmentally important areas, including wetlands, forests, grasslands, and other natural habitats, are less adverse than those of Category A projects. These impacts are site-specific; few if any of them are irreversible; and in most cases mitigatory measures can be designed more readily than for Category A projects. The scope of EA for a Category B project may vary from project to project, but it is narrower than that of Category A EA. Like Category A EA, it examines the project's potential negative and positive environmental impacts and recommends any measures needed to prevent, minimize, mitigate, or compensate for adverse impacts and improve environmental performance. The findings and results of Category B EA are described in the project documentation (Project Appraisal Document and Project Information Document).

Category C: A proposed project is classified as Category C if it is likely to have minimal or no adverse environmental impacts. Beyond screening, no further EA action is required for a Category C project.

Category FI: A proposed project is classified as Category FI if it involves investment of Bank funds through a financial intermediary, in subprojects that may result in adverse environmental impacts.

7.4 Environmental Assessment (EA)

After the screening process and classification of the category of the project, the type and extent of the EA required is decided and executed. It is expected that all eligible sub-projects will either (i) an ESIA and its corresponding Environmental and Social Management Plan (ESMP) or (ii) only require an ESMP. The ESC will support the KWSB to prepare either the ESIA and or the ESMPs using the guidelines presented in Box-B. After the ESIA and or ESMP will be prepared, consultations on the ESIA and or ESMP will be held and ESIA and or ESMP will be disclosed in the sub-project area. After incorporating the comments raised during the consultations, the ESIA and or ESMP will be incorporated in the sub-project documents, including the civil works contract for the sub-project. Finally, the sub-project documents (including the ESMP) will be submitted for approval.

Box-B

ESMP Guidelines for Sub-Projects

When a subproject includes distinct mitigation measures (physical works or management activities), an Environmental and Social Management Plan (ESMP) needs to be included with the subproject application.

Sub-Project ESMP General Format/ Contents:

An ESMP usually includes the following components:

Description of adverse effects: The anticipated effects are identified and summarized.

Description of mitigation measures: Each measure is described with reference to the effect(s) it is intended to deal with. As needed, detailed plans, designs, equipment descriptions, and operating procedures are described.

Description of monitoring program: Monitoring provides information on the occurrence of environmental and social effects. It helps identify how well mitigation measures are working, and where better mitigation may be needed. The monitoring program should identify what information will be collected, how, where and how often. It should also indicate at what level of effect there will be a need for further mitigation. How environmental and social effects are monitored is discussed below.

Responsibilities: The people, groups, or organizations that will carry out the mitigation and monitoring activities are defined, as well as to whom they report and are responsible. There may be a need to train people to carry out these responsibilities, and to provide them with equipment and supplies.

Implementation schedule: The timing, frequency and duration of mitigation measures and monitoring are specified in an implementation schedule, and linked to the overall subproject schedule.

Cost estimates and sources of funds: These are specified for the initial sub-project investment and for the mitigation and monitoring activities as a subproject is implemented. Funds to implement the EMP may come from the subproject grant, from the community, or both. Government agencies and NGOs may be able to assist with monitoring.

Monitoring Methods:

Methods for monitoring the implementation of mitigation measures or environmental effects should be as simple as possible, consistent with collecting useful information, so that community members can apply them themselves.

After the screening process and classification of the category of the project, the type and extent of the EA required is decided and executed. KWSB will prepare the Terms of References (TORs) for the EA or other analysis and to hire the necessary experts to carry it out. KWSB will also get assistance of Bank wherever required.

Additional, under Component two investments, and Environmental Audit (EA) and management action plan will be required for TP1 and TP3 waste water treatment plants before any rehabilitation works start, and rehabilitation works will only be implemented if these two wastewater treatment plants meet relevant standards and if they don't cause any long term or irreversible environmental impacts.

Implementation and Supervision: The ESMPs and the EA management action plans,provide the basis for supervising the environmental aspects of project implementation. KWSB will implement measures to mitigate anticipated environmental impacts, to monitor programs, to correct unanticipated impacts, and to comply with any environmental conditionality. Procedures for startup and continuing operation of the project will normally specify these agreements, as well as measures to protect the health and safety of project staff. Proper staffing, staff training, and procurement of spare parts and equipment to support preventive, predictive and corrective maintenance are also necessary elements of implementation.

Supervision is an essential aspect of the Bank's environmental review, since the environmental clearance decision is based in part on the assumption that mitigating measures and other provisions will be fully implemented and will be effective in avoiding or controlling adverse impacts that might otherwise have made the project unacceptable for Bank support. Supervision is carried out through a combination of the i) compliance reports from KWSB, ii) status of mitigating measures, results of monitoring programs and other environmental aspects of the project etc.. Bank supervision missions will also review implementation of environmental provisions, corrective actions taken to respond to impacts, and compliance with environmental conditionality, including institutional strengthening components; and site visits by Bank environmental specialists or consultants as required to supervise complex environmental components or respond to environmental problems.

7.5 Environmental Assessment Requirement of Sindh Environmental Protection Agency (SEPA)

The Sindh Environmental Protection Agency Review of the IEE and EIA Regulations, 2014 categorizes development projects into three schedules, according to their anticipated potential environmental impact. The proponents of the projects with the potential for more adverse environmental impacts (see Schedule II) are required to submit an Environmental Impact Assessment (EIA). While, for the proponents of projects with the potential for less environmental impact (see Schedule I), must submit an Initial Environmental Examination (IEE) with the respective environmental protection agency (EPA). The proponent of the projects falling under Schedule III shall conduct screening and file environmental checklist. Box-B presents Schedule I, II and III.

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

1. To determine whether a sub-project is categorized as requiring an IEE, EIA or screening, as per the three schedules attached to the Regulations.
2. An EIA, IEE or screening is conducted as per the requirements outlined in the SEPA Guidelines.

BOX-B

SEPA's Environmental Assessment Schedules

Schedule I (IEE)

A. Agriculture, Livestock and Fisheries

1. Poultry, livestock, stud and fish farms
2. Projects involving packaging, formulation, cold storage and warehouse of agricultural products.

B. Energy

1. Hydroelectric power generation less than 50 MW
2. Thermal power generation less than 100MW
3. Coal fired power plants with capacity less than 50 MW
4. Transmission lines less than 11 KV, and grid station
5. Waste-to-energy generation projects including bio-mass less than 25 MW
6. Solar project
7. Wind project

C. Oil and Gas Projects

1. Oil and gas 2D/3D Seismic survey and drilling activities
2. Oil and gas extraction projects including exploration and production located outside the

Schedule II (EIA)

B. Oil and Gas Projects

1. Petroleum refineries.
2. LPG and LNG Projects(including LNG Terminals, re-gasification units) except LPG filling stations
3. Oil and gas transmission systems
4. Oil and gas gathering system, separation and storage.

C. Manufacturing and Processing

1. Cement plants
2. Chemical manufacturing industries
3. Fertilizer plants
4. Steel Mills
5. Sugar Mills and Distilleries
6. Food processing industries including beverages, dairy milk and products, slaughter houses and related activities with total cost more than Rs. 200 Million
7. Industrial estates (including export processing zones)
8. Man-made fibers and resin projects with total cost of Rs 200 M and above
9. Pesticides (manufacture or formulation)
10. Petrochemicals complex
11. Synthetic resins, plastics and man-made fibers, paper and paperboard, paper pulping, plastic products, textiles (except apparel),printing and publishing, paints and dyes, oils and fats and vegetable ghee projects, with total cost more than Rs. 10 million
12. Tanning and leather finishing projects

Schedule III (Checklist)

a. Construction of, offices and small commercial buildings (1-6 story),home industrial units, ware houses, marriage / banquet facilities, large scale motor vehicles workshops, restaurants / food outlets ,large baking unit subject to the compliance with existing zoning laws.

b. Reconstruction / rehabilitation of roads (small roads in urban area and farm to market roads more than 2 km).

c. On-farm dams and fish farms.

d. Pulses mills.

e. Flour Mills

f. Projects promoting energy efficiency (small scale).

g. Lining of existing minor canals and /or water courses.

h. Canal cleaning

i. Forest harvesting operations

j. Rain harvesting projects

k. Rural schools (Secondary and Higher Secondary) and rural and basic health units having at least ten beds capacity.

l. BTS Towers

m. Lime Kilns

environmentally sensitive areas

3. Construction of LPG storage facilities

4. Construction of LPG,CNG filling station and petrol pumps

D. Manufacturing and Processing

1. Ceramics and glass units less than 500 million

2. Food processing industries with total cost less than Rs. 200 millions

Schedule II (EIA)

A. Energy

1. Hydroelectric power generation over 50 MW

2. Thermal power generation over 100 MW

3. Coal power projects above 50 MW

4. Transmission lines (11 KV and above) and distribution projects.

5. Nuclear power plants

6. Wind energy projects if falls under any sensitive, protected area.

13. Battery manufacturing plant

D. Mining and Mineral Processing

1. Mining and processing of coal, gold, copper, sulfur and precious stones

2. Mining and processing of major non-ferrous metals, iron and steel rolling

3. Smelting plants (total cost of Rs. 100 M and above)

E. Transport

1. Airports

2. Federal or Provincial highways or major roads (including rehabilitation or rebuilding or reconstruction of existing roads)

3. Ports and harbor development

4. Railway works

5. Flyovers, underpasses and bridges having total length of more than 500 m

F. Water Management, Dams, Irrigation and Flood Protection

1. Dams and reservoirs with storage volume of 25 million cubic meters and above having surface area of 4 square kilometers and above

2. Irrigation and drainage projects serving 15,000 hectares and above

3. Flood Protection

G. Water Supply and Filtration

Large Water supply schemes and filtration plants.

n. Ice factories and cold storage.

o. Cotton oil mill

p. Warehouses for pesticides and pharmaceuticals

Source: SEPA Review of IEE & EIA Regulations, 2014

3. The Fee (depending on the cost of the sub-project and type of report) is submitted along with the EIA or IEE document.
4. The IEE/EIA is also accompanied by an application in the format prescribed in Schedule V of the Regulations.
5. The EPA conducts a preliminary review of the report and replies within 15 days of the submission. It either a) confirms completeness, or b) asks for additional information, if needed, or c) returns the report and asks for additional studies, if necessary.
6. The Agency shall make every effort to carry out its review of the environmental checklist within thirty days, IEE within sixty days, and of the EIA within four months of issue of confirmation of completeness under regulation 9.

7. The EPA accords their approval, subject to certain conditions:
    a. Before commencing construction of the sub-project, the proponent is required to submit an undertaking accepting the conditions.
    b. Before commencing operation of the sub-project, the proponent is required to obtain from the SEPA a written confirmation of compliance with the approval conditions and requirements of the IEE.
8. An Environmental Management Plan (EMP) is to be submitted with a request for obtaining confirmation of compliance.
9. The SEPA is required to issue confirmation of compliance within 20 days of receipt of the request and complete documentation.
10. The IEE/EIA approval is valid for three years from the date of operational phase NOC.
11. After completion of construction, a monitoring report is to be submitted to the SEPA, followed by annual monitoring reports, during operations.

7.6 Categorization of KWSSIP Subprojects

On the basis of above-mentioned guidelines of World Bank and Sindh Environmental Protection Agency (SEPA), the preliminary assessment of the categorization of the KWSSIP SOP 1 subprojects and environmental assessment requirements are given in Table 12.

For the rehabilitation of water supply and sewerage subprojects in low income communities, SEPA does not require any environmental assessment whereas these are under category B subprojects for World Bank which will require limited EIA in the form of IEE, Environmental and Social Management Plan (ESMP) etc. The priority sewer network rehabilitation subprojects will be of Schedule II and category B under SEPA and World Bank respectively.

Table 12: Preliminary Categorization and EA Requirements of KWSSIP Subprojects

KWSIIP Subprojects	Categories & Requirements			
	World Bank		SEPA	
	Category	EA Required	Schedule	EA Required
i) Rehabilitation of sewerage in three low income communities ii) Priority sewer network rehabilitation	i) B ii) A	i) Limited EIA ii) Detailed EIA	i) Nil ii) III	i) Not Required ii) EIA
i) Rehabilitation of water supply in three low income communities ii) Priority water network rehabilitation	i) B ii) B	i) Limited EIA ii) Limited EIA	i) Nil ii) Nil	i) Not Required ii) Not Required

7.7 Generic Mitigation Plan

Table 13 presents generic mitigation plan for the avoiding or mitigating the potential environmental impacts identified above.

Table13: Generic Mitigation Plan

Subproject (s):

Rehabilitation of sewerage in three low income communities, , Priority sewer network rehabilitation, Rehabilitation of water supply in three low income communities, , Priority water network rehabilitation

Potential Environmental Impacts	Mitigation Measure	Responsibility	Implementation Stage
	Construction Phase		
Vegetation	**Restoration of the Construction Sites**		
Removal of top soil, air pollution, soil erosion and disturbance of aesthetic of the area due to clearing of land for camp sites, laying pipelines and building infrastructure	Where grading or excavation occurs within farmland, topsoil will be separated and stockpiled during the construction period. The topsoil stockpile will be secured with plastic. Following construction, the topsoil will be applied evenly to the site during the restoration process. The topsoil will be properly compacted and stabilized to prevent erosion and sediment transport.	Contractor	Start and end of construction
	During the design stage of the project and finalizing the project location and alignment for the pipe laying, it will be the priority to avoid those areas where there are chances of cutting of significant trees and clearing of vegetation/crops.	Designer	Design
	Tree Plantation		
	In case if it is not possible to avoid, then the project site will be restored to its original as much as possible by planting trees, vegetation and crops at the cleared land. All works will be carried out in a fashion that ensures minimum damage or disruption to the flora.	Contractor	End of construction
Natural Habitats	**Protection of Natural Habitats**		
Disturbance of natural habitats and biodiversity during construction activities	During site selection and finalization of pipelines and sewers alignment, the protection of the natural habitats will be the high priority area. Alternatives will be considered for site selection and pipelines and sewer alignments, in case of presence of natural habitats at the project areas to protect them at best.	Designer	Design
	During environmental assessment, surveys will be conducted for rare plants and priority or endemic wildlife species prior to civil work activities at all the sites. If any rare plants or sensitive wildlife species occur at the	Contractor	During construction

Subproject (s): *Rehabilitation of sewerage in three low income communities, , Priority sewer network rehabilitation, Rehabilitation of water supply in three low income communities, , Priority water network rehabilitation*			
Potential Environmental Impacts	**Mitigation Measure**	**Responsibility**	**Implementation Stage**
	construction sites, the sensitive resource will be fenced, and no activities will be allowed within 15 meters (50 feet) of the resource.		
	Construction activities will be scheduled outside of the prime bird nesting season to the extent feasible. If construction activities occur during the prime nesting bird season, these will be conducted at least 75 meters (250 feet) from the forested areas where suitable nesting habitat for priority bird species may be located.	Contractor	During construction
	Prior to construction activities during the nesting season, a qualified biologist will survey potentially suitable nesting habitat for priority species birds. If active nests are identified, a qualified biologist will monitor the nesting birds' responses to the loudest level of construction noise for an appropriate duration. If the nesting birds show signs of disturbance that could result in nest failure, all work activities that disturb the birds will be temporarily halted and visual and acoustic barriers will be erected between the nesting location and work areas. Installation of any visual and acoustic barriers will be overseen and approved by the qualified biologist.	Biologist	During environmental assessment
Physical Cultural Resources (PCRs)	**Protection of Physical Cultural Resources (PCRs)**		
Chances of loss of PCRs at the project sites during construction activities	During environmental assessment, surveys will be conducted for archeological and cultural resources prior to civil work activities at all the sites.	Environmentalist	During environmental assessment
	All necessary and adequate care will be taken to minimize impact on cultural properties which includes cultural sites and remains, places of worship including mosques, churches, etc., graveyards, monuments and any other important structures as identified during design and all properties / sites / remains notified. The design options for cultural property relocation and enhancement will need to be prepared.	Designer	Design

Subproject (s): *Rehabilitation of sewerage in three low income communities, , Priority sewer network rehabilitation, Rehabilitation of water supply in three low income communities, , Priority water network rehabilitation*			
Potential Environmental Impacts	**Mitigation Measure**	**Responsibility**	**Implementation Stage**
	No work will spill over to these properties, premises and precincts. All conservation and protection measures will be taken up as per design. During earth excavation, if any property is unearthed and seems to be culturally significant or likely to have archaeological significance, the same will be intimated to the KWSB. Work will be suspended until further orders from the KWSB. The Archaeological Department will be intimated of the chance find and the KWSB will carry out a join inspection with the department. Actions as appropriate will be intimated to the Contractor along with the probable date for resuming the work. The contractor workers will be sensitized and fully informed about the importance of PCRs before the commencement of the work as their negligence during excavation and construction activities could damage these resources. All fossils, coins, articles of value of antiquity and structures and other remains or things of geological or archaeological interest discovered on the site will be the property of the Government, and will be dealt with as per provisions of the relevant legislation.	Contractor	During construction
Air Quality	**Suppression of Dust Emission**		
Air pollution resulting in poor visibility, loss of vegetation, property damages, soil contamination and health implications on workers and nearby community due to fugitive emissions of dust (SPM, PM_{10}, $PM_{2.5}$), stack and vehicular emissions during construction activities	Regular water sprinkling will be the responsibility of the contractor at the dust generation points, during construction activities. The water will be also sprinkled at vehicular and machinery movement routes to avoid dust spreading to the nearby community. In addition, the provision of dust masks and ensuring their use by the workers will also be the responsibility of the contractor under Construction Phase Environmental Mitigation Plan (CPEMP).	Contractor	During construction
	Control of Stack and Vehicular Emissions		
	The stack emissions from generators, if used as standby source of power supply and vehicular/machinery movement at the site can affect the ambient air quality at project site. It will be the responsibility of the contractor to use well maintained generators and vehicles/machines to keep ambient air quality within the desired level. The contractor will be obliged to provide fitness certificate/maintenance records of the	Contractor	During construction

Subproject (s): *Rehabilitation of sewerage in three low income communities, , Priority sewer network rehabilitation, Rehabilitation of water supply in three low income communities, , Priority water network rehabilitation*			
Potential Environmental Impacts	**Mitigation Measure**	**Responsibility**	**Implementation Stage**
	generators, vehicles and machines before deploying them at the construction sites.		
Solid Waste	**Solid Waste Management**		
Nuisance, health implications on workers and community (due to breeding of mosquitos and flies), surface water and soil contamination due to improper disposal of domestic and hazardous solid waste from construction camps and construction waste	The construction contractors will implement a Waste Management Plan (mentioned in CPEMP). At a minimum, the plan will address the sources of waste; waste minimization, reuse, and recycling opportunities; and waste collection, storage, and disposal procedures. The Waste Management Plan will distinguish between solid and liquid waste, as applicable, and include procedures for addressing waste that may be hazardous to health and the environment. In addition, the Waste Management Plan will address the following: • All food waste will be contained in covered bins and disposed of on a frequent basis to avoid attracting wildlife. • Trash bins will be accessible at all locations where waste is generated. • The project area will be kept clean and free of litter and no litter will be allowed to disperse to the surrounding area. • Solid waste will be removed from the site and transported to a municipal landfill or disposal site. • Waste will not be dumped or buried in unauthorized areas or burned. • Human waste associated with the worker camp and latrines will be properly contained and disposed of. The construction contractors will ensure all workers receive training on proper disposal of all waste prior to working on the project site. The debris produced during construction will preferably be dumped at nearby depressions rather than being thrown away and left unattended. Leftover material will not be dumped into storm water drains or watercourses, because such practices can clog these man-made and natural drainage systems and cause many other problems for the residents.	Contractor	During construction

Subproject (s): *Rehabilitation of sewerage in three low income communities, , Priority sewer network rehabilitation, Rehabilitation of water supply in three low income communities, , Priority water network rehabilitation*			
Potential Environmental Impacts	**Mitigation Measure**	**Responsibility**	**Implementation Stage**
	Hazardous Solid Waste Management The construction contractors will implement the Hazardous Solid Waste Management Plan (mentioned in CPEMP). The Hazardous Solid Waste Management will identify proper management procedures for all hazardous materials and wastes that may be encountered during construction, including handling, labeling, transporting, and storing procedures. In addition, the plan will address the following: • Non-toxic and biodegradable produces will be used whenever possible. • Hazardous materials will be transported and stored in appropriate containers with clearly visible labels. Hazardous materials will be stored at least 100 feet from any down gradient drainage or within secondary containment capable of containing its entire volume. • Storm water flows will be directed away from hazardous material storage areas. • Equipment and work areas will be regularly inspected for signs of leaks and spills. Spill containment and cleanup kits will be available wherever hazardous materials are being used or stored. Any incidental spills or leaks will be contained and cleaned up as soon as it is safe to do so. Any contaminated soil will be collected and disposed of in an appropriate land fill. • Equipment refueling and maintenance will be limited to designated areas at least 30 meters (100 feet) from any down gradient drainage. Management of spoil material (collection and disposal at appropriate site/cleaning of sludge dumping site thoroughly) All workers will receive training on proper handling and storage of hazardous materials, as well as spill response and cleanup procedures, prior to working on the project site.		
Soil Soil contamination due to storage of oily parts and oily rags on unpaved floors, spillage and	**Soil Pollution Control** Soil pollution will be controlled by taking following measures:	Contractor	During construction

Subproject (s): *Rehabilitation of sewerage in three low income communities, , Priority sewer network rehabilitation, Rehabilitation of water supply in three low income communities, , Priority water network rehabilitation*			
Potential Environmental Impacts	**Mitigation Measure**	**Responsibility**	**Implementation Stage**
leakage of chemicals, fuel, and lubricants on soil (construction camps/sites)	• Storage of fuel, paint, and oil containers, oil filters, oily parts and oily rags on impervious floor under shade or storing of fuel and lubricants on a sand flooring of at least 6 inch thick, done on brick edge flooring lined with polyethylene sheet • Placement of fuel containers under containment and proper decantation arrangement to avoid its spillage and leakage on floor • Presence of spill kit to remove spills from the floor • Avoid washing the contaminated floors rather dry cleaning the spills from the floor with saw dust and rags • Location of fuel storage and refilling areas at least 500 m from all cross drainage structures and important water bodies		
Noise Nuisance, health implications of workers and nearby community, loss of biodiversity due to noise from construction machineries, generators, construction activities and vehicular movement	**Noise Abatement** Construction noise and the associated effects will be reduced or minimized, to the extent possible, by implementing the following procedures: • Selecting quieter equipment and construction activities, whenever feasible; • Carrying out regular inspection and maintenance of the construction vehicles and equipment; • Replacing worn and noise producing parts of construction machinery in a timely manner; • Ensuring motorized vehicles and equipment are equipped with the greatest possible noise reduction parts, such as mufflers, silencers, insulators, and enclosures; • Workers will use noise protection equipment when working in a noisy area; • Locating noise generating equipment as far from sensitive receptors as feasible; • Limiting civil work activities to daytime hours (8:00 to 18:00), to the extent feasible; • Notifying and coordinating with residents adjacent to project areas prior to construction to inform them of the possibility of temporary noise disruption, and how to report noise complaints; • Installing acoustic barriers between stationary equipment and sensitive receptors located within 300 meters (1,000 feet); • Implementing a Noise Complaint Program to record and respond to noise complaints during construction	Contractor	During construction

Subproject (s):

Rehabilitation of sewerage in three low income communities, , Priority sewer network rehabilitation, Rehabilitation of water supply in three low income communities, , Priority water network rehabilitation

Potential Environmental Impacts	Mitigation Measure	Responsibility	Implementation Stage
Health and Safety	**Occupational Health and Safety Management**		
Safety hazards for workers and community due to construction activities/sites	The construction contractors will implement a Health and Safety Plan (mentioned in CPEMP) that addresses the applicable risks and prevention procedures applicable to each contractor's work. At a minimum, the Health and Safety Plan will address hazards that may be encountered during construction, including prevention and response procedures, for the following topics: General occupational hazards that may be encountered (e.g., moving machinery and motorized equipment, working at heights or in confined spaces, repetitive motions, falling objects, exposure to heat, loud noises, and hazardous materials, protective clothing). The risk of fires will be evaluated for each project site based on the activities that occur, environmental conditions, and presence of ignitable or combustible materials in the area. If the activities pose a risk of igniting a wildfire, appropriate fire prevention and response equipment will be available at each active site such as shovels, axes, fire extinguishers, and dedicated water tanks. All workers will be trained on proper fire prevention and response procedures prior to working on the site. Any smoking on site will be restricted to barren areas away from ignitable or combustible material. Smoking waste will be fully extinguished and disposed of appropriately. The construction contractors will supply all workers with personal protective equipment (PPE), and ensure workers use the proper PPE during all work activities. At a minimum, PPE for workers shall include: • Safety headgear • Steel toed boots • Safety glasses or impact-resistant eye protection • Ear protective devices • Harnesses for workers operating at heights • Respirators • Gloves • High visibility clothing or vests	Contractor	During construction

Subproject (s): *Rehabilitation of sewerage in three low income communities, , Priority sewer network rehabilitation, Rehabilitation of water supply in three low income communities, , Priority water network rehabilitation*			
Potential Environmental Impacts	**Mitigation Measure**	**Responsibility**	**Implementation Stage**
	• Other specialized protective equipment for the drilling, welding, etc. All PPE will be properly fitted for each worker, including body size and gender, and workers will be trained in the proper use of PPE, prior to working on the project site. Medical facilities will be provided to the labor at the construction camp. Suitable transport will be provided to take injured or ill person(s) to the nearest approachable hospital. First Aid Box will be provided at every construction campsite and under the charge of a responsible person who will always be readily available during working hours. The contractor will be responsible for providing safe drinking water and for implementing appropriate sanitation conditions, and for supplying hygienic food and a sewerage system for the construction team at the site. The construction activities, particularly the excavation, will not be carried out during rainy season to avoid any accident. The excavated areas will be properly cordoned off, and warning and safety signs will be posted at accident prone areas to warn the passersby the potential danger at the construction site. The traffic will be diverted well before the construction area as per the traffic management plan. The construction contractors will install temporary signs and fences around all unsafe areas to prevent members of the public from entering the areas. If installing fences is not feasible, the area will be clearly identified as unsafe with signs and flagging.		
Traffic Traffic congestion at or around construction sites due to construction activities	**Traffic Management** At all times, the contractor will provide safe and convenient passage for vehicles, pedestrians and livestock. The contractor will comply the Traffic Management Plan (TMP) as provided in CPEMP. The traffic control plans will contain details of temporary diversions at different locations. Temporary diversion for road traffic will be constructed with the approval of the KWSB. Special consideration shall be given in the preparation of the traffic control plan to the safety of pedestrians and workers at night. The temporary traffic detours in settlement areas will be kept free of dust by	Contractor	During construction

Subproject (s): *Rehabilitation of sewerage in three low income communities, , Priority sewer network rehabilitation, Rehabilitation of water supply in three low income communities, , Priority water network rehabilitation*			
Potential Environmental Impacts	**Mitigation Measure**	**Responsibility**	**Implementation Stage**
	frequent application of water. The contractor will take all necessary measures for the safety of traffic during construction work and provide, erect and maintain such barricades, including signs, markings, flags, lights and flagmen as may be required for the information and protection of traffic approaching or passing through the construction site. All signs, barricades, pavement markings will be as per road specification Informational signs will be posted where lane and road closures could substantially disrupt traffic circulation at least 7 days prior to the closure. Proper traffic controls will be in place during closures to minimize impacts on traffic circulation and for traffic safety. Appropriate safety precautions will be taken when transporting large equipment on public roadways.		
Campsite	**Campsites Restoration**		
Disturbance to aesthetic and landscaping of the campsites	After the completion of construction activities at each site, all construction camp facilities will be dismantled and removed from the site. The site will be restored to a condition in no way inferior to the condition prior to commencement of the works. Various activities to be carried out for site rehabilitation will include: • Oil and fuel contaminated soil will be removed and transported and buried in waste disposal areas. • Soak pits, septic tanks will be covered and effectively sealed off. • Debris (rejected material) will be disposed of suitably. • Underground water tank in a barren/non-agricultural land will be covered. However, in an agricultural land, the tank will be removed. • If the construction camp site is on an agricultural land, the top soil will be preserved and good earth will be spread back for a minimum 30 cm for faster rejuvenation of the land. • In cases, where the construction camps site is located on a private land holding, the contractor will have to restore the campsite as per this specification. The rehabilitation is mandatory and will be included in the agreement with the landowner by the contractor. Also, he will have to obtain a certificate for satisfaction from the landowner.	Contractor	After the completion of construction activities

Subproject (s): *Rehabilitation of sewerage in three low income communities, , Priority sewer network rehabilitation, Rehabilitation of water supply in three low income communities, , Priority water network rehabilitation*			
Potential Environmental Impacts	**Mitigation Measure**	**Responsibility**	**Implementation Stage**
Management of Black Water Diversion	Contractor will take all the precautionary measures while diverting the dirty water to avoid soil contamination, odor, nuisance, outbreak of diseases for the nearby community. The care will be taken that these channels should not pass close to the water supply infrastructure. The temporary channels will be paved and covered to avoid seepage to underground water resources, soil contamination and spreading of pathogens to the surrounding.	Contractor	Construction
Operational Phase Rehabilitation of sewerage in three low income communities Priority sewer network rehabilitation			
Soil and water contamination, odor and outbreak of diseases due to leakages and damaging of sewers and malfunctioning of disposal pumps	**Maintenance of Sewerage System and Disposal Pumps** KWSB staff will look after the proper functioning of the sewerage system and disposal pumps throughout the project lifecycle. For such system, KWSB will equip itself with proper trained workforce and requisite machinery with the support of vigilant governance system. Standby disposal pumps and generator system will be installed to cope with all sort of emergency situation. Regular maintenance and upkeep of these pumps and generator system will be under strict operation and maintenance regime.	Chief Engineer (KWSB)	Operational
Energy inefficiency of disposal pumps	**Implementation of Energy Efficiency Measures** Frequent energy audits of the disposal pumps will be conducted and energy efficiency measures will be implemented to reduce energy consumption and consequent environmental problems.	Chief Engineer (KWSB)	Operational

Subproject (s): *Rehabilitation of sewerage in three low income communities, , Priority sewer network rehabilitation, Rehabilitation of water supply in three low income communities, , Priority water network rehabilitation*			
Potential Environmental Impacts	**Mitigation Measure**	**Responsibility**	**Implementation Stage**
Rehabilitation of water supply in three low income communities Priority water network rehabilitation			
Water borne diseases, shortage of water supply, water contamination due to damaging pipelines, improper water treatment (chlorination, filtration etc.) and malfunctioning of water supply system (water pumps)	**Ensuring Proper Functioning of Water Supply and Treatment System** KWSB staff will look after the proper functioning of the water supply pipelines, pumping facilities and water treatment facilities (filtration, chlorination etc.) throughout the project lifecycle. For such system, KWSB will equip itself with proper trained workforce and requisite machinery with the support of vigilant governance system. Standby pumps and generator system will be installed to cope with all sort of emergency situation. Regular maintenance and upkeep of these water supply pipelines, pumps, generators and water treatment facilities will be under strict operation and maintenance regime.	Chief Engineer (KWSB)	Operational
Energy inefficiency of water pumps and water treatment plants	**Implementation of Energy Efficiency Measures** Frequent energy audits of the water pumps and water treatment plants will be conducted and energy efficiency measures will be implemented to reduce energy consumption and consequent environmental problems.	Chief Engineer/Plant Manager (KWSB)	Operational
Health implications on workers and nearby community and loss of biodiversity due to noise	**Noise Abatement at Project Sites** *(Common to Water Pumps, Disposal Pumps)* Noise will be generated at following project locations during operational phase: • Tube wells and water pumps • Generators (water treatment, disposal station and water supply facilities)	Chief Engineer (KWSB)	Operational

Subproject (s):

Rehabilitation of sewerage in three low income communities, , Priority sewer network rehabilitation, Rehabilitation of water supply in three low income communities, , Priority water network rehabilitation

Potential Environmental Impacts	Mitigation Measure	Responsibility	Implementation Stage
	Most of the above mentioned facilities will be enclosed and their noise impact will be restricted to the facilities only and noise will not disturb the nearby community. However, the designers of these facilities will take noise aspect into the consideration and built all the noise producing equipment (pumps, turbines, generators etc.) under enclosure to attenuate the noise impact to surrounding. To minimize noise impacts on workers, working at noise prone areas, the following measures will be taken: • Carrying out regular inspection and maintenance of the equipment • Replacing worn and noise producing parts of the equipment in a timely manner • In case of severe noise, using sound barriers to avoid the dispersion of sound waves into the nearby community • Workers will use noise protection equipment when working in a noisy area. • The noise level of 85 dBA for 8 hour working for the workers is considered safe. The management will ensure keeping noise levels within safe limits. In case of higher noise levels (more than 85 dBA), the workers will be rotated. The workers at higher noise level areas will not be allowed to work for more than two to three hours and shifted to calm places for rest of the hours.		
Soil contamination due to chemicals spillage and leakages	**Soil Pollution Control** The improper handling and storage of chemicals, fuel, lubricant, oily solid waste etc. at water treatment facilities, will lead to soil pollution. Soil pollution will be controlled by taking following measures: • Storage of fuel, paint, and oil containers, oil filters, oily parts and oily rags on impervious floor under shade or storing of fuel and lubricants on a sand flooring of at least 6 inch thick, done on brick edge flooring lined with polyethylene sheet • Placement of fuel containers and liquid chemicals under containment and proper decantation arrangement to avoid its spillage and leakage on floor	Chief Engineer (KWSB)	Operational

Subproject (s): *Rehabilitation of sewerage in three low income communities, , Priority sewer network rehabilitation, Rehabilitation of water supply in three low income communities, , Priority water network rehabilitation*			
Potential Environmental Impacts	**Mitigation Measure**	**Responsibility**	**Implementation Stage**
	• Presence of spill kit to remove spills from the floor • Avoidance of washing the contaminated floors rather dry cleaning the spills from the floor with saw dust and rags • Location of fuel storage and refilling areas at least 500 m from all cross drainage structures and important water bodies		
Health implications for workers and nearby community due to air emissions, odor and breeding of mosquitos/flies	**Protection of Workers from Health and Safety Hazards** The management of the projects (disposal stations) will comply with all the precautions as required for the safety of the workmen as per the national and World Bank requirements. The Plant Manager/Engineer will ensure that all operators of heavy or dangerous machinery are properly trained/certified, and also insured. The Plant Manager/Engineer will supply all necessary safety appliances such as safety goggles, helmets, masks, safety shoes etc., to the workers and staff. Workers, who are engaged in welding works, will be provided with welder's protective eye-shields. Maintenance activities will be carried out by taking strict safety measures. The hazardous material and chemicals will be handed as per the instruction of the specific Safety Data Sheet (SDS). Medical facilities will be provided to all the workers at the working locations. Suitable transport will be provided to take injured or ill person(s) to the nearest approachable hospital. The first aid box will be provided at every facility and under the charge of a responsible person who will always be readily available during working hours. **Protection of Community Health** Community health can be affected due to noise and odor from the facilities, and improper disposal of solid waste and sludge. Noise control measures have already been mentioned above. The trees will be planted at the periphery of the sites, particularly, the wastewater disposal stations and drains so that odor and noise could be attenuated due to the tree cover. The waste sludge from the sewerage system will be properly collected, stored and disposed at designated places. The transportation vehicles will be covered from the top to avoid any nuisance while passing through the residential areas.	Chief Engineer (KWSB) Plant Manager	Operational

Subproject (s):

Rehabilitation of sewerage in three low income communities, , Priority sewer network rehabilitation, Rehabilitation of water supply in three low income communities, , Priority water network rehabilitation

Potential Environmental Impacts	Mitigation Measure	Responsibility	Implementation Stage
Nuisance at the areas due to sitting of the disposal pumps and drains	**Landscaping to Improve Aesthetic of the Sites** The aesthetic of the sites such as disposal stations and drains will be improved by landscaping. The green spaces will be developed at these sites to create their positive image among nearby community.	Landscape Specialist	After construction activities

7.8 Monitoring Framework

Monitoring of the Mitigation Plan (MP) is required at construction and operational phases of the project components. The monitoring is the requisite for World Bank and Sindh Environmental Protection Agency (SEPA). The monitoring framework is illustrated in Figure 9.

7.8.1 Construction Phase Monitoring

Construction phase monitoring of the project components will be required for the compliance of MP and Environmental Management Plan (EMP) mentioned in the Environmental Assessment (EA) for World Bank and SEPA respectively.

a) Project Implementation Unit

The overall responsibility of compliance of MP and compliance reporting to World Bank and SEPA will be with KWSB. The Project Implementation Unit (PIU), established under KWSB for the management of KWSIIP project activities, will overall supervise the monitoring and compliance of MP.

b) Environmental and Social Cell (ESC)

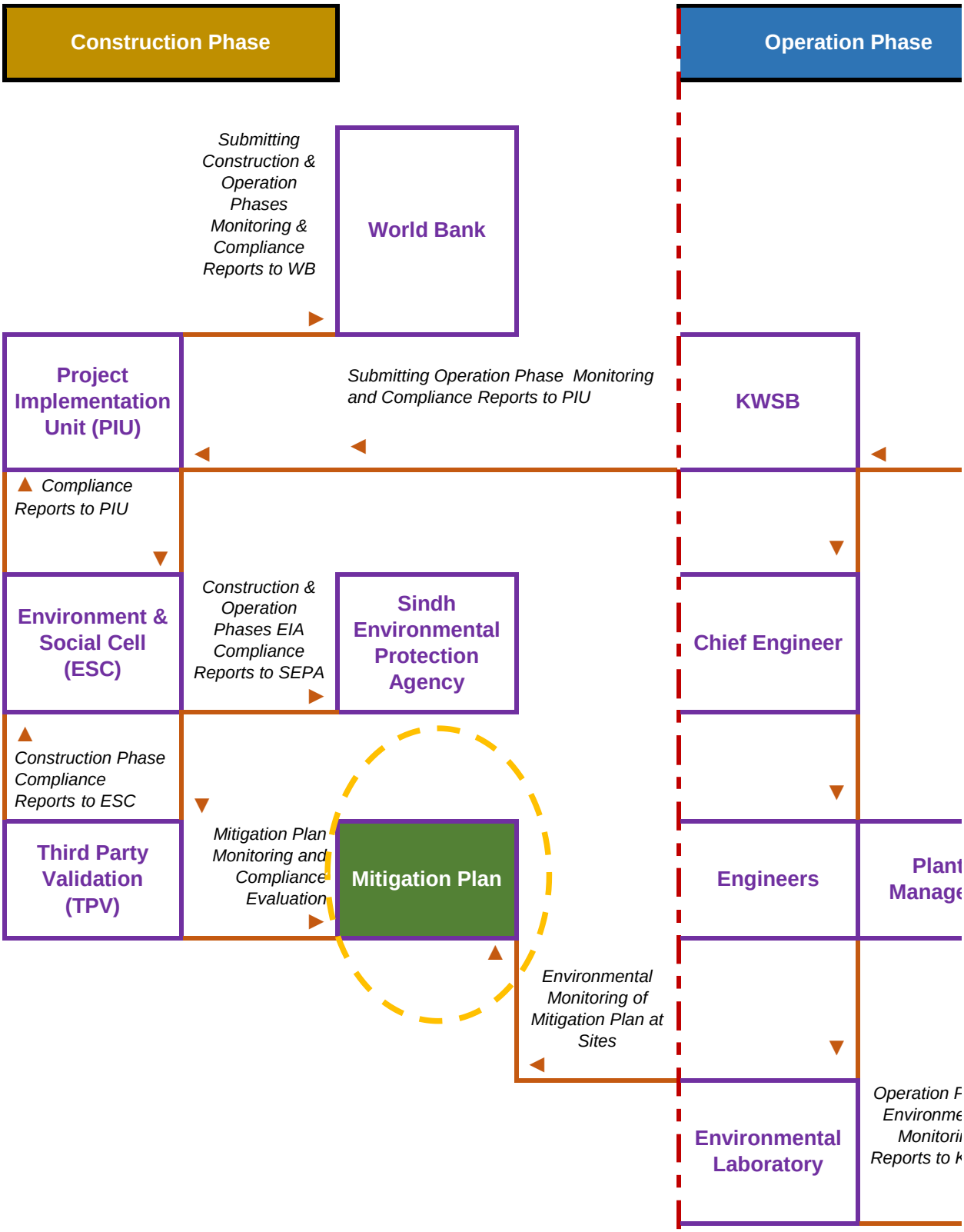
The Environment and Social Cell (ESC) under PIU will take care of environmental and social aspects of the project activities. ESC will arrange environmental monitoring and prepare compliance reports and submit to PIU for further submitting to the World Bank and SEPA, to fulfill their monitoring, reporting and compliance requirements of environmental safeguard.

The Construction Phase Environmental Management Plan (CPEMP) will be prepared and appended with the tender document for the contractors. It will be a standard document. The contractors will be required to prepare their own site specific EMPs. These EMPs will contain following plans to eliminate, offset or reduce environmental, health and safety impacts during construction phase:

- Sanitation plan
- Soil pollution control plan
- Dust control plan
- Waste management plan
- Health and safety plan
- Noise abatement plan
- Traffic management plan
- Campsite restoration plan
- Tree plantation plan

The compliance of CPEMP will be the responsibility of the contractor and compliance cost will be added in the bidding documents. The ESC will be responsible to ensure compliance of CPEMP during construction phase through contractors. The compliance will require measurements of environmental parameters and observations at the construction sites to evaluate compliance. The ESC will hire the services of independent environmental consultancy firm as Third Party for Third Party Validation (TPV).

Figure 9: Monitoring Framework



c) Third Party Validation

The Third-Party Validation will be carried out through independent environmental consultancy firm. The consultant firm will monitor the environmental parameters and conduct field surveys at the construction sites to evaluate compliance level by the contractors. The consultant firm will prepare monthly monitoring and evaluation report for each site and submit to ESC. The ESC will review the report, discuss with the consultant firm and finalize the findings. In case of noncompliance from the contractors, the ESC will have the authority to halt the construction activities or impose penalties as per the contract conditions. The ESC will submit the final version of monitoring and evaluation reports to PIU. PIU will submit these reports to World Bank for their review and further action. Also these reports will be submitted to SEPA as per the frequency to be mentioned in the construction phase 'No Objection Certificate (NOC)' requirements (Quarterly and yearly).

7.8.2 Operational Phase Monitoring

The overall responsibility of compliance of operational phase MP will be with KWSB.

a) KWSB

In the organizational hierarchy of KWSB, Deputy Managing Director Technical Services (DMDTS), will be overall responsible for the operation and maintenance of water supply and sewerage infrastructure. The Chief Engineer of each district will be the sole responsible for the utility services in his respective district. The operation of utilities (water supply and treatment, sewerage and disposal pumps) and plants (wastewater treatment, desalination, water treatment) will be under direct jurisdiction of Engineers and Plant Managers respectively.

The monitoring and compliance of operational phase MP will be under the responsibilities of Engineers and Plant Managers for respective utility and plant. These personnel will report to the DMDTS) for the compliance and monitoring of MP.

b) Environmental Laboratory

The KWSB Engineers and Plant Managers will have the leverage to hire the services of competent environmental laboratory to monitor environmental parameters at utilities and plant sites. The compliance reports will be submitted by the respective Engineers and Plant Managers to Deputy Managing Director at set frequency (fortnightly). The laboratory reports will be the part of these compliance reports.

The respective Engineers and Plant Managers will take corrective actions and preventive measures in case of any nonconformity against the MP. These corrective and preventive measures and rectification will also be the part of the compliance reports.

The DMDTS will submit the operational phase MP compliance reports to PIU for further submission to World Bank.

The monitoring plan is presented in Table 14.

Table 14: Mitigation and Monitoring Plan

Subproject (s): Rehabilitation of *sewerage in three low income communities, Priority sewer network rehabilitation, Rehabilitation of water supply in three low income communities, Priority water network rehabilitation*

Mitigation Measure	Monitoring Responsibility	Monitoring Parameters	Frequency
Construction Phase			
Restoration of the Construction Sites Tree Plantation	Environmental Consultancy Firm	***Evaluation for*** i) Proper stockpiling of topsoil ii) proper application of topsoil iii) tree plantation as per Tree Plantation Plan	Fortnightly at each site
Protection of Natural Habitats	Environmental Consultancy Firm	***Evaluation for*** i) Fencing of the sensitive resources ii) construction activities restricted to about 15 m of the resources iii) construction activities whether occurring during prime nesting season or not iv) if construction is carried out, it should be at about 75 m from the forested area to avoid disturbing nesting habitats v) the placement of visual and acoustic barriers at the vicinity of nesting habitats	-do-
Protection of Physical Cultural Resources (PCRs) .	Environmental Consultancy Firm	***Evaluation for*** i) the care taken by the contractor for the protection of PCRs (identification, protection measures taken, reporting etc.)	-do-
Suppression of Dust Emission Control of Stack and Vehicular Emissions	Environmental Consultancy Firm	***Evaluation for*** i) regular water sprinkling at dust generation points at construction sites and vehicular and machineries routes ii) use of dust masks by the workers iii) fitness certificates/maintenance records of vehicles/machines ***Monitoring for*** i) TSPM, PM_{10}, $PM_{2.5}$ at construction sites, vehicular routes, nearby community ii) stack monitoring of generators (CO, NOx, SOx iii) vehicular emissions (CO, NOx, SOx, Lead)	Weekly at each site
Solid Waste Management Hazardous Solid Waste Management	Environmental Consultancy Firm	***Evaluation for*** i) compliance of waste management plan ii) compliance of hazardous solid waste management plan iii) training of the workers iv) use of PPE during handling of hazardous solid waste v) management of spoil material	Weekly at each site

Subproject (s): Rehabilitation of *sewerage in three low income communities, Priority sewer network rehabilitation, Rehabilitation of water supply in three low income communities, Priority water network rehabilitation*

Mitigation Measure	Monitoring Responsibility	Monitoring Parameters	Frequency
Soil Pollution Control	Environmental Consultancy Firm	***Evaluation for*** i) compliance of soil pollution control plan ii) availability of spill kit iii) spill response procedures iv) training of the workers	Weekly at each site
Noise Abatement	Environmental Consultancy Firm	***Evaluation for*** i) compliance of noise abatement plan ii) use of ear plugs/ear muffs by the workers iii) enclosures for the noisy equipment iv) erection of noise barriers at appropriate places v) equipment are fitted for silencers/mufflers v) fitness certificates/maintenance records of vehicles/machines vi) noise complaints records ***Monitoring for*** i) Noise levels (dBA) at construction sites ii) vehicular noise at about 7.5 m distance iii) noise levels at nearby community/forests.	Weekly at each site Noise monitoring after every two hours at each location (8:00 am to 6:00 pm)
Occupational Health and Safety Management	Environmental Consultancy Firm	***Evaluation for*** i) compliance of health and safety plan ii) availability and use of PPE by the workers iii) accident records iv) availability of First Aid Boxes and trained staff for first aid v) medical facilities vi) safety measures at sites taken while working and operating machines vii) availability and use of fire control equipment viii) training of the staff ix) maintenance of hygiene conditions x) availability of safe drinking water ***Monitoring for*** i) drinking water quality	Weekly at each site
Traffic Management	Environmental Consultancy Firm	***Evaluation for*** i) compliance of traffic management plan during construction	Weekly at each site
Campsites Restoration	Environmental Consultancy Firm	***Evaluation for*** i) compliance of campsite restoration plan ii) pre and post scenario of the campsites	Pre and post construction activities at each site
Management of Black Water Diversion	Environmental Consulting Firm	***Evaluation for*** i) black water diversion management i.e. paved drain, covering of drains, soil pollution control, protection of water supply infrastructure	Monthly

Subproject (s): Rehabilitation of *sewerage in three low income communities, Priority sewer network rehabilitation, Rehabilitation of water supply in three low income communities, Priority water network rehabilitation*			
Mitigation Measure	**Monitoring Responsibility**	**Monitoring Parameters**	**Frequency**
Subproject(s): Rehabilitation of sewerage in three low income communities, Priority sewer network rehabilitation			
Operational Phase			
Maintenance of Sewerage System and Disposal Pumps	Chief Engineer (KWSB)/ Engineers	***Evaluation for*** i) compliance of Standard Operating Procedures (SOPs) ii) compliance of preventive maintenance schedule iii) records of complaints and their rectification iv) maintenance activities v) availability and condition of equipment for sewerage system upkeep vi) conditions of the equipment vii) training of the staff	Daily
Implementation of Energy Efficiency Measures	Chief Engineer (KWSB)/ Engineers	***Evaluation for*** conduction of energy audit and implementation of energy efficiency measures	Annual
Rehabilitation of water supply in three low income communities Priority water network rehabilitation			
Operational Phase			
Ensuring Proper Functioning of Water Supply and Treatment System	Chief Engineer (KWSB)/Engineers	***Evaluation for*** i) compliance of Standard Operating Procedures (SOPs) ii) compliance of preventive maintenance schedule iii) records of complaints and their rectification iv) maintenance activities v) availability and condition of equipment for water supply system upkeep vi) conditions of the equipment vii) effectiveness of the treatment facilities viii) training of the staff ***Monitoring for*** i) treated water quality	Daily/ Water sampling and analysis (one sample daily from each site)
Implementation of Energy Efficiency Measures	Chief Engineer/Engineers/Plant Manager (KWSB)	***Evaluation for*** conduction of energy audit and implementation of energy efficiency measures	Annual

Subproject (s): Rehabilitation of *sewerage in three low income communities, Priority sewer network rehabilitation, Rehabilitation of water supply in three low income communities, Priority water network rehabilitation*

Mitigation Measure	Monitoring Responsibility	Monitoring Parameters	Frequency
Soil Pollution Control *(Disposal pumps, Water Treatment)*	Chief Engineer (KWSB)/Engineers	***Monitoring for*** i) compliance of soil pollution control SOPs	Daily
Implementation of Energy Efficiency Measures	Engineers (KWSB)	***Evaluation for*** conduction of energy audit and implementation of energy efficiency measures	Annual
Operational Phase			
Protection of Workers from Health and Safety Hazards Protection of Community Health	Chief Engineer (KWSB)/Engineers	***Evaluation for*** i) compliance of health and safety SOPs ii) availability and use of PPE by the workers iii) training of the workers iv) maintenance activities as per safety standards v) handling and storage of hazardous material as per safety standards and SDS requirements vi) availability of medical facilities i.e. first aid, first aid boxes, transportation, hospitalization etc. vii) proper disposal of sludge and other waste material viii) plantation of trees ix) implementation of insect, mosquitos and flies control methods	Daily
Landscaping to Improve Aesthetic of the Sites *(Disposal Stations, Drains)*	Chief Engineer (KWSB)/Engineers	***Evaluation for*** i) maintenance of landscaping as per requirements	Daily

7.9 Capacity Building

Capacity building will be required for the stakeholders involved for the implementation, supervision, monitoring, evaluation, and reporting of the mitigation measures during construction and operational phases of the project components. This section describes the capacity building requirements for the stakeholders involved.

Following are the key stakeholders involved for the accomplishment of the environmental safeguard requirements of the KWSSIP project:

- KWSB Technical Services Staff (KWSBTS)
- Environment and Social Cell (ESC)
- Environmental Consultancy Firm (ECF)
- Environmental Laboratory (EL)
- Contractors (CONTs)

Table 15 presents detail of trainings required for the capacity building of above mentioned key stakeholders on environmental safeguard requirements.

Table 15: Training Requirements

#	Trainings *(Resource Person)*	Key Stakeholders *(Frequency)*				
		KWSBTS	**ESC**	**ECF**	**EL**	**CONTs**
1	Overview of Project and Subprojects and their Environmental Impacts and Mitigation Measures	■	■	■		■
	(Environmentalist)	*Once at the start*				*Once for Every Contractor*
2	Construction Phase Environmental Management Plan (CPEMP)	■	■	■		■
	(Environmentalist)	*Once at the start*				*Once for Every Contractor*
3	Environmental Monitoring and Evaluation Requirements during Construction and Operational Phases	■	■	■	■	
	(Environmentalist)	*Once at the start*				
4	Environmental Assessment of the Projects		■			
	Environmentalist/EIA Expert		Once at start			
5	Environmental Monitoring, Evaluation and Compliance Reporting Requirements	■	■	■		
	(Environmental Safeguard Specialist)	*Once at the start*				

6	Public Consultation, Disclosure and Grievance Redress Mechanism Requirements *(Environmental Safeguard Specialist)*	■	■			
		Once at the start				

8.0 GRIEVANCE REDRESS MECHANISM

This chapter describes the Grievance Redress Mechanism to be adopted by the KWSB to facilitate resolution of any community complaints and grievances about the project's environmental performance, in line with the requirements of World Bank.

8.1 Requirements of Grievance Redress Mechanism (GRM)

KWSB will respond to concerns and grievances of project affected parties related to the environmental and social performance of the project in a timely manner. For this purpose, KWSB will propose and implement a grievance redress mechanism (GRM) to receive and facilitate resolution of such concerns and grievances. The GRM will be proportionate to the potential risks and impacts of the project and will be accessible and inclusive. Where feasible and suitable for the project, the GRM will utilize existing formal or informal GRM, supplemented as needed with project specific arrangements.

(a) The GRM is expected to address concerns promptly and effectively, in a transparent manner that is culturally appropriate and readily accessible to all project-affected parties, at no cost and without retribution. The mechanism, process or procedure will not prevent access to judicial or administrative remedies. KWSB will inform the project-affected parties about the grievance process in the course of its community engagement activities, and will make publicly available a record documenting the responses to all grievances received; and

(b) Handling of grievances will be done in a culturally appropriate manner and be discreet, objective, sensitive and responsive to the needs and concerns of the project-affected parties. The mechanism will also allow for anonymous complaints to be raised and addressed.

8.2 Grievance Redress Mechanism for KWSSIP

The KWSB will establish a Grievance Redress Mechanism (GRM) to facilitate the resolution of community complaints and grievances about the project's environmental and social performance. This will be in line with the requirements of the World Bank. Under this mechanism, a Grievance Redress Cell (GRC) will be established in the Project Implementation Unit. At least there will be one focal person for GRM at each construction sites during construction phase. This person will be directly accessible to the community for the registration of complaints and their resolution.

The established GRM will be communicated to the public and particularly the affected communities through print and electronic media and during public consultations and community engagement events.

This cell will maintain a Community Complaints Management Register (CCMR), at the site, for registering complaints and grievances. All written and oral grievances will be recorded in the Register. The information will include the date and the particulars of the complainant; a description of the grievance; the follow-up action required; the person responsible for implementing the action; and a target date for its completion. Each complaint will be recorded in the register with a complaint number and provided to the affected person for follow up purpose. GRC designated person will take necessary actions as per the nature, scale and type of the grievance registered. He or she will halt the construction activities in case the contractors do not comply with the CPEMP and causing grievances to the nearby community.

For operational phase GRM, the respective Engineers and Plant Managers of the utilities and plants respectively will be responsible for maintaining community complaints in the CCMR and their resolution. They will also get the assistance of other team members of KWSB and PIU for the resolution of the complaints.

Android based GRM Application (GRM App) will also be established, launched and publicized to make GRM effective, easy and accessible to everybody. This App will be designed in a very user friendly simple format to lodge a complaint. After receiving the complaint, complaint number will be sent to the applicant immediately. He or she will be contacted, if required. He or she will be informed as soon as his/her complaint is resolved or time to time updated for the progress of the complaint. This App will be maintained by GRC. All the records of GRM will be accessible to the public and World Bank. A monthly Grievance Redress Report (GRR) will be prepared and be part of the compliance reports.

8.3 World Bank's Grievance Redress Service (GRS)

Communities and individuals who believe that they are adversely affected by a World Bank supported project may submit complaints to existing project-level grievance redress mechanisms or the WB's Grievance Redress Service (GRS). The GRS ensures that complaints received are promptly reviewed in order to address project-related concerns. Project affected communities and individuals may submit their complaint to the WB's independent Inspection Panel which determines whether harm occurred, or could occur, as a result of WB non-compliance with its policies and procedures. Complaints may be submitted at any time after concerns have been brought directly to the World Bank's attention, and Bank Management has been given an opportunity to respond. For information on how to submit complaints to the World Bank's corporate Grievance Redress Service (GRS), web link (http://www.worldbank.org/en/projects-operations/products-and-services/grievance-redress-service) can be used.

9 BUDGET

This chapter describes the tentative budget for the environmental assessment and compliance of mitigation plan during construction and operational phases of the project and subprojects.

10.1 Tentative Budget

The yearly tentative budget under different cost head is mentioned in Table 16. Total tentative budget for the compliance of environmental safeguard requirements is about Rs.101.6 million.

Table 16: Tentative Yearly Budget for Environmental Assessment and Compliance

All Costs are in Pak Rupee (PKR)

#	Cost Head	Unit Cost	No. of Units	Total Amount
	A- Environmental Assessment (Lump Unit Cost)			
1	Rehabilitation of sewerage in three low income communities	500,000	1	500,000
2	Priority sewer network rehabilitation	500,000	1	500,000
3	Rehabilitation of water supply in three low income communities	500,000	1	500,000
4	Priority water network rehabilitation	500,000	1	500,000
	Total-A			***2,000,000***
	B- Construction Phase CPEMP Implementation			
5	Fixed cost per project (fire safety equipment, septic tanks, installation of noise barriers, and environmental monitoring equipment) Estimated 20 sub-projects, and lump sum each project cost	1,000,000	10	10,000,000
6	Monthly operational cost (PPE, first aid, solid waste management, water sprinkling, traffic management, Restoration of camp sites etc.) for 12X10=120 months	300,000	120	36,000,000
	Total-B			***46,000,000***
	C-Operational Phase MP Implementation			
7	Fixed cost per project (as above)	500,000	10	5,000,000
8	Monthly operational cost (For One Year)	1,000,000	12	12,000,000
	Total-C			***17,000,000***
	D-Training			
9	Training cost (EMF) for 6 trainings	500,000	6	3,000,000
	Total-D			***3,000,000***

	E- Third Party Validation Cost			
10	Third party validation cost (For One Year)	1,000,000	12	12,000,000
	Total-E			***12,000,000***
	F- Operation of Environment & Social Cell			
11	Environment and Social Cell Cost (For One Year) (Salary of Environmental Engineer, Junior Environmental Scientist at PIU, and one environmental Scientist at each district and Operational expenses of the cell)	1,800,000	12	21,600,000
	Total-F			***21,600,000***
	Grand Total			**101,600,000**

ANNEXURE-1

PROCEEDINGS

Stakeholder consultation workshop was organized on March 22, 2019 at KWSB office, Karachi. The objective of the workshop was to disseminate draft version of Environmental and Social Management Framework (ESMF) of the 'Karachi Water and Sewerage Services Improvement Project (KWSSIP)' to the stakeholders and get their feedback. The draft ESMF will be finalized in the light of stakeholders' feedback, suggestions and their concerns. This consultation is one of the requirement of the World Bank as per its stakeholder consultation and disclosure policy.

About 24 participants attended the workshop. They were the representatives of KWSB, DMCs, KMC, NESPAK, Sindh EPA, Asian Infrastructure Investment Bank (AIIB), Karachi Chamber of Commerce and Industry (KCCI), Sindh Solid Waste Management Board (SSWMB), MM Pakistan and consultants.

KWSB started the proceedings, welcomed all the participants, explained the objective of the consultation workshop and briefly described the subject projects. After brief introduction of the project, the environmental expert, presented the Environmental Management Framework (EMF). After EMF presentation, the social expert, presented the Social Management Framework (SMF).

After the presentation session, participants were requested to pose questions regarding both the frameworks presented. Following were the key questions raised by the participants and corresponding answers by the KWSB, environmental and social experts:

Q: What type of the subprojects will be under the project and their location?
A: At this stage, the type of subprojects and their locations are not finalized. These will be finalized later on.

Q: What will happen for those subprojects in Katch Abadis in case the land is under litigation? Mostly Katch Abadis land is under litigation.
A: KWSSIP will follow court order and proceed as per the law of the land.

Q: Will roads be rehabilitated after the completion of water and sewerage subprojects? Mostly we have observed that roads remain unattended after the rehabilitation work and cause problem to the community.
A: Road renovation/rehabilitation will be the part of KWSSIP. Complaint Cell in KWSB will also redress grievances of the community regarding all such issues.

Q: Will KWSB consult stakeholder/community at all stages of the project?
A: It is mandatory to consult and engage all the stakeholder and community and disclose information at all stages of the project.

Q: Climate change impacts are not mentioned in the framework
A: This project focuses on climate change impacts of flood and heat wave in the form of sewerage and water supply projects.

Q: What was the basis of KWSSIP design?
A: KWSB Master Plan 2008 was followed while designing the project.

Q: Storm water drains are being used for the disposal of industrial wastewater due to which flooding is the major issue in Karachi. Will this project address this issue?

A: Yes. This is also one of the focused areas of the project to monitor industrial discharges in the storm water drainage and design projects accordingly. The S III and Malir Basin Interceptor are the major projects due to which city wastewater will not be discharged in Lyari and Malir rivers.

Annexure 2: Agreed Project Screening mechanism

The selection criteria outlined in this section apply to and will guide the selection of infrastructure investments in SOP-1 of this SOP, and are the following:

A. General Criteria

1. Selected infrastructure investments must be within Sindh Province, Pakistan and benefit the area of Karachi Municipality;

2. Selected investments must directly improve water supply, access to safely managed sanitation and/or the financial sustainability of KWSB or be otherwise in line with the project development objective;

3. Selected investments which may *indirectly* lead to improvements in water supply, access to safely managed sanitation and/or the financial sustainability of KWSB may be eligible if the linkages with such improvements are convincingly demonstrated;

4. Selected investments must follow all social-, environmental-, procurement- and financial management requirements of the World Bank and the Government of Pakistan and Government of Sindh, and obtain all required environmental and regulatory clearances;

5. Selected investments must comply with the set of criteria defined in the KWSSIP Project Risk Reducing Procedure (KWSSIP-RRP) as outlined in Annex 4 of this document, and in detail in the Social Management Framework; Furthermore, investments and preparatory studies of any kind for investments that would either be risk rated EA Category A under Environmental Assessment OP4.01 or High under Environmental and Social Standards 1 (ESS1), will NOT be eligible for financing under this project (i.e. SOP1)

6. Investment will not be prepared for, or take place in, areas where the standards and conditions of the Bank's operational policy on involuntary resettlement (OP 4.12), and/or Environmental and Social Standard 5 (ESS5 of the Bank's Environmental and Social Framework (ESF)) on land acquisition, restrictions on land use, and involuntary resettlement cannot be ensured. OP 4.12 and ESS5, among other stipulations, require compensation and (if applicable) rehabilitation of affected people including persons without land title, squatters, vendors, hawkers etc.

7. *Ceteris paribus*, priority shall be given to infrastructure investments that align with the reform program of Component 1 of SOP-1;

8. Cost effectiveness and cost efficiency shall be key criteria for selected investments. *Ceteris paribus*, interventions with higher expected return shall be given priority.

9. Selected investments shall not adversely change the quality or quantity of water flows to other riparian(s), and will not be adversely affected by the other riparian states possible water use;

B. Appraisal Criteria and Standards of Preparation

10. Preparation shall be based on the completion of detailed field surveys and engineering designs to ensure feasibility, cost-effectiveness and compliance of technical standards with international best practice;

11. Preparation should be based on a suitable design period for each kind of asset based on forecasts of: population, water use/supply, and wastewater quantity and quality. These assumptions must be suitably validated

12. A detailed Project Implementation Plan must be prepared for each selected investment with realistic timelines for each stage of preparation and implementation;

13. Adequate budget provisions must be confirmed, including price and physical contingencies as appropriate;

14. Adequate consideration is to be given to operations and maintenance costs and arrangements to ensure investments are sustainable from a financial and institutional point of view;

15. Planning and design should be consistent with other investments undertaken by KWSB, and in particular, expected works under Projects 2 and 3 of this SOP;

16. Where possible, selected investments should use local labor and include suitable provisions for improving the working conditions of local workers;

17. Selected investments should avoid areas of disputed land tenure, although such areas will be considered with clear proposals for early resolution. Priority will be given to subprojects that avoid land acquisition altogether and/or can obtain land through donation;

C. Selection and Approval Cycle

18. *Stage 1 - Annual Planning Meeting:* An annual planning meeting will be organized by the Project Implementation Unit with participation of KWSB management, the Project Steering Committee and other relevant stakeholders. At this meeting, the PIU will update stakeholders on project progress and present a draft action plan with a proposed long-list of investments to be undertaken in the next planning period.

19. Any proposed investments are to comply with the General and Appraisal Criteria outlined above. Taking into account feedback received at the meeting, the PIU will then submit a finalized action plan to the World Bank for comments, review and no objection.

20. *Stage 2 – Preparation and Evaluation of Detailed Project Reports (DPRs):* The PIU will prepare DPRs for investments contained in the approved action plan. This will involve compiling feasibility reports with detailed engineering designs, cost projections and the environment and social assessments as needed in line with the Environment & Social Management framework of the project.

21. The PIU with support of KWSB will conduct consultations with the local community on all aspects of the proposed investment(s), while making available all relevant information to the public. Evidence of consultations and community agreement are to be integrated into the DPR.

22. Finalized DPRs will be submitted to KWSB management for approval, and subsequently to the World Bank for review and no-objection.

23. *Stage 3 –Approval:* DPRs recommended by KWSB management and in receipt of no-objection by the World Bank will be considered approved for tendering for contract amounts below US$ 5 million. Contracts above this threshold will be reviewed and receive approval from the Project Steering Committee.

24. *Stage 4 – Bid Documents and Bidding:* The Project Implementation Unit will be responsible for managing the tendering processes associated with approved DPRs in line with World Bank procurement and financial management rules.

25. *Stage 5 – Construction Supervision, Quality Assurance, Monitoring and Evaluation:* The PIU would be responsible for putting in place arrangements for supervision of all contracts. All civil and mechanical works

investments would require comprehensive on-site construction supervision, in accordance with international best practice.

26. If required, the PIUs may procure and manage supervision consultants to address any capacity gap for effective construction supervision. Based on quarterly monitoring reports, the Project Steering Committee will also help monitor the implementation of investments.

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