Environmental & Social Impact Assessment (ESIA)

April 2024

K-IV Augmentation Works

Karachi Water & Sewerage Services Improvement Project
SOP-II, Component-II,

KWSSIP

KARACHI WATER AND SEWERAGE BOARD

Pakistan

Government of Sindh

Second Karachi Water and Sewerage Services Improvement Project (KWSSIP-2)

K-IV Augmentation Works

Environmental and Social Impact Assessment (ESIA)

Karachi Water and Sewerage Corporation (KWSC)

Abbreviations and Acronyms

AF	Associated Facility
AED	Anti-Encroachment Drive
AIDS	Acquired Immunodeficiency Syndrome
AIIB	Asian Infrastructure Investment Bank
AMSL	Average Mean Sea Level
BOD	Biochemical Oxygen Demand
BoQs	Bills of Quantities
CBO	Community Based Organization
CCI	Council of Common Interest
CCR	Community Complaints Register
CDA	Canal and Drainage Act
CDM	Clean Development Mechanisms
CHS	Community Health and Safety
CoC	Code of Conduct
COD	Central Ordinance Deport
CoI	Corridor of Impact
CPID	Consultation, Participation and Information Disclosure
CPR	Cardiopulmonary resuscitation
CSG	Civil Society Group
dB	Decibels
DCR	District Census Report
DG	Directorate General
DMC	District Municipal Corporation
E&S	Environment and Social
EA	Environmental Assessment
EC	Environmental Checklist
ECO	Economic Cooperation Organization
EHS	Environment, Health and Safety
EHSG	Environmental, Health, and Safety Guidelines
EIA	Environmental Impact Assessment
EL	Environmental Laboratory
EPA	Environmental Protection Agency
ERP	Emergency Response Plan
ESC	Environment and Social Cell
ESCP	Environmental and Social Commitment Plan
ESF	Environment and Social Framework
ESIA	Environmental and Social Impact Assessment
ESMP	Environmental and Social Management Plan
ESS	Environmental and Social Standard
FFD	Fire Fighting Department
FGD	Focus Group Discussion
GBV	Gender Based Violence
GDP	Gross Domestic Product
GHG	Greenhouse Gases
GIIP	Good International Industry Practice
GKBWS	Greater Karachi Bulk Water Supply
GoP	Government of Pakistan
GoS	Government of Sindh
GRC	Grievance Redress Cell / Grievance Redress Committee
GRM	Grievance Redress Mechanism
GTS	Garbage Transfer Station
H&S	Health and Safety
HAVS	Hand Arm Vibration Syndrome
HDPE	High Density Polyethylene

HIV	Human Immunodeficiency Virus
IEE	Initial Environmental Examination
ILO	International Labour Organization
IPOE	International Panel of Expert
IUCN	International Union for Conservation of Nature
JV	Joint Venture
KDA	Karachi Development Authority
KMC	Karachi Metropolitan Corporation
KSDP	Karachi Strategic Development Plan
KWSC	Karachi Water and Sewerage Corporation
KWSSIP	Karachi Water and Sewerage Services Improvement Project
LAA	Land Acquisition Act
LDA	Lyari Development Authority
LMP	Labor Management Procedures
LPG	Liquefied Petroleum Gas
MDA	Malir Development Authority
MGD	Million Gallons Per Day
MS	Mild Steel
NCS	National Conservation Strategy
NDMA	National Disaster Management Authority
NDWI	Normalized Difference Water Index
NESPAK	National Engineering Services Pakistan
NGO	Non-Government Organization
NOC	No Objection Certificate
NPO	No project Option
NPZ	Noise Perimeter Zone
NRCS	Natural Resources Conservation Service
NRL	National Refinery Limited
NRW	Non-Revenue Water
NS	Not Specified
O&M	Operation and Maintenance
OHS	Occupational Health and Safety
P&D	Planning and Development
PAF	Pakistan Air Force
PAPs	Project Affected Parties/Persons
PCC	Plain Cement Concrete
PCEA	Prohibition of Child Employment Act
PCRWR	Pakistan Council of Research in Water Resources
PD	Project Director
PDHS	Pakistan Demographic and Health Survey
PDMA	Provincial Disaster Management Authority
PGA	Peak Ground Acceleration
PIU	Project Implementation Unit
PM	Project Manager
PM	Particulate Matter
PMD	Pakistan Metrological Department
PPEs	Personal Protective Equipment
PPV	Peak Particle Velocity
PRRP	Project Risk Reducing Procedure
PTCL	Pakistan Telecommunication Company Limited
QESMR	Quality Environmental and Social Monitoring Report
RF	Resettlement Framework
RoW	Right of Way
RP	Resettlement Plan
SC	Supervision Consultant

SEA	Sexual Exploitation and Abuse
SEP	Stakeholder Engagement Plan
SEPA	Sindh Environmental Protection Act / Sindh Environmental Protection Agency
SEQS	Sindh Environmental Quality Standards
SH	Sexual Harassment
SKAA	Sindh Katchi Abadis Act
SLGA	Sindh Local Government Act
SLR	Sea Level Rise
SMF	Social Management Framework
SOPs	Series of Projects
SOP	Standard operating procedure
SSESMP	Site Specific Environmental and Social Management Plan
SSGPL	Sui Sothern Gas Pipelines Limited
SSSD	Sindh Strategy for Sustainable Development
SSWMB	Sindh Solid Waste Management Corporation
SSWP	Sindh Strategic Water Plan
STD	Sexually Transmitted Disease
TMP	Traffic Management Plan
TORs	Terms of Reference
TPV	Third Party Validation
UNCRPD	United Nations Convention on the Rights of Persons with Disabilities
UNO	United Nations Organization
VEC	Valued Environmental Components
WB	World Bank
WBG	World Bank Group
WHO	World Health Organization
WWF	World Wildlife Fund

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Executive Summary

1. The Second Karachi Water and Sewerage Improvement Project (KWSSIP-2) will be implemented by the Government of Sindh together with the Karachi Water and Sewerage System Corporation (KWSC). This is the second project series (SOP-2) of the KWSSIP which will deepen the reforms commenced under SOP-1. This project consists of three components with the overall objective of increasing the access to safe water and sanitation in Karachi City, Pakistan.

2. One of the subcomponents of the Component 2 of SOP-2 is the KIV Augmentation Works which aims to convey about 260 MGD of water from the government financed KIV water reservoirs going to the existing water networks in Karachi City by installing water pipes. There are three new water supply networks that will be installed under this subcomponent.

3. The overall E&S risk of SOP-2 is high considering that the environmental risk is substantial while the social risk is high, based on the internal E&S risk classification of World Bank. An ESIA was prepared for KIV Augmentation Works to assess the E&S risks associated with the construction and operation of this subcomponent and develop a corresponding ESMP to avoid or minimize the adverse impacts to the environmental and stakeholders.

4. The scope of the ESIA includes (i) review of the applicable national E&S legislative and policy, (ii) assess the existing physical, biological and socio-economic baseline conditions, (iii) Identify potential adverse and positive E&S impacts from all stages of the project, (iv) assess and compare different subproject alternatives in terms of E&S impacts, (v) identify stakeholders that are likely to be affected or have interest or a stake in the project, with emphasis on disadvantaged and vulnerable groups and carry out consultation to solicit their concerns regarding the project, and (vi) provide ESMP for all stages of the project as a tool for the implementation of the suggested measures, along with monitoring and evaluation mechanism with adequate resources including capacity building of implementing agencies.

5. The KIV Augmentation Works will consist of laying water pipes from three KIV reservoirs to Karachi City. There three routes identified: (i) Route 1 will convey water from Reservoir 1 to the Y Junction in Landhi. This will transport 65 MGD of water and is approximately 28 km long. (ii) Route 2 consists of 39.5 km long pipe that will convey 130 MGD water from Reservoir 2 to Gulbai and (iii) Route 3 will run from Reservoir 3 to Qasba and Banaras and will consist of 28.5 km pipe to transport 65 MGD water.

6. The RoW of this project consist of the 5-m trench for the water pipe (diameter of pipe ranges from 6 to 8 ft), 2 meters from one side of the trench and additional 10 meters from the other side.

7. The proposed water pipes will be installed in open/barren areas, built-up areas, green areas/parks, nullah/drain and roads. There are two water bodies near the proposed routes namely, Lyari River and Gujjar Nullah. These water bodies receive the sewage from the nearby households but are usually dry. There are about 1,719 trees located within the proposed three routes of which, two tree species, Guggul and Bhai Guggul are considered as critically endangered and endangered, respectively, in the IUCN Red list.

8. There are about 66 sensitive receptors identified within the RoW which include nine shrines and graveyards, 29 mosques, 20 educational institutes, and eight health institutes.

9. The following are the potential environmental and social risks and impacts during the **construction phase** of the project.

Impacts related to ESS 2: Labor and Work Conditions

10. The construction workers will be exposed to the occupational health and safety hazards associated with the construction activities. To ensure safety protocols are implemented during construction, the contractor is required to develop and implement an OSH Program.

11. Workers may also be exposed to labor risks such as child and forced labor, GBV, discrimination, SEA/SH and labor exploitations. A Labor Management Procedure was developed for KWSSIP-2 to manage the identified labor risks. The key highlights of the LMP on how to address the issues of child and forced labor, labor influx, GBV, SEA/SH, occupational health and safety, and trafficking will be included in the bid documents of the contractors.

Impacts related to ESS 3: Resource Efficiency and Pollution Prevention Management

12. Oil/chemical spill and leaks may contaminate the nearby water bodies and soil. Appropriate measures to contain the leaks and proper maintenance of the equipment shall be observed.

13. Wastewater will be generated by the workers and from the construction sites. Surface run-off from the excavated areas may also increase the suspended solids of the water bodies. Wastewater and the surface runoff should not be discharged directly to the water bodies without proper treatment.

14. Improper management of domestic solid wastes and hazardous wastes may cause deterioration of soil quality and water sources quality.

15. Excavation activities may cause the generation of dust. Vulnerable groups such as children and the elderly are at risk when exposed to high dust emission. With this, mitigating measures such as regular watering of construction sites, covering of spoils and other measures to contain or minimize the dust emissions shall be implemented.

16. Vehicles and heavy equipment will emit gaseous pollutants when in use. All vehicles and equipment should be maintained in good working condition to minimize the exhaust emissions and subsequent impacts

Impacts related to ESS 4: Community Health and Safety

17. One of the major impacts of the project is the generation of traffic within the area. The water pipes will cross major highways and roads which may cause road closures during construction. The delivery of construction materials onsite, the operation of heavy equipment and the tunnel activities may also increase the traffic congestion in the area. These activities may also cause road accidents and road damages. A traffic management plan should be implemented, and the contractor should inform the public if there will be road closures.

18. Passersby and vehicles may also accidentally fall in the excavated areas especially during night. With this, barricades, warning signs and safety signages will be provided int the construction site.

19. The local community may also be exposed to communicable and vector-borne diseases because of the influx of workers. The influx of workers may increase the

crime rate within the locality including GBV and SEA/SH. This is included in the LMP developed for KWSSIP-2.

20. Social conflicts may arise between the labor force and local community. A GRM has been established to resolve all issue related to the community.

21. A disruption in some basic services may also be experienced since there are existing sewer lines, gas pipes, electricity and telephone lines within RoW. This will be relocated prior the start of the construction. The public will be notified for the disruption and close coordination with the concerned departments will be done to reduce inconvenience to the residents.

Impacts related to ESS 5: Land Acquisition, Restriction on Land Use and Involuntary Resettlement

22. The whole RoW is owned by the government thus, land acquisition is not required. However, there are small business operators within the RoW that are needed to be relocated. A Resettlement Action Plan is being prepared and to be implemented.

Impacts related to ESS 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources

23. It is estimated that about 1,685 trees within the RoW are to be removed during construction. A tree plantation sub-plan was developed. All trees to be cut shall only be limited to within RoW and tree replacement shall be observed.

Impacts related to ESS 7: Indigenous People

24. There are no know tribal or indigenous people within CoI.

Impacts related to ESS 8: Cultural Heritage

25. There are no cultural sites within the CoI. However, shrine, graveyards and mosques are located within the CoI that may be exposed to the environmental and social impacts of the project.

26. The operation of the project is limited to maintenance activities and repair of pipes if needed. The following are the potential E&S impacts of **the O&M activities**.

Impacts related to ESS 2: Labor and Working Condition

27. Workers are exposed to occupational health and safety hazards when doing the repair or maintenance of the pipes. An OSH program should also be developed and implemented.

28. Labor risks such as labor exploitation, child and forced labor are also a potential risk. The LMP developed for KWSSIP should also be implemented during operation phase.

Impacts related to ESS 3: Resource Efficiency and Pollution Prevention Management

29. A standby generator will be operated as a backup power source. This may emit gaseous pollutants and may generate noise. However, this is expected to be minimal only since it will only be used during power outages.

Impacts related to ESS 4: Community Health and Safety

30. The project is expected to reduce and possibly eliminate water shortage and water borne diseases, increase water carrying capacity by installing new water mains and uplift the aesthetics of the area through tree plantations.

31. Pipe damages/leaks and illegal water connections along the proposed KIV Augmentation Works can be a point of entry of contaminants and therefore, will deliver contaminated water to the households. With this, a regular inspection of the pipes should be done. A Water Safety Plan should also be developed and implemented to ensure the safety of the water.

32. As part of the ESIA, an Environmental and Social Management Plan (ESMP) to mitigate the identified environmental and social risks. In addition, a Stakeholder Engagement Plan, a Labor Management Procedure and a Resettlement Action Plan were developed for this project. A CESMP should also be developed by the contractors to demonstrate their approach on how to comply with the ESMP. An Environmental and Social Monitoring Plan was also developed to monitor and verify the effectiveness of the implementation of mitigating measures in terms of minimizing the negative impacts. The total estimated cost for the environmental and social management, monitoring and auditing during pre-construction, construction and O&M (annual cost and will be updated for next upcoming years accordingly) comes to about **PKR 136.08 million** excluding resettlement and compensation cost.

33. The proposed project is under the PIU of KWSSIP-2 during the pre-construction and design phase. The Project Director (PD) has the overall responsibility for the design and pre-construction requirements. During construction, the ESC will be responsible for the overall implementation of the ESMP, RP, and other related requirements. The operation of the project will be under the direct jurisdiction of Engineers and Plant Managers, who shall also be responsible for the monitoring and compliance to the ESMP.

34. A Grievance Redress Mechanism (GRM) was developed to address any complaints or grievances that may arise during the implementation of the project. Complaints will include, but not limited to, E&S issues (dust, noise, air pollution, social and cultural issues), damage and blockage of public utilities, traffic inconvenience, gender-based violence (GBV) and harassment, resettlement issues including loss of livelihood; and issues related to compensation of resettlement impacts. Separate Grievance Redress Committees (GRC) are to be formed for the community, subproject and at the PUI level. A GRC dedicated to resolve GBV-related issues will also be formed. The objectives of the GRM are (i) establish an organizational structure to resolve any grievances from individuals and communities fairly and equitably, (ii) provide a platform for the aggrieved individual or community to deliver their grievances, (iii) ensure that affected communities and individuals are treated fairly at all times, (iv) identify flaws in the operational functions of the project and suggest corrective measures; and (v) ensure the sustainability of the project. Complainants may lodge their grievances through several channels, including online, mail, phone, WhatsApp, e-mail, and complaint boxes. Moreover, PIU has established an e-Portal for filing and tracking progress of complaints lodged online.

35. This ESIA report should be updated as needed due to changes in project design, baseline conditions or identification of potential new impacts.

1 Introduction

1.1 Background

1. The Government of Sindh (GoS), through the Karachi Water and Sewerage Corporation (KWSC), will be implementing the Second Karachi Water and Sewerage Improvement Project (KWSSIP-2) to improve the access to safe water supply and sewerage services in Karachi, Pakistan. This is the second project series (SOP-2) of the KWSSIP which will deepen the reforms commenced under SOP-1.

2. The SOP-2 has three project components: Component 1 will finance reform and capacity building measures, Component 2 will undertake selected infrastructure investments, thereby ameliorating water and sewer services in Karachi and increasing the city's resilience to water shortages, floods, and saltwater intrusion and lastly, Component 3 will fund project management and associated studies.

3. Under Component 2 of SOP-2 is the subcomponent KIV Augmentation that will connect the government financed water reservoirs under the KIV water project to the existing water supply network in Karachi.

1.2 Purpose of the ESIA

4. The overall risk of KWSSIP SOP-2 has been classified as substantial for environment, and high for social which includes the risk for sexual exploitation and abuse and sexual harassment (SEA/SH). The overall E&S risk is therefore categorized as high thus, Environmental and Social Impact Assessment (ESIA) should be prepared.

5. This report is the ESIA for the K-IV Augmentation Works, a subcomponent of KWSSIP SOP-2. The objective of this ESIA is to assess the environmental and social risks associated with the activities of this subcomponent and to develop an environmental and social management plan (ESMP) to minimize the impacts of the identified risks.

1.3 Scope of the ESIA

6. The study has been conducted in accordance with the applicable environmental and social policies, laws, guidelines, acts and legislations of the Government of Pakistan (GoP) and Sindh and the World Bank (WB) Environmental and Social Framework (ESF) and its relevant Environmental and Social Standards (ESSs).

7. Based on the categorization of Sindh Environmental Protection Act of 2014 (SEPA), the proposed K-IV Augmentation project falls under Schedule II, Category G – Water Supply and Filtration which requires the project to submit an Environmental Impact Assessment (EIA) to SEPA. The ESIA prepared for proposed project will also be submitted to SEPA by KWSSIP to initiate the process of NOC.

8. The scope of work conducted as part of the ESIA are the following:

    - Review the applicable national E&S legislative and policy;
    - Assess the existing physical, biological and socio-economic baseline conditions;
    - Identify potential adverse and positive E&S impacts from all stages of the project;

- Assess and compare different subproject alternatives in terms of E&S impacts;
- Identify stakeholders that are likely to be affected or have interest or a stake in the project, with emphasis on disadvantaged and vulnerable groups and carry out consultation to solicit their concerns regarding the project ; and
- Provide Environmental and Social Management Plan (ESMP) for all stages of the project as a tool for the implementation of the suggested measures, along with monitoring and evaluation mechanism with adequate resources including capacity building of implementing agencies.

9. The ESIA was conducted within the defined Project Corridor of Impact (CoI) which includes the areas that are most likely be affected, directly and indirectly, by the project.

(i) Project Right-of-Way (RoW)

10. The project RoW is the area that KWSC is legally entitled to. The project RoW is approximately 17 meters wide (5-meter trench for the water pipe and additional 2 meters on one side and 10 meters on the other side of the trench) for the entire water pipe laying.

11. In general, major construction activities will be confined within the RoW. All the infrastructure and commercial activities within the existing or proposed RoW are to be relocated since they will be directly affected by the project.

(ii) Corridor of Impact (CoI)

12. The proposed CoI is delineated as the direct and indirect impact areas of the project. The direct impact area comprises of the RoW and the designated areas for the support facilities for the construction such as the workers camp site, spoil storage area, construction yard and others. The project area of influence that can be indirectly affected by the project is estimated to be 15 meters from each side of the Row.

1.4 Approach and Methodology of the ESIA

13. The detailed approach and methodology employed for the ESIA is discussed below.

14. The E&S team conducted the reconnaissance field visits in November 2021. The major objective of the reconnaissance field visits was to be familiarized with the environment in general, and the main outcome was the refinement of limits of RoW and CoI. Furthermore, the stakeholder consultation and acquisition of secondary data/information were also carried out for identification of impacts at scoping stage.

15. For the primary data acquisition, the E&S team conducted the detailed field visit from February 2022 to June 2022. The major objective of the field visits was to collect the baseline data on physical, eco-biological and social aspects along with identification, assessment, and categorization of the significant environmental and social impacts of the proposed project.

16. Secondary data was collected from published sources/reports and relevant departments. Data collected was verified through visual observations during reconnaissance, route optimization, and detailed surveys.

1.4.1 Environmental and Social Baseline

17. A review of the biophysical, ecological, and legal literature relevant to the project was conducted. The review of secondary sources and informal initial field investigations were undertaken to prepare a preliminary assessment of the identified study area's physical and social environment, biodiversity, and conservation significance. These preliminary literature reviews also assisted in identifying data gaps which would require the collection of additional primary information through a physical field survey. The following activities were included in this stage of the project:

    - Data and information were collected from the various government relating to site aspects climate (weather), groundwater quality, and soils; secondary ecological data sources were collected and assessed;
    - An appraisal was made of all legislation having direct and indirect relevance to environmental management within the study area, including aspects such as biodiversity conservation, water quality, waste management, natural resource management, and spill response;
    - Previous environmental site studies, where available, were reviewed as well as relevant scientific journal articles; and
    - Thereafter, an information gap analysis was undertaken to identify the areas where further primary data collection would be required to complete the ESIA.

18. **Physical Environment.** The information acquired for the establishment of physical environment baseline included the following main parameters:

- Land resources (including land use pattern, soil composition, contamination of soil and soil erosion etc.);
- Water resources (including available surface and groundwater resources and natural streams, hydrology, spring water, water supply, water contamination etc.);
- Climate data (including temperature, rainfall, humidity, wind speed and direction etc.);
- Ambient air quality and noise level monitoring data; and
- Existing solid waste management and effluents disposal practices and storm water drainage.

19. **Ecological Environment.** The information collected through primary (field surveys) and secondary data sources for the establishment of ecological environment baseline included the following main parameters:

    - Flora (trees, herbs, shrubs, grasses and overall vegetation including valuable or rare trees and their loss due to implementation of the project etc.);
    - Fauna / Wildlife (Mammals, reptiles, amphibians and avifauna);
    - Agriculture and livestock;
    - Protected areas, National Parks, Game reserves, Game sanctuaries any other ecologically important areas (survey confirmed that there are no such areas found in and around the CoI and project footprint area);
    - Migratory birds' corridors (survey confirmed that migratory bird's corridors are not found in and around the CoI and project footprint area); and
    - Endangered species (both flora and fauna).

20. **Ambient Air Quality and Noise Monitoring.** Ambient air quality and nose level monitoring were done in 27 selected sampling locations within the three routes. The sampling points were selected where there are sensitive receptors.

21. Ambient air quality monitoring (24-hour averaging period) was done for the following parameters: sulfur dioxide, nitrogen dioxide, total suspended solids, PM_{10}, and $PM_{2.5.}$ Sampling of carbon monoxide were taken within an 8-hour averaging time, while ozone was taken within a 1-hour averaging time. Noise level was measured during daytime (7:00 to 22:00) and nighttime (22:00 to 7:00).

22. The location of the ambient air quality and noise level monitoring stations is presented in Table 1-1.

Table 1-1: Ambient Air Quality and Noise Sampling Location

Monitoring Point	Location
Route 1 – Reservoir 1 to Y-Junction	
1	Reservoir 1
2	Link Road – Gulshan-e-Hadeed Junction
3	Settlements along RoW in Gulshan-e-Hadeed
4	Steel Town Roundabout
5	Pakistan Railways Main Line Crossing
6	Bhains Colony – Settlements
7	Landhi Industrial Area
8	Y- Junction
Route 2 – Reservoir 2 to Gulbai	
1	Gulbai Roundabout
2	Ghani Chowrangi
3	SITE Area flyover over Manghopir Road
4	Gujjar Nullah crossing on Sir Shah Muhammad Suleman Road
5	Civic Center Karachi
6	Al-Hilal Housing Society
7	COD Hills Filter Plant
8	Abul Hasan Isphahani Road next to Bhayani Heights
9	Intersection of New Karachi University Road and Hijri Road
10	Intersection of Karachi-Hyderabad Motorway M9 and Northern Bypass Link
11	Northern Bypass Link next to Masjid Omer Farooque (near Gulshan e Sachal)
12	Reservoir 2
Route 3 – Reservoir 3 to Banaras and Qasba	
1	Reservoir 3
2	Main Intersection along RoW between Lyari Basti and Ajmer Goth
3	KDA Chowrangi
4	Powerhouse Chowrangi
5	Talib Chaman Park
6	Shahrah Noor Jahan next to SDPO Shadman Office
7	Banaras Terminal Point

23. **Surface Water Quality Sampling and Analysis.** Within the three proposed routes, water bodies were only seen in Route 2 namely, Gujjar Nullah and Lyari River. These

water bodies receive the wastewater generated by the households and nearby industries. One water sample was collected in each water body and were analyzed in terms of chemical oxygen demand (COD), biological chemical demand (BOD), total dissolved solids (TDS), total suspended solids (TSS), chloride, fluoride, oil and grease, phenols, cyanide, MBAS, sulfate, sulfide, ammonia, total coliform, heavy metals, etc.

24. **Drinking Water Quality Sampling and Analysis.** Six drinking water samples were collected within the three routes. The water samples were analyzed in terms of and were analyzed in terms of color, turbidity, total dissolved solids (TDS), total suspended solids (TSS), chloride, fluoride, nitrate, cyanide, fecal coniform, total coliform, heavy metals, etc.

Table 1-2: Location of Drinking Water Quality Sampling

Monitoring Point	Location
Route 1 – Reservoir 1 to Y-Junction	
1	Reservoir 1
2	Y- Junction
Route 2 – Reservoir 2 to Gulbai	
1	Ghani Chowrangi
2	Northern Bypass Link next to Masjid Omer Farooque (near Gulshan e Sachal)
3	Near Bait ul Mukaram
Route 3 – Reservoir 3 to Banaras and Qasba	
1	Main Intersection along RoW between Lyari Basti and Ajmer Goth

25. **Socio-economic survey.** A survey was conducted to assess the socio-economic situation in the project areas. Information obtained from the survey was used to identify the potential social impacts of the proposed project. Mitigating measures are also suggested considering the baseline socio-economic conditions. The findings of the survey are discussed in the succeeding sections. The socio-economic survey had 463 respondents, which is about 5.3% of the estimated number of households along the CoI.

26. Site reconnaissance was done prior to the conduct of the survey. The comprehensive survey was done thereafter using the following tools. The survey tools used are attached as **Annex-II.**

- Socio-economic survey
- Women's Survey
- Public Consultation
- Gender Consultation

27. The following major aspects were covered in the socio-economic baseline survey of the sample population settled along the CoI. :

- Demographic characteristics;
- Literacy status/ education;
- Nature of business/occupation;
- Livelihood/income;
- Living standard of the population;

- Access to credit;
- Social Infrastructure available;
- Gender issues;
- Pressing needs of the people;
- Community perception about the project etc.;
- Labor Influx to project area;
- Waste management services;
- Religious, cultural and heritage information (mosques, shrines, graveyards);
- Archaeological monuments;
- Buildings and infrastructure details, including residential, commercial, and animal shed for complete/partial relocation; and
- Other private/public infrastructures such as roads, telephone poles, hand pumps, tube wells, schools, universities, markets, hospitals, shops, libraries, mosques, etc.

28. Extensive public consultations were conducted in various locations along the proposed routes. Gender consultations were done by female staff. Apprehensions and suggestions of the stakeholders were recorded.

29. The information obtained through the surveys were used in determining the existing socioeconomic conditions, predicting potential impacts on people and identifying the mitigation measures.

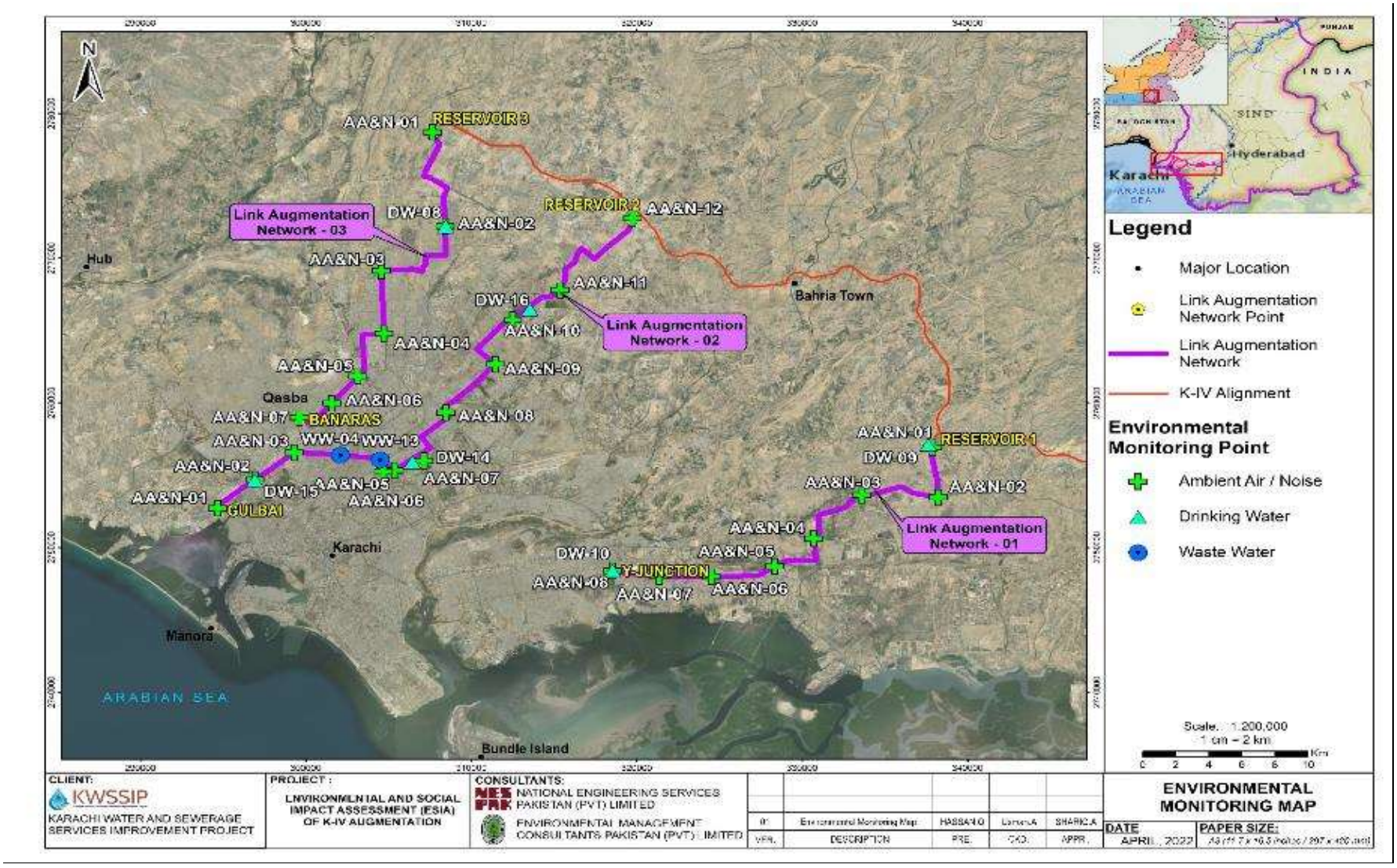


Figure 1-1: Location of Environmental Quality Sampling

1.4.2 Analysis of Alternatives

30. It is a mandatory requirement for ESIA study to analyze each potential alternative available that could have been developed to meet the objectives and recommend the most environmentally, socially and economically feasible option.

31. To select the most viable route keeping in view the environmental, economic and social constraints, the analysis of different alternatives was carried out. Moreover, the No Project Option (NPO) was also considered with reference to the increased water supply demand due to existing population. This exercise confirmed the justification for the need of the proposed project.

1.4.3 Stakeholder Consultations

32. Stakeholder identification and consultation were done as per the Stakeholder Engagement Plan (SEP) of KWSSIP-2. The project stakeholders were identified during inception/scoping stage. The project stakeholders were consulted during the field surveys to gather comments or inquiries on the anticipated environmental and social issues related to the project and to get suggestions on potential mitigation measures.

33. Moreover, two stakeholder consultation workshops were also conducted to engage the concerned stakeholders. These workshops were arranged on April 28, 2022 and July 28, 2022 at Marriott Hotel and Regent Plaza Karachi, respectively. About 45 representatives (of 29 entities) participated in the first workshop while about 70 representatives (of 47 entities) took part in the second workshop. The consultation workshops were conducted in relation to information disclosure and stakeholder's engagement on KWSSIP-2 project.

1.4.4 Impact Identification and Risk Assessment

34. The E&S impacts arising from each phase of the proposed project have been identified and assessed based on field data, secondary data, expert opinions and examining previous similar projects in Pakistan. These include effects on physical, biological and socio-economic environment.

35. The risk of each E&S impact was assessed using a semi-quantitative analysis. The risk was computed using the formula below.

RISK = MAGNITUDE OF IMPACT X SENSITIVITY TO RECEPTORS

a. Impact Magnitude

36. The E&S impacts are categorized as major, moderate, minor or nominal based on consideration of the parameters such as i) duration of the effect; ii) spatial extent of the impact; iii) reversibility; iv) likelihood; and v) legal standards and established professional criteria as presented in Table 1-3.

Table 1-3: Parameters for Determining Magnitude of Impacts

Parameter	Major (4)	Moderate (3)	Minor (2)	Minimal (1)
Duration of E&S impact	Long term (beyond the project life)	Medium Term Lifespan of the project (within the project life span)	Limited to construction period	Temporary with no detectable E&S impact

Parameter	Major (4)	Moderate (3)	Minor (2)	Minimal (1)
Spatial extent of the E&S impact	Widespread far beyond project boundaries	Beyond next project components, site boundaries or local area	Within project boundary	Specific location within project component or site boundaries with no detectable the E&S impact
Reversibility of the E&S impacts	E&S impact is effectively permanent, requiring considerable intervention to return to baseline	Environmental or social parameter needs a year or so with some responsesto come back to baseline	Baseline returns naturally or with limited response within a few months	Baseline remains constant
Legal standards and established professional criteria	Breaches national standards and or international guidelines/obligations	Complies with limits given in national standards but violates international lender guidelines in one or more parameters	Meets minimum national standard limits or international guidelines	Not applicable
Likelihood of E&S impacts occurring	Occurs under typical operating or construction conditions (Certain)	Happens under worst case (negative consequences) or best case (positive impact) working conditions (Likely)	Occurs under abnormal, exceptional or emergency conditions (occasional)	Unlikely to happen

b. Sensitivity of Receptor

37. The sensitivity of a receptor was determined based on the review of the population (including proximity/numbers/vulnerability) and the presence of features on the site or the surrounding area. For each E&S impact of the subprojects, sensitivity of the related receptor was determined using the criteria outlined in Table 1-4**.**

Table 1-4: Criteria for Determining Sensitivity

Sensitivity Determination	Definition
Very Severe (4)	Vulnerable receptor with little or no ability to absorb proposed changes or minimal opportunities for mitigation.
Severe (3)	Vulnerable receptor with little or no ability to absorb proposed changes or limited opportunities for mitigation.
Mild (2)	Vulnerable receptor with some ability to absorb proposed changes or moderate opportunities for mitigation
Low (1)	Vulnerable receptor with good ability to absorb proposed

Sensitivity Determination	Definition
	changes or/and excellent opportunities for mitigation

c. Risk Significance

38. Based on the assessment of magnitude, the quality and sensitivity of the receiving environment or potential receptor, the significance of each E&S impact is established using the impact significance criteria matrix as shown in Table 1-5.

Table 1-5: Risk Assessment Matrix

Magnitude of Impact	Sensitivity of Receptors			
	Very Sever (4)	Severe (3)	Mild (2)	Low (1)
Major (4)	16	12	8	4
Moderate (3)	12	9	6	3
Minor (2)	8	6	4	2
Minimal (1)	4	3	2	1
Risk Score and Significance				
>12 High	9-12 Substantial	5-8 Medium	2-4 Low	1 Negligible

1.4.5 Environmental and Social Management Plan (ESMP)

39. An Environmental and Social Management Plan (ESMP) has been developed for effective implementation of the recommended mitigation measures. The ESMP includes controls to minimize the identified impacts and a monitoring program to monitor effects of mitigation measures implemented and residual impacts, if any, during implementation. The ESMP has identified roles and responsibilities of all concerned parties during the implementation of the project. It defines prequalification criteria and obligation of the contractors, institutional arrangements of all stakeholders, monitoring mechanism, and capacity building arrangements to effectively implement the mitigation measures and preventive actions identified during the ESIA study.

1.5 ESIA Team

40. A team comprised of ten E&S specialists have prepared the ESIA report. The team included environmental specialists, social safeguard specialists, gender experts, design engineers, etc.

2 Policy, Legal and Administrative Framework

2.1 Introduction

41. This chapter discusses the existing national and local environmental and social legal and regulatory framework that is applicable and relevant to the project.

42. The Project will be co-financed by the World Bank (WB) and Asian Infrastructure Investment Bank (AIIB) with the WB as lead co-financier and its environmental and social (ES) risks and impacts have been assessed in accordance with the WB's Environment and Social Framework (ESF). To ensure a harmonized approach to addressing the ES risks and impacts of the Project, and as permitted under AIIB's Environmental and Social Policy (ESP), AIIB agreed that the WB ESF will apply to the project in lieu of AIIB's ESP. AIIB has reviewed the WB ESF and is satisfied that: (a) it is consistent with AIIB's Articles of Agreement and materially consistent with the provisions of AIIB's ESP and the relevant ES Standards; and (b) the monitoring procedures that are in place are appropriate for the project.

2.2 Sindh Environmental and Social Regulatory Authorities

43. The key national regulatory agencies that are the implementers of the applicable environment and social policies are listed in Table 2-1.

Table 2-1: Functions of Sindh's Environmental and Social Regulatory Authorities

Organization	Functions / Role
Sindh Environmental Protection Agency (SEPA)	• Regulating the environmental issues • Reviewing and checking environmental assessment report prepared as per the legal requirements. • Environmental approvals of the Project. • Ensuring the implementation of government policies, during the project implementation. • Ensuring compliance and reviewing the performance of environmental management plans implementation.
Sindh Labour & Human Resources Department	• Guaranteeing the rights of the workers like the right to organize, the right to collective bargaining, participation in the affairs of the implementing agency, health & safety, minimum wages, compensation, etc., are followed in the project.
Sindh Social Welfare Department and Women Development Department	• Transformation of the government into an organization that actively practices and promotes gender equality and women empowerment. • Mainstreaming gender equality perspective across public policies, laws, programs, and projects by departments and agencies of the government with a focus on women empowerment. • Looking after various marginalized segments of population such as poor, persons with disabilities, orphans, victims of violence and specifically

Organization	Functions / Role
	women to ensure the welfare and support the marginalized group of society.
Employees' Old Age Benefit Institute (EOBI)	• Making sure that workers are benefitted after retirement from the collected/raised funds.

2.3 National and Sindh Environmental and Social Policies

44. The applicable national and Sindh environmental policies are presented in Table 2-2 while the social policies which include policies for occupational health and safety, labor, gender and others are in Table 2-2. The construction and operation activities of the proposed project will adhere to the requirements of these policies.

Table 2-2: Summary of Applicable National and Sindh Environmental Policies

No.	Policy/Strategy/Guidelines	Brief Description	Relevance to project
1	National Conservation Strategy (NCS),1992	Pakistan NCS 1992 is the principal policy document on environmental issues in the Country. The NCS outlines the Country's primary approach towards encouraging sustainable development, conserving natural resources and improving efficiency in the use and management of resources.	The core areas that are relevant in the context of the proposed project are pollution prevention during construction and conserving biodiversity and forestry. These aspects are covered in the impact assessment and relevant mitigation measures have been included in the ESMP.
2	Sindh Strategy for Sustainable Development, 2007	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 Sindh Environmental Quality Standards (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.	This strategy is applicable as the project involves the laying of water main pipes to improve the water supply system and increase the water quantity as per demand with least environmental burden and sustainable operation of system in the city. Similar to above, the E&S sustainable development measures such as tree plantation, resource conservation, economic development, provision of clean water are provided in this ESIA and EMMP which will be implemented accordingly.
3	Sindh Drinking Water Policy, 2017	This 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 basic objective of this policy is to introduce legislative measures and regulations to create an enabling framework for safely managed drinking water supply, regulation of water usage, extraction, treatment transportation and distribution.	This policy is applicable for the project construction phase in terms of regular water quality supply, monitoring (as per plan suggested in ESMoP), and all discharges/wastewater streams (as per plan suggested in ESMoP) comply with environmental quality standards and reuse, recycle and recharge of water for other municipal and productive use.
4	Sindh Environmental Protection Act, 2014	The Sindh Environmental Protection Act of 2014 is the provincial version of the Pakistan Environmental	The project falls under Schedule II Category of SEP Act which requires the submission of

No.	Policy/Strategy/Guidelines	Brief Description	Relevance to project
		Protection Act, 1997 (PEPA). Section 11 (Prohibition of Certain Discharges or Emissions) states that "Subject to the provisions of this Act and the rules and regulations made thereunder, no person shall discharge or emit, or allow the discharge or emission of, any effluent or waste or air pollutant or noise in an amount, concentration or level which is in excess of the Environmental Quality Standards." Section 13-I (Initial Environmental Examination and Environmental Impact Assessment) requires that "No proponent of a project shall commence construction or operation unless he has filed with the Federal Agency an IEE or, where the project is likely to cause an adverse environmental effect, an EIA, and has obtained from the Federal Agency approval in respect thereof." Section 15 (Handling of Hazardous Substances) requires that "Subject to the provisions of this Act, no person shall generate, collect, consign, transport, treat, dispose of, store, handle, or import any hazardous substance except (a) under a license issued by the EPA and in such manner as may be prescribed; or (b) in accordance with the provisions of any other law for the time being in force, or of any international treaty, convention, protocol, code, standard, agreement, or other Instrument to which Pakistan is a party." Enforcement of this clause requires the EPA to issue regulations regarding licensing procedures and to define 'hazardous substance.' Section 16 (Regulation of Motor Vehicles): Subject to the provision of this clause of the Act and the rules and regulations made thereunder, no person shall operate a motor vehicle from which air pollutants or noise are being emitted in an amount, concentration or level which	EIA.

No.	Policy/Strategy/Guidelines	Brief Description	Relevance to project
		is in excess of the EQS, or where the applicable standards established under clause (g) of subsection (1) of Section-6 of the Act	
5	Sindh Environmental Protection Agency, (Review of EC, IEE and EIA) Regulations, 2021	These regulations set out: • Key policy and procedural requirements for filing an EIA; • The purpose of Environmental Assessment (EA); • The goals of sustainable development; • The requirement that EA be integrated with feasibility studies; • The jurisdiction of the Provincial EPA and Planning & Development (P&D) Departments; • The responsibilities of proponents; • Duties of responsible authorities; • Provides schedules of proposals that the project requires either EC, IEE or an EIA; • The environmental screening process of the projects under schedule I, II and III; and The procedure for the environmental approval for filing the case with the Sindh EPA for the granting of the NOC.	The provisions of these regulations are applicable for environmental screening of the project, which implies that an EIA/ESIA is required for the proposed project.
6	Sindh Environmental Quality Standards, 2016	SEPA has formulated the SEQS as per Clause (g) of sub-section (1) of Section 6 of Sindh Environmental Protection Act 2014. The SEQS were promulgated in 2016 which includes standards for liquid effluent, industrial gaseous emissions, ambient air, drinking water quality, noise levels and standards for motor vehicle exhaust, diesel vehicle, and petrol vehicles.	The proposed project is being implemented in Sindh; therefore, it will conform to SEQS during all the phases i.e. construction and operation. In the cases where WBG standards are more stringent than the SEQS, the project will follow WBG standards, thereby going beyond the SEQS compliance.
7	Guidelines for the Preparation and Review of Environmental Reports, 1997	These guidelines describe the format and content of IEE/EIA reports to be submitted to SEPA for obtaining NOC / approval. The guidelines present:	These guidelines serve to describe the format, practices, and procedures to be employed when reporting EA for the

No.	Policy/Strategy/Guidelines	Brief Description	Relevance to project
		• The EA report format; • Assessing impacts; • Mitigation and impact management and preparing an environmental management plan; • Reporting; • Review and decision making; • Monitoring and auditing; and project Management.	proposed project.
8	Guidelines for Environmental Assessment, 1997	Pak-EPA has published a set of environmental guidelines for conducting EAs and the environmental management of different types of development Projects. The guidelines that are relevant to the proposed project are listed below. • Guidelines for the Preparation and Review of Environmental Reports, Pakistan Environmental Protection Agency, 1997; • Guidelines for Public Consultation, Pakistan Environmental Protection Agency, May, 1997; and Sectoral Guidelines: Pakistan Environmental Assessment Procedures, Pakistan Environmental Protection Agency, October 1997.	These guidelines serve to describe the format, practices, and procedures to be employed when conducting EAs for the proposed project.
9	Sindh Forest Act, 2012	The Forest Act 1927 has been replaced by the provincial Forest Act 2012, after forestry became into the provincial domain under the 18th amendment to the Constitution of Pakistan. However, the main applicable clauses still hold true in essence. The Act reserve the areas having forest cover, or significant wildlife, to regulate movement and transit of forest produce, and duty levi-able on timber and other forest produce. It also defines the procedure to be followed for declaring an area to be a Reserved Forest, a Protected Forest or a Village Forest.	This act is applicable as the trees on the government land are owned by the Sindh Forest Department as well as KMC. The damage and cutting/removal of these trees shall be catered for by the provisions of this act. Approval will be taken from the concerned department before any tree cutting. Compensatory plantation will be carried out in the places identified by the concerned department (Sindh Forest Department and/or KMC).

No.	Policy/Strategy/Guidelines	Brief Description	Relevance to project
10	Cutting of Trees (Prohibition) Act, 1992	The Act was enforced in 1992 to place restrictions on cutting of trees in order to restrain unchecked trend of tree felling without replacement plantations.	This act is applicable to the subject project where tree cutting will be involved. Replacement of 10 tree in lieu of one tree has been proposed in this ESIA.
11	Sindh Solid Waste Management Board (SSWMB) Act, 2014	The SSWMB Act, 2014 enacted to establish a board for collection and disposal of all solid waste, to arrange effective delivery of sanitation services, to provide pollution free environment and to deal with other relevant matters. The Board established under the Act headed by the Chief Minister or his nominee and constitutes of thirteen other ex-officio members of other relevant departments.	The proposed project will generate construction and domestic solid waste which will be managed and disposed of as per the requirements of this act.
12	Pakistan Penal Code, 1860	The Code deals with the offences where public or private property or human lives are affected due to intentional or accidental misconduct of an individual or organization. The Code also addresses control of noise, noxious emissions and disposal of effluents.	The provisions of the Penal Code, 1860 are applicable to the project in terms of penalties for effecting human lives and public property. It also addresses the control of noise, air emissions and effluent disposal.
13	The Canal and Drainage Act, 1873	The Canal and Drainage Act (CDA), 1873 focuses on construction and maintenance of drainage channels and defines powers to prohibit obstruction or order their removal. It also covers issues related to canal navigation. It briefly addresses issues relating to environmental pollution. Section 70(5) of the CDA clearly states that no one is allowed to “corrupt or foul the water of any canal so as to render it less fit for the purposes for which it is ordinarily used.” In addition, Section 73 of the CDA gives power to arrest without warrant or to be taken before the magistrate a person who has willfully damaged or obstructed the canal or “rendered it less useful.”	This Act is applicable as the proposed project involves the construction of water mains.

No.	Policy/Strategy/Guidelines	Brief Description	Relevance to project
14	Hazardous Substances Rules, 2014	The rule describes the procedure of handling, transportation and disposal of hazardous substances and hazardous waste. General safety precautions for handling hazardous substances as well as safety precautions for workers, and notification requirements in the event of an accident are also described in these rules.	The proposed project might generate hazardous waste in the form of fuel or chemical spills. These Rules are applicable to the proposed project due to involvement of such hazardous material as well as waste handling and disposal during different construction activities at the construction stage. Accordingly, a Waste Management Plan has been developed aligned with these rules (refer **Annex-X**).

Table 2-3:Summary of Applicable National and Sindh Social Policies

No.	Policy/Strategy/Guidelines	Brief Description	Relevance to project
1	Pakistan Labor Policy, 2010	The following are the objectives of this policy: • Workers' right to form unions and unions should be protected and an institutional framework be made available to foster close cooperation between workers and employers at establishment level. • Equitable adjustment of rights between workers and employers should be ensured in an atmosphere of harmony, mutually beneficial to the workers and the management. • Consultations between workers and employers on matters of interest to the establishment and welfare of workers should be made more effective. • Adequate security of jobs should be available to the workers and there should be expeditious redressal of their grievances. • Conditions should be created that workers and employers are committed to enhancing the labor productivity. • Promotion to higher jobs be ensured at all levels based on suitability and merit and for this purpose arrangements should be made for inservice training facilities. • Facilities for proper matching of job opportunities and the job seekers be strengthened and standard procedures be	Laborers (skilled and unskilled) will be hired for the construction and O&M of the proposed project. The LMP was prepared and will be implemented based on the provisions of this policy.

No.	Policy/Strategy/Guidelines	Brief Description	Relevance to project
		streamlined. • Social insurance schemes to be further strengthened • Just and humane conditions of work be guaranteed to all workers. • Forced labour in all its forms to be eliminated. • Provisions relating to the employment of children to be strictly adhered to and be enforced.	
2	National Action Plan for COVID-19 Pakistan	GoP has launched the National Action Plan for COVID-19 Pakistan to combat the challenge of prevailing virus,	This Action Plan for COVID-19 is applicable to the proposed project as it is being launched during this pandemic. SOPs for COVID 19 are attached as **Annex-XV** to be followed during the project
3	The Sindh Local Government Act (SLGA) 2013 and Sindh Local Government (Amendment) Act, 2021	Under the SLGA, 2013 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. The 2021 amendment served to define municipal corporations and committees, along with establishing a relationship between elected councils and provincial departments working in administrative boundaries.	This act is applicable for the proposed project due to its location and nature of use of public sources during construction.
4	Sindh Public Property Act, 2010	The act has been passed to avoid illegal encroachments and provide measures for removal of encroachment from public	This act is applicable if there is any encroachment at the proposed public /

No.	Policy/Strategy/Guidelines	Brief Description	Relevance to project
		property and to retrieve possession. The City Government will provide continuous oversight and reinforcement to facilitate the properties to remain free from illegal encroachments.	government land allocated for the proposed project.
5	Sindh Factories (Amendment) Act, 2021	The Act deals with regulations related to project area workers and workplace Environment Health and Safety (EHS) requirements. The Factories Act also provides regulations with provision for general Health and Safety (H&S) of the work force in their work area. Conditions are specified for clean work place, toilets, waste handling, provision of drinking water quality, worker health and hygiene etc. Under the Act, no occupier of a factory shall be allowed to start manufacturing process unless they have obtained factory registration certificate from the Directorate of Labor. The Act does not allow a child below the age of 14 years to work in a factory in any case. The new Law restricts the employment of contractual labor in manufacturing process. The amendment 2021 is specifically related to the provision of safe transportation facility to women workers, working hours and working periods of seasonal and whole year factories.	This act is applicable for the project workers including men, adults, women, adolescent working in and near the construction area during construction phase. The project will provide clean workspace, toilets, safe drinking water to its workers and contractors.
6	The Sindh Occupational Safety and Health Act, 2017	This Act provides for occupational safety and health conditions at all workplaces for the protection of persons at work against risk of injury arising out of the activities at workplaces and for the promotion of safe, healthy and decent working environment adapted to the physical, physiological and psychological needs of all persons at work. Under the Act, the employer would be responsible for ensuring the health and safety of the workers at workplaces (construction sites are also considered as workplaces under the act). The act mentions health and safety requirements which need	This law is applicable to construction and project workers and will be complied with during construction and operation phases. The workers' H&S will be ensured during the project construction through implementation of LMP prepared for this project.

No.	Policy/Strategy/Guidelines	Brief Description	Relevance to project
		to be complied with by the employer/site in-charge and the workers. The Chief Inspector and the inspectors appointed under the act shall be responsible for enforcing health and safety requirements prescribed by the act. Penalties shall be imposed in case of noncompliance with the requirements.	
7	The Sindh Transparency and Right to Information Act, 2016	The purpose of this Act to provide transparency and freedom of information to ensure that all citizens have better access to public information, to make the government more accountable to citizens, to enforce the fundamental right to information in all matters of public importance, toensure transparency in all Government matters. Transparency and access to information are essential principles of democracy which not only enable the citizens to hold the Government and their institutions accountable but also help in improving the system of governance.	This act is applicable as the proposed project is the public sector project and shall be transparent for public.
8	The Protection against Harassment of Women at the Workplace Act, 2010	The Protection Against Harassment of Women at the Workplace Act (2010) refers to Sexual Harassment (SH) at the workplace.	This Act is applicable to the project in case of the employment of women worker during the construction of the proposed project.
9	Sindh Prohibition of Child Employment Act, 2017	Article 11(3) of the Constitution of Pakistan prohibits employment of children below the age of 14 years in any factory, mines, or any other hazardous employment. In accordance with this Article, the Prohibition of Child Employment Act (PCEA) 2017 disallows child labor in Sindh. The PCEA defines a child as a person who has not completed his/her fourteenth years of age, and an adolescent means a person who has completed fourteenth year of age but has not completed eighteenth years of his age. No child shall be employed or permitted to work in any establishment including construction, but an adolescent can be employed or permitted to work under strict guidelines provided in the PCEA and rules.	The relevance of this act to the project is to prohibit child employment for construction activities of the proposed project.

No.	Policy/Strategy/Guidelines	Brief Description	Relevance to project
		An adolescent shall not be employed in any hazardous work included in the schedule to the PCEA.	
10	Labor Laws as part of Constitution of Pakistan, 1973	The Constitution of Pakistan contains a range of provisions with regards to labor rights, in particular: • Article 11 of the Constitution prohibits all forms of slavery, forced labor and child labor; • Article 17 provides a fundamental right to exercise the freedom of association and the right to form unions; • Article 18 proscribes the right of its citizens to enter upon any lawful profession or occupation and to conduct any lawful trade or business; • Article 25 lays down the right to equality before the law and prohibition of discrimination on the grounds of sex alone; and • Article 37(e) makes provision for securing just and human conditions of work, ensuring that children and women are not employed in vocations unsuited to their age or sex, and for maternity benefits for women in employment. Labor law is controlled at both provincial and national levels with compulsory employment agreements containing the terms set out by the labor laws. The labor laws are a comprehensive set of laws in Pakistan dealing with the following aspects: • Contract of Employment; • Termination of Contract; • Working Time and Rest Time; • Working hours; • Paid Leave; • Maternity Leave and Maternity Protection; • Other Leave Entitlements;	The labor laws are relevant as it deals with employment of labor for the construction of proposed project. Following are the major labor laws which are applicable to the project: • Sindh Workers Compensation Act, 2015; • Sindh Minimum Wage Act, 2015; • Sindh Terms of Employment (Standing Orders) Act, 2015; • Sindh Bonded Labor System (Abolition) Act, 2015; • Sindh Payment of Wages Act, 2015; • Sindh Occupational Safety and Health Act, 2017; and • Sindh Factories Act, 2021.

No.	Policy/Strategy/Guidelines	Brief Description	Relevance to project
		• Minimum Age and Protection of Young Workers; • Equality; • Pay Issues; • Workers' Representation in the Enterprise; • Trade Union and Employers Association Regulation; and Other Laws.	
11	Sindh Bonded Labor (Abolition) Act, 2015	The Act is gender sensitive, an anti-discrimination clause is added to each new proposed Law in accordance with International Labor Organization (ILO) requirement viz: "No discrimination shall be made on the basis of sex, religion, political affiliation, sect, color, caste, creed and ethnic background in considering and disposing of issues relating to the enforcement of this Act". In all proposed Laws the cognizance has been changed from that of the Judicial Magistrate to the Presiding Officer Labor Courts who is a Session Judge.	This Act is applicable as the proposed project may involve the numbers of staff/worker having different religion, political affiliation, sect, color, caste, creed and ethnic background.
12	Building Code of Pakistan, 2007	The provision of Building Code of Pakistan shall apply for engineering design of building like structure and related components. The construction in violation of the Building code shall be deemed as violation of professional engineering work. Moreover, a certificate for the proposed action will be obtained from Provincial Building Control Authority.	These Codes are being used in structural design of associated structures constructed under this proposed project.
13	The Sindh Minimum Wages Act, 2015	To provide the regulation of minimum rates of wages and various allowances for different categories of workers employed in certain industrial and commercial undertakings and establishments.	This Act is applicable to the project to ensure that the minimum wages and allowances are given to the project labor (skill and unskilled employed for the construction of the proposed project.
14	Sindh High Density	The Act promulgated to ensure coordinated and integrated	This Act is applicable as the proposed

No.	Policy/Strategy/Guidelines	Brief Description	Relevance to project
	Development Board Act, 2010	development of high-density zones in the urban centers of the Province including Karachi. The Law empowered the board to identify and mark high density zones keeping in view the general principles of the KSDP 2020.	project involves major water supply infrastructure developmental works in high density zones of Karachi.
15	Sindh Katchi Abadis Act (SKAA), 1987 and Sindh Katchi Abadis (Amendment) Act, 2009	Under the SKAA, 1987, settlements can be declared as official Katchi Abadis and allows the right of urban squatters to rehabilitations. The SKAA envisages the regularization and provision of infrastructure to all squatter settlements on government land which were established before 30 June 1997 (as per the 2009 Amendment). The SKAA was tasked to coordinate the process of awarding leases to the residents and to provide infrastructure and other basic services. It is a provincial wide agency that operates in other towns and cities as well as Karachi. The Act stipulates the transfer of government owned land to the urban squatters or allocates funds for cash assistance.	This Act is applicable as the proposed project also involves water supply infrastructure developmental works in Katchi Abadis of Karachi and its surrounding areas along the project corridor.
16	The Sindh Differently Able Persons (Employment, Rehabilitation and Welfare (Amendment) Act, 2017	The Act provides for the employment, rehabilitation and welfare of differently able persons. The definition of "differently able" is any persons who on account of injury, disease or congenital deformity, is challenged for undertaking any gainful profession or employment in order to earn his livelihood and includes a person who is blind, deaf, physically challenged or mentally challenged. In the Sindh Differently Able Persons (Employment, Rehabilitation and Welfare) Act, 2014 was amended and job quota was increased from two percent to five percent. The Act also waived admission fees at public educational institutions for people with disabilities as well as 75% of tuition fee, along with establishing reserved seats. Pakistan is a signatory of the United Nations Convention on the Rights of Persons with Disabilities (UNCRPD).	To comply with this Act, the KWSSIP will provide jobs to the PWD as per the defined qouta.

No.	Policy/Strategy/Guidelines	Brief Description	Relevance to project
17	The Sindh Commission on the Status of Women Act, 2015	The Act has enabled the government to constitute a Commission to be known as the Sindh Commission on the Status of Women, to exercise the powers to examine the policy, programs and other measures taken or to be taken by Government for gender equality, women's empowerment, political participation, representation, assess, implementation and make suitable recommendations to the concerned authorities. In addition, the Commission will be responsible to review all provincial laws, rules and regulations prejudicial to the legitimate interest and rights of women and suggest accordingly.	This Act is applicable as the proposed project involves the numbers of female staff/worker as well as local resident women along the project corridor which are directly or indirectly linked with project activities.
18	Gender Equality as part of Constitution of Pakistan, 1973	The Constitution of Pakistan contains a range of provisions regarding gender equality, in particular, provides the principle of equal rights and equal treatment to all citizens/ persons, without any distinction including on the basis of sex: • Article 3 calls upon the State to eliminate all forms of exploitation; • Article 4 provides for the right of individual to enjoy the protection of law and to be treated in accordance with the law. This applies to the citizens as well as "to every other person for the time being within Pakistan" without distinction. This article also clearly states that certain rights cannot be suspended; • Article 25 ensures equality before the law and equal protection of the law and states that there shall be no discrimination on the basis of sex alone; • Articles 25(3) and 26(2) allow the state to make special provisions for the protection of women and children; • Article 26 and 27 provide for equal access to public places and equality of employment in the public and private sector; • Article 34 directs the state to take appropriate measures to	The articles of Constitution of Pakistan are relevant as it would deal with employment of male and female labor having different religion, political affiliation, sect, color, caste, creed and ethnic background for the construction of proposed project.

No.	Policy/Strategy/Guidelines	Brief Description	Relevance to project
		enable women to participate in all spheres of life and social activities; and Article 37 (e) directs the state to make provisions for securing just and humane conditions of work ensuring that children and women are not employed in vocations unsuited to their age or sex, and for ensuring maternity benefits for women in employment.	

2.3.1 Environmental Impact Assessment Review

45. The Review of IEE/EIA, 2021 of SEPA provides the necessary details on the preparation, submission, and review of the EC, IEE and the EIA reports. Categorization of projects for IEE and EIA is one of the main components of these regulations. Projects have been classified on the basis of expected degree of adverse environmental impact.

46. The proposed project falls under Schedule II (Category 'G' of "Public Water Supply and Filtration") and requires an EIA study for obtaining NOC/environmental approval from SEPA. The ESIA prepared for proposed project will be submitted to SEPA though project proponent to initiate the process of NOC.

47. The regulations stipulate that within ten (10) working days of the ESIA/EIA report submission, SEPA will confirm that the document submitted is complete for the purpose of review. During this time, should the agency require the proponent to submit additional information, it will return the ESIA/EIA to the proponent for revision, clearly listing those aspects that need further discussion. Subsequently, SEPA would make every effort to complete an ESIA/EIA review within ninety (90) days of filing (refer Figure 2-1).

48. The prescribed procedure for review of ESIA/EIA by the SEPA is described in Review of EC, IEE and EIA Regulations, 2021. Article 17(4) of Sindh Environmental Protection Act 2014 binds the agency to communicate its approval or otherwise within a period of four months from the date that the environmental impact assessment is filed complete in all respects in accordance with the regulations, failing which the environmental impact assessment shall be deemed to have been approved, to the extent to which it does not contravene the provisions of this Act and the rules and regulations.

49. The proposed K-IV Augmentation project has been approved from SEPA after fulfilling all the regulatory requirements. The ESIA Report was submitted to SEPA in November 2023 and after successfully conducted Public Hearing on Jan 18, 2024, SEPA accorded approval on February 15, 2024 (see Annex XXVIII).

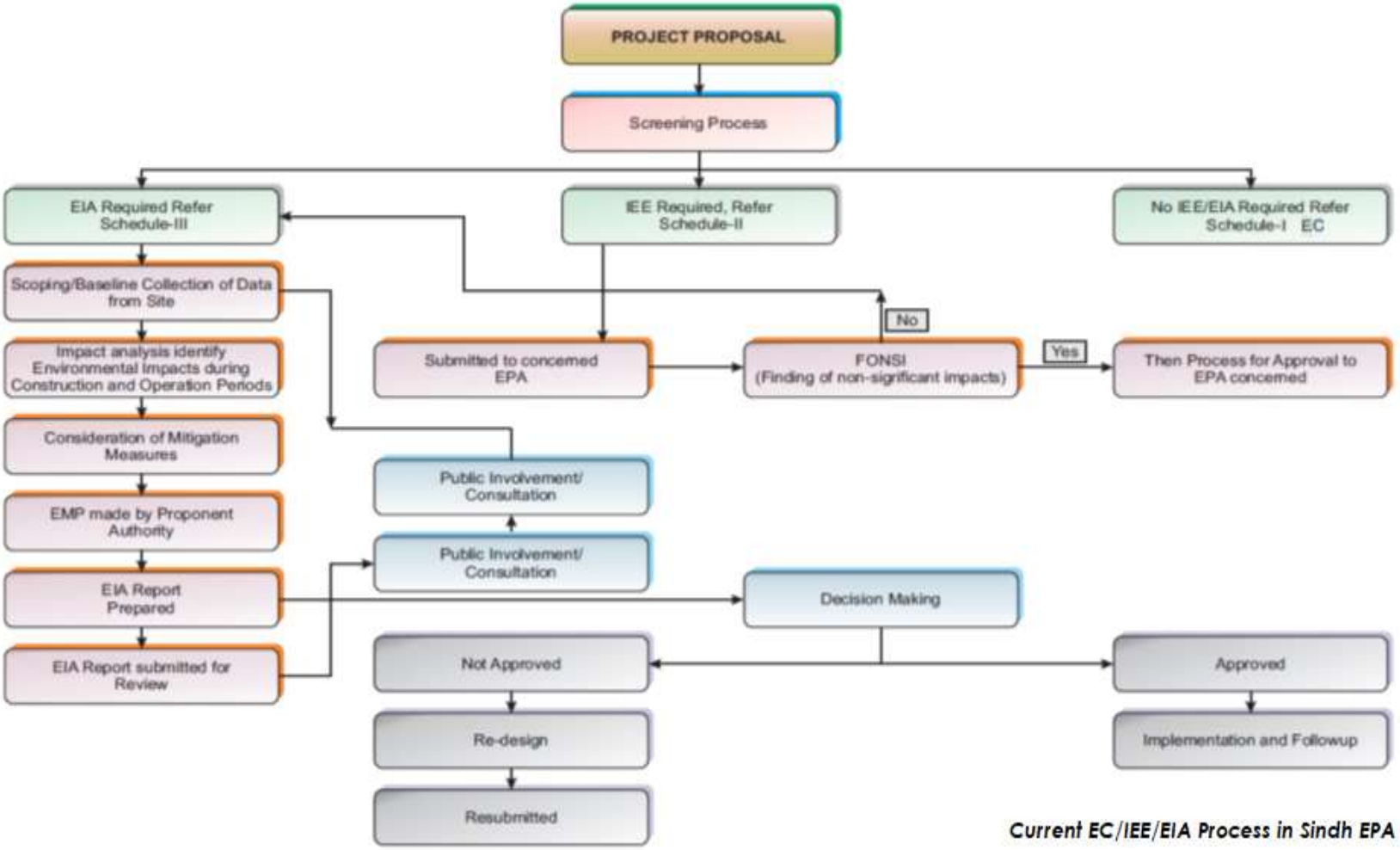


Figure 2-1: EC, IEE and EIA Procedures in Sindh - Pakistan

2.4 World Bank Environment and Social Framework and Standards (ESS)

50. World Bank's Environmental and Social Framework (ESF) sets out ten Environmental and Social Standards (ESS) to (a) support borrowers in achieving good international practice relating to environmental and social sustainability, (b) assist borrowers in fulfilling their national and international environmental and social obligations, (c) enhance nondiscrimination, transparency, participation, accountability and governance, and (d) enhance the sustainable development outcomes of projects through ongoing stakeholder engagement.

51. Each ESS has mandatory requirements that the borrowers should meet. The ESSs are designed to guide the borrowers in managing the risks and impact of the project and improve their environmental and social performance.

52. Table 2-4 presents the ten ESSs and the applicability of each to the proposed project.

Table 2-4: Applicability of the ESSs to the Project

World Bank ESS Policy, Standards, Directive	Objectives	Requirements	Relevance to the Project	Relevant National / Provincial Regulations / Laws and Gaps	Actions undertaken to fill the gap and/or to comply with ESS
ESS-1 Assessment and Management of Environmental and Social Risks and Impacts	• Identify, evaluate and manage the environment and social risks and impacts of the project in a manner consistent with the ESSs. • Adopt a mitigation hierarchy approach to: (a) Anticipate and avoid risks and impacts; (b) Where avoidance is not possible, minimize or reduce risks and impacts to acceptable levels; (c) Once risks and impacts have been minimized or reduced, mitigate; and (d) Where significant residual impacts remain, compensate for or offset them, where technically and financially feasible. • Adopt differentiated measures so that adverse impacts do not fall disproportionately on the disadvantaged or vulnerable, and they are not disadvantaged in sharing development benefits and opportunities resulting from the project. • Utilize national environmental and social institutions, systems, laws, regulations and procedures in the assessment, development and implementation of projects, whenever appropriate. • Promote improved environmental and social performance, in ways which recognize and enhance Borrower capacity	Conduct an environmental and social assessment of the proposed project, including stakeholder engagement. Undertake stakeholder engagement and disclose appropriate information in accordance with ESS10 Develop an ESCP, and implement all measures and actions set out in the legal agreement including the ESCP. Conduct monitoring and reporting on the environmental and social performance of the project against the ESSs.	The overall risk of KWSSIP SOP-2 has been classified as substantial for environment, and high for social which includes the risk for sexual exploitation and abuse and sexual harassment (SEA/SH). The overall E&S risk is categorized as high thus, Environmental and Social Impact Assessment (ESIA) should be prepared. The KIV mainstream project was identified as an auxiliary facility of the proposed KIV augmentation works. An E&S audit was conducted for the KIV mainstream project.	Sindh Environmental Protection Act 2014 SEPA (Review of IEE and EIA) Regulations, 2014. • The Provincial Act and the Review of IEE/EIA Regulations contain procedures and guidelines for the assessment, evaluation and mitigation of impacts for development projects. However, it categorizes the risk level of a project indirectly – mostly by project type and size. • Furthermore, it does require commitment from the proponents for E&S measures implementation but not in the form of a separate environmental and social commitment plan Also, while ESS-1 specifically mentions disadvantaged or vulnerable groups, the Act does not touch upon this theme directly.	• Project components were thoroughly screened to ensure that they meet the requirements of ESS and Sindh's and Pakistan's laws and regulations. • This ESIA was conducted in accordance with the requirements of the ten ESSs. • E&S risks and impacts were identified in the ESIA based on surveys and consultations with primary stakeholders including communities and implementing agency; • Environmental and Social Management Plan (ESMP) was prepared based on the screening outcome and impact assessment in the ESIA. It includes the mitigating measures that will be implemented to minimize or avoid the adverse impacts of the project and also, the monitoring plan to ensure the compliance of the project with the WB and national standards. • Mitigations proposed in this ESIA and the other E&S tools (e.g, RAP, LMP and SEP) have taken into consideration the marginalized and vulnerable groups.
ESS-2 Labor and Working Conditions	• Promote safety and health at work. • Promote fair treatment, non-discrimination, and equal opportunity of project workers. • Protect project workers, with particular emphasis on vulnerable workers. • Prevent the use of all forms of forced labor and child labor. • Support the principles of freedom of association and collective bargaining of project workers in a manner consistent with national law. • Provide project workers with accessible	• Develop and implement written labor management procedures applicable to the project. The procedures will clearly identify the terms and conditions on which community labor will be engaged. • Provided workers with information and documentation that is clear and understandable regarding their terms and conditions of employment.	The ESS2 is applicable as the project will involve direct workers; contracted workers engaged in construction work and consultancy services for the project, and primary supply workers	The Sindh Factories Act 2015 The Sindh Workers Welfare Fund Act, 2014 The Sindh Workers Compensation Act, 2015 The Sindh Minimum Wages Act, 2015 The Sindh Payment of Wages Act, 2015. The Sindh Prohibition of Employment of Children Act, 2017	• A labor management procedure (LMP) was prepared to regulate working conditions and management of workers relations including worker specific GRM, terms and conditions of employment, non-discrimination, and equal opportunity, GBV, protection of workforce, the prohibition of child /forced labor, and provision of OHS Plan for contractors. • Potential occupational health and

World Bank ESS Policy, Standards, Directive	Objectives	Requirements	Relevance to the Project	Relevant National / Provincial Regulations / Laws and Gaps	Actions undertaken to fill the gap and/or to comply with ESS
	means to raise workplace concerns.	Labor and working conditions should be compliant with the national labor law. • Observe nondiscrimination and equal opportunity of workers. • Protecting the workforce against child labor and forced labor. • Provision of grievance mechanism for all direct workers and contracted workers. • Implement occupational health and safety measures. • Establish procedures for managing and monitoring the performance of contractors and subcontractors in relation to the requirements of this ESS. • Identify potential risks of child labor, forced labor and serious safety issues which may arise in relation to primary suppliers.		The Sindh Employees Social Security Act, 2016 The Sindh Occupational Safety and Health Act, 2017 The Protection against Harassment of Women at the Workplace Act, 2010 • The local labor laws fulfill all of the requirements of ESS-2 for direct workers and labor but not primary supplier worker and community workers in the project.	safety risks were considered in this ESIA, and appropriate mitigating measures were identified. • Guidelines on Occupational Health and Safety Plan was developed (Annex XXVI)
ESS-3 Resource Efficiency and Pollution Prevention and Management	• Promote the sustainable use of resources, including energy, water, and raw materials. • Avoid or minimize adverse impacts on human health and the environment caused by pollution from project activities. • Avoid or minimize project-related emissions of short and long-lived climate pollutants. • Avoid or minimize generation of hazardous and non-hazardous waste. • Minimize and manage the risks and impacts associated with pesticide use.	• Implement technically and financially feasible measures for improving efficient consumption of energy, water and raw materials, as well as other resources. • Avoid the release of pollutants or, when avoidance is not feasible, minimize and control the concentration and mass flow of their release using the performance levels and measures specified in national law or the EHSGs, whichever is most stringent • Requires the implementation of management measures for air pollution, hazardous and	The construction of the proposed project will utilize resources such as water, energy and raw materials. The construction activities may also emit air pollution, generate wastes (hazardous and non-hazardous) and wastewater.	SEQS 2016 Hazardous Substances Rules 2014 The local laws fulfill the requirements of ESS-3 associated with pollution prevention and management. However, national quality standards are restricted to the pollution control only. Energy efficiency, water efficiency and non-hazardous waste management are not adequately discussed under local laws.	• Resource efficiency and pollution prevention measures were developed as part of this ESIA. • A Resource Conservation Plan to be implemented during construction phase was developed (Annex VII). • Guidelines/management plans to minimize pollution were also developed: ○ Waste Management Plan (Annex X) ○ Slurry Management Plan (Annex XI)

World Bank ESS Policy, Standards, Directive	Objectives	Requirements	Relevance to the Project	Relevant National / Provincial Regulations / Laws and Gaps	Actions undertaken to fill the gap and/or to comply with ESS
		non-hazardous wastes, chemical and hazardous materials, and contains provisions to address historical pollution.			
ESS-4 Community Health and Safety	• Anticipate or avoid adverse impacts on the health and safety of project-affected communities during project life cycle from routine and non-routine circumstances. • Promote quality, safety, and climate change considerations in infrastructure design and construction, including dams. • Avoid or minimize community exposure to project-related traffic and road safety risks, diseases, and hazardous materials. • Have in place effective measures to address emergency events. • Ensure that safeguarding of personnel and property is carried out in a manner that avoids or minimizes risks to the project-affected communities.	Evaluate the risks and impacts of the project on the health and safety of the affected communities during the project life cycle in terms of infrastructure and equipment design and safety, traffic and road safety, ecosystem services, community exposure to health issues, emergency preparedness and response, management and safety of hazardous materials and security.	The proposed water pipes will be installed within populated areas in Karachi City. This exposes the community to health and safety hazards of the construction activities.	Sindh Occupational Safety and Health Act, 2017 National Policy on Ending Violence Against Women and Girls Constitution of Pakistan, Articles 25, 26, 27, 37 • Sindh Occupational Safety and Health Act 2017 is more focused on workers' H&S and does not contain adequate provisions for the H&S of the nearby communities. • The Constitution of Islamic Republic of Pakistan provides equal rights and the chapter on Principles of Policy underlines the principle of equal rights and equal treatment to all citizens/ persons, without any distinction including on the basis of sex.	• The ESIA identified community health and safety hazards and proposed relevant mitigating measures. • The following guidelines/management plans were developed: ○ Traffic Management Plan (Annex XIII) ○ Emergency Response Plan (Annex XVI)
ESS-5 Land Acquisition, Restrictions on Land Use and Involuntary Resettlement	• Avoid or minimize involuntary resettlement by exploring project design alternatives. • Avoid forced eviction. • Mitigate unavoidable adverse impacts from land acquisition or restrictions on land use by providing compensation at replacement cost and assisting displaced persons in their efforts to improve, or at least restore, livelihoods and living standards to pre-displacement levels or to levels prevailing prior to the beginning of project implementation, whichever is higher. • Improve living conditions of poor or vulnerable persons who are physically displaced, through provision of adequate housing, access to services and facilities, and security of tenure. • Conceive and execute resettlement activities as sustainable development programs • Ensure that resettlement activities are planned and implemented with	Applies to permanent or temporary physical and economic displacement resulting from different types of land acquisition and restrictions on access. Does not apply to voluntary market transactions, except where these affects third parties. Provides criteria for "voluntary" land donations, sale of community land, and parties obtaining income from illegal rentals. Prohibits forced eviction (removal against the will of affected people, without legal and other protection including all applicable procedures and principles in ESS5). Requires that acquisition of land and assets is initiated only after payment of compensation and resettlement has occurred. Requires community engagement and consultation, disclosure of information and a grievance mechanism.	The pipe laying works will temporarily disrupt business activities within RoW.	LAA, 1894 In general, the institutional framework for land expropriation in Pakistan is not completely in compliance with the ESS5, and the most evident differences relate to the requirements to compensate at replacement cost for land vis-à-vis the national requirement of compensating land at market value without payment of taxes and fees as part of compensation package. Additionally, the national law does not recognize informal users, occupiers and settlements. Similarly, livelihood losses are not considered for compensation. It does not require a project specific GRM, a social impact assessment, gender segregated data and assistance to vulnerable persons.	• A separate Resettlement Plan has been prepared in accordance with ESS5. The livelihood losses caused by the project will be compensated in accordance with RP (no land needs to be acquired). • A GRM has been established.

World Bank ESS Policy, Standards, Directive	Objectives	Requirements	Relevance to the Project	Relevant National / Provincial Regulations / Laws and Gaps	Actions undertaken to fill the gap and/or to comply with ESS
	appropriate disclosure of information, meaningful consultation, and the informed participation of those affected.				
ESS-6 Biodiversity Conservation and Sustainable Management of Living Natural Resources	• Protect and conserve biodiversity and habitats. • Apply the mitigation hierarchy and the precautionary approach in the design and implementation of projects that could have an impact on biodiversity. T • Promote the sustainable management of living natural resources.	Avoid adverse impacts on biodiversity and habitats. When avoidance of adverse impacts is not possible, the Borrower will implement measures to minimize adverse impacts and restore biodiversity in accordance with the mitigation hierarchy provided in ESS1 and with the requirements of this ESS.	ESS6 is relevant as the project activities are anticipated to have E&S impacts on the natural habitats due to loss of vegetation along the routes of the K-IV Augmentation.	Sindh Forest Act, 2012 Cutting of Trees (Prohibition) Act, 1992 Sindh Wildlife Protection, Preservation, Conservation and Management Act, 2020 The local laws fulfill the requirements of ESS-6 except categorization of modified, natural and critical habitats, invasive alien species	• A separate Ecological/Biodiversity Assessment study has been prepared for the entire KWSSIP-2 project in addition to addressing these aspects in this ESIA. • A tree plantation plan (refer **Annex IX**) was prepared for the proposed project
ESS-7 Indigenous-Peoples/Sub-Saharan African Historically Underserved Traditional Local Communities	• Ensure that the development process fosters full respect for affected parties' human rights, dignity, aspirations, identity, culture, and natural resource-based livelihoods. • Promote sustainable development benefits and opportunities in a manner that is accessible, culturally appropriate, and inclusive. • Improve project design and promote local support by establishing and maintaining an ongoing relationship based on meaningful consultation with affected parties. • Obtain the Free, Prior, and Informed Consent (FPIC) of affected parties in three circumstances. Recognize, respect, and preserve the culture, knowledge, and practices of Indigenous Peoples, and to provide them with an opportunity to adapt to changing conditions in a manner and in a timeframe acceptable to them.	Applies when the Indigenous Peoples are present or have a collective attachment to the land, whether they are affected positively or negatively and regardless of economic, political, or social vulnerability. The option to use different terminologies for groups that meet the criteria set out in the Standard. The use of national screening processes, providing these meet World Bank criteria and requirements. Coverage of forest dwellers, hunter gatherers, pastoralists and other nomadic groups. Requirements for meaningful consultation tailored to affected parties and a grievance mechanism. Requirements for a process of free, prior, and informed consent in three circumstances.	ESS 7 is not relevant since there are no indigenous peoples that will be affected by the proposed project.		
ESS-8 Cultural Heritage	• Protect cultural heritage from the adverse impacts of project activities and support its preservation. • Address cultural heritage as an integral aspect of sustainable development. • Promote meaningful consultation with stakeholders regarding cultural heritage. • Promote the equitable sharing of benefits from the use of cultural heritage.	• Requires a chance finds procedure to be established. • Recognition of the need to ensure peoples' continued access to culturally important sites, as well as the need for confidentiality when revealing information about cultural heritage assets that would compromise or jeopardize their safety or integrity.	ESS8 is not relevant as there is no known cultural heritage present in the project.	The Sindh Cultural (Protection) Act 1994 The local laws fulfill the requirements of ESS-8. However, there are no provisions for commercial use of cultural heritage in local laws.	Chance Find Procedures (refer **Annex-XIV**) was included in this ESIA.

World Bank ESS Policy, Standards, Directive	Objectives	Requirements	Relevance to the Project	Relevant National / Provincial Regulations / Laws and Gaps	Actions undertaken to fill the gap and/or to comply with ESS
		• Requirement for fair and equitable sharing of benefits from commercial use of cultural resources. • Provisions of archaeological sites and material-built heritage, natural features with cultural significance, and moveable cultural heritage.			
ESS-9 Financial Intermediaries	Sets out how Financial Intermediaries (FI) will assess and manage environmental and social risks and impacts associated with the subprojects it finances. Promote good environmental and social management practices in the subprojects the FI finance. Promote good environmental and sound human resources management within the FI.	Financial Intermediaries (FIs) to have an Environmental and Social Management System (ESMS) - a system for identifying, assessing, managing, and monitoring the environmental and social risks and impacts of FI subprojects on an ongoing basis. FI to develop a categorization system for all subprojects; with special provisions for subprojects categorized as high or substantial risk. FI borrowers to conduct stakeholder engagement in a manner proportionate to the risks and impacts of the FI subprojects.	Not relevant as there is no financial intermediary involved.		
ESS-10 Stakeholder Engagement and Information Disclosure	• Establish a systematic approach to stakeholder engagement that helps Borrowers identify stakeholders and maintain a constructive relationship with them. • Assess stakeholder interest and support for the project and enable stakeholders' views to be considered in project design. • Promote and provide means for effective and inclusive engagement with project-affected parties throughout the project life cycle. • Ensure that appropriate project information is disclosed to stakeholders in a timely, understandable, accessible, and appropriate manner.	• Requires stakeholder engagement throughout the project life cycle, and preparation and implementation of a Stakeholder Engagement Plan (SEP). • Requires early identification of stakeholders, both project-affected parties and other interested parties, and clarification on how effective engagement takes place. Stakeholder engagement to be conducted in a manner proportionate to the nature, scale, risks and impacts of the project, and appropriate to stakeholders' interests. • Specifies what is required for information disclosure and to achieve meaningful consultation.	The ESS10 is applicable as the project involves diverse stakeholders.	Review of IEE and EIA Regulations 2014 Guideline for Public Consultation, 1997 The regulations and guidelines fulfill most requirements of this ESS during the design and construction phases up to the grant of EPA NOC, except the nomenclature for the types of stakeholders such as Primary Stakeholder (named as project Affected Parties including Vulnerable / disadvantaged Group) and Secondary Stakeholders (Other Interested Parties). However, the regulations do not demand continued stakeholder engagement after the NOC has been granted, leading to a potential disconnect between the project and the affected people during construction and operations phases. Moreover. these regulations do not require specific SEP for a project,	• An SEP has been prepared in accordance with this ESS. The SEP outlines the process and frequency of stakeholder engagement at all project stages and establishes the contours of an effective GRM.

World Bank ESS Policy, Standards, Directive	Objectives	Requirements	Relevance to the Project	Relevant National / Provincial Regulations / Laws and Gaps	Actions undertaken to fill the gap and/or to comply with ESS
				neither do these require a GRM to be put in place.	

2.5 World Bank Group Environmental, Health and Safety Guidelines

53. The WBG General Guidelines on EHS is a technical document that can be used as guidance in identifying project hazards and risks and provides recommendations on how to prevent or minimize the hazards. It includes potential environmental impacts, occupational health and safety hazards, community health and safety hazard and hazards during construction and decommissioning. It contains general and industry-specific examples of Good International Industry Practice (GIIP).

54. In addition to the General EHS Guidelines prepared by World Bank Group (WBG) in 2007, the EHS Guidelines of Water and Sanitation is also relevant to this project since it involves the operation and maintenance of drinking water distribution system.

2.6 International Protocols and Conventions

55. As a member of several international organizations, Pakistan is a signatory to various environmental protocols and treaties. Therefore, the project will follow the covenants of such international protocols and obligations related to the environment. The major protocols, ratification dates by Pakistan and obligations related to the proposed project are provided in **Annex-III.**

2.7 Comparison of International and Local Environmental Quality Standards

56. To select the more stringent standards that will be applied in the project, the national and local standards were compared to the available international standards such as the WBG EHS Standards and the World Health Organization (WHO).

Noise Level

57. Table 2-5 presents comparison of the allowed noise levels of SEQS in different zone areas and the noise level guidelines provided in Section 1.7 Noise of WBG EHS Guidelines. Furthermore, the WBG EHS guidelines states that if the existing ambient noise levels already exceeded the thresholds, the project should not result in an increase of more than 3 dB over existing ambient noise at the nearest receptor location off-site.

58. As shown in the table, SEQS standards for noise level in commercial areas (daytime and nighttime) are more stringent as compared to the WBG EHS guidelines. Noise level standard of SEQS in industrial areas during nighttime is also stricter than the WBG EHS guidelines however, the daytime noise level is more relaxed.

Table 2-5: Comparison of Environment Noise Limits

Sr. No.	Category of Area/Zone	Limit in dB(A) Leq			
		SEQS		WBG-EHS*	
		Day Time 06:00 – 22:00	Nighttime 22:00-06:00	Day Time 07:00 – 22:00	Nighttime 22:00-07:00
1	Residential area (A)	55	45	55	45
2	Commercial area (B)	65	55	70	70
3	Industrial area (C)	75	65	70	70
4	Silence zone (D)	50	45	55	45

Ambient Air Quality

59. A comparison of applicable local and international guidelines for ambient air quality is provided in Table 2-6 below. In the case of most pollutants, the SEQS standards for ambient air quality are more stringent than the WHO/WBG-EHS standards/guidelines.

Table 2-6: Comparison of International and Local Ambient Air Quality Standards

Sr. No.	Pollutants	SEQS		WHO/WBG-EHS	
		Avg. Time	Standard	Avg. Time	Standard
1	SO2	Annual Mean 24 hr.	80 µg/m^3 120 µg/m^3	24 hr. 10 min	20 µg/m^3 500 µg/m^3
2	CO	8 hr. 1 hr.	5 mg/m^3 10 mg/m^3	-	-
3	NO2	Annual Mean 24 hr.	40 µg/m^3 80 µg/m^3	1 yr. 1 hr.	40 µg/m^3 200 µg/m^3
4	O_3	1 hr.	130 µg/m^3	8 hr.	100 µg/m^3
5	TSP	Annual Mean 24 hr.	360 µg/m^3 500 µg/m^3	-	-
6	PM10	Annual Mean 24 hr.	120 µg/m^3 150 µg/m^3	1 yr. 24 hr.	20 µg/m^3 50 µg/m^3
7	PM2.5	Annual Mean 24 hr.	15 µg/m^3 35 µg/m^3	1 yr. 24 hr.	10 µg/m^3 25 µg/m^3
* In instances where the air shed is significantly degraded and the pollutant levels are already exceeding the ambient pollutant concentrations provided in the table above, it shall be ensured that the project activities cause as small an increase in pollution levels as feasible, and amounts to a fraction of the applicable short term and annual average air quality guidelines or standards as established in the project specific EA.					

Drinking water quality standards

60. Quality of the drinking water of workers during construction and operation phases will be monitored. The comparison of water quality standards of SEQS and WHO is provided in Table 2-7.

Table 2-7: Comparison of National and International Standards on Drinking Water

Sr. No.	Parameter	Units	SEQS	WHO Standards
1	Color	Pt-Co	≤15TCU	<15TCU
2	pH	pH unit	6.5-8.5	6.5-8.5
3	Turbidity	NTU	<5	<5
4	Total Hardness	mg/L	<500	-
5	Total Dissolved Solid (TDS)	mg/L	<1000	<1000
6	Fluoride F^-	mg/L	<1.50	1.50
7	Chloride(Cl^-)	mg/L	<250.00	250
8	Nitrate $(NO_3)^-$	mg/L	<50.00	50.00

Sr. No.	Parameter	Units	SEQS	WHO Standards
9	Odor	-	Non Objectionable / Acceptable	Non Objectionable / Acceptable
10	Taste	-	Non Objectionable / Acceptable	Non Objectionable / Acceptable
11	Arsenic (As)	mg/L	< 0.05	0.01
12	Zinc (Zn^{2+})	mg/L	5.0	3.0
13	Nitrite	mg/L	<3	3
14	Boron	mg/L	<0.3	0.3
15	Aluminum	mg/L	< 0.2	0.2
16	Antimony	mg/L	<0.005	0.02
17	Cadmium	mg/L	0.01	0.003
18	Mercury	mg/L	<0.001	0.001
19	Nickel	mg/L	<0.02	0.02
20	Selenium	mg/L	0.01	0.01
21	Barium	mg/L	0.7	0.7
22	Total Chromium	mg/L	<0.05	0.05
23	Copper	mg/L	2	2
24	Lead	mg/L	<0.05	0.01
25	Cyanide (CN)	mg/L	<0.05	0.07
26	Manganese	mg/L	<0.5	0.5
27	Total Coliforms	cfu/100ml	0/100 ml	0/100 ml
28	Fecal Coli forms (E.Coli)	cfu/ml	0/100 ml	0/100 ml

Effluent Standards

61. The construction activity may generate wastewater from the workers' camps that will be discharged into existing KWSC sewerage system. A comparison of effluent standards in Table 2-8 shows the WBG-EHS guidelines are more stringent as compared to SEQS standards but parameters in WBG-EHS guidelines are lesser.

Table 2-8: Comparison of National and International Effluent Standards

Sr. No.	Parameter	Units	SEQS (Effluent – Discharged into KWSC System)	WBG-EHS Effluent Guideline
1	Temperature	°C	≤ 3°C	--
2	pH	pH unit	6-9	6-9
3	Chemical Oxygen Demand	mg/L	150	125
4	Biochemical Oxygen Demand (BOD)	mg/L	80	30
5	Solids, Total dissolved (TDS)	mg/L	3500	-
6	Solids, Total suspended (TSS)	mg/L	200	50
7	Chloride	mg/L	1000	-
8	Fluoride (F-)	mg/L	10	-
9	Oil and grease	mg/L	10	10
10	Phenols, Total (Phenolic Compounds)	mg/L	0.10	-
11	Cyanide(CN-)	mg/L	1	-
12	Anionic Detergents as	mg/L	20	-

Sr. No.	Parameter	Units	SEQS (Effluent – Discharged into KWSC System)	WBG-EHS Effluent Guideline
	MBAS			
13	Sulfate (SO4-2)	mg/L	600	-
14	Sulfide (S)	mg/L		-
15	Ammonia NH3	mg/L	40	-
16	Cadmium (Cd)	mg/L	0.10	-
17	Chromium (Cr) as Hexavalent and Trivalent	mg/L	1	-
18	Copper (Cu)	mg/L	1	-
19	Lead	mg/L	0.50	-
20	Nickel	mg/L	1	-
21	Zinc	mg/L	5	-
22	Iron	mg/L	8	-
23	Manganese	mg/L	1.50	-
24	Selenium	mg/L	0.50	-
25	Silver	mg/L	1	-
26	Arsenic	mg/L	1	-
27	Barium	mg/L	1.50	-
28	Boron	mg/L	6	-
29	Mercury	mg/L	0.01	-
30	Chlorine	mg/L	1	-
31	Total Toxic Metals	mg/L	2	-
32	Nutrients as Nitrogen	mg/L	-	10
33	Nutrients as Phosphorous	mg/L	-	2
34	Total Coliform	MPN/100ml	-	400

3 Project Description

3.1 Needs of the Project

62. Many households in Karachi do not have access to piped safe water while households that have water connections are experiencing inadequate, irregular and inequitable water supply. Water supply is typically only available for a few hours per day and has low pressure. Water tankers are the main source of domestic water however these are inefficient and expensive. There are also available groundwater sources in the area, however, water is brackish which makes it unsuitable for use.

63. The K-IV Augmentation is one of the subcomponents of SOP-2 of KWSSP which aims to secure sustainable water supply within Karachi. This sub-component will connect the government financed KIV treatment plants to the existing water network, thus leveraging existing counterpart investments to significantly improve the water supply. This project will deliver about 260 MGD of water from the KIV water reservoirs to Karachi.

3.2 Project Location

64. The proposed K-IV Augmentation project involves laying of water pipes from the KIV reservoir to three identified routes within Karachi. The routes of the water pipes are discussed below.

65. The proposed project area falls under the jurisdiction of Deputy Commissioners of District Malir, Korangi, Karachi East and Karachi Central and Keamari.

Table 3-1: Summary of KIV Augmentation Routes

Route No.	Route Details		Districts that will be Traversed
	Start Point	End Point	
1	Reservoir 1 near Pipri/ Eastern Bypas	Y Junction in Landhi	Malir and Korangi
2	Reservoir 2 near NEK Old Filtration Plant	Gulbai	Malir, Karachi East, Karachi Central, Keamari
3	Reservoir 3 near Hub Dam Road/ Northern Bypas	Qasba and Banaras	Malir and Karachi Central

a. Route-1: 65 MGD pipeline from Reservoir 1 to Y Junction (28 km)

66. Route 1 will convey 65 MGD water from Reservoir 1 to Y Junction in Landhi.

67. Reservoir 1 is located off eastern bypass near Goth Muhammad Ali Jokhiyo and approximately 65 km from Keenjhar Lake. From Reservoir 1, the pipeline runs for 28 km and ends at Y-Junction in Landhi.

68. Most of the route passes through the Malir district. The first 13 km of the proposed route from the reservoir passes through the open area/barren land till Pak- Steel Chowrangi. Afterward it moves through the industrial area along Mehran Highway. The last 3 km of the route is located in Korangi district.

69. Route1 traverses through the following roads:
    - Eastern Bypass Road near Samandari Baba Mazar Road;
    - Pak Steel Road near Pak Steel Showrangi;

- Mehran Highway from Port Qasim road to Y Junction; and
- Lalabad Road near International Steel Limited

70. The proposed alignment of Route 1 is illustrated in Figure 3-1.

b. Route-2: 130 MGD pipeline from Reservoir 2 to Gulbai (39.5 km)

71. Route 2 will transport about 130 MGD water from Reservoir 2 to Gulbai. Reservoir 2 is located approximately 95 km from Keenjhar Lake.

72. This is the longest route with an overall length of 39.5 km. It starts from Sethani Gabol Goth of Gadap Town and ends at Gulbai at Mauripur Road. This route passes through four districts of Karachi namely district Malir, Karachi East, Karachi Central and Keamari. The first 15km of the pipeline traverses through the rural area of Malir district till M9 Motorway. This stretch runs along the Northern Bypass Link Road. The next 17km of this route passes through District East and Central. This stretch intersects a number of very busy roads in and around heavily populated areas. A small portion of 1km of this route passes through the Essa Nagri (a katchi abadi). The last 7.5km of the proposed route moves through the industrial area along Estate Avenue of district Keamari.

73. The following roads will be traversed by Route 2:
    - Karachi-Dadu-Dureji-Hub Road from Taiser Town and Afgan Basti to Northern Bypass;
    - M10 and M9 Link Road;
    - Dr. Mushtaq Hussain Road along M9 upto Jamali bridge;
    - New Karachi-University Link Road;
    - Maulana Ubaidullah Sindhi Road near Highway Colony and Quetta Town;
    - Hijri Road crossing Suparco Road;
    - Abdul Hasan Isphahani Road from Mubina Thana to Muskan Chowrangi;
    - Allama Shabbir Ahmed Usmani Road from Muskan Chowrangi to Gulshan Chowrangi flyover,
    - Sardar Ali Sabari Road;
    - University Road from Aziz Bhati Park to Hassan Square Flyover;
    - Sir Shah Muhammad Suleman Road from National Stadium to Nazimabad crossing the University Road, Shahrah e Pakistan, and Liyari Expressway;
    - Nazimabad Road upto Habib Bank Chowrangi; and
    - Estate Avenue till M10 upto Gulbai

74. The proposed alignment of this route is in Figure 3-2.

c. Route-3: 65 MGD pipeline from Reservoir 3 to Qasba and Banaras (28.5 km)

75. This pipeline route starts from Reservoir 3 located off Hub Dam Road near Goth Khairo Brohi and ends at the Banaras (near Bacha Khan Flyover). The total length of this route is 28.5km passing through district Malir and Karachi Central. This route will transport 65 MGD of water to Qasba and Banaras.

76. The initial 7km of this route traverse through the semi urban area of Malir district where the population density is much lesser whereas the next 10km passes through the moderately populated residential areas. The last 12km of this route passes through District Central along the Ajmer Nagri Road up to Ajmer Nagri Roundabout Mangopir and Shahrah–e-Noor Jahan Road.

77. Route 3 will pass through the following roads:
    - Hub dam road upto M10;

- Lyari Basti Road upto Karachi Development Authority (KDA) Chowrangi (Sirjani Power Station);
- Khawaja Shamsuddin Azeemi Road from Sirjani Power Station Chowrangi to Powerhouse Roundabout;
- Ajmer Nagri Road upto Ajmer Nagri Roundabout Mangopir;
- Shahrah–e-Noor Jahan Road from Ajmer Nagri Roundabout Mangopir to State Bank of Pakistan crossing Qalandri Chock and Ada Mor; and
- Orangi Road from State Bank to Banaras.

78. The proposed alignment of Route 3 is presented in Figure 3-3**.**

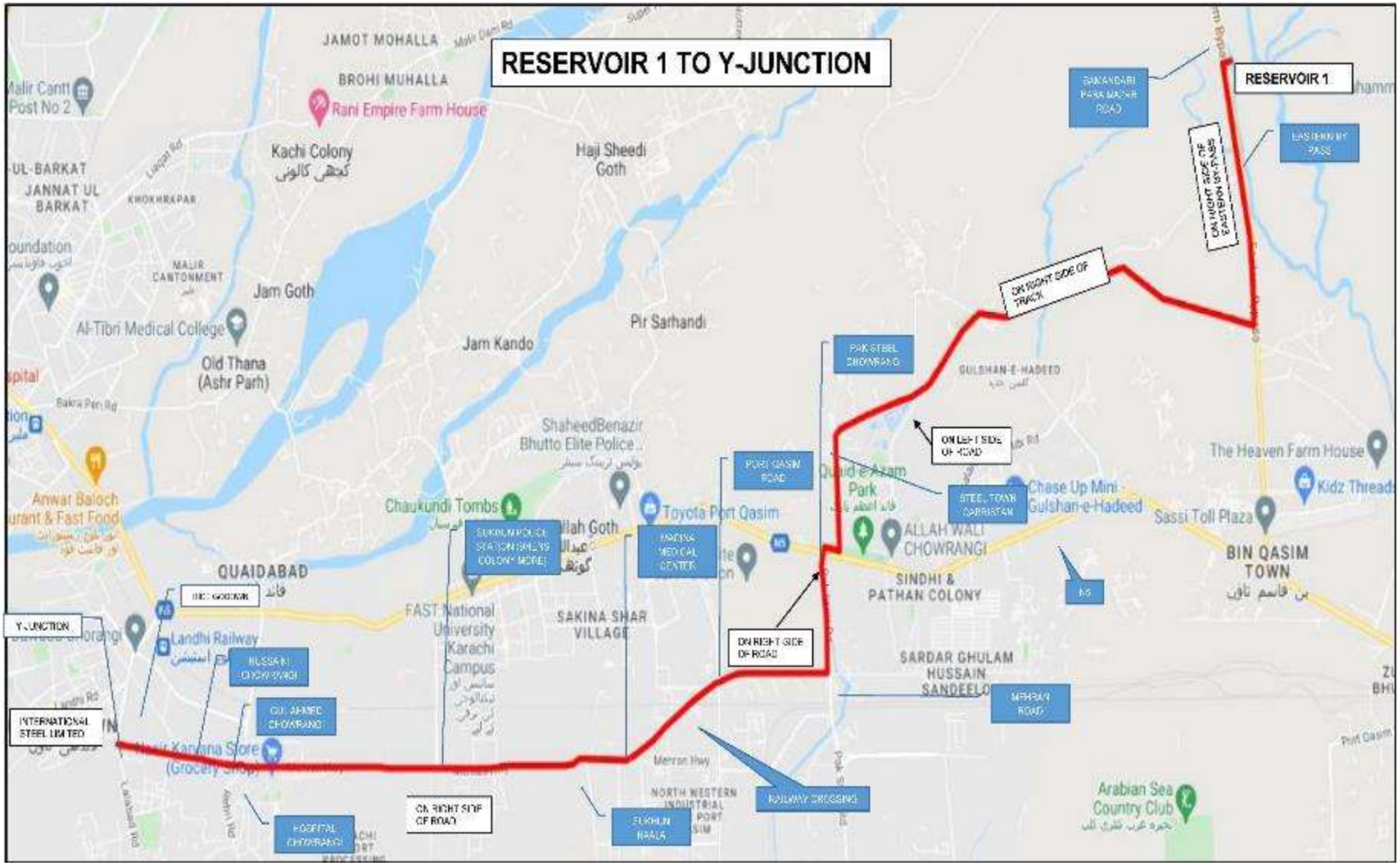


Figure 3-1: Route 1 Proposed Alignment

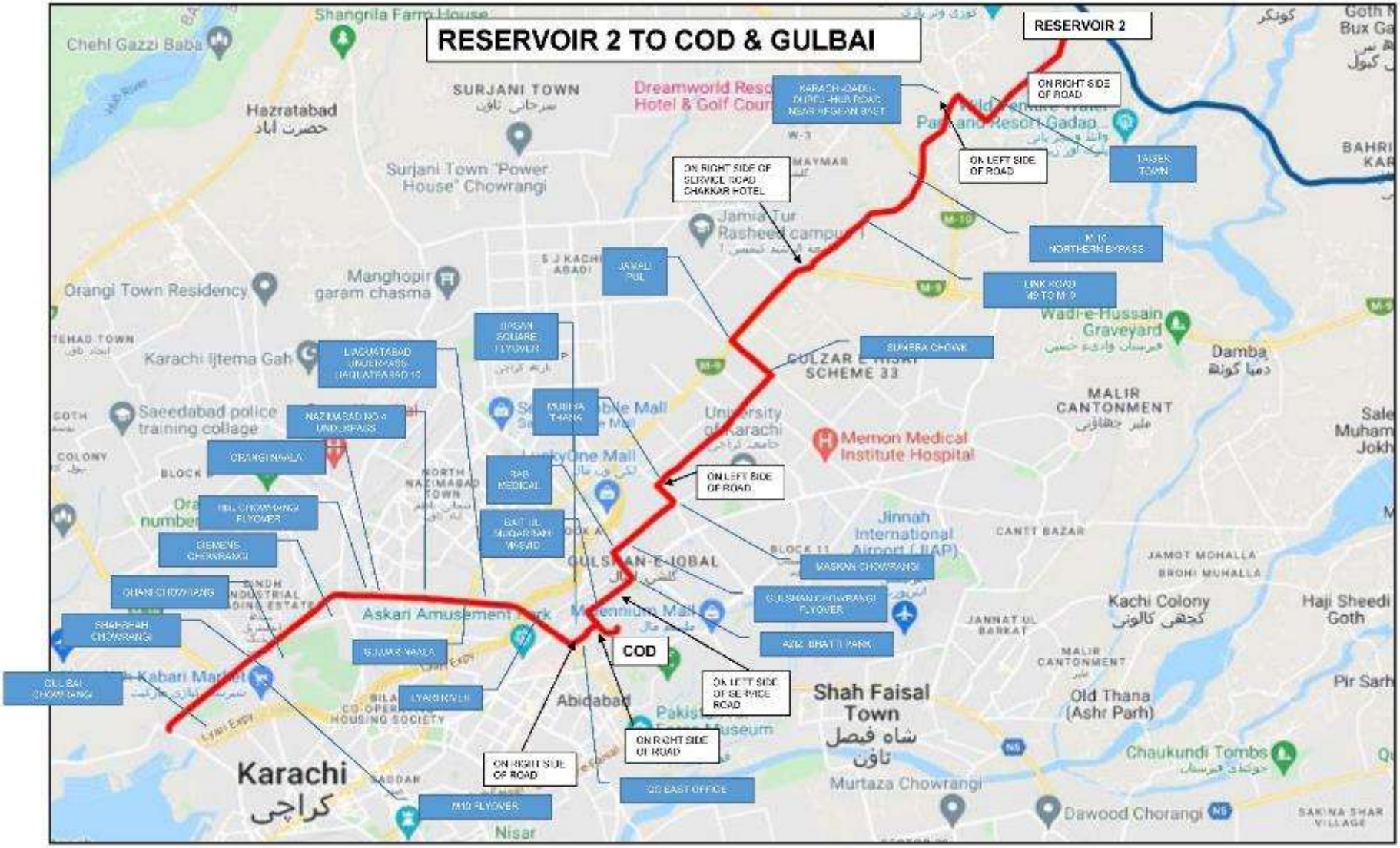


Figure 3-2: Roue 2 Proposed Alignment

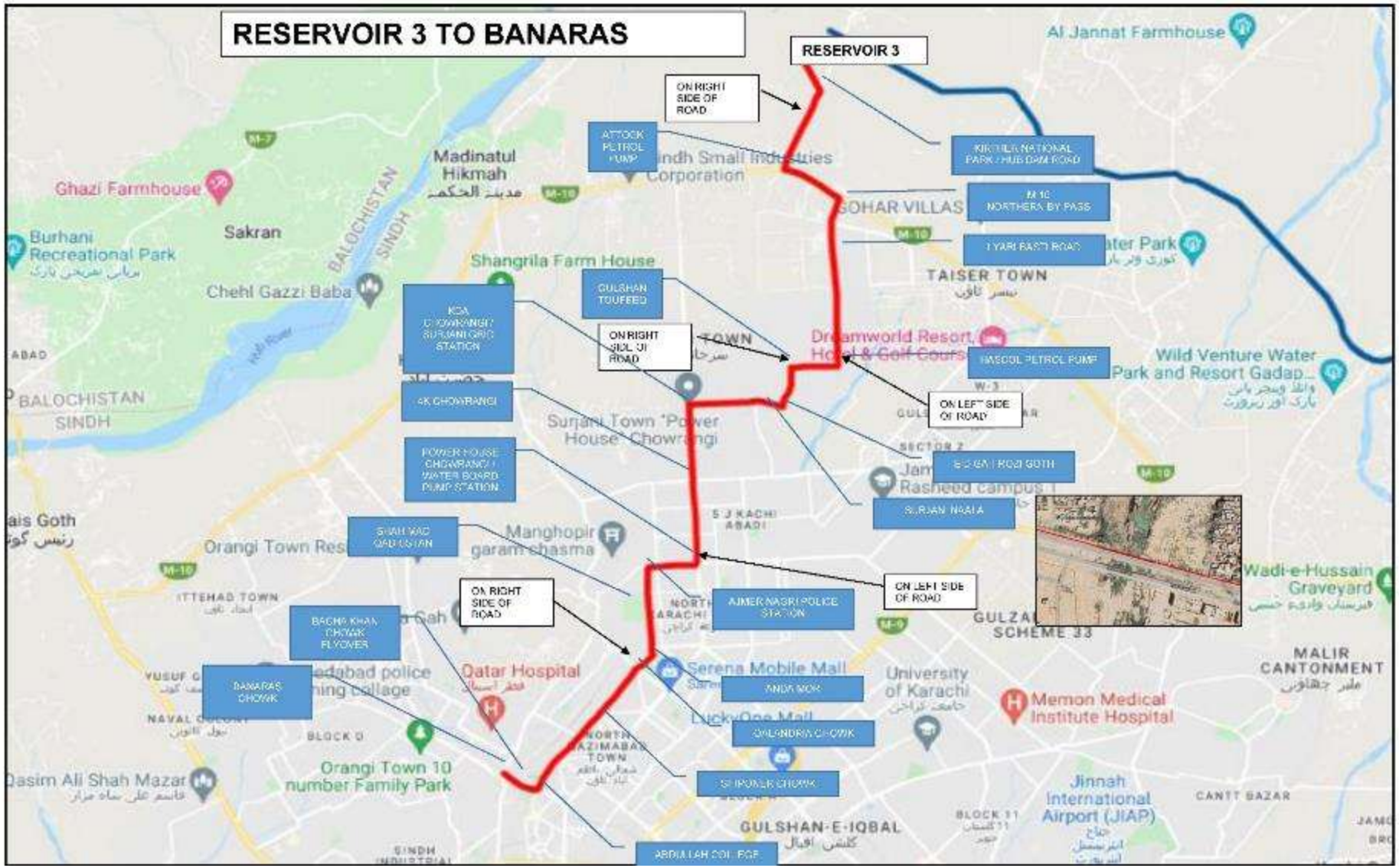


Figure 3-3: Route 3 Proposed Alignment

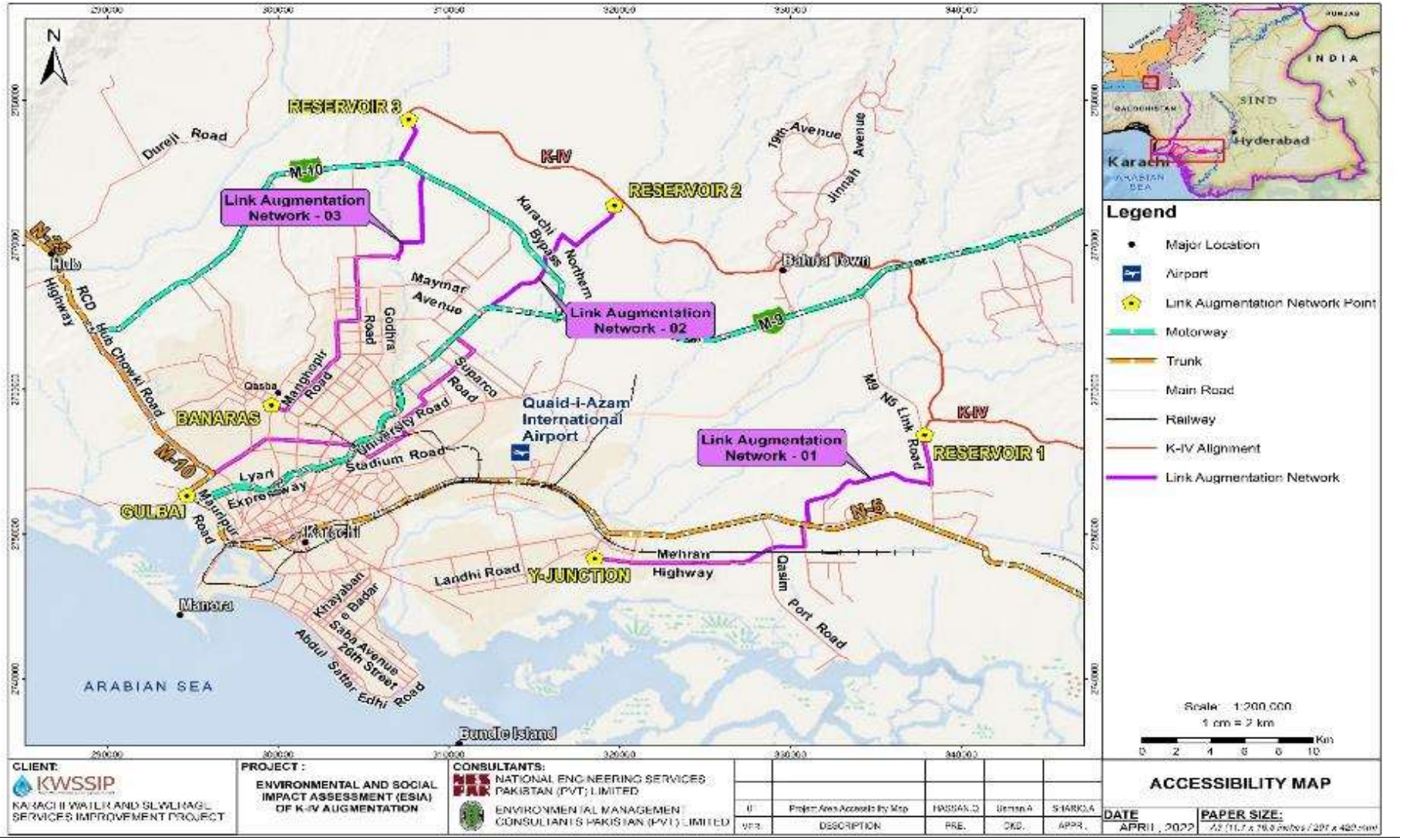


Figure 3-4: Project Site Accessibility Map

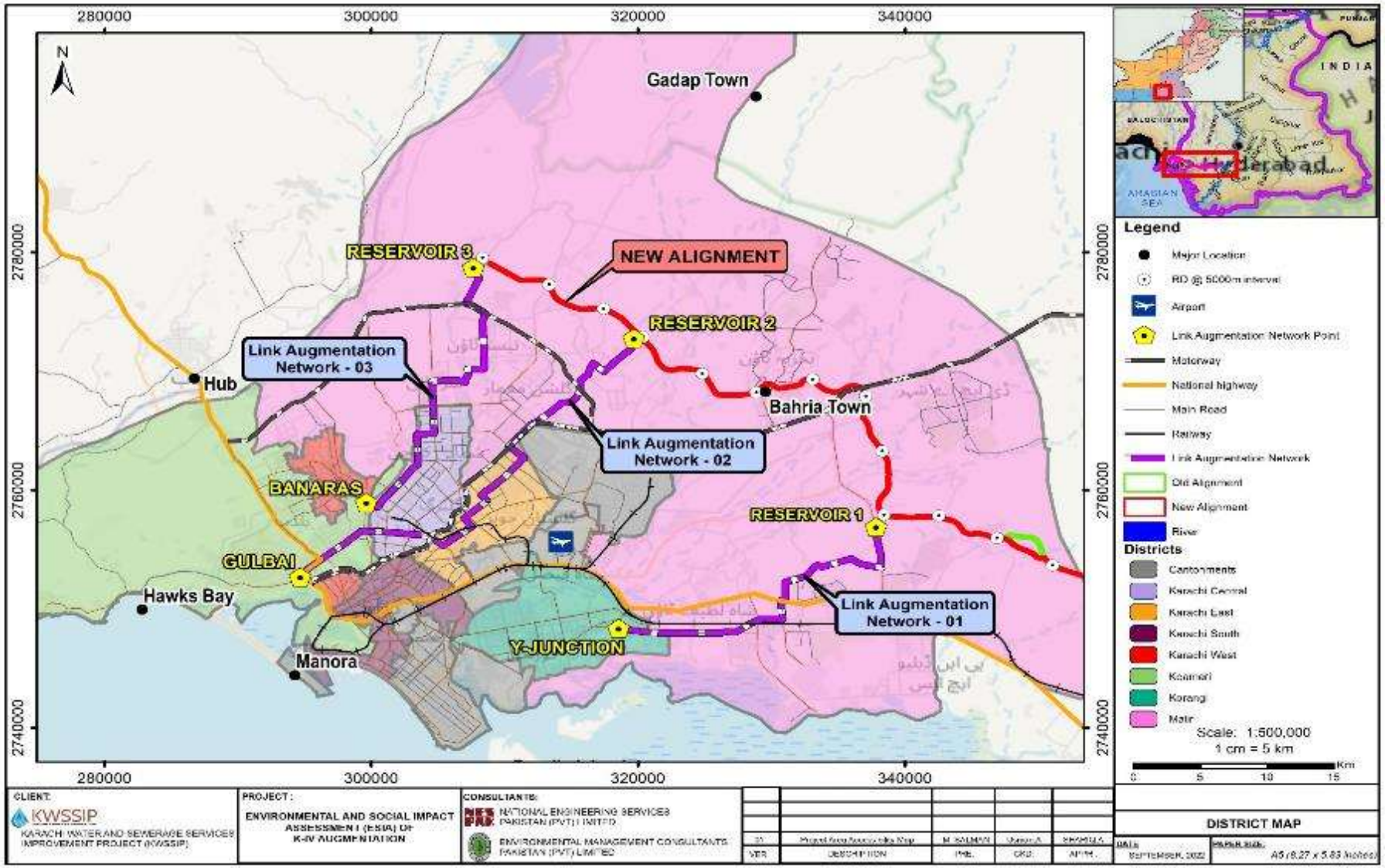


Figure 3-5: Districts Traversed by the Proposed KIV Augmentation Works

3.3 Project Components

3.3.1 Major Components

79. The proposed water pipe network will be designed for gravity flow. The design life of the water supply scheme is 25 years and that of machinery is 40 years for the projected population.

Table 3-2: Detailed Design Parameters for Routes 1 to 3

Parameters	Unit	Specification			
		Route-1	Route-2		Route-3
Pipe Diameter	m	1.8	1.8	2.4	1.8
Pipe Length	km	28	14.7	28.0	28.5
Total Flow	MGD	65 MGD	65	130	65
Pipe Material		MS Pipe	MS Pipe	MS Pipe	MS Pipe
Flow Velocity	m/s	1.37	1.37	1.55	1.37
Pipe Wall Thickness	mm	12.7	12.7	20.6	12.7
Head (no pumping required)					
Net Head	m	22.99	26.97	24.58	24.36
Total Static Head	m	51.56	41.22	47.04	51.87
Total Dynamic Head Loss due to Friction	m	25.97	12.96	20.43	25.0

80. The major components of the water main pipes/conveyance system are described below:

- Mild steel pipes with diameter of 1.8m and 2.4m will be used as water pipes.
- Butterfly valves are to be located at the main control points for balancing and regulating the flows. Apart from this, butterfly valves are to be provided at some regular intervals within the length of the pipe so that the pipe can be repaired between two valves if required without emptying the entire transmission main.
- Air release valves will be installed every 600-meter interval in straight reaches and at every high point to facilitate escape of trapped air.
- Washout valves will be provided at the lowest points to washout all kinds of debris and the undesired accumulated water in the trench.

3.3.2 Temporary facilities during Construction

a. Machines and Heavy Equipment

81. Table 3-3 presents the list of machinery and heavy equipment that will be utilized during construction.

Table 3-3: Machinery and Equipment Requirement during Construction

Sr. No.	Type of Machinery and Equipment	Route-1	Route-2	Route-3
1.	Mobile Crane 20-50 Ton	2	4	3
2.	Excavators Caterpillar 330 or equivalent	5	8	4
3.	Excavator with hammer Caterpillar 345 or equivalent	5	7	5
4.	Dump Trucks	20	25	20

Sr. No.	Type of Machinery and Equipment	Route-1	Route-2	Route-3
5.	Wheel Loader	20	22	20
6.	Mobile Lubricator / Diesel Tankers	10	13	10
7.	Generators Various capacities 10-500 kVA	3	5	3
8.	Motor Grader	10	15	10
9.	Rollers vibrator	10	15	10
10.	Water Tankers / Sprinkler (5000 gallon)	5	8	5
11.	Compactors	10	13	8
12.	Concrete Batching Plants	2	4	2
13.	Concrete Pump	4	4	4
14.	Transit Mixer (6 m^3 capacity)	10	15	9
15.	Poker Vibrator	15	20	13
16.	Concrete Pump	--	4	--
17.	Dewatering Pumps	3	6	3
18.	Bar Bender Machine	10	20	10
19.	Bar Cutter Machine	10	12	9
20.	Flat Bed Trailer	2	5	3
21.	Tractor trolley	5	8	5
22.	Mobile welding plant	2	5	2

b. Construction Camps/Construction Yard

82. The location of the construction camps and other facilities such as workshops, parking area for machinery, construction material storage area and others will be finalized by the contractor, with the assistance of Supervision Consultant (SC), prior the start of the construction activities. In selecting the locations, the following shall be considered.

- There will be no resettlement issues for the location of the camps;
- Camp site will be away from the residential areas and sensitive receptors;
- Selection of sites for construction camps shall be near the project area having proper access to the nearby main/link road;
- Record of number of workforce deployed;
- The camps must be located in a place where the drainage from and through the camps will not threaten any domestic or public water supply;
- Camp site must be adequate in size to prevent overcrowding of necessary structures;
- The camp site will consider avoiding any damage of property, vegetation, irrigation, and drinking water supply systems;
- The camp site must not be subject to periodic flooding;
- There will not be any ecologically sensitive areas e.g. wildlife sanctuaries, game reserves, national parks, forest areas, etc. near to the construction camp site

83. Overall, three construction camps (one camp for each route) will be established during construction phase. Based on the abovementioned criteria, tentative location of the construction camps were identified and presented in Figure 3-6. The

construction camps will be located outside the RoW thus, lease from private landowners may be required.

3.3.3 Associated Facility

84. As stated in the WB's Environmental and Social Policy for Investment Project Financing, the application of the ESSs is also required to associated facilities. The KIV mainstream project is considered as an associated facility of the KIV Augmentation Works since it met the criteria of WB as listed in Table 3-4. With this, an Environmental and Social Audit/Review was done for the K-IV Mainstream Project.

85. The K-IV Mainstream Project will supply over 650 million Gallons per Day (MGD) of water in three separate phases, and deposit it into 3 reservoirs on the outskirts of Karachi. Phase 1 of the project is currently planned, through funding by the Federal Government, where 260 MGD of water will be supplied to the proposed reservoirs. Under K-IV Augmentation Project, three pipelines will be connected to the three reservoirs to transport the 260 MGD of water that is to be supplied to the city under Phase 1 of the K-IV Mainstream Project.

Table 3-4: Identification of Associated Facility

S. No.	Requirement For Qualification as an Associated Facility under ESS1	Applicability to K-IV Mainstream Project
1	Facilities or activities that are not funded by the World Bank	Funded by the Federal Government
2	Directly & Significantly Related to the Project	The K-IV Mainstream Project is the precursor to the K-IV Augmentation project, as it will supply water to the outskirts of Karachi, where the Augmentation project will convey it to the city's existing water supply system. Thus, establishing a direct and significant relation between the two.
3	Carried out or planned to be carried out contemporaneously with the project	The K-IV Mainstream Project has currently started, where the Augmentation Project is also expected to start soon after the World Bank's approval. Given that only when both projects are completed, will water actually reach the residents of Karachi, hence, it has been planned by the authorities to ensure that both projects construction finishes at the same time, therefore ensuring that both projects will be carried out contemporaneously. However, currently only Phase 1 of the K-IV Mainstream Project is planned, where the construction dates for the other 2 phases are not planned for any time soon.
4	Necessary for the project to be viable and would not have been constructed, expanded, or conducted if the project did not exist	The K-IV augmentation project would not be viable or exist without the K-IV Mainstream project as the Mainstream project is what will bring water to the reservoirs from where the pipelines planned under the augmentation project will provide

S. No.	Requirement For Qualification as an Associated Facility under ESS1	Applicability to K-IV Mainstream Project
		the connection to the city's existing water supply network.

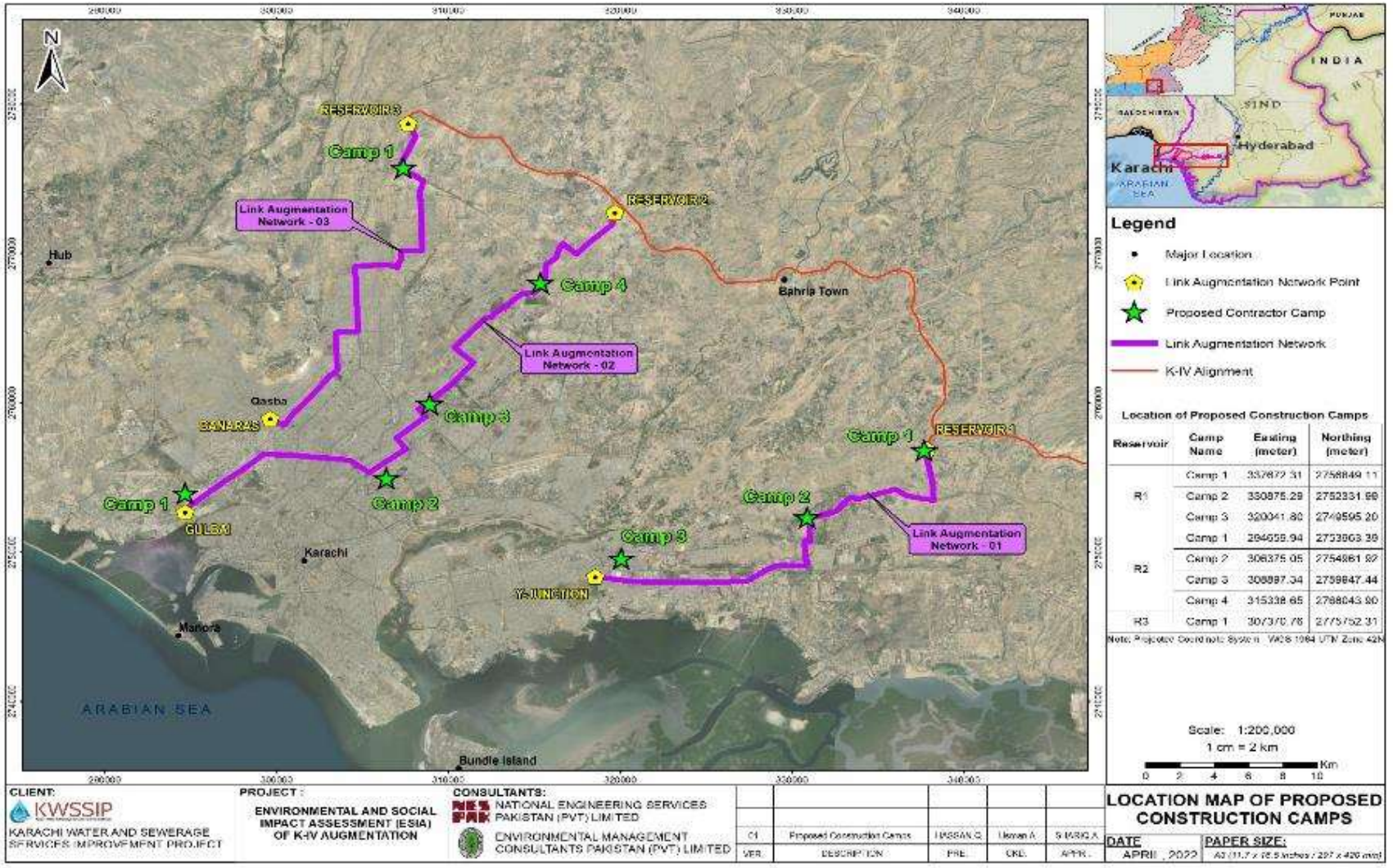


Figure 3-6: Tentative Location of Proposed Construction Camps

3.4 Project Utilities

3.4.1 Water

86. The water requirement for the construction activities is about 30 m^3/day. An additional 17.2 m^3/day of water is required for domestic use of the workers. This will be supplied by water tankers.

87. The source of water during the construction phase for non-potable uses, such as for sanitation and bathing at construction sites and camps, will be from water bowser tanks whereas filtered (bottled) water will be utilized for drinking purposes.

3.4.2 Power

88. The main source of electricity during construction is K-Electric for construction camps and diesel generators for construction machinery.

89. During the operational phase it would be taken from main electric power grid, supplying power to the main city.

3.4.3 Construction Materials

90. Construction materials will include coarse aggregates (crush), fine aggregates (sand), soil, water, asphalt, reinforcement, cement, bentonite, MS Pipes, valves etc. The estimated quantity of construction material for the proposed project is shown in Table 3-5.

91. All the construction materials, except pipes and valves, are locally available within Karachi City and will be purchased from licensed suppliers. The pipes and valves will be imported.

92. About 1.187 million cubic meter of soil materials will be excavated. Out of the total, about 0.721 million cubic meters, or about 60% of the total excavated materials, we be used for backfilling while the remining can be reused in other project sites or be disposed of within approved site of SSWMB or KMC. With this, there is no need to purchase the backfilling material from outsource.

Table 3-5: Estimated Construction Material for the Proposed Project

Sr. No.	Material Type	Unit	Route-1	Route-2	Route-3	Total
1	Cement	Tons	511	981	518	2,011
2	Crush	m^3	1,490	2,876	1,510	5,876
3	Sand	m^3	744	1,441	755	2,940
4	Reinforcement	Tons	135	257	137	529
5	Water	m^3	204	392	207	804
6	MS Pipe	M	26,500	39,600	28,500	94,600

3.5 Project Activities

3.5.1 Construction

93. Construction activities will involve the following:

a. Site clearance and grabbing;
   - Removal of vegetation in the RoW;

- Temporarily shifting the small kiosks and stalls from the RoW;

b. Clearance and relocation of utilities (above ground);
   - Shifting of transmission lines, telephone lines, gas pipelines after proper compensation to the concerned department;

c. Material haulage and storage;
   - Transpiration of steel, cement, crush, sand and MS pipe;
   - Storage of these material in storage yard;

d. Establishment of camps, offices and workshops;

e. Earth work of the water main pipe and all associated works includes:
   - Excavation and removal of the existing pavement materials and the existing road embankment;
   - Removal and relocation of the existing utilities (underground);
   - Trench preparation and bedding for the proposed project except the road crossings where the tunnel boring method will be adopted;
   - Pipe installation which includes the laying of pipelines, mechanical jointing, fitting and coupling;
   - Pipe encasement (cement concrete/engineered filled material) where required;
   - Testing, commissioning and disinfection of the water main pipe;
   - Backfilling of trench; and
   - Site restoration including the road pavement.

3.5.2 Operation

94. Operation and Maintenance (O&M) activities include the regular pipe inspection and maintenance activities (in case of damage and disruption) such as excavation, repairing of pipeline, backfilling and restoration of road.

3.6 Project Implementation Schedule

95. The proposed project is estimated to be completed within fourteen (14) months after the award of contract to successfully bidders.

3.7 Project Cost

96. The total estimated cost of the K-IV Augmentation Works is PKR 41,526.54 million[1].

[1] Review of Feasibility Report for Component B – KIV Augmentation Works. (MM Pakistan, June 2022).

4 Environmental and Socio-Economic Baseline

4.1 Introduction

97. This section describes existing environmental and social conditions of the project areas. Available secondary data from published literature, case studies, DCRs, previous studies conducted by the Consultant in the area, and other documents were used to develop the baseline profile. Aside from secondary data review, rigorous interviews and environmental monitoring were also done.

98. The map of District Karachi with its surroundings is shown Figure 4-1.

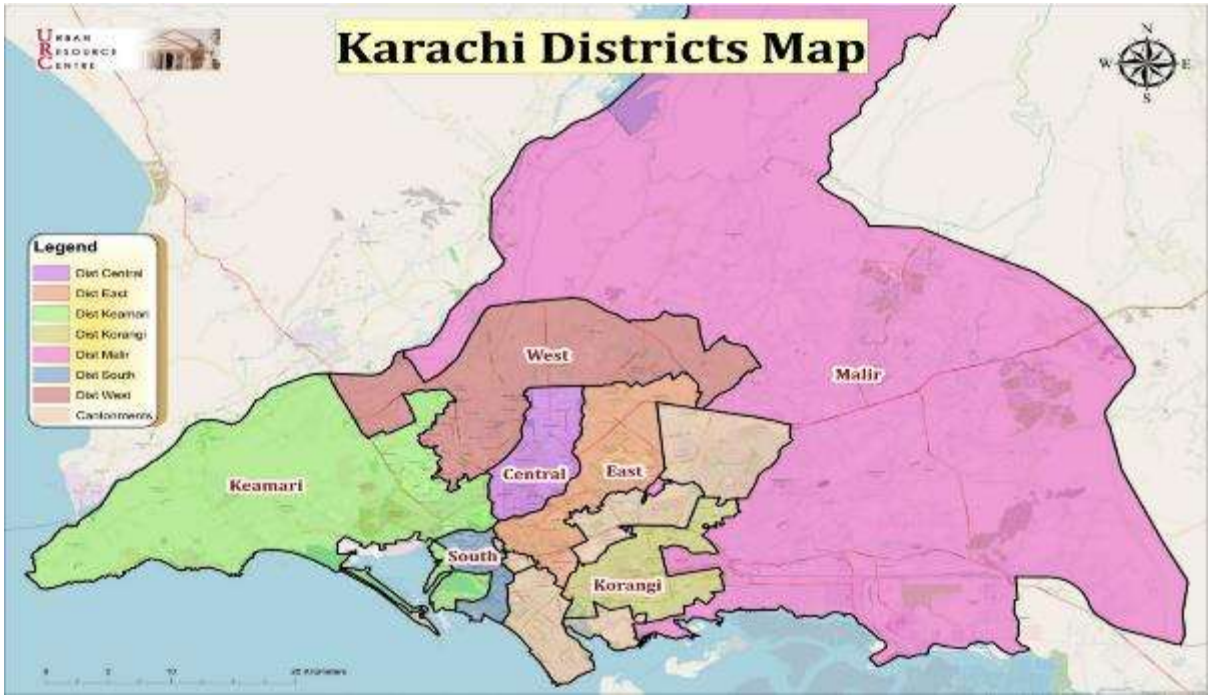


Figure 4-1: District Map of Karachi Division

4.2 Physical Environment

4.2.1 Land Use

99. The land use within the CoI of the proposed project include open/barren areas, built-up areas, green areas/parks, nullah/drain, and roads. Table 4 1 lists the various land uses within the CoI.

Table 4-1: Land Uses within the Project CoI (in hectares)

Route of K-IV Augmentation	Route Segment	District	Built-up Area	Commercial Area	Nullah/Drain	Open Area / Barren Land	Green Area / Park	Road
Route-1 (R1 Reservoir to Y Junction)	RD 0-5	Malir	None	None	None	16.71	None	6.53
	RD 5-10	Malir	None	None	0.04 (Drain)	18.70	None	4.56
	RD 10-15	Malir	None	None	None	17.18	None	6.08
	RD 15-20	Malir	0.65	1.41	None	15.61	None	5.55
	RD 20-25	Malir up to 24 and 24-25 Korangi	4.50	None	None	5.01	None	13.76
	RD 25-28	Korangi	2.63	None	None	3.57	0.06	6.26
Route-2 (R2 Reservoir to Gulbai)	RD 0-5	Malir	0.22	None	0.47 (Gijjar Nullah)	15.30	None	7.30
	RD 5-10	Malir	4.05	None	None	9.92	None	9.27
	RD 10-15	Malir	1.73	None	None	7.78	None	13.76
	RD 15-20	Karachi East	0.93	None	None	8.98	None	13.29
	RD 20-25	Karachi East	2.21	None	None	5.86	0.07	15.06

Route of K-IV Augmentation	Route Segment	District	Built-up Area	Commercial Area	Nullah/Drain	Open Area / Barren Land	Green Area / Park	Road
	RD 25-30	Karachi East up to 27.5 km and reaming in Karachi Central	0.25	None	None	1.29	None	21.74
	RD 30-35	Karachi Central up to 32 km and remaining in Keamari	1.50	None	None	2.25	None	19.48
	RD 35-39.5	Keamari	0.48	0.29	None	1.15	None	18.35
Route-3 (R3 Reservoir to Baranas, Qasba)	RD 0-5	Malir	0.14	None	None	22.83	None	0.37
	RD 5-10	Malir	3.80	None	None	8.65	None	10.77
	RD 10-15	Malir	2.42	None	None	13.10	None	7.72
	RD 15-20	Malir up to 16.5 and remaining in Karachi Central	5.83	None	None	7.46	0.14	9.80

Route of K-IV Augmentation	Route Segment	District	Built-up Area	Commercial Area	Nullah/Drain	Open Area / Barren Land	Green Area / Park	Road
	RD 20-25	Karachi Central	6.19	None	None	5.17	0.31	11.57
	RD 25-28.5	Karachi Central	6.08	None	None	1.94	0.52	7.24

4.2.2 Physiography

100. The proposed project is within an Alluvial Plain (Piedmont Plain). Among the physiographic features are low flat-topped parallel hills devoid of vegetation interspersed with widespread plains and dry riverbeds. The elevation ranges between 30m to 93m along the routes of the proposed project, as shown in Figure 4-2**.**

4.2.3 Geology and Soil

Geology

101. The proposed project area falls under Neogene Rocks, Miocene Rocks, and Oligocene Rocks. The area is comprised of marine shale and limestone, fossiliferous, topmost sandstone, and shale estuarine with abundant molluscan and few vertebrate fauna, in the early Miocene period.

102. The stratigraphy of this area consists of sand, shale, and conglomerate. Soil formations in this area are fresh and lightly weathered, recent, and sub recent shoreline deposits. These deposits are derived from Gaj/Manchar formation of Lower Miocene to Middle/Upper Miocene to Pliocene age. Quaternary deposits are represented by an extensive Conglomerate, which overlies the Manchar rocks and slightly overlaps on to the Gaj Series.

103. The site-specific geological map of the area is shown in Figure 4-3. The information related to geological formation and sub-strata were used to assess the bearing capacity as well as suitability of natural ground conditions for design of the pipelines and associated structures.

Seismology of Project Area

104. According to the seismic zone map of Pakistan prepared by Geological Survey of Pakistan and PMD, the proposed project sites lie in Zone 2B, where minor to moderate damage can occur. Figure 4-4 presents the geological map of the project area, while the zones are defined in Table 4-2

Table 4-2: Seismic Zones

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

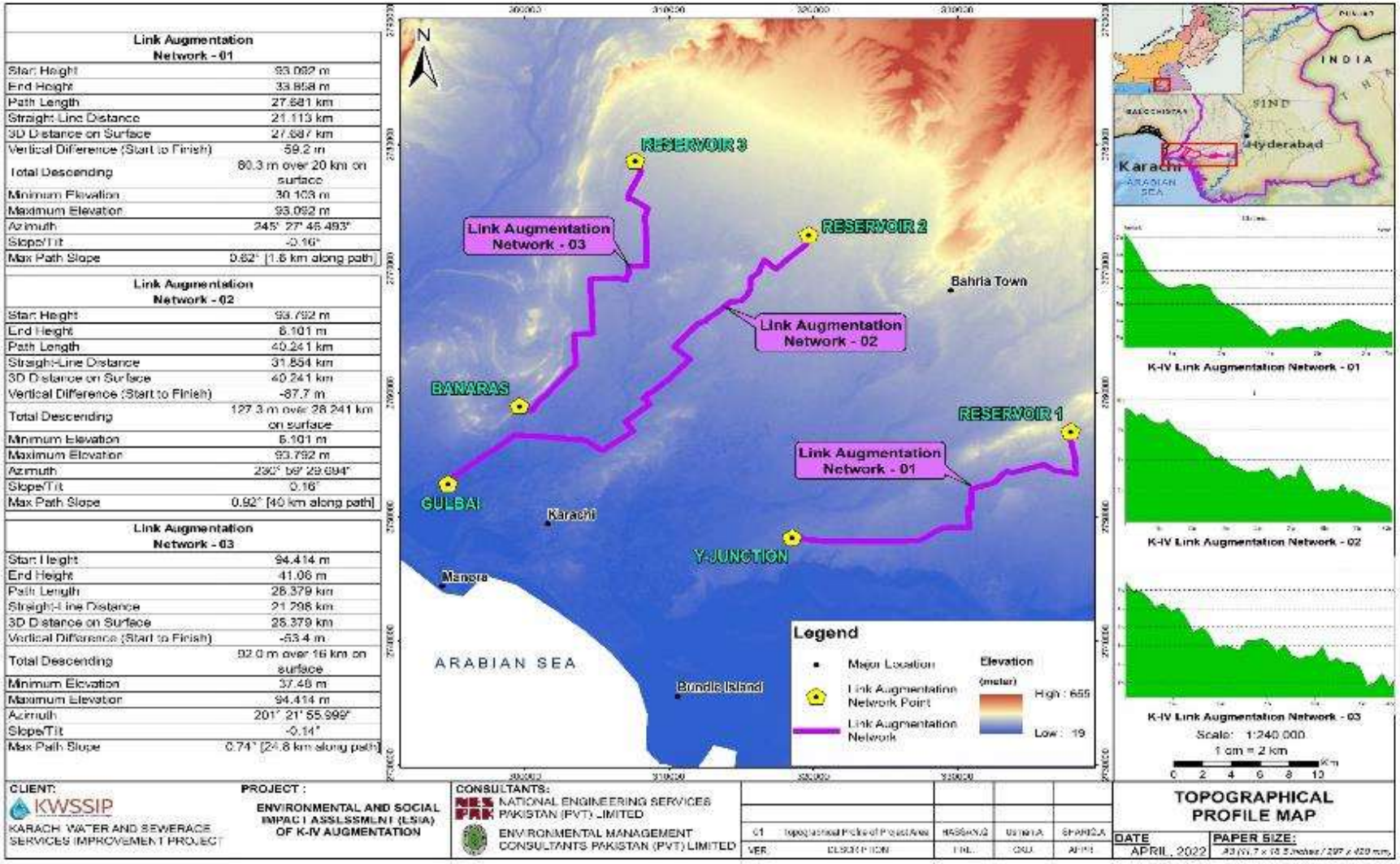


Figure 4-2: Topographic Profile Map of Project Area

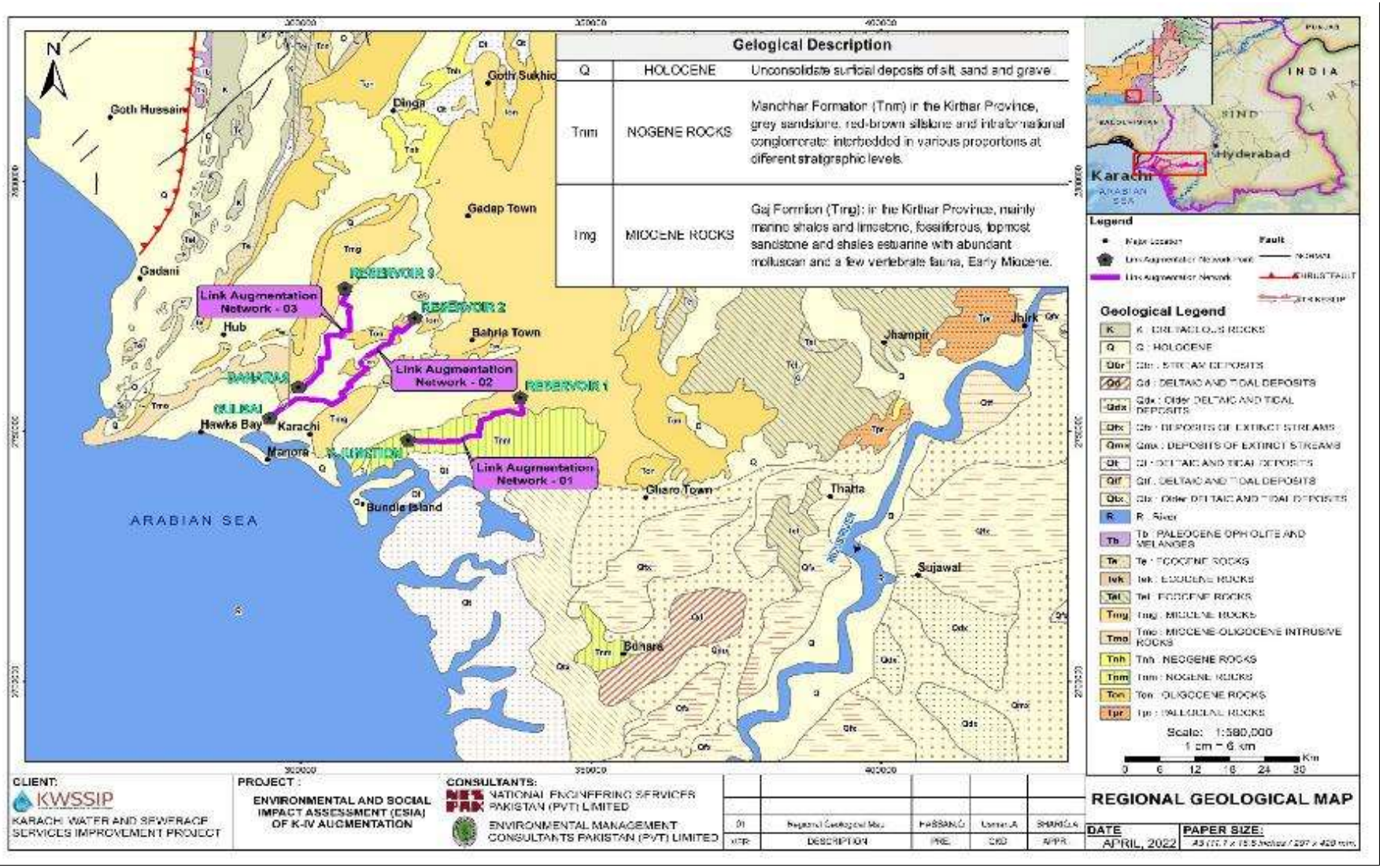


Figure 4-3: Site Specific Geological Map of Project Area

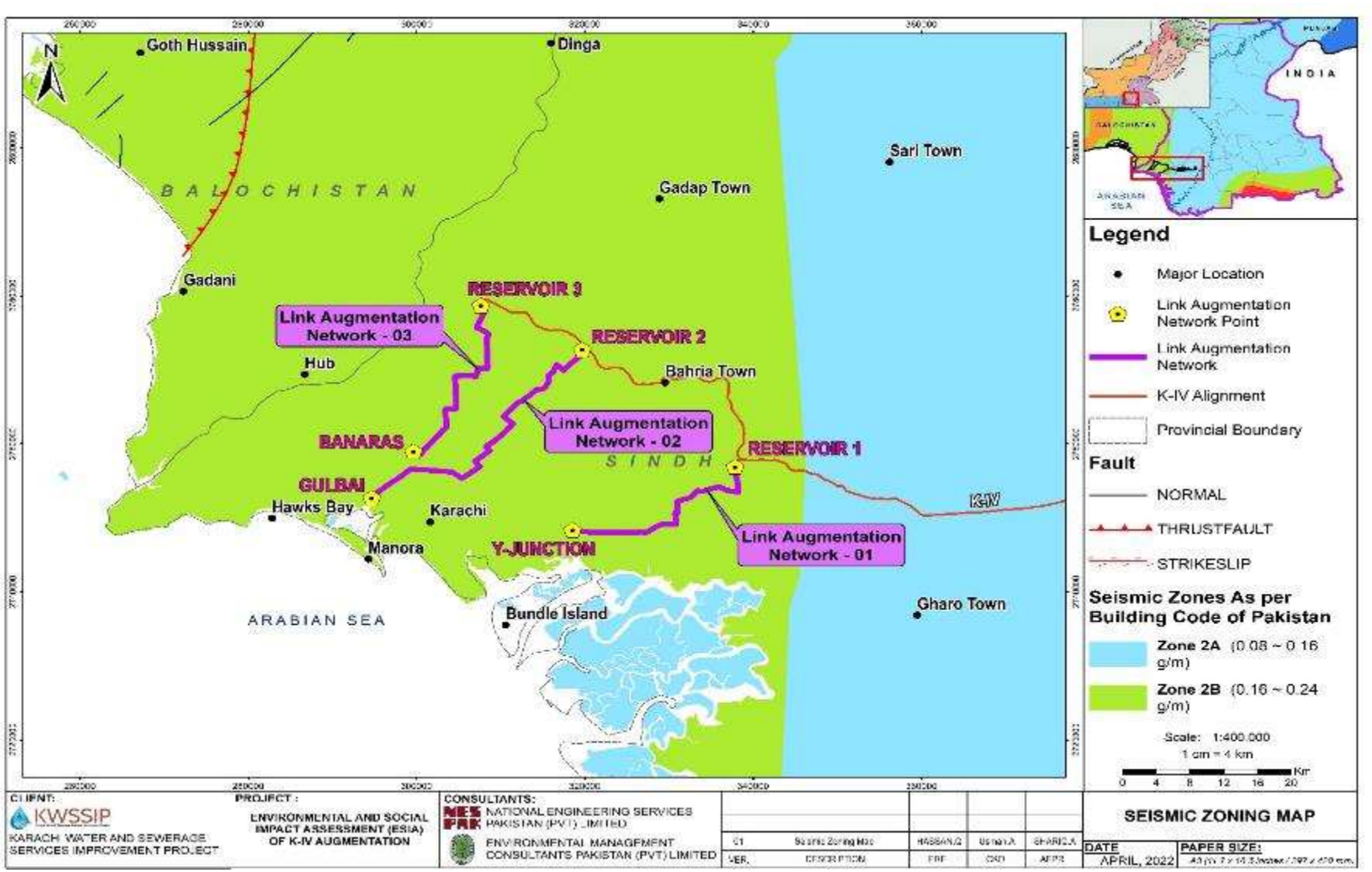


Figure 4-4: Seismic Zones Map of the Project Area

Soil

105. The project area mostly lies in Hydrological Soil Group B (moderately low run-off potential) and Soil Group C (moderately high run-off potential). Soil categorized as Group B is deep and well-drained with moderately fine to moderately coarse texture. Figure 4-5 to Figure 4-7 shows the hydrological soil group grid with 250-meter resolution acquired from Earth Data (NASA), overlaying the K-IV Augmentation routes. The project area soil classification map is shown in Figure 4-8.

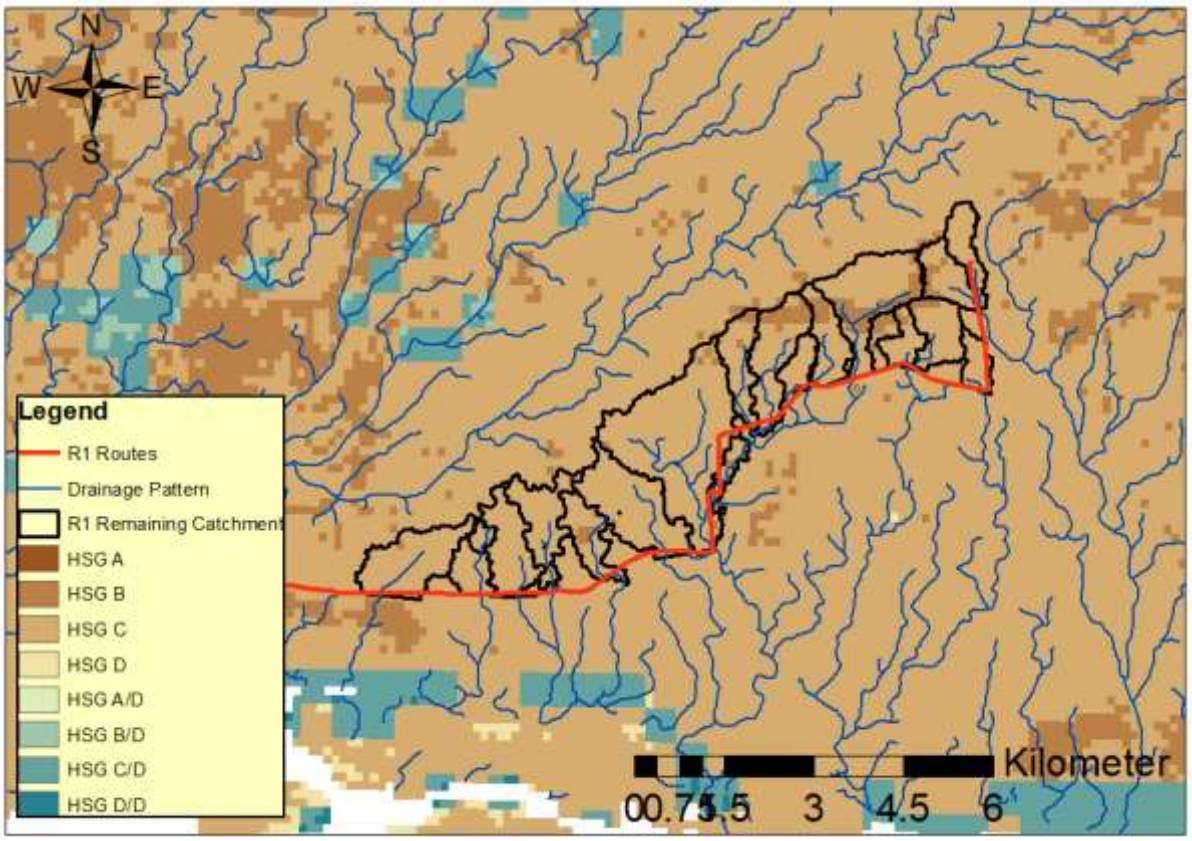


Figure 4-5: Hydrological Soil Group Grid Map of Route-1

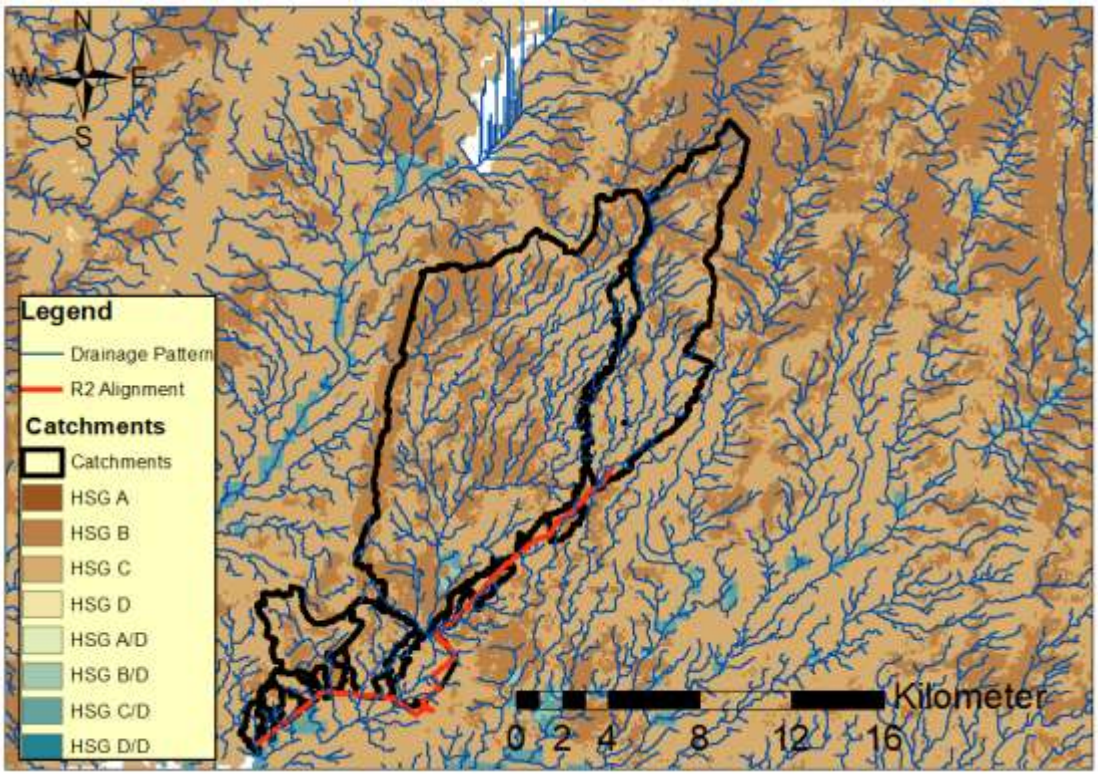


Figure 4-6: Hydrological Soil Group Grid Map of Route-2

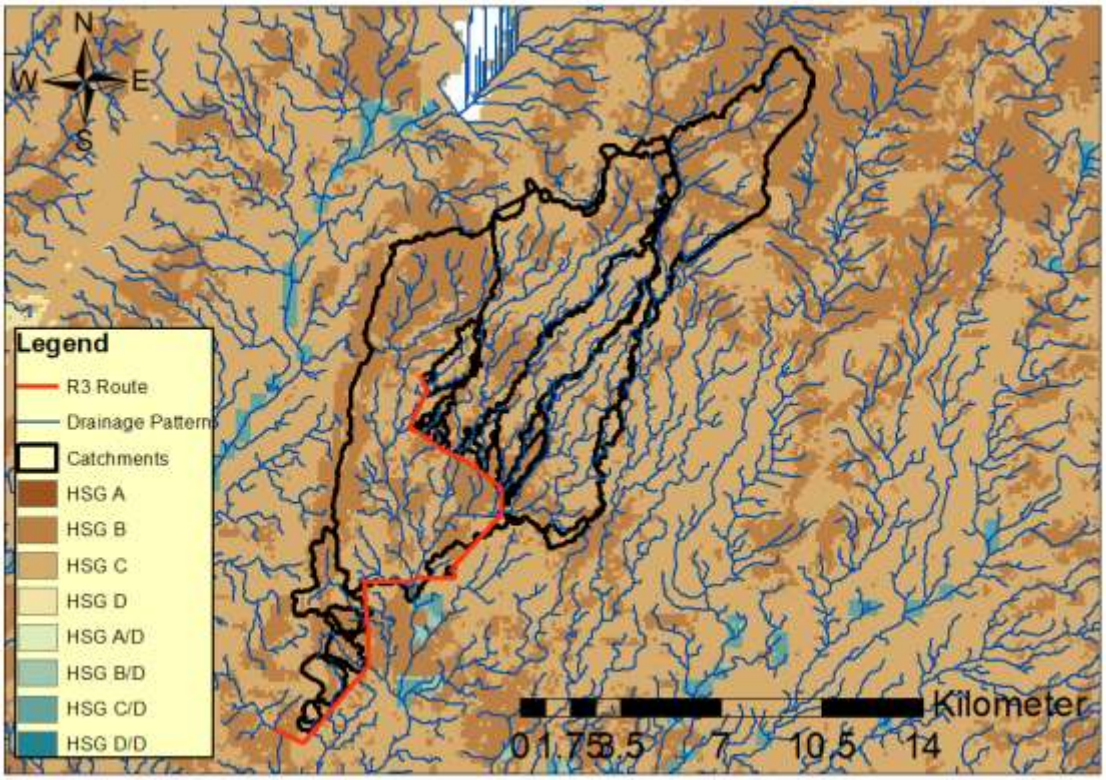


Figure 4-7: Hydrological Soil Group Grid Map of Route-3

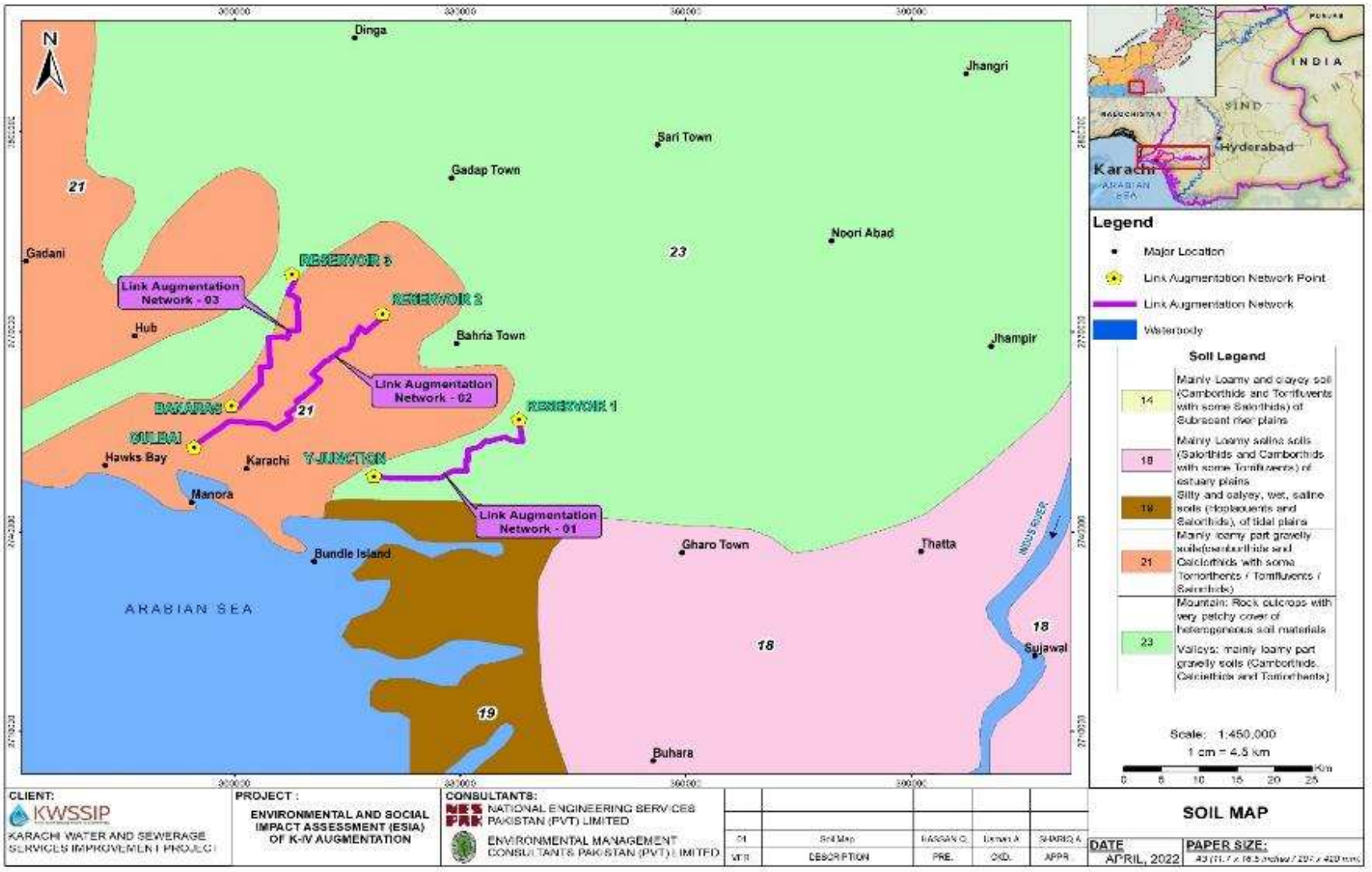


Figure 4-8: Project Area Soil Classification Map

4.2.4 Hydrology and Water Sources

Hydrology

106. Rivers in Karachi are usually dry. However, natural storm drains and rivers retain water during monsoon season, especially after heavy rainfall. The partially treated sewage of Karachi goes into the sea through the natural drains or the natural nullahs.

107. The natural storm water drains connect to two seasonal rivers: The Lyari River and the Malir River. The rivers, approximately 14 km apart, run through the foothills of the Kirthar Range and run parallel to each other. There are 58 storm water drains (nullahs) that carry water to these two rivers. Over 600 smaller drains feed into the nullahs.

108. The Lyari River and Gujjar Nullah are the main water bodies in the vicinity of the proposed project routes (Figure 4-9).

Lyari River

Gujjar Nullah

Figure 4-9: Water Bodies near the Project Site

Water Sources

109. Karachi is within the Hub River Basin and the Malir River Basin. The Malir River and the Lyari River are within the Malir River Basin. Untreated industrial and domestic effluent is discharged into these rivers, which eventually drain into the sea. The aquifer of Karachi is recharged by seepage from Hub River, Hub Dam, Malir River, and Lyari River.

110. Several pumping wells were installed in the past few years for irrigation and drinking water supply. Saltwater intrusion is anticipated due to excessive pumping of groundwater.

111. A map of water resources of proposed project area is shown in Figure 4-10**.**

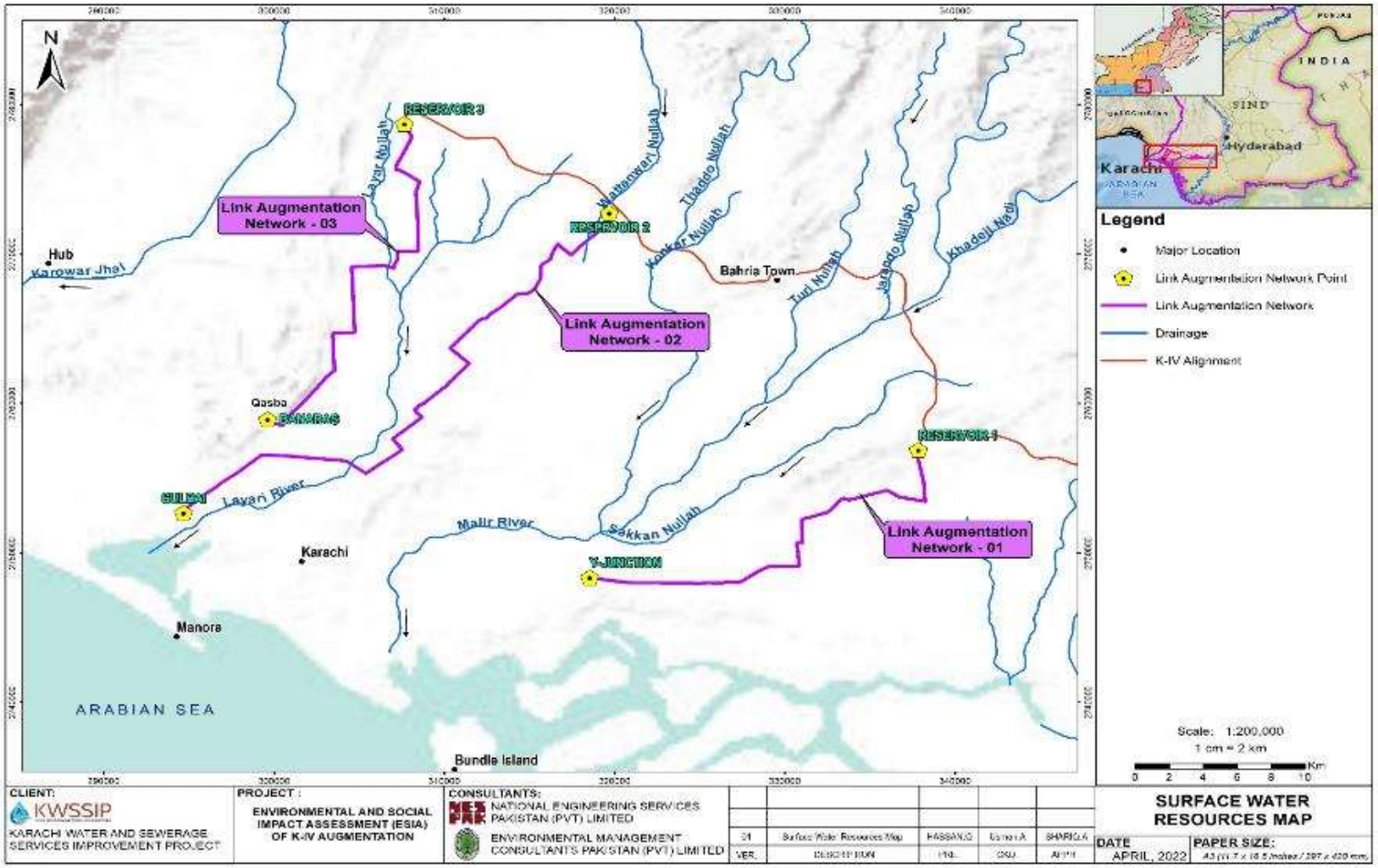


Figure 4-10: Surface Water Resource Map of the Project Area

4.2.5 Climate

112. Karachi is just above the tropical zone on the coast of the Arabian Sea, about 20 m above sea level. Karachi is bounded by Hub-River (Baluchistan Province) on the west, Badin District to the east, Dadu District on the North, and Arabian Sea on the South.

113. The climate of Karachi can be characterized by dry, hot, and humid conditions. It is generally sunny and humid. A mild winter is experienced from mid-December to mid-February, followed by a long hot and humid summer extending from April to September. The monsoon season is from July to mid-September. The level of precipitation is low throughout the year, whereas the humidity levels remain high from March to November. Humidity is very low during winter as the wind direction is north-easterly.

Temperature

114. The air temperature in the Karachi Division and its coastal areas is generally moderate throughout the year due to presence of the sea. Climate data generated by the meteorological station at Karachi Airport represents the climatic conditions for the region. According to the temperature data collected, the warmest month is June while the coolest month is January.

Precipitation

115. Being in a semi-arid climatic zone, rainfall is mostly experienced from July to September during SW Monsoon season; rainfall is extremely low in other months of the year. Moreover, the amount of precipitation is erratic, as some years are very dry. The average yearly rainfall is 217 mm, with most rainfall in July and August. Occasional winter rains, which account for 15-25% of the total annual rainfall, are also experienced in from December to February due to NE winds.

116. Rainfall records of Pakistan Metrological Department (PMD) at Karachi Airport (2001-2009 and 2012-2020) suggests that July and August are the wettest months, and that the maximum rainfall recorded in Karachi during the monitoring periods was 366.8 mm in August 2020. The maximum annual rainfall was 474.2 mm in 2020, followed by 367.3 mm in 2019.

Humidity

117. The relative humidity of the project areas typically ranges from 25% (dry) to 70% (humid) over the course of a year, rarely dropping below 20% (very dry) and reaching as high as 90% (very humid).

Wind Speed and Direction

118. The wind direction and speed between the summer and winter monsoon seasons are rather unsettled, with large variations of speed and direction. The wind velocity record (2001-2009 and 2012-2021) indicates that the velocity ranges between 1.0 m/s to 13.4 m/s. High wind speed from May to August is recorded.

Climate Vulnerability

119. Karachi has an arid climate with low rainfall. However, torrential rains within short periods of time are also experienced periodically. Heavy rainfall leads to intensification of surface runoff due to low rate of water percolation.

120. Heavy monsoon rains in July and August typically cause flooding in the city. In the last two years, heavy rains caused significant urban flooding that affected infrastructure. Major floods affected areas including Kharadar, Mithadar, Buner Road, Ram-swami, and Arambagh.

4.3 Environmental Quality

4.3.1 Ambient Air Quality

121. The results of the ambient air quality monitoring in 27 selected sampling sites are presented in Table 4-3, Table 4-4, and Table 4-5. Results were compared with the Sindh Environmental Quality Standards (SEQS) and with World Health Organization (WHO) and World Bank Group (WBG) EHS Guidelines, whichever is more stringent.

122. Results of ambient air quality monitoring along Route-1, Route-2, and Route-3 exhibit elevated concentrations of SO_2, PM_{10}, and $PM_{2.5}$. This is mainly due to the presence of point and mobile sources in the sampling areas.

Table 4-3: Ambient Air Quality Results along Route-1

Sr. No.	Pollutants	Applicable Stringent Standards		Route 1							
		Avg. Time	Standard	Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8
1	SO_2	**24 hr.**	**20 ug/m^3**	29.86	32.7	19.6	29.67	17.2	27.5	25.7	29.84
2	CO	**8 hr.**	**5 mg/m^3**	0.4	0.57	0.46	1.19	0.98	0.77	0.24	1.2
3	NO_2	**24 hr.**	**80 ug/m^3**	20.2	27.2	17.8	20.62	20.6	19.7	26.3	20.84
4	O_3	**1 hr.**	**130 ug/m^3**	15.8	16	14	19.2	16.4	15.5	14.2	18.21
5	TSP	**24 hr.**	**500 ug/m^3**	318.8	376.1	245.4	320	279.7	378.3	343.4	320.2
6	PM_{10}	**24 hr.**	**50 ug/m^3**	108.6	123.9	100.4	109.1	117	134.3	116.1	109.4
7	$PM_{2.5}$	**24 hr.**	**25 ug/m^3**	49.36	63.9	67.87	49.48	65.4	68.4	65.7	49.7

Table 4-4: Ambient Air Quality Results along Route-2

Sr. No.	Pollutants	Applicable Stringent Standards		Route 2											
		Avg. Time	Standard	Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12
1	SO_2	**24 hr.**	**20 ug/m^3**	28.7	23	19.1	16.5	19	13.6	13.7	18.3	11.6	20.3	18.5	13.2
2	CO	**8 hr.**	**5 mg/m^3**	1	1.2	1	0.95	0.5	0.69	0.99	0.9	0.5	0.98	0.89	0.69
3	NO_2	**24 hr.**	**80 ug/m^3**	34.9	38	26.8	21.7	21.9	14.6	21.6	29.6	23.2	41.1	28.3	19.8
4	O_3	**1 hr.**	**130 ug/m^3**	17.8	16.4	15.2	17.3	16.3	14.1	15.8	17.2	15.3	16.4	15.4	14.8
5	TSP	**24 hr.**	**500 ug/m^3**	248.9	400	322.6	344.9	253.6	241.4	264.2	301.7	296.4	400.9	328.5	287.5
6	PM_{10}	**24 hr.**	**50 ug/m^3**	110.5	146.7	126.9	138.6	109	114.2	130.2	133.9	96.8	121.8	123.4	125
7	$PM_{2.5}$	**24 hr.**	**25 ug/m^3**	43.5	73.6	59.6	60.4	52.4	42.4	52.3	53.7	55	68.1	48.3	34.4

Table 4-5: Ambient Air Quality Results along Route-3

Sr. No.	Pollutants	Applicable Stringent Standards		Route 3						
		Avg. Time	Standard	Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7
1	SO_2	**24 hr.**	**20 ug/m^3**	15.6	19.6	16.3	38.5	14.3	23.7	26
2	CO	**8 hr.**	**5 mg/m^3**	1	0.46	0.8	1.19	0.7	1	0.26
3	NO_2	**24 hr.**	**80 ug/m^3**	25.5	17.8	27.9	30.3	25.3	32	20.5
4	O_3	**1 hr.**	**130 ug/m^3**	17.2	14	15.8	13.8	17.8	17.8	18.4
5	TSP	**24 hr.**	**500 ug/m^3**	227.1	245.4	201.7	326.8	239.2	231.5	318.3
6	PM_{10}	**24 hr.**	**50 ug/m^3**	106	100.4	73.5	121.3	92.4	115.8	102.2
7	$PM_{2.5}$	**24 hr.**	**25 ug/m^3**	45.8	67.87	53.3	44.8	46.4	58.7	29.8

4.3.2 Ambient Noise Level

123. Ambient noise sampling areas should ideally be assigned in residential, commercial, industrial, and silent zones. However, due to lack of distinct zoning in the study areas, the sampling areas depended on the dominant land use in the area. Results of the ambient noise sampling are given in Table 4-6.

124. The results were compared with applicable noise standards for residential, commercial, and industrial areas. Most of the ambient noise levels exceeded the permissible stringent limits.

Table 4-6: Ambient Noise Quality Results

Monitoring Point	Zone	Applicable Stringent Standards*		Average Monitored Values	
		Day Time	Nighttime	Day Time	Nighttime
		07:00-22:00	22:00-07:00	dB(A) Leq	dB(A) Leq
Route 1					
1	Commercial	**65**	**55**	65	63
2	Industrial	**70**	**65**	74	71
3	Residential	**55**	**45**	77	72
4	Industrial	**70**	**65**	69	67
5	Industrial	**70**	**65**	76	72
6	Industrial	**70**	**65**	76	71
7	Industrial	**70**	**65**	65	62
8	Industrial	**70**	**65**	69	66
Route 2					
1	Industrial	**70**	**65**	69	66
2	Industrial	**70**	**65**	70	67
3	Industrial	**70**	**65**	70	67
4	Industrial	**70**	**65**	61	59
5	Commercial	**65**	**55**	69	65
6	Residential	**55**	**45**	56	53
7	Residential	**55**	**45**	56	54
8	Commercial	**65**	**55**	64	62
9	Residential	**55**	**45**	69	67
10	Commercial	**65**	**55**	67	64
11	Residential	**55**	**45**	60	58
12	Commercial	**65**	**55**	56	54
Route 3					
1	Commercial	**65**	**55**	63	67
2	Residential	**55**	**45**	74	71
3	Residential	**55**	**45**	65	62
4	Residential	**55**	**45**	69	65
5	Residential	**55**	**45**	68	66
6	Residential	**55**	**45**	68	66
7	Commercial	**65**	**55**	69	65

4.3.3 Surface Water Quality

125. Along the project route, only two water bodies, namely the Gujjar Nullah and Lyari River, were encountered. These bodies of water receive domestic and industrial effluent. Results of the water quality assessment are given in Table 4-7.

126. Results of the water quality testing were compared with the applicable stringent standards. Elevated levels of pH, COD, BOD, TSS, TDS and total coliform were detected in both water bodies.

Table 4-7: Surface Water Quality Testing Results

Sr. No.	Parameter	Units	Applicable Stringent Standards	Gujjar Nullah	Lyari River
1	Temperature	^{O}C	**40**	29	30
2	pH	pH unit	**<5.3**	7.7	7.7
3	Chemical Oxygen Demand	mg/L	**150**	519	339
4	Biological Oxygen Demand	mg/L	**80**	105	65
5	Solids, Total dissolved (TDS)	mg/L	**2000**	1,870	2,120
6	Solids, Total suspended (TSS)	mg/L	**200**	248	88
7	Chloride	mg/L	**1000**	630	705
8	Fluoride (F^-)	mg/L	**10**	0.82	0.77
9	Oil and grease	mg/L	**10**	0.071	0.082
10	Phenols, Total (Phenolic Compounds)	mg/L	**0.1**	0.005	0.006
11	Cyanide(CN^-)	mg/L	**1**	0.041	0.082
12	Anionic Detergents as MBAS	mg/L	**20**	0.053	0.066
13	Sulfate (SO_4^{-2})	mg/L	**600**	38	41
14	Sulfide (S)	mg/L	**1**	0.05	0.03
15	Ammonia NH_3	mg/L	**40**	32	38
16	Cadmium (Cd)	mg/L	**0.1**	0.004	0.005
17	Chromium (Cr) as Hexavalent and Trivalent	mg/L	**1**	0.05	0.08
18	Copper (Cu)	mg/L	**1**	0.72	0.91
19	Lead	mg/L	**0.5**	Below Detection Limits	Below Detection Limits
20	Nickel	mg/L	**1**	Below Detection Limits	Below Detection Limits

Sr. No.	Parameter	Units	Applicable Stringent Standards	Gujjar Nullah	Lyari River
21	Zinc	mg/L	**5**	0.66	0.79
22	Iron	mg/L	**8**	2.1	2.5
23	Manganese	mg/L	**1.5**	0.04	0.7
24	Selenium	mg/L	**0.5**	Below Detection Limits	Below Detection Limits
25	Silver	mg/L	**1**	Below Detection Limits	Below Detection Limits
26	Arsenic	mg/L	**1**	0.04	0.02
27	Barium	mg/L	**1.5**	1.1	1.4
28	Manganese	mg/L	**0-61**	0.5	0.7
31	Boron	mg/L	**0-2**	0.04	0.08
32	Mercury	mg/L	**0.01**	Below Detection Limits	Below Detection Limits
34	Total Toxic Metals	mg/L	**2**	0.55	0.68
41	Total Coliform	MPN/100ml	**--**	950	1150
NS = Not Specified					

4.3.4 Drinking Water Quality

127. Six drinking water samples were collected along the project routes. Results of the drinking water quality testing are presented in Table 4-8.

128. Most of the parameters were within the applicable stringent environmental quality standards. However, elevated levels of hardness, total dissolved solids, and chloride were observed in samples collected along Route-1 and Route-2. This could be due to the brackish water in the sampling areas. Furthermore, total coliform and E. Coli were detected in drinking water samples from Route-1, Route-2, and Route-3. This indicates fecal contamination of the drinking water.

Table 4-8: Drinking Water Quality Testing Results

Sr. No.	Parameter	Units	Applicable Stringent Standards*	Route 1		Route 2			Route 3
				Sample 1 (Link Road)	Sample 2 (Y Junction)	Sample 1 (Near Baitul Mukaram)	Sample 2 (Ghani Chorangi)	Sample 3 (Gulshan e Sacchal)	Sample 1 (Lyari Basti)
1	Temperature (During Sample Collection)	^{O}C	**NS**	-	-	-	-	-	-
2	Color	Pt-Co	**≤15TCU**	BDL	<5	06	BDL	<5	0.3
3	pH	pH unit	**6.5-8.5**	7.01	7.65	7.74	7.18	7.32	7.76
4	Turbidity	NTU	**<5**	<5	BDL	<5	BDL	0.3	0.62
5	Total Hardness	mg/L	**<500.00**	566.8	215.89	510	66	291	219
6	Total Dissolved Solid (TDS)	mg/L	**<1000.00**	1460	339	1228	195	624	513
7	Total Suspended Solid (TSS)	mg/L	**NS**	-	-	-	-	-	-
8	Ammonia	mg/L	**NS**	-	-	-	-	-	-
9	Fluoride F^-	mg/L	**<1.50**	1.28	0.49	0.64	0.35	0.37	0.46
10	Sulfate (SO_4^{-2})	mg/L	**NS**	-	-	-	-	-	-
11	Chloride(Cl^-)	mg/L	**<250.00**	420.61	130.76	351	41	142	107
12	Nitrate $(NO_3)^-$	mg/L	**<50.00**	0.13	BDL	0.19	0.04	0.013	0.011
13	Odor	-	**Non Objectionable / Acceptable**	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable
14	Taste	-	**Non Objectionable / Acceptable**	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable
15	Sodium	mg/L	**NS**	-	-	-	-	-	-

Sr. No.	Parameter	Units	Applicable Stringent Standards*	Route 1		Route 2			Route 3
				Sample 1 (Link Road)	Sample 2 (Y Junction)	Sample 1 (Near Baitul Mukaram)	Sample 2 (Ghani Chorangi)	Sample 3 (Gulshan e Sacchal)	Sample 1 (Lyari Basti)
16	Iodine	ppm	**NS**	-	-	-	-	-	-
17	Arsenic (As)	mg/L	**0.01**	BDL	BDL	BDL	BDL	BDL	BDL
18	Iron (Fe^{3+})	mg/L	**NS**	-	-	-	-	-	-
19	Zinc (Zn^{2+})	mg/L	**3.0**	0.012	0.06	0.031	0.020	0.3	0.05
20	Conductivity	µS/cm	**NS**	-	-	-	-	-	-
21	Bicarbonate	mg/L	**NS**	-	-	-	-	-	-
22	Nitrite	mg/L	**<3**	0.06	BDL	0.70	0.002	0.009	0.006
23	Magnesium	mg/L	**NS**	-	-	-	-	-	-
24	Calcium	mg/L	**NS**	-	-	-	-	-	-
25	Phosphate	mg/L	**NS**	-	-	-	-	-	-
26	Potassium	mg/L	**NS**	-	-	-	-	-	-
27	Boron	mg/L	**<0.3**	0.1	<0.1	0.10	0.01	0.1	0.02
28	SAR Iodine (I)	mg/L	**NS**	-	-	-	-	-	-
29	Aluminum	mg/L	**< 0.2**	<0.01	BDL	BDL	BDL	BDL	BDL
30	Antimony	mg/L	**<0.005**	BDL	BDL	BDL	BDL	BDL	BDL
31	Cadmium	mg/L	**0.003**	BDL	BDL	BDL	BDL	BDL	BDL
32	Mercury	mg/L	**<0.001**	BDL	BDL	BDL	BDL	BDL	BDL
33	Nickel	mg/L	**<0.02**	BDL	BDL	BDL	BDL	BDL	BDL
34	Selenium	mg/L	**0.01**	BDL	BDL	BDL	BDL	BDL	BDL
35	Barium	mg/L	**0.7**	0.1	BDL	0.11	0.001	0.4	0.3
36	Total Chromium	mg/L	**<0.05**	BDL	BDL	BDL	BDL	0.05	0.02
37	Copper	mg/L	**2**	<0.05	<0.05	0.29	0.10	0.28	0.27
38	Lead	mg/L	**0.01**	BDL	BDL	DL	BDL	BDL	BDL
39	Cyanide (CN)	mg/L	**<0.05**	BDL	BDL	BDL	BDL	BDL	BDL
	Manganese	mg/L	**<0.5**	<0.01	BDL	<0.01	<0.01	0.4	<0.01
40	Total Coliforms	cfu/100ml	**0/100 ml**	12	BDL	303	BDL	439	74
41	Fecal Coli	cfu/ml	**0/100 ml**	BDL	BDL	65	BDL	97	08

Sr. No.	Parameter	Units	Applicable Stringent Standards*	Route 1		Route 2			Route 3
				Sample 1 (Link Road)	Sample 2 (Y Junction)	Sample 1 (Near Baitul Mukaram)	Sample 2 (Ghani Chorangi)	Sample 3 (Gulshan e Sacchal)	Sample 1 (Lyari Basti)
	forms (E.Coli)								

4.4 Biological Environment

129. Information on biodiversity in the vicinity of the proposed project was collected. Data references include published literature, consultations with stakeholders, provincial departments of forestry, and wildlife sectors. Field visits were also done.

4.4.1 Bio-Ecological Zone

130. The bio-ecological zone is within the Indus Ecoregion, which covers approximately 65% of the land area of Sindh Province. Flora and fauna in the project site is linked to with the Indo-Malayan bio-geographical origin. The flora and fauna of greater Karachi can be classified into three edaphic regions:

- The coastal landscape and muddy coastal swamps;
- The coastal sand dunes; and
- The barred, undulating landscape of calcareous rocky terrain.

131. The contrasting edaphic conditions support various flora and fauna. The project area is within tropical thorn forests with degraded indigenous biodiversity. The three routes are within barren, undulating landscapes.

132. Karachi is an urban environment, therefore, there is barely any natural flora and fauna. Faunal frequency is low due to the disturbances and absence of favorable habitat. However, grass can be observed at the project areas adjacent to the coastline. Some mangrove stands can also be observed along the coastline, although its growth is stunted due to environmental conditions. The principal habitat at the project areas along the coast are arid hills and low-lying sandy areas. Vegetation of the hill slopes and hillsides comprises of camelthorn (*Prosopis spicigera*), wild caper (*Capparis decidua*) and large succulents such as (*Euphorbia caudicifolia*). Typical vegetation in the sandy areas include small trees such as *Acacia senegal, Zizyphus nummularia* and *Prosopis cineraria.* Presented in is the vegetation trend in Karachi from 1998 to 2018.

133. Based on the field evaluations, secondary data review, and consultation, the proposed project area is categorized as “Modified Habitats” which has a large proportion of non-native species. Furthermore, anthropogenic interference has substantially modified the primary ecological functions and species composition of the area. There are no critical or natural habitats within the project areas. No species for conservation are reported.

134. The project routes are within barren lands and are not classified as biodiversity hotspot. The site is not designated as forest land under the Sindh Forest Act 2012.

4.4.2 Flora Biodiversity

135. The harsh climatic conditions are further augmented by drought and land clearing due to rapid urbanization, which has resulted in sparse vegetation.

136. Desertscrub is the native vegetation in the project areas. Native vegetation is composed by a wide variety of bushes and shrubs including karir (*Capris aphylia*), babul (*Acacia nilotica*), khor (*Acacia senegal*), khabar (*Salvadora oleoides*), kandi (*Prosopsis senegal*), kikar (*Acacia arabica*), lai (*Tamarix gallica*), tamarix aphylla, populus euphratica (willo or bahan), Aerua javanica, Maerva arenaria, Abutilou sp, Amaranthus viridis, Cordia gharaf, Rhazya sticta, karil (*Capparis aphyila*), acacia or siris (*Acacia lebbek*), papal (*Ficus religiosa*) and tamarind (*Tamarindus indica*).

137. However, the native vegetation is not observed at the project areas since the routes pass through urban areas. Soil in these areas cannot support root growth. Furthermore, invasive species dominate the area.

Trees

138. Trees observed in the project area and the surrounding areas during the site surveys are listed in Table 4-9. The corresponding conservation status based on the International Union for Conservation of Nature (IUCN) of each tree is also listed.

139. All tree species observed in the area are naturally grown. About 22 specimens of *Commiphora wightii* were observed along Route-1, while 12 such trees were also observed along Route-2. Two specimens of *Commiphora stocksiana* were observed along Route-1. The species are found along the routes, approximately 4-5 km from the reservoirs. Moreover, 130 specimens of *Guaiacum Officinale,* 123 along Route-2 and seven along Route-3, were found within the RoW.

Table 4-9: Trees in the Project Area

Sr. No.	Scientific Name	Local/Common Name	IUCN Conservation Status	Route-1	Route-2	Route-3
1.	*Azadarichta indica*	Neem	Not Evaluated	X	X	X
2.	*Capparis decidua*	Kirrir	Least Concern	X	-	-
3.	*Prosopis glandulosa*	Honey mesquite	Not Evaluated	X	X	X
4.	*Prosopis cineraria*	Kandi	Not Evaluated	X	X	X
5.	*Senegalia senegal*	Gum Arabic tree	Not Evaluated	X	-	X
6.	*Vachelia nilotica*	Babul	Not Evaluated	X	X	X
7.	*Parkinsonia aculeata*	Palo verde	Least Concern	X	X	X
8.	*Ficus virens*	White fig	Least Concern	X	X	X
9.	*Eucalyptus citriodora*	Safeeda	Least Concern	X	X	X
10.	*Ficus benghalensis*	Fig tree	Not Evaluated	X	X	X
11.	*Mangifera indica*	Aam, Mango	Data Deficient	X	X	-
12.	*Phoenix dactylifera*	Khajoor, Date Palm	Least Concern	X	X	X
13.	*Phoenix sylvestris*	Jangli khajor	Not Evaluated	-	-	X
14.	*Cocos nucifera*	Coconut palm	Not Evaluated	-	X	X
15.	*Ziziphus jujuba*	Beer	Least Concern	X	X	X
16.	*Conocarpus erectus*	Cono	Least Concern	X	X	X
17.	*Casuarina equisetifolia*	She oak	Least Concern	X	-	-
18.	*Moringa oleifera*	Suwanja	Least Concern	X	X	X
19.	*Ficus religosa*	Peeple	Not Evaluated	X	X	X
20.	*Ficus benjamina*	Weeping fig	Least Concern	-	X	X
21.	*Syzygium cumini*	Jamun	Least Concern	X	X	-

Sr. No.	Scientific Name	Local/Common Name	IUCN Conservation Status	Route-1	Route-2	Route-3
22.	*Melia azedarach*	Bakain	Least Concern	X	X	X
23.	*Albizia lebbeck*	Siris	Least Concern	X	X	X
24.	*Bismarkia nobilis*	Silver bismarkia palm	Not Evaluated	X	-	-
25.	*Cordia sebestena*	Geiger tree	Least Concern	X	-	-
26.	*Cordia myxa*	Lasura	Least Concern	-	X	X
27.	*Manilkara zapota*	Chiku/ sapodela	Least Concern	X	X	-
28.	*Alstonia scholaris*	Blackboard tree	Least Concern	X	X	-
29.	*Pithecellobium dulce*	Jungle jalebi	Least Concern	X	X	X
30.	*Ficus elastica*	Rubber tree	Not Evaluated	X	X	-
31.	*Delonix regia*	Gul e mohar	Least Concern	-	X	X
32.	*Guaiacum Officinale*	Lignum vitae	Near Threatened	-	X	X
33.	*Leucaena leucocephala*	White lead tree	Not Evaluated	-	X	X
34.	*Terminalia catappa*	Tropical almond tree	Least Concern	-	X	X
35.	Commiphora wightii	Guggul	Critically Endangered	X	X	-
36.	Commiphora stocksiana	Bhai Guggul	Endangered	X	-	-

Shrubs and Herbs

140. Shrubs and herbs observed in the CoI during field visits are presented in Table 4-10. The respective IUCN status of the shrubs and herbs are also mentioned.

Table 4-10: Shrubs and Herbs in the Project Area

Sr. No.	Scientific Name	Local/Common Name	IUCN Conservation Status	Route-1	Route-2	Route-3
Shrubs						
1	*Alhagi maurorum*	Kandero	Not Evaluated	X	X	-
2	*Barleria acanthoides*	---	Not Evaluated	X	X	X
3	*Capparis decidua*	Kirrir	Least Concern	X	X	X
4	*Euphorbia caducifolia*	Thohar	Not Evaluated	X	X	-
5	*Grewia tenax*	White crossberry	Least Concern	X	X	X
6	*Haloxylon stocksii*	Saxaul	Least Concern	X	X	X
7	*Prosopis juliflora*	Devi/ vilayati kikkar	Not Evaluated	X	X	X
8	*Salvadora oleoides*	Khabbar	Data Deficient	-	-	X
9	*Salvadora persica*	Khabbar	Least Concern	-	-	X
10	*Suaeda fruticosa*	Láani	Not Evaluated	X	X	X
11	*Tamarix aphylla*	Lai	Not Evaluated	X	-	-

Sr. No.	Scientific Name	Local/Common Name	IUCN Conservation Status	Route-1	Route-2	Route-3
12	*Lycium europaeum*	Gangro mariri	Not Evaluated	X	-	-
13	*Maytenus senegalensis*	Hekel, Malkangni	Not Evaluated	X	-	
14	*Salsola imbricata*	Saltwort	Not Evaluated	X	X	X
15	*Ziziphus nummularia*	Beer	Not Evaluated	X	X	X
Herbs						
1	*Amaranthus viridis*	Chull	Not Evaluated	X	-	X
2	*Aerva javanica var. javanica*	Booh	Not Evaluated	X	X	X
3	*Arnebia hispidissima*	Arabian Primrose	Not Evaluated	X	-	-
4	*Blepharis sindica**	Bhangri	Not Evaluated	X	X	X
5	*Calotropis procera*	Aak	Not Evaluated	X	X	X
6	*Citrullus colocynthis*	Tooh	Not Evaluated	X	X	X
7	*Cometes surattensis*	Golden senna	Not Evaluated	X	-	-
8	*Convolvulus glomeratus*	Clustered Bindweed.	Not Evaluated	-	X	-
9	*Convolvulus prostratus*	Sireen, Dodak	Not Evaluated	-	X	-
10	*Corbichonia decumbens*	---	Not Evaluated	-	-	X
11	*Cressa cretica*	Rudranti	Least Concern	X	X	X
12	*Crotalaria burhia*	Saniya	Not Evaluated	X	-	X
13	*Eclipta prostrata*	False daisy	Least Concern	-	X	-
14	*Euphorbia granulata*	---	---	X	X	X
15	*Euphorbia prostrata*	Ground Spurge	Not Evaluated	-	X	-
16	*Fagonia indica*	Dhamasa	Not Evaluated	X	X	X
17	*Farsetia hamiltonii*	---	Not Evaluated	-	X	-
18	*Heliotropium rariflorum*	Jamandar ka landa	Not Evaluated	X	X	X
19	*Heliotropium europium*	---	---	X	X	X
20	*Ipomea spp.*	---	---	-	X	-
21	*kochia indica*	Kochia	Not Evaluated	X	-	-
22	*Salvia santolinifolia*	Santolina sage	Not Evaluated	-	X	-
23	*Senna holosericea,*	Sana mukhi	Not Evaluated	X	X	X
24	*Portulaca oleracea*	little hogweed	Least Concern	X	X	-
25	*Solanum surattense*	kundiari, ‘Momoli, Mokri	Not Evaluated	X	X	X
26	*Tribulus terrestris*	Tekundi	Least Concern	X	X	-
27	*Trichodesma indica*	Indian borage	Not Evaluated	X	X	X
28	*Zygophyllum simplex*	Hurium	Not Evaluated	-	X	-

Grasses

141. Grasses observed within the CoI during site surveys are listed in Table 4-11. The respective IUCN status of the observed grass species are also listed.

Table 4-11: Grasses in the Project Area

Sr. No.	Scientific Name	Local/Common Name	IUCN Conservation Status	Route-1	Route-2	Route-3
1	*Aristida adscensionis*	Lumb	Not Evaluated	-	X	-
2	*Cyperus rotundus*	Nutgrass	*Least Concern*	-	-	X
3	*Cenchrus ciliaris*	Dhaman	*Least Concern*	X	X	-
4	*Chloris barbata*	Ganni, Jargi	Not Evaluated	-	-	X
5	*Desmostachya bipinnata*	Dabh/drabh	*Least Concern*	X	X	X
6	*Dichanthium annulatum*	Marvel grass	Not Evaluated	X	X	X
7	*Lasiurus scindicus*	Sain	Not Evaluated	-	-	X
8	*Phragmites australis*	Kaano	*Least Concern*	X	X	-
9	*Typha domingensis*	Booh	*Least Concern*	X	X	-

Agriculture/Horticulture

142. No significant agricultural or horticultural practices were observed. However, there were some guava, papaya, and lemon trees within the CoI. There were also some trees such as date palm, coconut, and jaman trees.

4.4.3 Fauna Biodiversity

143. The environment in the project areas is not ideal for thriving fauna due to the unavailability of water, as well as the polluted water bodies. The shrubs and sandy areas serve as habitat for mammals, birds, and reptiles within or near the project areas. Domestic livestock, such as goats, sheep, and camels are found grazing in suburban towns and rural areas. Birds such as Indian roller, common mynah, pigeon, and house sparrow were also observed.

Birds

144. Birds in the vicinity of the project site as well as the corresponding IUCN status are listed in Table 4-12. The proposed project is not within any bird migration corridors. Birds such as sparrows, crows, bulbuls, mynas, and egrets are reported by the Wildlife Department.

145. There are no endangered species of birds. However, a vulnerable (*Aythya ferina),* commonly known as the common pochard, was observed by the Wildlife Department. This species requires well-vegetated, eutrophic to neutral swamps, marshes, lakes, and slow-flowing rivers. No such areas within the project routes can serve as habitat for this species. However, the reservoirs may eventually be a viable habitat for the common pochard. Specific mitigation measures are discussed in the Environmental and Social Management Plan.

Table 4-12: Birds in the Project Area

Sr. No.	Common Name	Scientific Name	IUCN Conservation Status
1.	Herring Gull	*Larusargentatus*	*Least Concern*
2.	Sanderling	*Calidris alba*	*Least Concern*
3.	Pariah kite	*Milvusmigrans*	*Least Concern*
4	Mynah	*Acridotheros tristis*	*Least Concern*

Sr. No.	Common Name	Scientific Name	IUCN Conservation Status
5.	Bulbul	*Pycnontidae*	*Least Concern*
6.	House Sparrow	*Passer domesticus*	*Least Concern*
7.	House Crow	*Corvus splendens*	*Least Concern*
8.	Heron	*Ardeolagrayii*	*Least Concern*
9.	Egret	*Egrettagarzetta*	*Least Concern*
10.	Plover	*Charadriinae*	*Least Concern*
11.	Black headed Gull	*Chroicocephalus ridibundus*	*Least Concern*
12.	Little Tern	*Sterna albifrons*	*Least Concern*
13.	Herring Gull	*Larusargentatus*	*Least Concern*
14.	Sanderling	*Calidris alba*	*Least Concern*
15.	Pariah kite	*Milvusmigrans*	*Least Concern*
16.	Common Pochard	*Aythya ferina*	*Vulnerable*

Consultation with Wildlife Department Sindh

Mammals

146. The mammals listed in Table 4-13 are based on available secondary data[2] and consultation with the Wildlife Department. The corresponding IUCN status of each species is also included. As presented, the Scaly Anteater *(Manis crassicaudata)* is evaluated as endangered based on the IUCN Red List. Significant threats on Scaly Anteater primarily due to illegal poaching and illegal trade for their scales, which are used in traditional medicine. Detailed conservation assessments specific to Pakistan may be limited but conservation efforts are underway to protect these species, including habitat conservation, anti-poaching measures, raising awareness, and combating illegal wildlife trade.

Table 4-13: Mammals in the Project Area

Sr. No.	Common Name	Scientific Name	IUCN Conservation Status
1	Jackal	*Canis aureus*	*Least Concern*
2	Wild boar	*Sus scrofa*	*Least Concern*
3	Fox	*Vulpus*	*Least Concern*
4	Hare	*Lepus tinidus*	*Least Concern*
5	Hedge Hog	*Hemiechinu sauritus*	*Least Concern*
6	Mouse	*Musmus culus*	*Least Concern*
7	Scaly Anteater	*Manis crassicaudata*	*Endangered*
8	Common Mongoose	*Herpestesed wardsii*	*Least Concern*
9	Porcupine	*Hystrix indica*	*Least Concern*

Consultation with Wildlife Department Sindh

Reptiles

147. The reptiles listed in Table 4-14 are based on secondary data[3] and consultation with Wildlife Department Sindh. The corresponding IUCN status of each species is also listed.

Table 4-14: Reptiles in the Project Area

Sr. No.	Common Name	Scientific Name	IUCN Conservation Status
1.	Viperine Sea Snake	*Praescutataviperina*	*Least Concern*

[2] *EIA of Malir Expressway project, Karachi 2021*
[3] *EIA of Malir Expressway project, Karachi 2021*

Sr. No.	Common Name	Scientific Name	IUCN Conservation Status
2.	Annulated Sea Snake	*Hydrophiscyancinctus*	*Least Concern*
3.	Common Krait	*Bungarus Caeruleus*	*Not Evaluated*
4.	Common Sand Lizard	*Lacertaagilis*	*Least Concern*

Consultation with Wildlife Department Sindh

4.4.4 Protected Areas and Endangered Species

148. There are national parks and wildlife sanctuaries in Pakistan allotted for conservation. However, no such areas are found within the vicinity of the CoI.

149. Scaly Anteater is reported to be present in Pakistan that is considered as an endangered species as per the IUCN Red List while Common Pochard is identified as a vulnerable species.

4.5 Socio-Economic Environment

150. Aside from primary data collected during the socio-economic survey, available secondary data on the socio-economic condition of the project area was also studied. These include District Population Census Reports, documents related to designs, and maps. Consultation with pertinent officials were also conducted.

4.5.1 Overview of the Project Area along the Routes

Route 1

151. Route-1 starts from reservoir-1, which is located at the eastern by-pass, near the Goth Muhammad Ali Jokhiyo. This route is 28 km long and ends at Y-junction in Landhi. Majority of the route is within the Malir district, which is the least populated district of Karachi and the only district with rural Union Councils (UCs). The first 13 km of the route passes through the open area/barren land of Pak-Steel Chowrangi. The route then traverses the industrial area along the Mehran Highway.

152. Settlements are concentrated at the final 9 km stretch of the route, as nine out of ten identified sensitive receptors are within this area.

153. Most of the route traverses areas with wide roads that can accommodate heavy cargo traffic. Disruption due to construction activities is not anticipated in these areas given the wide roads.

154. The majority of the population along this stretch live in small to medium houses. Most people in these areas own businesses such as small shops and kiosks.

155. Adults in this area are mostly illiterate.

156. There is a mix of various ethnicities in the area, including Cattle Colony, Labor Colony, Bilal Colony, Sherpao Colony, and other settlements.

Route 2

157. Route-2 is the longest project with a total length of 39 km. The route starts from Sethani Gabol Goth of Gadap Town, and ends in Gulbai at Mauripur Road. This route traverses four districts of Karachi, which are Malir, karachi East, Karachi Central, and Keamari. The first 15 km from reservoir 2 traverses the rural area of Malir until the M9 Super Highway, where the population density is less compared to other parts of the

route. This route runs along the Northern Bypass Link Road, where there is relatively less traffic; there is ample working space in this area. There Some of the residential areas along this segment include Yasrab Colony, Noor Muhammad Village, and Gulshan-e-Shacal. This area has small to medium households, with small shops and kiosks.

158. The next 17 km of the route passes through the East and Central districts. This segment traverses busy roads and heavily populated areas. Most of the major educational and health institutions such as Karachi University, Federal Urdu University, Liaqat College, Institute of Business and Technology, Ashfaq Memorial Hospital, Samad Hospital, Rub Medical Center are in this stretch. Out of the 22 sensitive receptors identified along Route-2, 19 are situated in this stretch. Furthermore, there may be a lack of working space in this segment given that the facades of commercial and residential buildings are along the main roads.

159. People along this segment live in medium to large houses and have their own businesses and shops. Most people are employed by private and government entities. The adult population in this area is mostly literate. Major residential areas along this stretch include Highway Colony, PCSIR Society, Memon Nagar, Gulshan-e-Iqbal and Nazimababd. Urdu is the major language spoken in this area.

160. A small portion of the route passes through the Essa Nagri (an informal settlement or *katchi abadi*) populated by Punjabi-speaking Christian community.

161. The final 7.5 km of the route passes through the industrial area along Estate Avenue in Keamari. Major settlements along this stretch are Haroonabad, Shershah Colony and Gulbai. There is significant movement of cargo transport due to the prevailing land use in the area.

Route 3

162. Route-3 starts from Reservoir 3, located off Hub Dam Road near Goth Kairo Brohi. The total length of this route is 28.5 km and passes through Malir and Karachi Central. The initial 7 km traverses through the semi-urban area of Malir, where population density is relatively less than the other segments. Literacy rate of the people in this area is relatively low.

163. The succeeding 1- km passes through moderately populated areas, which include Dachoor Dara Goth, Yar Muhammad Goth, Gushan-e-Noor, Khuda Ki Basti, Hassan Goth, Gulshan-e-Fatima Society and Yousaf Goth. Most people in this area are Sindhi and Pashtun, and are living in small to medium houses. Literacy rate in this area is relatively high, with people either having their own businesses or employed. Traffic on the Hub Dam Road and Lyari Basti road is low and can therefore accommodate working spaces without major disruption to the road users.

164. The final 12 km of the route passes through District Central along the Ajmer Nagri Road until the Ajmer Nagri Roundabout, Mangopir, and Sahrah-Noor Jahan Road. This area is heavily congested. Substantial disruptions to the road users is anticipated. The main settlements along this area are Shadman Town, Khilalabad, Zhob Colony, Usman Ghani Colony, Allama Iqbal Town, Bangash Colony and Pahar Ganj.

165. While there are no sensitive receptors identified at the upper portion of the route near the reservoir, the sensitive receptors are observed along the succeeding 22 km stretch of this route.

4.5.2 Demographics

Population and Household Size

166. Karachi division has a total of seven districts. The proposed pipeline routes under the project pass through the jurisdiction of Districts Malir, Korangi, Karachi East, Karachi Central and Keamari. Area, density and population of these districts are provided Table 4-15.

Table 4-15: Area, Density and Population of Karachi Districts

District	Number of Sub-Divisions	Area (Sq. km)	Density (2017) Sq. km	Population Census (2017)
District Malir	6	2,160	891	1,924,346
District Central	5	69	43,064	2,971,382
District East	4	139	20,686	2,875,315
District Korangi	4	108	23,866	2,577,556
District Keamari	4	559	3273	1,829,837
Source: Finalized Census Results of Karachi 2017 – Pakistan Bureau of Statistics Govt. of Pakistan				

167. According to the 2017 census, the total population along the CoI is approximately 59,732, with an average household size is of 5.75 persons.

Educational Attainment

168. The educational attainment of the respondents is presented in Table 4-16. Most respondents (43%) are illiterate, followed by respondents with primary education (14%). The low literacy rate may be due to the lack of financial resources.

Table 4-16: Educational Level of the Respondents

Sr. No.	Educational Level	Number of Respondent	Percentage (%)
1	Illiterate	199	43
2	Primary	65	14
3	Middle	42	9
4	Matric	69	15
5	Intermediate	37	8
6	Graduation and Above	23	5
7	Darse-e-Nizami	9	2
8	Other Religious	19	4
Total		**463**	**100**

Source: Socio-Economic Survey

Occupation

169. The occupation of the respondents is listed in Table 4-17**Error! Reference source not found.**. Most respondents own small businesses, which include shops and kiosks (34%). This is followed by laborers (24%). Contractors may be able to hire workers

during the construction of the project given the high number of laborers in the area; this measure shall be included in the ESMP.

Table 4-17: Occupation of the Respondents

Sr. No.	Profession	Number of Respondent	Percentage (%)
1	Labor Workers	110	24%
2	Shopkeepers/ Business	158	34%
3	Mechanic	34	7%
4	Government Employee/ Retired	6	1%
5	Driver	5	1%
6	Private Service	63	14%
7	Business	57	12%
8	House Wives	15	3%
9	Hotel	10	2%
10	Others	5	1%
Total		**463**	**100**

Source: Socio-Economic Survey

Religion

170. Majority of the respondents (97%) are Muslims, while the rest (3%) are either Hindu or Christian (Table 4-18). There are some Christian families living in Essa Nagri and some Hindu families residing near Reservoir 1 and Reservoir 3.

Table 4-18: Religion of the Respondents

Sr. No.	Religion	Number of Respondent	Percentage (%)
1	Muslim	449	97
2	Other	14	3
Total		**463**	**100**

Ethnicity and Caste

171. Urdu is the most spoken language in the area. Other languages spoken in the area are Pashto, Punjabi, and Sindhi. According to the survey, Mallah and Pathan are the major ethnic groups residing within the project area. Other ethnic groups in the area are Bangali, Syed, and Magsi. The ethnicities of the respondents are listed in Table 4-19.

Table 4-19: Ethnic Structure of the Respondents

Sr. No.	Ethnic Group	Number of Respondent	Percentage (%)
1	Mallah	63	14%
2	Pathan	56	12%
3	Bangali	43	9%
4	Syed	37	8%
5	Magsi	35	8%
6	Blouch	28	6%
7	Kathiawari	15	3%
8	Abbassi	13	3%

Sr. No.	Ethnic Group	Number of Respondent	Percentage (%)
9	Others	173	37%
Total		**240**	**100**

Source: Socio-Economic Survey

Family Structure

172. The survey indicates that more than half of the household within the proposed project area are nuclear families (Table 4-20). Most of the residents are migrant workers from other parts of the country. Additionally, the Urdu-speaking community generally prefer a nuclear family system.

Table 4-20: Family Structure

Sr. No.	Family Structure	Number of Respondent	Percentage (%)
1	Joint	208	45
2	Nuclear	255	55
Total		**463**	**100**

Source: Socio-Economic Survey

4.5.3 Socio-Economic Situation

Income and Expenditure

173. The poverty line of Pakistan is at PKR 3,030 per capita per month. Most of the respondents are above the poverty line since their average household income is approximately PKR 20,907 per month. More than 80% of the households live above the minimum wage set by the GoS (PKR 25,000 per month). The average monthly income of the respondents is shown in Table 4-21.

Table 4-21: Average Monthly Income of the Respondents

Sr. No.	Average Monthly Income	Number of Respondent	Percentage (%)
1	Less than 25,000	84	18
2	25,001 – 45,000	279	60
3	45,001 – 65,000	44	10
4	Above 65,000	56	12
Total		**463**	**100**

Source: Socio-Economic Survey

174. Table 4-22 shows the range of monthly expenditures of the respondents. Their expenses include basic needs such as housing, food, health, education, transportation, clothing, and other basic non-food items.

175. Comparing the reported income to the range of monthly expenditures, about 15 households indicated spending more than they earn, while 63 households manage to save some of their earnings.

Table 4-22: Range of Monthly Expenditures of the Respondents

Sr. No.	Average Monthly Expenditures	Number of Respondent	Percentage (%)
1	less than 25,000	108	23

Sr. No.	Average Monthly Expenditures	Number of Respondent	Percentage (%)
2	25,001 – 45,000	294	63
3	45,001 – 65,000	39	08
4	Above 65,000	22	05
Total		**463**	**100**

Source: Socio-Economic Survey

Ownership and Construction of the Houses

176. Ownership status of the houses is shown in Table 4-23. About half of the respondents live in their own houses (54%).

Table 4-23: Ownership Status of Houses

Sr. No.	Ownership Status	Number of Respondent	Percentage (%)
1	Owner	252	54
2	Rented	156	34
3	Encroacher	55	12
Total		**463**	**100**

Source: Socio-Economic Survey

177. Majority of the houses (56%) are pacca houses, or those made of heavy materials such as concrete and brick. This is followed by semi pacca houses (25%). There are also respondents that live in katcha houses (14%), which are made of light materials such as bamboo, reed, grass, and straw. 5% of the respondents live in huts.

Table 4-24: Housing Construction Pattern

Sr. No.	Type of House	Number of Respondent	Percentage (%)
1	Pacca	260	56
2	Semi Pacca	115	25
3	Katcha	65	14
4	Hut House	23	05
Total		**463**	**100**

Source: Socio-Economic Survey

178. Considering the relatively low income of the residents, the housing ownership and permanent housing construction is relatively high.

Anti-Encroachment Drive

179. Informal settlements and squatters are widespread in Karachi, including residential and commercial encroachers on vacant lands, sidewalks, public spaces etc. A major Anti-Encroachment Drive (AED) was initiated in Karachi in October 2018 on the order of the Supreme Court of Pakistan. The Court ordered to vacate public spaces (such as parks, footpaths, amenity plots) across the city from unauthorized uses and occupations. The order is currently under implementation by various civic and local agencies, including KMC, who are required to report periodically to the Court regarding progress. The focus of the AED is on commercial activities encroaching on public spaces. Thousands of businesses, street vendors, and hawkers have been affected, primarily in most commercial districts. Acknowledging the adverse impacts of AED on the poor and vulnerable groups, the GoS and local agencies like KMC are making efforts to relocate some affected businesses.

180. The AED-related screening was assessed through the following means:

- Information from a focal person of the concerned district;
- Visual observations of focal persons, consultants, and PIU-KWSSIP specialists at the time of screening survey; and
- Public consultations

181. The Commissioner's office was approached to collect previous data available with the department with reference to AED. Unfortunately, no past data is available in this regard, therefore, AED-related screening of proposed project sites was carried out in different districts of Karachi with the help of focal persons of District Municipal Corporations (DMCs), Municipal Corporations (MCs), and District Councils nominated by concerned Deputy Commissioners' offices.

182. Joint visits of focal persons from civic agencies, Environmental and Social Experts of KWSSIP) and the E&S Consultant of K-IV Augmentation was conducted to screen out the proposed project affected by AED during June 2022.

183. Based on the information provided by the focal person, visual observations, and public consultations, it is concluded that no AED has been carried out in the RoW of the proposed project since October 2018. The PIU has obtained a formal certificate from the City Administration (Commissioner's Office) in this regard, stating that no AED has been carried out in the project area.

Credit Sources

184. There are formal and informal credit sources in the area. Based on the survey, most of the respondents do not have outstanding loans (91%). The few respondents who obtained loans used the money for marriage and household expenses.

Table 4-25: Borrowing Status of the Respondents

Sr. No.	Borrowing Status	Number	Percentage (%)
1	Yes.	42	09
2	No.	421	91
Total		**463**	**100**

Source: Socio-Economic Survey

Transportation

185. Most of the respondents have their own means of transportation (42%), while 24% use public transportation only. 35% of the respondents claim to use both modes of transportation.

Table 4-26: Mode of Transport

Mode of Transport	Number of Respondents	Percentage (%)
Personal	193	42
Public	109	24
Public and Personal (both)	161	35
Total	**463**	**100**

Source: Socio-Economic Survey

4.5.4 Basic Services

186. Respondents claim to have access to basic services such as mobile services (100%), metal road (97%), and electricity (89%). Only 66% of the respondents have access to education, while 61% have access to water supply.

Table 4-27: Access to Social Amenities in the Project Area

Sr. No.	Social Amenities	Number of Respondents	Access to Basic Service (%)
1	Electricity	412	89
2	Water Supply	282	61
3	Health Facilities	338	73
4	Education	306	66
5	Metal Road	451	97
6	Mobile Service	463	100
7	Sewerage	254	55
8	Sui Gas	322	70

Source: Socio-Economic Survey

Water Supply

187. The water supply and sewerage systems are managed by KWSC. The city has experienced unprecedented population growth, but the water supply infrastructure was unable to keep up with the growing population. As a result, water shortage is experienced in most areas.

188. Water is supplied to consumers through bulk water, which is sourced from the Indus River (through the GKWBS System), Hub Dam (through the Karachi Water Supply Canal), and Dumlottee wells (through the Dumlottee Conduit). Approximately 33% of the total water supply is unfiltered. Water from filtration plants and reservoirs is supplied through the water trunk mains and distribution pipelines. Details of the water filtration plants are presented in **Error! Reference source not found.**.

Table 4-28: Water Filtration Plants

Location	Gharo		Central Ordinance Depot (COD)		Pipri			NEK Old	NEK New	Hub
No. 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

189. The water supply and sewerage system are shown in Figure 4-10. Based on the existing water distribution system of KWSC, Route-1 is within Zone-1; Route-2 is within Zone-IIA, Zone IIIA, and Zone IIIB; while Route-3 falls under Zone-IIIA and Zone-IIIB.

190. According to the water supply situation (Figure 4-12), almost 10% of areas along Route-1 and Route-2 experience acute water supply shortage. Approximately 40% of Route-2 experience water supply shortage. 10% of the areas along Route-3 experience acute water supply shortage, while 20% experience water supply shortage.

191. Low water pressure, illegal connections to the pipes, outdated systems, water shortages, improper operations and maintenance, and revenue loss are among the issues that plague the water supply system of Karachi. Moreover, the water supply in the project area is interrupted due to power failures at KWSC pumping stations.

192. Most of the population use piped water as source of potable water. The water pipes are either connected to houses or to a community tap. More than half of the respondents are unsatisfied with water quality and supply. The different sources of domestic water is presented in Table 4-29.

Table 4-29: Sources of Drinking Water

Sr. No.	Source of Water	Number of Respondent	Percentage (%)
1	Water Supply	282	61
2	Borehole	71	15
3	Tanker	110	24
Total		**463**	**100**

Source: Socio-Economic Survey

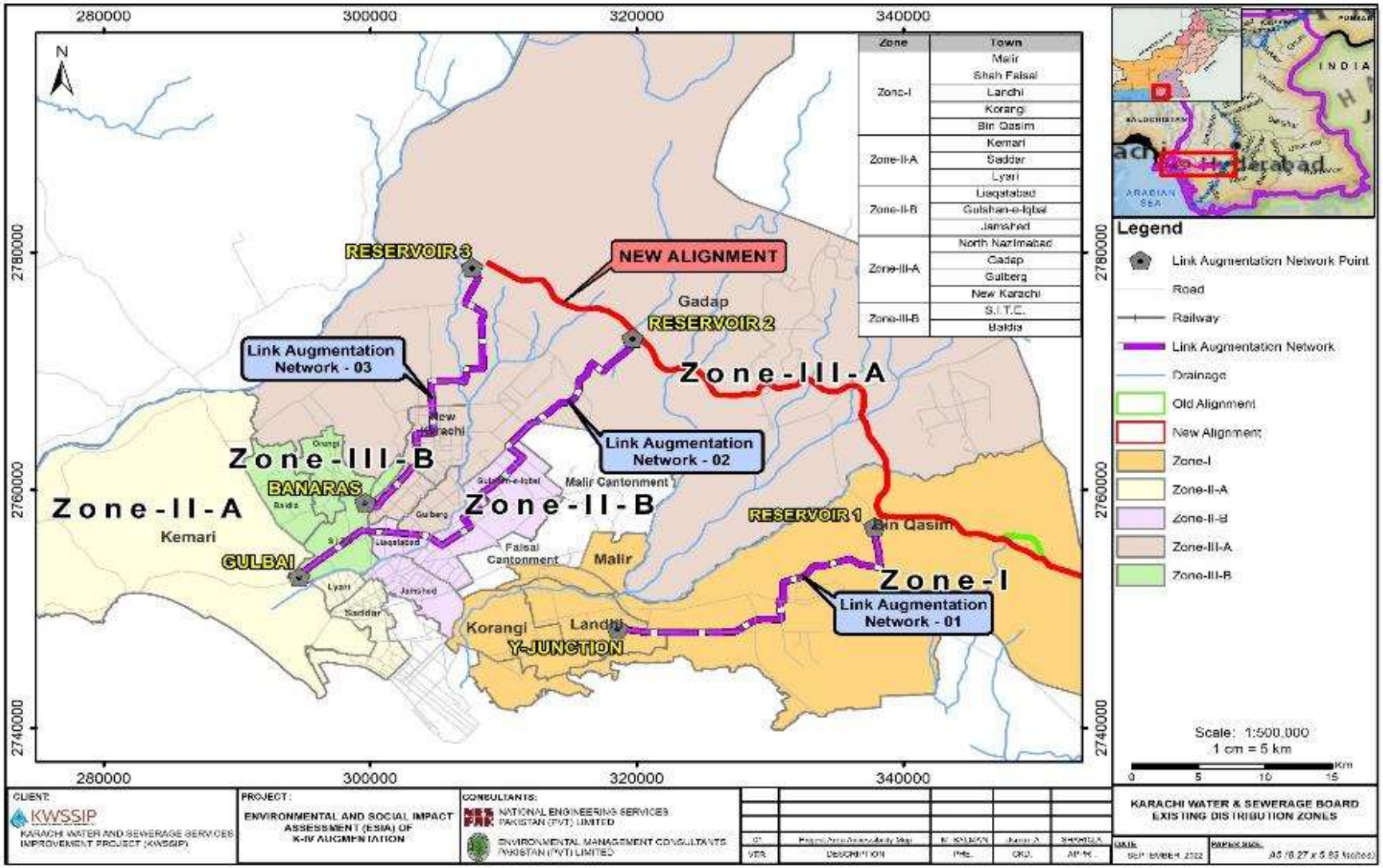


Figure 4-11: Existing Water Distribution Zones

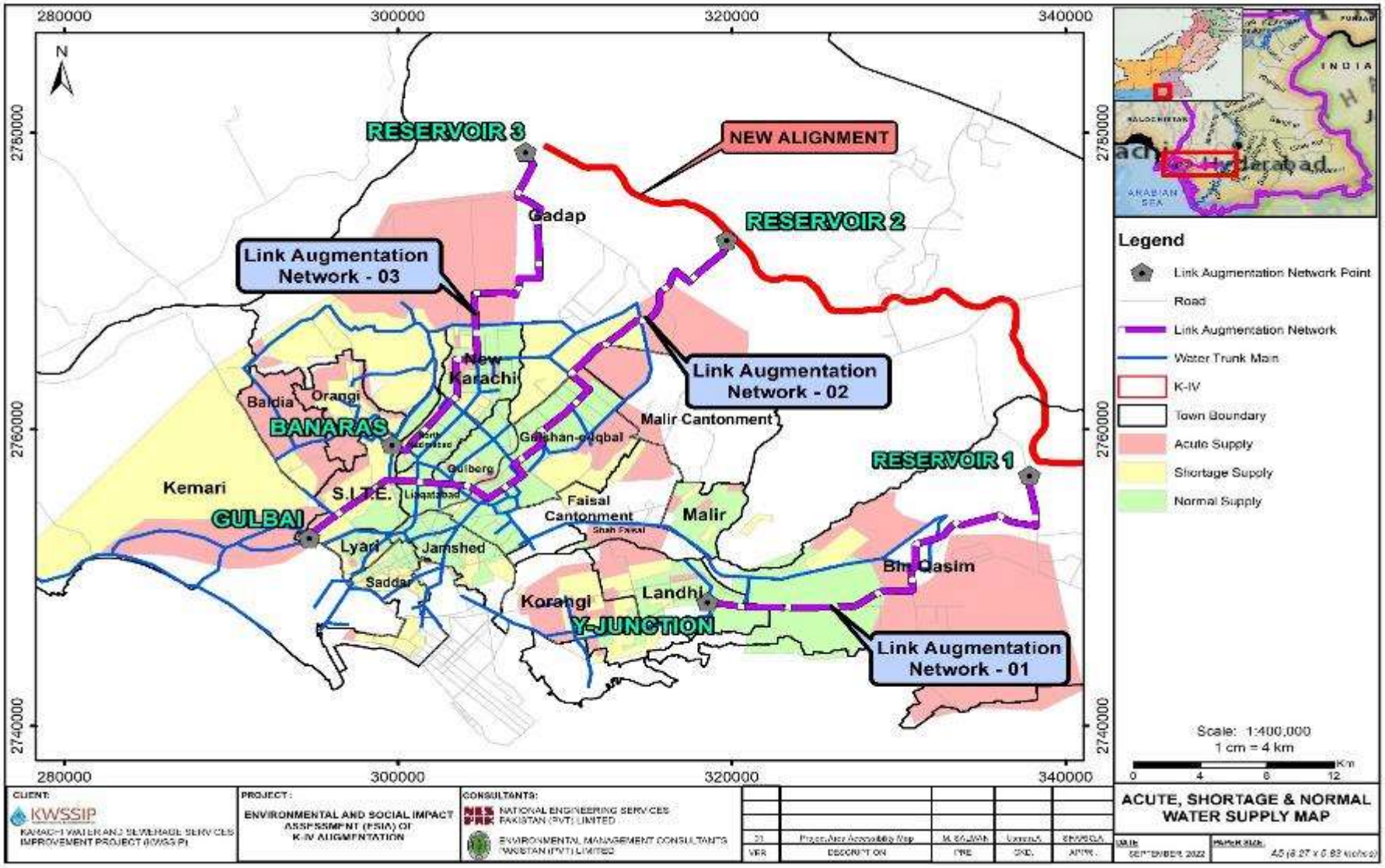


Figure 4-12: Existing Water Supply Situation Map

4.5.5 Gender Analysis

193. Most women in the area are unemployed. Women within the project areas are engaged in various livelihood activities such as farming, post-harvest activities, and poultry & livestock production. Some women work in industries in Karachi to supplement their household income. Women within the project area work in the education and health sectors.

194. Women in the rural and semi-urban areas are major contributors to sub-sectors such as livestock production, and industry. Most women are also responsible for household activities such as acquisition of food and fuel, food preparation & preservation, and caring for children. The role of women is unrecognized in semi-urban and in informal settlements (or *katchi abadis*).

Participation of Women

195. Women have vital roles in their household as majority are engaged in domestic activities. Aside from their roles at home, women in the project area also assist their male family members in income generation. Based on the socio-economic survey, 5% of women in the area are employed, while 1% is engaged in livestock rearing (Table 4-30). Participation of women in political activities is almost negligible (0.1%).

Table 4-30: Participation of Women in Various Activities

Sr. No.	Activities	Participation Level
1	Household work	93%
2	Childcare	92%
3	Livestock rearing	1%
5	Employment	5%
6	Participation (marriage, birthday and other functions)	100%
7	Local representation (counselor /political gathering)	0.1%

Source: Socio-Economic Survey

Issues Relevant to Women

196. Women were also asked about issues relevant to them during the socio-economic survey. Responses included issues on public transport service, availability of safe drinking water, access to medical treatment, access to educational institutions, skills development, access to sanitation facilities, and women empowerment & participation.

4.5.6 Primary Issues in the Area

197. While water scarcity is an issue in many parts of the world, it is one of the major issues in Pakistan, specifically in the Sindh province. Most residents are affected by poor sanitation and drinking water scarcity.

198. The area is also suffering from poor water quality, which has caused various health human issues such as renal disease, skin allergies, blood disorders, and the presence of carcinogens. According to the socio-economic survey respondents, the most pressing need of the area is the access to clean drinking water; the respondents stated the need for water filtration plants. The survey team explained the augmentation works will improve water supply and water quality. Furthermore, installation of new water filtration plants, as well as the rehabilitation of existing ones are included in the KWSSIP.

199. Survey respondents also expressed the need for employment in the area. The project contractor will be compelled to hire local labor for the construction works. It shall be stipulated in the ESMP that a clause requiring contractors to employ local labor shall be included in their contract. The contractor shall prepare a Local Employment Plan.

200. Other issues such as the scarce supply of natural gas and lack of medical facilities in the area were also mentioned by the survey respondents.

4.5.7 Traffic

201. Secondary data on the traffic count of the following roads were reviewed (Table 4-31):

- Eastern Bypass Road
- Pak Steel Road
- Mehran Highway
- M9 (Super Highway)
- University Road
- Sir Shah Muhammad Suleiman Road
- M10 (Northern Bypass)
- Lyari Basti Road.

202. Based on the traffic data, more than 50% of heavy vehicles such as trucks, trailers, coaches, and buses, travel on the highways (Eastern Bypass, M9, and M10). A smaller number of light vehicles (40% to 45%) pass traverse the highways.

203. More than 90% of the traffic volume is reported along University Road, Sir Shah Muhammad Suleiman Road, and Lyari Basti Road. Only 1-2% of heavy vehicles pass through these roads.

Table 4-31: Traffic Count along the Major Roads

Route	Major Road	Total Traffic	Car and Taxi	Motorcycle and Rickshaw	Coach and Bus	Heavy Vehicle (Truck and Trailer)
		Average Daily Traffic				
Route-1	Eastern Bypass Road[4]	3,673	1,396	184	257	1,837
	Pak Steel Road[5]	11,707	3,894	2,569	815	4,390
	Mehran Highway	19,923	3,966	10,441	2,638	2,811
Route-2	M9 (Super Highway)[6]	32,642	14,323	-	2,056	16,354
	University Road[7]	109,985	38,777	67,144	2,061	2,003
	Sir Shah Muhammad Suleiman Road	173,528	52,411	116,072	3,535	1,510
Route-3	M10 (Northern Bypass)	4,723	1,795	236	331	2,362
	Lyari Basti Road	74,352	19,653	50,284	3,518	897

[4] *Karachi Transportation Improvement project 2012*
[5] *JICA Investment Climate Improvement in Karachi 2012*
[6] *Traffic Study Report of Malir Expressway 2019*
[7] *Traffic Count Provided in EIA Report of Redline Karachi BRT 2019 (ADB Funded)*

4.5.8 Security

204. Karachi was once known as a dangerous city; it is now considered a relatively peaceful area. The security situation is usually related to the political situation.

205. According to the survey respondents, there will be no security concerns even if construction personnel live and work within the project area. Furthermore, the labor force will most likely be composed of people from all ethnicities who are living in Karachi and therefore will not pose any security issues. As a precaution workers will not be permitted to loiter outside the construction camps during nighttime.

206. Security Management is included in the ESMP and the ESCP. A security assessment will be required before mobilizing any contractors in the area.

4.5.9 Sensitive Receptors

207. Sensitive receptors include the educational, health, religious, cultural, and archaeological resources in the CoI. There are 66 sensitive receptors in the area. These include nine shrines and graveyards, 29 mosques, 20 educational institutes, and eight health institutes. The sensitive receptors are listed from Table 4-32 to Table 4-34, and are shown from Figure 4-13 to Figure 4-15. The receptors are further detailed in Annex VI.

208. All mitigating measures to avoid any impacts on sensitive receptors were included in the ESMP.

Table 4-32: Sensitive Receptors along Route-1

Sr. No.	Category of Sensitive Receptor	Numbers	Average Distance from RoW (m)	Type of Vulnerability
1	Masjid	3	11-27	• Disturbance due to Noise • Accessibility
2	Educational Institute	2	50-80	• Accessibility • Air Pollution and Dust • Disturbance due to Noise • GBV • SEA & SH • Community H&S • Child Abuse
3	Health Institute	3	42-49	• Accessibility • Air Pollution and Dust • Disturbance due to Noise • GBV • SEA & SH • Community H&S
4	Shrine and Graveyard	2	12-30	• Accessibility

209. Two masjids and one graveyard are present within the project working space (within 5m to 13m). The working space shall be shifted to the opposite side of the sensitive receptor to minimize any possible impacts. Construction activities shall be planned to avoid disturbance due to noise during prayer times at the masjids. Educational and health institutions are located away from the CoI. Although this is the case, impacts on the institutions are still anticipated.

210. Proper construction planning and management, along with stakeholder consultations shall be done to minimize any impacts on the sensitive receptors. Furthermore, construction activities at the start and end of the school day shall be halted to ensure the safety of the children.

Table 4-33: Sensitive Receptors along Route-2

Sr. No.	Category of Sensitive Receptor	Numbers	Average Distance from RoW (m)	Type of Vulnerability
1	Masjid	9	14-33	• Disturbance due to Noise • Accessibility
2	Educational Institute	10	16-72	• Accessibility • Air Pollution and Dust • Disturbance due to Noise • GBV • SEA & SH • Community H&S • Child Abuse
3	Health Institute	2	18-28	• Accessibility • Air Pollution and Dust • Disturbance due to Noise • GBV • SEA & SH • Community H&S
4	Graveyard	1	28	• Accessibility

211. None of the sensitive receptors are located within the 5m to 13m working space. Therefore, minimal impacts on the receptors, if any, is anticipated. Working spaces shall be established opposite the sensitive receptors to minimize any impacts of the construction activities. Additionally, there are seven educational institutions and two health institutions within the CoI.

212. Proper construction planning and management, along with stakeholder consultations shall be done to minimize any impacts on the sensitive receptors. Furthermore, construction activities at the start and end of the school day shall be halted to ensure the safety of the children attending the educational institutions. Construction activities may also pose noise and accessibility impacts on the masjids. Temporary access to the masjids shall be provided, and construction activities near the masjids will be halted during times of prayer.

Table 4-34: Sensitive Receptors along Route-3

Sr. No.	Category of Sensitive Receptor	Numbers	Average Distance from RoW (m)	Type of Vulnerability
1	Masjid	17	10-64 (4)	• Disturbance due to Noise • Accessibility
2	Educational Institute	8	12-91 (1)	• Accessibility • Air Pollution and Dust • Disturbance due to Noise • GBV • SEA & SH • Community H&S • Child Abuse
3	Health Institute	3	09-51 (1)	• Accessibility • Air Pollution and Dust • Disturbance due to Noise • GBV • SEA & SH • Community H&S
4	Shrine and Graveyard	6	13-92 (1)	• Accessibility

213. Sensitive receptors within the project working space include four masjids, one shrine, one educational institution, and one health institution. Working spaces will be situated opposite the sensitive receptors to minimize any impacts. Additionally, there are eight educational institutions and three health institutions within the CoI.

214. Proper construction planning and management, along with stakeholder consultations shall be done to minimize any impacts on the sensitive receptors. Furthermore, construction activities at the start and end of the school day shall be halted to ensure the safety of the children attending the educational institutions. Construction activities may also pose noise and accessibility impacts on the masjids. Temporary access to the 17 masjids shall be provided, and construction activities near the masjids will be halted during times of prayer.

215. A Government Women College is also located near the proposed project site; GBV and SEA/SH may be prevalent. Construction workers shall receive appropriate training to avoid issues on GBV and SEA/SH. Furthermore, the contractor shall impose strict measures and penalties relevant to GBH and SEA/SH. Workers will not be allowed to loiter in the vicinity of the Government Women College. These matters shall be covered in the SEA/SH action plan.

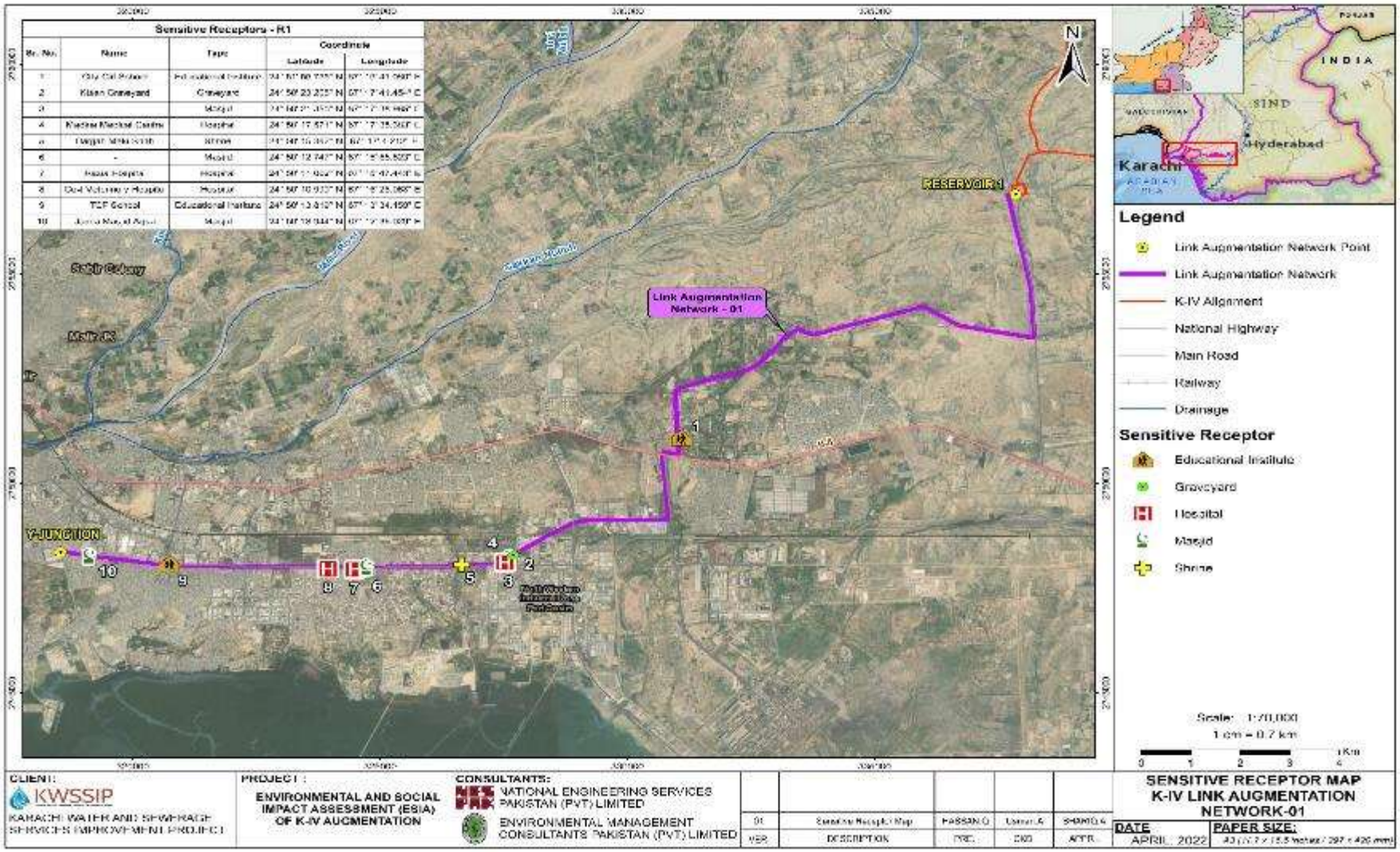


Figure 4-13: Sensitive Receptor Map of Route-1

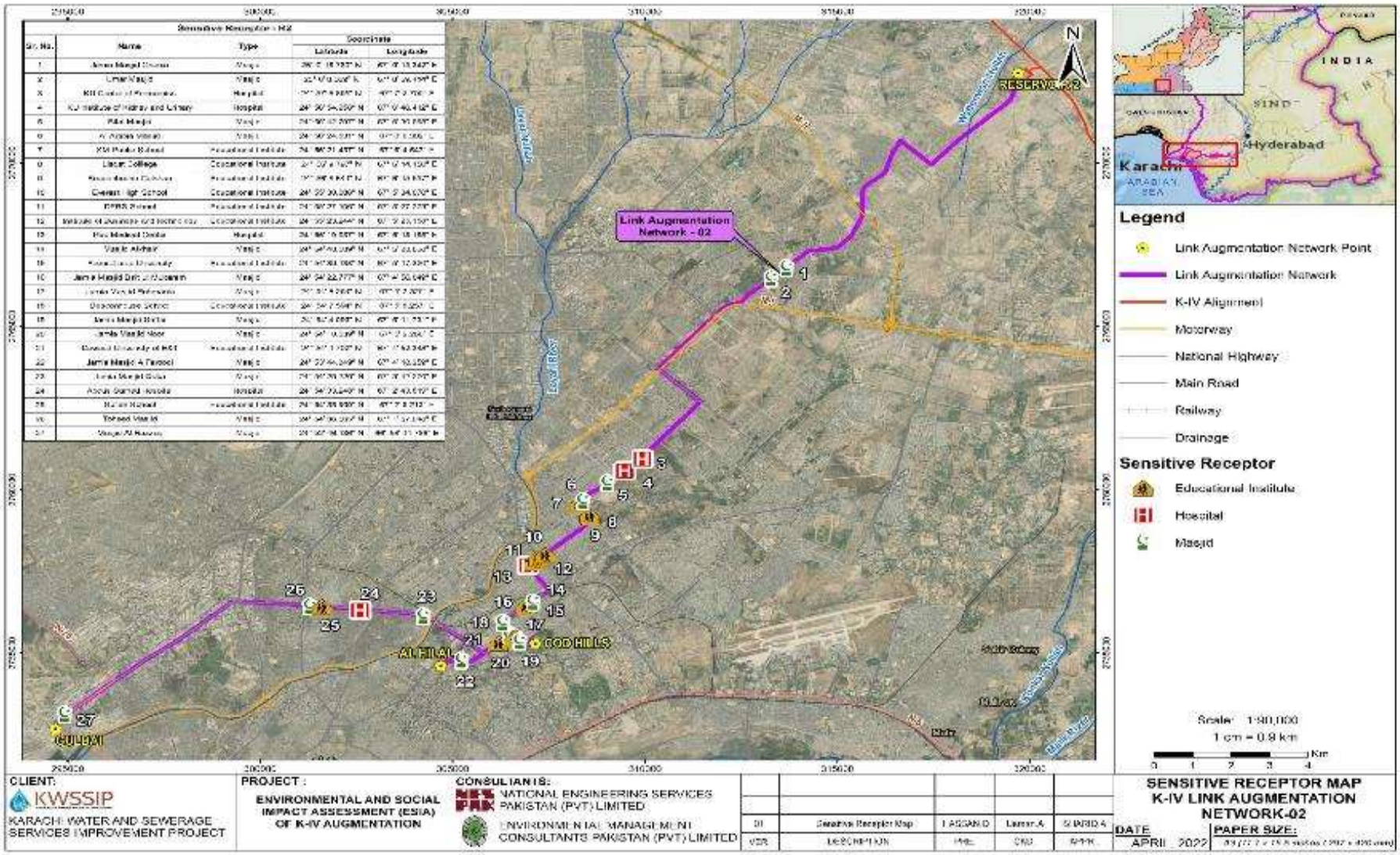


Figure 4-14: Sensitive Receptor Map of Route-2

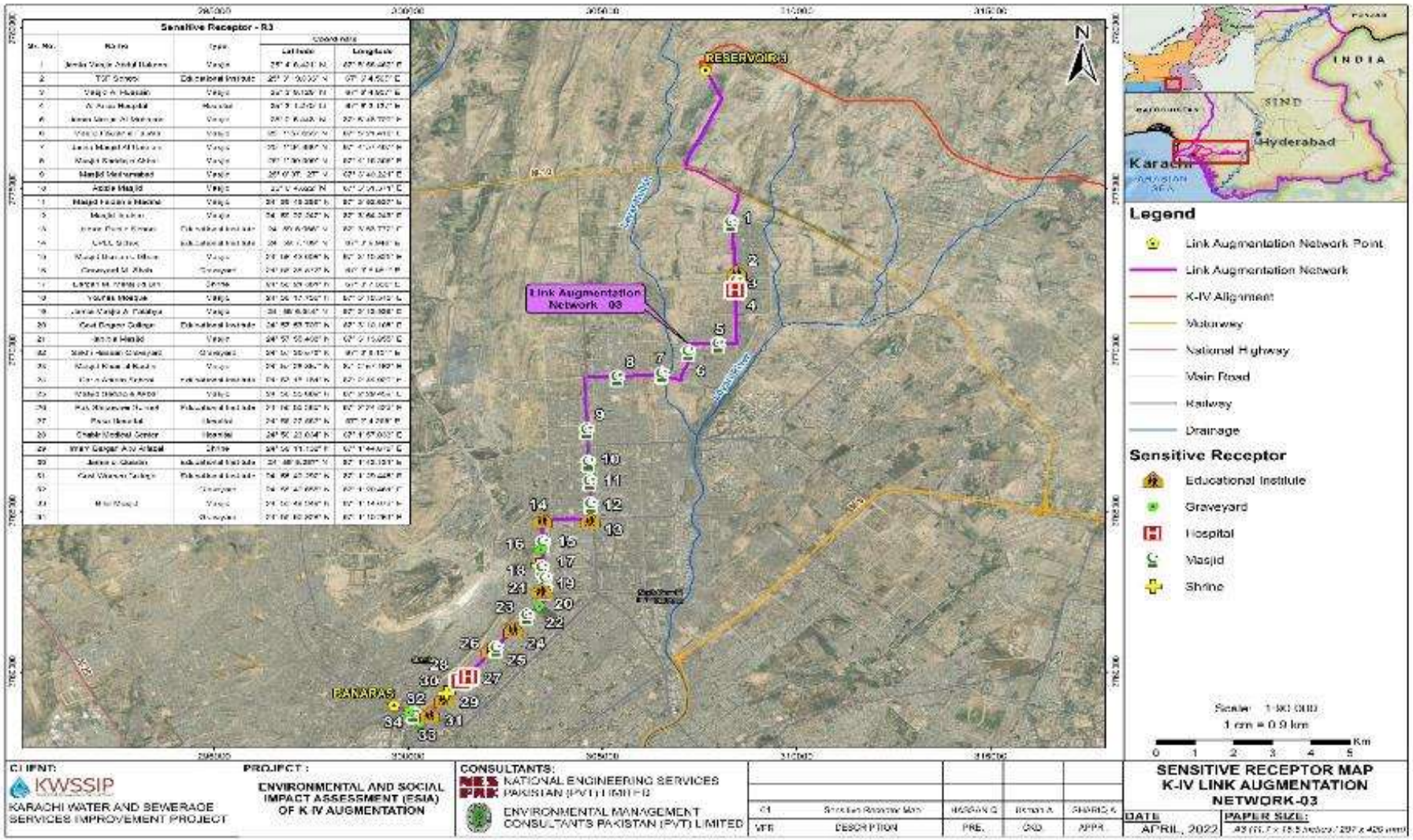


Figure 4-15: Sensitive Receptor Map of Route-3

5 Analysis of Alternatives

5.1 Introduction

216. This chapter presents an analytical overview of the different alternatives considered for the KIV Augmentation. Besides the economic viability, environmental sustainability and social soundness were also considered in selecting the proposed alignments.

5.2 No Project Option

217. Without the project, water from the government financed KIV water treatment plants will not be distributed to Karachi City thus, increase in access to safe water supply will not be realized. Lack of access to safe water may cause the spread of infectious diseases and water-borne diseases. Children and elderly are particularly at risk from these risks. In addition to exposure to diseases, women also face additional health risks from potential harassment, violence and injury when they have to go outside to get water.

5.3 Route Alternatives

5.3.1 Option 1

218. The proposed routes for this option are the following. Figure 5-1 shows the proposed alignments for this option.

219. Based on the preliminary analysis performed for this option, the following issues on technical design, environmental and socio-economic aspects were identified:

- Pipeline has been proposed over heavily encroached area within the city that involves land acquisition and loss of livelihood;
- Quantum of distribution between COD Filter Plant and Al-Hilal, Banaras and Y-junction are not well defined;
- Involves excessive tree cutting;
- Increased traffic jams and congestion due to construction of pipes in densely populated areas of Karachi and along the parking places;
- Graveyards, shrines and culturally important areas are located along the proposed route alignments; and
- At turning from M-10 towards Surjani town link road, there is a naturally elevated area with an elevation that is more than the starting elevation of Reservoir 2 which can create hydraulic problems and thus, can increase excavation depth unnecessarily.

a. Route 1: Reservoir to COD Filter Plant

220. This route is designed to carry 130 MGD of water from Reservoir 1 to COD Filter Plant. It consists of 7km of 2.4m diameter MS pipe then changes to twin 1.8m diameter MS pipe which runs 17 km until the COD filter plant. This route runs along M-9, Jamali Bridge, Gulzar-e-Hijri Road, Suparco road and at the backside of Karachi University.

b. Route 2: Reservoir 2 to Qasba and Banaras

221. This route will convey 65 MGD water from Reservoir 2 to Qasba and Banaras. This route has a total length of 26 km and will traverse Hub dam Road, Surjani Town Road, Powerhouse Chowrangi, Surjani Town link road, Al-Amna Ave and Mangophir road.

c. Route 3: Reservoir 3 to Y-Junction

222. This route is proposed to be done by laying a trunk main of 2.1m diameter from Reservoir 3 and parallel to link road (connecting with National highway and Superhighway). After reaching crossing point of existing alignment of GKBWS scheme up to the Pipri Reservoir, connection can be given to New Malir Housing Scheme, and other emerging Housing Schemes of DHA and Bahria Town. Interconnection can also be given to Malir Town using the existing 0.9m diameter pipe in the area.

5.3.2 Option 2

223. Option 2 was the recommended option and was considered in this ESIA study. Refer to Section 3.2 for the description of the alignments in this option.

224. The following criteria were considered in assessing the two options.

- No or least possible land acquisition;
- Availability of space over ground for construction to minimize traffic, noise and air emission issues;
- Minimum relocation of existing underground utilities;
- Shorter pipe to be used to transport the water from starting point to respective terminating points;
- Avoid game reserves, wildlife sanctuaries, national parks, reserved forests and ecologically sensitive areas (if reported in project area or any other component of proposed project);
- Avoid excessive tree cutting;
- Densely and sparsely populated areas, indigenous and tribal settlements and avoid private/ government infrastructures;
- No disturbance to the archaeological sites/ historical monuments (if any);
- Graveyards, shrines and culturally important areas will be avoided and protected (where possible);
- Try to avoid difficult terrain, extreme altitudes, steep slopes, landslides and unapproachable locations (where possible);
- Proximity to existing highway/roads for ease of mobility, construction and maintenance access; and
- Maintain adequate clearance from the public infrastructure and sensitive zones (especially Pakistan Air Force prohibited areas).

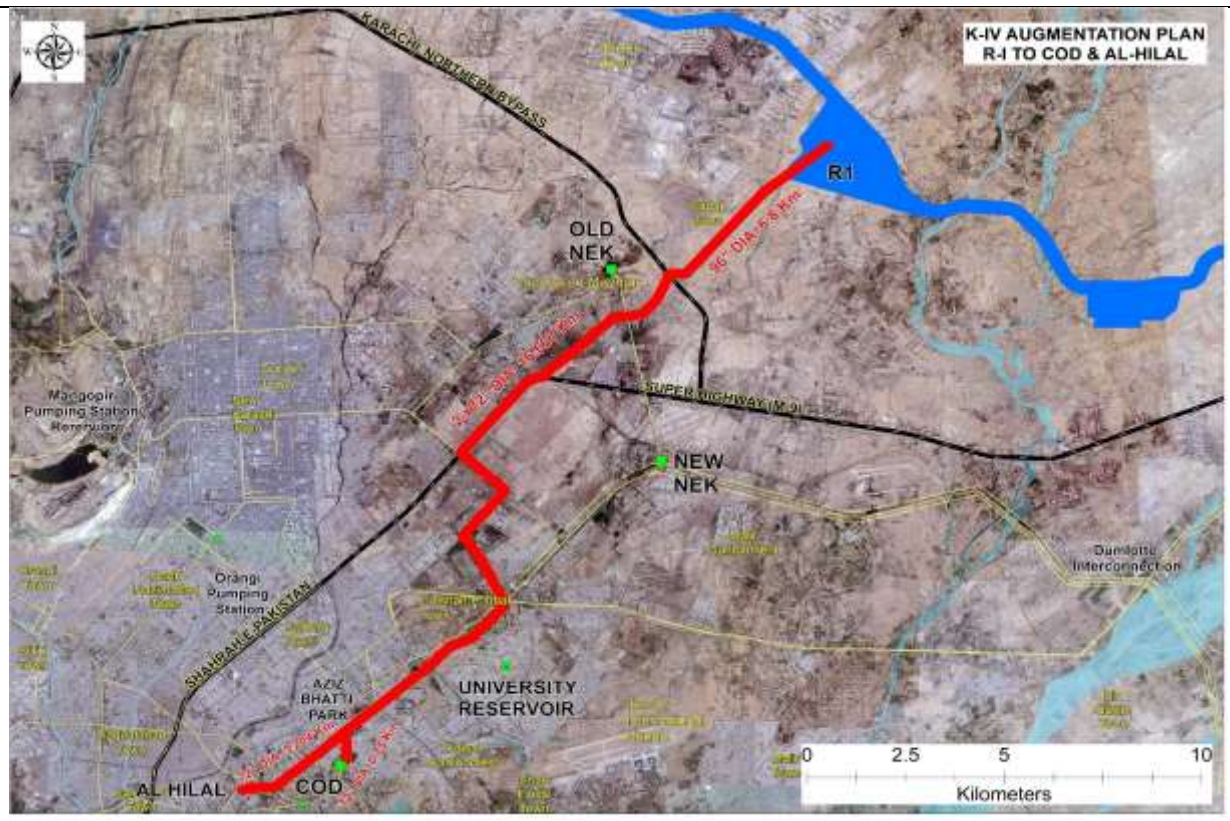
225. Table 5-1 shows the comparison of the options. As presented, Option 2 is more favorable in terms of environmental and social impacts and easier to be implemented than Option 1.

Table 5-1: Comparison of Alternative Routes

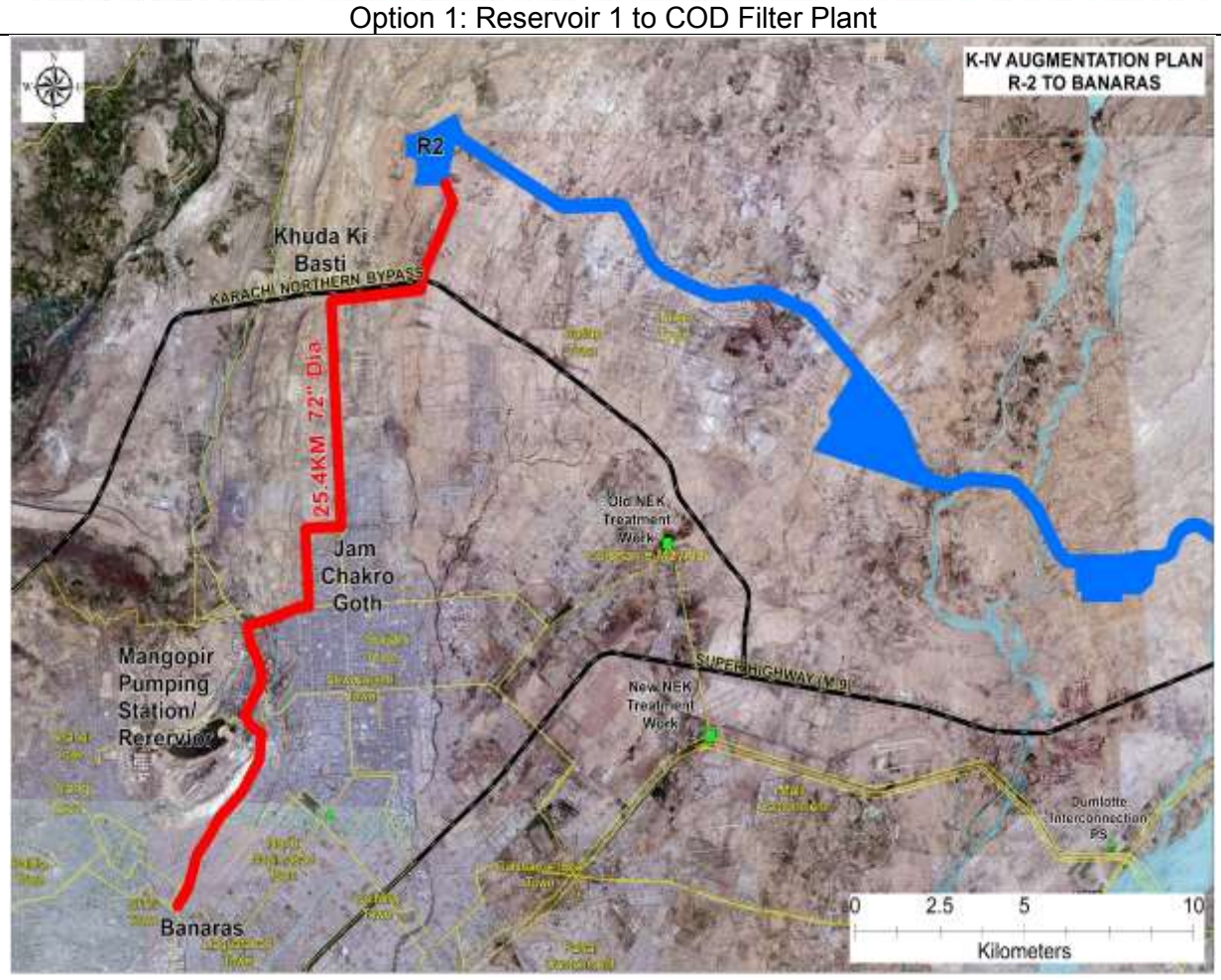
Criteria	Option 1	Option 2
Project Cost	**High**	**Medium**
	The estimated cost is high due to locatio n of the proposed route that is	There is no permanent resettlement related issues and reduced tree

Criteria	Option 1	Option 2
	heavily encroached area within the city that involves permanent resettlement issues, and excessive tree cutting was involved	cutting compared to the Option – 1 alternative
Difficulty for accessibility	**High**	**Medium**
	The impact is high because the water pipes are to be laid in highly encroached area and access roads will face severe traffic congestion problem for public as well as for the mobilization and movement during project execution	The impact is medium because the water lines are to be laid in lesser encroached and populated area. There will be less traffic congestions and accidents. This option was more suitable considering the movement of public as well as the mobilization and movement during the project execution.
Difficulty for surveying and designing	**High**	**Medium**
	The impact is substantial because there are certain foreseen issues such as the accessibility to the project area is difficult due to highly encroached areas, difficulty in conducting the surveys and different design studies in congested area, socio-cultural issues etc.	More accessible as compared to Option 1. Similarly, due to less congestion and minimum socio-cultural issues, it is relatively easy to conduct the design surveys and studies
Difficulty for Construction	**High**	**Medium**
	Less available space for construction activities. Longer pipes needed and deeper excavation. More disturbances to the socio-cultural sites and accessibility to the project area is difficult due to highly encroached areas.	More available space for construction activities. Overall shorter length and lesser depth of construction involved. Disturbance to the socio-cultural sites is estimated to be minimum and difficulty for accessibility is of medium nature and hence difficulty in construction activities will be of medium nature.
Difficulty for Operation and Maintenance	**High**	**Medium**
	Accessibility to the project area is difficult due to highly encroached areas, the risk of traffic congestions is higher and there is a naturally elevated area with an elevation more than the starting elevation of Option-2 which can create hydraulic problems during O&M phase.	More accessible and lesser traffic congestion.
Physical	**Medium**	**Medium**
	The impact is medium because majority of the physical impacts on possible sensitive receptors are of temporary and reversible nature	The impact is medium because difficulty for accessibility is of medium nature and lesser traffic congestion issues, hence difficulty in O&M activities will be of medium nature.
Biological	**Substantial**	**Medium**
	Even though there are no endangered fauna species, the noise from the construction activities may cause disturbance to the fauna. The alignment has more vegetation and will require excessive cutting of trees including endangered trees species.	Even though there are no endangered fauna species, the noise from the construction activities may cause disturbance to the fauna. Will require lesser cutting of trees. Endangered trees species will not be removed.
Social	**High**	**Medium**

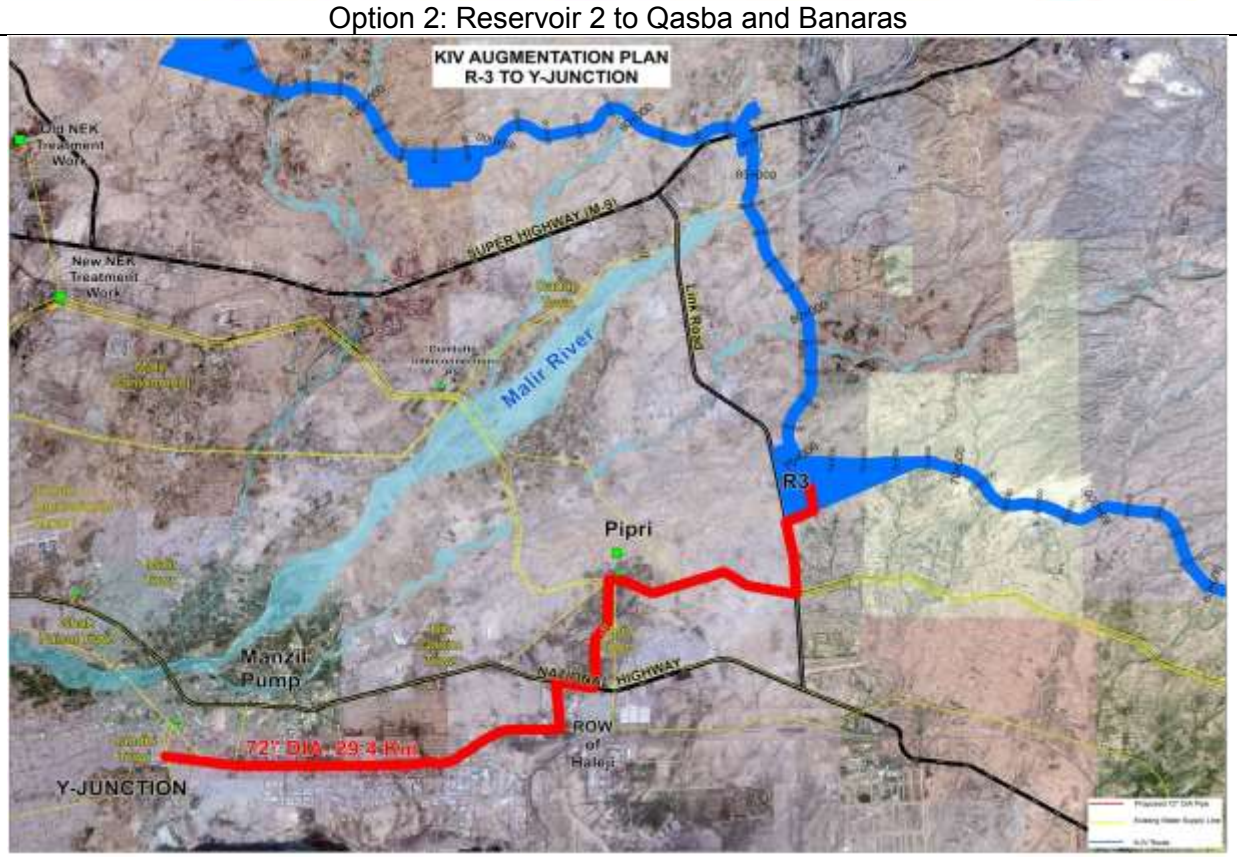
Criteria	Option 1	Option 2
	More utilities and households that need be relocated. Multiple cultural sites can be found along the routes.	Less utilities for relocation and less cultural sites along the routes.
Resettlement issues	**High**	**Medium**
	The impact is high because the proposed project is located in highly encroached areas which requires significant resettlement issues at few stretches along with the livelihood losses	No permanent resettlement impact because of the availability of required ROW. However, temporary resettlement and livelihood loss impacts are foreseen.
Security Risks	**Medium**	**Medium**
	Street crimes and security concerns in project area is of significant nature and influx of labor will also because security concerns for the community	Street crimes and security concerns in project area is of significant nature and influx of labor will also cause security concerns for the community
Overall Impacts	**High**	**Medium**
	The overall impact is high because of permanent resettlement of about 20 structures (mostly along Route-2), excessive cutting of trees (approx. 1950 numbers), increased traffic jams and traffic congestion involved, and presence of graveyard, shrines and mosques along RoW and hydraulic problems.	The overall impact is medium because it involves no permanent resettlement, relatively less tree cutting (1719 in numbers), minimum relocation of existing utilities, avoidance of densely populated areas and E&S sensitive receptors



Option 1: Reservoir 1 to COD Filter Plant



Option 2: Reservoir 2 to Qasba and Banaras



Option 3: Reservoir 3 to Y-Junction

Figure 5-1: Option 1 Proposed Route Alignments

5.4 Construction Methodology

226. The two most common methods used in pipe laying are the Open Cut Method and the Horizontal Boring/Pipe Jacking Machine Method. Open Cut Method will be mainly used during construction, but the Horizontal Boring/Pipe Jacking Machine Method will also be used in main corridors of the city where the water pipes intersect with the main roads and structures.

- Open Cut Method - Open cut trench excavation consists of excavating a trench for the manual installation of each "stick" or piece of pipe. The method involves excavating down to and exposing the existing pipe so that it can be repaired or replaced and then backfilled. The total length of cut and cover is just 810 m for each Route 1, Route 2 and Route 3 out of their total lengths.
- Horizontal Boring/Pipe Jacking Machine - A pipe jack is defined as a system of directly installing pipe behind an open-face tunnel boring machine. The pipe is then hydraulically jacked from a launch shaft, so that it forms a continuous string in the ground. The pipe, which is specially designed to withstand the jacking forces likely to be encountered during installation, forms the final pipeline once the excavation operation is completed.

Table 5-2: Comparison of Construction Methodology

Open Cut Method	Trenchless Technology
Open cut method often involves risk.	Pipe jacking are safer methods of working
Dismantling of road takes place throughout the pipe path.	Dismantling of road only requires for launch and reception shafts for entrance of pipe jacking machine. Substantial cost saving.
Slow construction, often takes more time.	Speedy construction.
Public Inconvenience.	No inconvenience to public.
More traffic disturbance.	Traffic disruptions are reduced or eliminated, Mobility above ground is not affected.
More Environmental effects, soil disturbance.	Minimum environmental effects less soil is disturbed and excavated.
Shifting of all underground utilities.	Minimum shifting underground utilities, services cost effective.
More transportation and re-handling of materials.	Reduce the quantities of incoming and outgoing materials.
Maximum visual impact to the local population.	Minimal visual impact to the local population and weather-proof construction.
Less reliability.	High degree of reliability.
Cost effectiveness.	Cost expensive.

5.5 Pipe Materials

227. There are three pipe materials considered as presented in Table 5-3. Considering the requirements, MS pipe is proposed to be adopted because of its higher strength against earth load, higher water pressure bearing capacity, low cost and widest availability. Material with longer life and is more durable will result with least solid waste at the end, and material with greatest strength to sustain water pressure would ideally lead to lesser maintenance activities and least supply disruption during operations.

Table 5-3: Comparison of Pipe Materials

Pipe Material	Advantages	Disadvantages
Ductile Iron Pipe	• High strength for supporting earth loads, long life. • Good corrosion resistance • Wide variety of available fittings and joints • Wide range of available thicknesses • Good resistance to water hammer • Most widely used because of its stiffness, strength, toughness and durability in many kinds of ground • Easy to lay, because of push-on joints, specifically in urban area, the pace of work is fast than other types of pipes such as MS or HDPE pipes.	• May required wrapping or Cathodic protection in corrosive soils • High cost, especially for long freight hauls
HDPE Pipe	• Light weight, very durable, very smooth, liners and wrapping not required for corrosion protection; usually jointing method is thermal but fusion, which develops the full strength of the pipe; flanges can be provided; • Low installed cost • Can be easily tempered by miscreants	• Subject (as are many plastics, including PVC) to permeation by low molecular weight organic solvents and petroleum products, unsuited for manifold piping for pumping stations; scratches on the pipe wall can significantly reduce service life.
MS Pipe	• High strength for supporting earth loads • Low cost, Widest variety of available fittings and joints and custom fittings can be metered and welded • Excellent resistance to water hammer	• Poor corrosion resistance unless both lined and coated or wrapped. • May require cathodic protection in corrosive soils. • When steel pipelines pass parallel to and up to about 50 to 200 m away from overhead high voltage lines, stray electrical potential may be induced on the pipeline. This will require the pipeline to be earthed, thus adds to the complexity for the protection of steel pipes. • The pace of work is very slow as compared to other pipes.

6 Environmental and Social Risks and Impacts

6.1 Introduction

228. This chapter presents the potential environment and social risks and impacts during pre-construction, construction and operation phases of the proposed project. The KIV Augmentation Works is expected to have negative impacts and threats, due to the nature of the construction activities, but is also expected to be beneficial to the people within Karachi City by providing access to safe water supply.

229. The results of the E&S risk assessment conducted for KIV Alignment Works is presented in Table 6-1.

Table 6-1: Summary of E&S Risk Assessment of the KIV Augmentation Works

Environmental and Social Risks and Impact	Risk Assessment		
	Project Phase	**Risk Rating**	**Description**
ESS 2: Labor and Working Condition			
Occupational Health and Safety	Construction	Substantial	Construction workers are exposed to occupational health and safety risks and hazards when performing construction activities such as excavation, operation of heavy equipment and machines, labor works, civil works and others. If asbestos cement pipes are encountered during excavation, workers are exposed to health hazards of asbestos.
	Operation	Low	Workers are exposed to occupational health and safety hazards during O&M activities.
Labor risks	Construction, Operation	Substantial	Workers are exposed to labor risks such as child and forced labor, GBV, discrimination, SEA/SH and labor exploitations.
ESS 3: Resource Efficiency and Pollution Prevention Management			
Resource efficiency	Construction	Medium	Non-renewable materials such as water (~850 m^3/day), crushed aggregates (5,900 m^3), sand (~3000 m^3), cement (~2000 m^3), and fuel will be used during construction.
Soil Contamination	Construction	Medium	The soil will be exposed to erosion due to removal of vegetation, excavations for laying water main trunks, construction camps and workshops. Erosion may increase during intense rainfall events. Contamination of soil may also be caused by oil and chemical spills or uncontrolled runoff from equipment washing yards.
Pollution of Water Resources	Construction	Medium	Runoff from the construction works area may contain increased loads of sediments, suspended solids and other contaminants which will increase the pollution load of the available water resources in the project area. The following are the potential sources of pollution of water sources: • Discharge of untreated wastewater from contractors' camps and construction site • Oil and chemical spills • Dumping of wastes from contractors' camps and

Environmental and Social Risks and Impact	Risk Assessment		
	Project Phase	**Risk Rating**	**Description**
			construction site
Air Pollution	Construction	Substantial	The use of vehicles, heavy equipment and generator sets will emit gaseous air pollutants such as carbon monoxide (CO), sulfur dioxide (SO_2), and nitrogen dioxide (NO_2). Earthmoving activities and excavation will generate dusts. This may cause nuisance and respiratory stresses to vulnerable groups such as children and elderly.
	Operation	Low	Operation of standby generator will have air emissions.
Noise	Construction	Substantial	The noise may be produced due to the operation of construction machinery and other equipment. Sources of noise during construction are heavy machinery such as bulldozers, excavators, stabilizers, concrete mixing plant, pneumatic drills, stone crushers, asphalt plants and other equipment. This may cause disturbance to the activities in the mosques, schools, hospitals and households within CoI.
	Operation	Low	The operation of the standby generator will generate noise.
Construction Wastes	Construction	Medium	Domestic solid wastes will be generated by the workers in the contractors' camps. Improper storing of kitchen and food wastes may attract rodents and other pests. Construction wastes will be generated. These wastes can also be hazardous. Improper storage and disposal of these wastes may cause pollution to soil and in water, if dump in water bodies.
ESS 4: Community Health and Safety			
Traffic	Construction	Substantial	The routes of the water pipes will pass through industrial areas and populated residential areas. The proposed alignment of the water pipes will pass through major highways such as Eastern Bypass Road, M9 (Super Highway), M10 (Northern Bypass)) and roads such as Pak Steel Road, University Road, Sir Shah Muhammad Suleiman Road, Lyari Basti

Environmental and Social Risks and Impact	Risk Assessment		
	Project Phase	Risk Rating	Description
			Road). This may cause severe traffic congestion or possible road closure during construction. The delivery of construction materials onsite, use of heavy equipment and the storage of excavated materials onsite will cause traffic jams and inconvenience to the public passing through the project area. Tunnel boring activities will also increase the heavy traffic in the major road crossings. Aside from traffic generation, these activities may also cause road accidents and road damages. The masjid, shrine and graveyards will not be directly affected during the pre-construction phase, but the people may face accessibility issues due to mobilization activities.
	Operation	Low	Pipe repairs and maintenance may cause localized traffic in the area.
Disruption of Basic Services	Construction	Substantial	Utility lines like sewerage, gas pipes, electricity and telephone lines exist within RoW. These will be relocated prior the start of construction activities. With this, access to these services may be disrupted.
Community Health and Safety Risks	Construction	Substantial	Community health and safety risks include (i) Exposure to dusts and air emissions from the construction site may cause respiratory distress most especially to the vulnerable groups such as children and the elderly (ii) Pedestrians or vehicles passing by may accidentally fall in the excavated areas especially during at night (iii) Exposure to hazardous materials and wastes The community may also be exposed to communicable diseases, vector-borne diseases and water-borne diseases due to the influx of workers.
	Operation	Substantial	Illegal connections and pipe damages may cause intrusion of contaminants in the water supply. This may result to delivery of contaminated water to the households.
Vibration	Construction	Medium	Construction activities may generate vibration that may cause structural damage to the nearby buildings and may also cause

Environmental and Social Risks and Impact	Risk Assessment		
	Project Phase	**Risk Rating**	**Description**
			disturbance to the activities of the community within CoI.
Social Conflict, GBV, SEA/SH	Construction	Substantial	During the construction phase of the project, conflicts may arise between labor force and local community, including the risk of SEA/SH and GBV.
ESS 5: Land Acquisition, Restriction on Land Use and Involuntary Resettlement			
Resettlement	Construction	Substantial	The project will impact the livelihood of 279 persons; an RP has been prepared to address these impacts in accordance with the ESS5. The clearance of ROW will impact the livelihood of 240 business operators. Among them, 172 are mobile vendors that will face temporary disruption of their businesses and the remaining 68 are small shops that will face temporary access problem during the construction activities. Details for these temporary impacts are provided in the Resettlement Plan of the proposed project.
ESS 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources			
Biodiversity Flora	Construction	Substantial	It is estimated that out of total 1,719 trees, almost 1,685 trees will be cut down for laying of pipelines and the efforts will be made to ensure that the 34 species that is ecologically important are preserved.
ESS 7: Indigenous People			
	Construction, Operation	Not applicable	There are no tribal or indigenous people within the CoI.
ESS 8: Cultural Heritage			
	Construction	Low	There are shrines, graveyards and mosques that are located within the CoI that may be exposed to the environmental and social impacts of the project
ESS 10: Stakeholder Engagement and Information Disclosure			
Stakeholder engagement	Construction	Low	The project-affected population and sensitive receptors are not aware of the proposed project.

6.2 Anticipated Potential Impact Related to ESS during Construction and Operation

6.2.1 Impacts related to Assessment and Management of Environmental and Social Risks and Impacts (ESS 1)

230. The construction activities of the proposed KIV Augmentation Works are anticipated to have high environment and social risks but with no significant residual environmental or social risks. This ESIA was developed for the KIV Augmentation works. This contains the identification and assessment of potential impacts relevant to the construction and operation of the project and the corresponding environmental and social management and monitoring plans. The potential impacts of the project to vulnerable groups and identified sensitive receptors were also incorporated in the ESIA.

231. The environmental and social management plan contains the mitigating measures that should be implemented to minimize and/or avoid the adverse impacts of the project. However, there is a risk that the contractors may not implement or comply with these management plans during construction.

232. If there are new hazards or risks encountered during the actual construction, the risk assessment should be reviewed and if necessary, be updated, and applicable mitigating measures should be applied.

6.2.2 Impacts related to Labor and Working Conditions (ESS 2)

233. The impacts identified in this ESS are applicable to the employees of KWSC, contractors and subcontractors that will be hired for the construction and O&M of the proposed project.

a. Occupational Health and Safety

234. Construction workers may be exposed to the following risks and hazards when performing construction activities such as excavation, operation of heavy equipment and machines, labor works, civil works and others.

- Over-exertion and ergonomic injuries and illnesses due to repetitive motion, over-exertion and manual handling.
- Poor housekeeping such as excessive waste debris, loose construction materials and liquid spill may cause slips and falls of the workers.
- Physical injuries from falling in excavated areas.
- Accidents can occur when workers come into contact with vehicles or equipment during the mobilization and use of materials and equipment.
- Exposure to chemicals and hazardous materials and wastes
- Eye injury, burn and electrocution from hot work
- During summer season, workers will have to work in extreme hot weather conditions which can bring heat stress
- Potential health and safety risks may also arise from dust, pollutants, noise and vibration generated from construction activities.
- Exposure of workers to bentonite slurry may cause respiratory issues, skin allergies and gastrointestinal problems.

235. There are asbestos cement pipes within Karachi City that were installed by KWSC in the past. However, there are no asbestos cement pipes located within the RoW based on the map of KWSC.

236. In case asbestos cement pipes are encountered during the excavation, the PIU will coordinate with KWSC, if the old pipes will be retained underground or will be replaced with non-asbestos materials. If the latter will be implemented, the asbestos cement pipe should be properly handled and disposed. Asbestos may contaminate the air and remain suspended in the air for long periods of time. If inhaled, it may pose a serious health risk to the exposed individual.

b. Labor and Working Condition

237. The workers may be exposed to the following labor risks:

- Child labour impact might arise during construction stage, as large number of skilled and unskilled labour will be required by the contractor for the construction activities of the proposed project.
- Forced labour and/or human trafficking.
- GBV might arise due to discrimination made against women by unequal work distribution and unequal pay structure among others.
- SEA/SH against women might occur as a consequence of mixing of men and women at the construction site.
- Labour exploitation such as unpaid and/or incorrect payment of wages by employer, poor working conditions

238. The workers may also be exposed to vector-borne and water-borne diseases due to poorly designed and maintained labor camps, sanitation facilities and unsafe drinking water. Communicable diseases such as HIV/AIDS and other sexually transmitted diseases may also spread due to labor influx if the laborers are not medically examined.

239. Improper management of the workers' camp and poor facilities provided may lead to discomfort of the workers.

6.2.3 Impacts related to Resource Efficiency and Pollution Prevention Management (ESS 3)

a. Resource Efficiency

240. Construction materials include coarse aggregates (crush), fine aggregates (sand), steel, water, asphalt, reinforcement and cement. Almost all the materials to be used are non-renewable and therefore, their sustainable use is necessary.

241. Fuel will be used to operate construction machinery and asphalt and batching plants. Sustainable use of energy resources is very important not only to continue future use but also to help to reduce air emissions/pollutants.

b. Soil Contamination

242. Since heavy equipment and vehicles will be used during construction, there is a risk of soil contamination due to possible oil leaks/spills during operation and maintenance of these heavy equipment. Contamination of soil may also be caused by chemical spills or uncontrolled runoff from equipment washing yards.

243. Excavated materials may also contain heavy metals and may contaminate the soil within the storage area.

c. Pollution of Water Sources

244. Route 2 will cross a river and a nullah while Route 3 will traverse a river. The following environmental aspects may contaminate these water bodies during construction. Groundwater sources may also be affected by these activities.

- Disposal of untreated domestic wastewater. Approximately 15 cubic meters per day of wastewater will be generated at the construction camps and from construction activities.
- Since the proposed project will entail excavation activities, surface run-off from these areas may increase suspended solids of the nearby water bodies.
- Dewatering activities during rainy season from excavated areas may contain suspended solids and oil and grease, and if disposed of untreated may affect the quality of nearby water bodies.
- Oil spills/leaks from heavy equipment and vehicles may also contaminate the water sources.
- Improper management of solid wastes and hazardous wastes
- The water lines may be periodically flushed to remove sediments or other impurities that accumulated in the water pipes. This activity will generate flushed water which may contain high level concentration of suspended solids, residual chlorine and other pollutants. Discharge of flushed water may contaminate the receiving water body.

d. Air Pollution

245. Excavation activities will generate dusts especially during dry season. Dust can cause nuisance, reduction of visibility and may cause respiratory diseases.

246. Aside from dust, gaseous emissions from heavy equipment, vehicles and generator sets that will be used in the construction site will produce short-term impacts on the ambient air quality. An increased concentration of carbon monoxide (CO), sulfur dioxide (SO_2), and nitrogen dioxide (NO_2) may be realized in the ambient air. This impact will only be temporary.

e. Noise

247. Noise may also be generated by construction operations and equipment. Although construction works are expected to occur regularly, these impacts may be considered temporary.

248. Sources of noise during construction are heavy machinery such as bulldozers, excavators, stabilizers, concrete mixing plant, pneumatic drills, stone crushers, asphalt plants and other equipment. The cumulative effects from several machines can be significant and may cause significant nuisances. However, these increased noise levels will prevail only for a short duration during the preconstruction and construction stage. The estimated noise that will be generated by each construction equipment is listed in

249.

250. Table 6-2.

Table 6-2: Noise Generated by Construction Equipment

Sr. No.	Equipment	Noise dB(A) at 15ft from Source
1	Wheeled loading	90
2	Grader	90
3	Vibration pavement roller	86
4	2-wheel vibration pavement roller	81
5	3-wheel pavement roller	81
6	Tire pavement roller	76
7	Bulldozer	86
8	Wheeled pneumatic dredger	84
9	Sprayer	87
10	Power generator	98
11	Impact drill	87
12	Impact pile driver	112
13	Truck	92
14	Concrete mixer	91
15	Concrete pump	85
16	Mobile lift	96
17	Pneumatic hammer and rock crusher	98
18	Breaker	84
19	Pneumatic spanner	95

Source: Quagliata, A., Ahearn, M., Boeker, E., Roof, C., Meister, L. & Singleton, H. (2018). Transit Noise and Vibration Impact Assessment Manual (No. FTA Report No. 0123).

f. Construction Waste Generation

251. Municipal, construction and hazardous waste will be generated from construction activities and contractors' camps. Wastes from the contractors' camps include papers, plastic containers, food wastes, kitchen wastes and other domestic solid wastes. Construction wastes include insulation, nails, electrical wiring, rebar, wood, plaster, scrap metal, paper bags, cement, bricks and excess excavated material.

252. Improper disposal of these wastes may cause pollution of soil and water bodies. Storing of kitchen and food wastes from construction camps can serve as breeding grounds for the disease spreading vectors and rodents.

253. Improper disposal of construction waste can also lead to nuisance and hazards towards environment and local population.

6.2.4 Impacts related to Community Health and Safety (ESS 4)

a. Employment and Economic Opportunities

254. It is estimated that a total of 182 full-time construction workers are needed during the construction of the three water lines (60 workers each in Routes 1 and 3 and 62 workers in Route 2). However, the peak number of construction workers may reach up to 500 workers, composed of both skilled and unskilled workers. The Contractor/s may hire skilled and unskilled laborers from the local community.

255. The influx of workers may also provide business opportunities to the local community to meet the daily requirements of the workers such as selling of food, housing rental and other services to the construction workers.

256. The proposed K-IV augmentation project has the potential to bring considerable benefits to citizens of Karachi within the subproject areas as well as adjoining informal settlements. Anticipated benefits include increased access to safe water supply services, job creation resulting in execution of projects related improvement in public health and sanitation conditions, time and energy savings particularly for women and children, among others. InIn addition, the following possible positive impacts can be anticipated:

- The significant and long-term positive social impact arising from the project will be a possible increase in the socio-economic status of the people of Karachi in terms of improved access to safe, economical and reliable water supply services and water resource conservation as a result of reduction in system leakages;
- The improvement of water services will have positive impacts on women's lives. They will enjoy a large part of the benefits of improved urban services;
- One of the key benefits will be health and reduced time from the household chores as a result of improved water supply services which would give them more time for productive and leisure activities;
- The health of the city residents is expected to improve due to improved hygiene and sanitation resulting in reducing the incidences of disease associated with the consumption of unsafe water;
- Economically, the citizens will benefit due to savings from money spent on medical services due to reduced incidence of water borne diseases, and increased productivity due to increased availability of water supply for various productive activities; and
- Another economic benefit will accrue from increased revenue collection by KWSC due to increased supply, improved accountability system, volume measuring devices and anticipated reduction in leakages and illegal holdings of water supply.

257. The above benefits will be monitored after the project implementation through the Results Framework for the overall KWSSIP-2. Based on the data collected, about 61% of households in project CoI the have access to clean drinking water supply. After implementation of this project, this aspect will be monitored and result will be drawn for access to safe water supply, reduction in water related disease, betterment in women life study with respect to the issues related to water availability. Moreover, the operation and financial efficiency of KWSC will also be monitored with respect to the baseline condition.

b. Traffic Generation

258. The crossing of the water pipes through major highways (Eastern Bypass Road, M9 (Superhighway), M10 (Northern Bypass) and roads (Pak Steel Road, University Road, Sir Shah Muhammad Suleiman Road, Lyari Basti Road) may cause severe traffic congestion and/or road closure which will cause significant impact on the road users during the tunnel boring activities at the major road crossings.

259. The delivery of construction materials to the construction site may also increase the traffic within the area. It is estimated that 919 numbers of 3 axel vehicles

will be utilized during the entire construction period.[8] Based on the proposed implementation schedule of 14 months, the overall load of the construction traffic will be estimated as 66 vehicles per month which is much lesser than the existing traffic load on the access roads. Road accidents may also happen due to the crossing of several vehicles in the area during delivery of materials.

260. The excavation, stacking of material and other construction activities along the congested intra city road will also cause traffic congestion during construction phase. The disruption of the existing traffic flow along the major intra city roads such as University Road, Sir Shah Muhammad Suleman Road and Lyari Basti Road will cause traffic jams and inconvenience to the public passing through the project area.

c. Road Safety and Damage

261. The construction activities and vehicular movement at construction sites and access service roads may also result in roadside accidents particularly the local communities who are not familiar with presence of heavy equipment and machinery and the sensitive receptors such as the mosques, hospitals and schools within CoI.

262. The construction activities may deteriorate the existing condition of the roads. The passing of delivery trucks and heavy equipment across the roads may also cause road damages.

d. Disruption and Competition to Basic Services

263. Quality of water resources available in the nearby local communities may get contaminated due to the construction activities, oil spillage and leakage.

264. The water pipes will be laid mostly in built-up areas where many utility lines like sewerage, gas pipes, electricity and telephone lines exist within RoW. These utilities will be relocated before the start of construction activities. If not handled properly, this may cause disruption to these public services within the area and may have impact on the daily activities of the people.

265. The presence of construction workers and service providers (and in some cases family members of either or both) can generate additional demand for the provision of public services, such as water, electricity, medical services, transport, education and social services. This is particularly the case when the influx of workers is not accommodated by additional and separate supply systems.

e. Increase in Access to Water Supply

266. The proposed KIV Augmentation Works will deliver a total of 260 MGD from the KIV reservoirs to Karachi City. This will increase the access of the public to safe water supply.

267. However, the water conveyed by the water pipes may also be exposed to contamination if not proper maintained. Contaminants may enter the water conveyance due to pipe breakage or damage.

[8] 17,527 tons of construction material and 804 m^3 of water will be transported to the project site through during the proposed implementation schedule of 14 months. Considering the 20 tons capacity of 3 axel truck for construction material and 19m^3 capacity of water tanker, approximately 919 vehicles will be utilized during the entire construction period. Based on the proposed implementation schedule of 14 months, the overall load of the construction traffic will be estimated as 66 vehicles/month.

268. There are also illegal water connections to the existing water lines in Karachi City and this may also happen to the proposed project once operational. This may affect the volume of water that will be conveyed and may also be a point of entry of contaminants.

f. Community Health and Safety Risks

269. The local community may also be exposed to the health and safety risks associated with the construction activities such the following:

- Exposure to dusts and air emissions from the construction site may cause respiratory distress most especially to the vulnerable groups such as children and the elderly.
- Pedestrians or vehicles passing by may accidentally fall in the excavated areas especially during at night
- Exposure to hazardous materials and wastes

270. The labor work with different transmittable diseases may cause spreading of those diseases in the local residents. The influx of people may bring communicable diseases to the project area, including STDs, or the incoming workers may be exposed to diseases to which they have low resistance. Workers with health concerns relating to substance abuse, mental issues or STDs may not wish to visit the project's medical facility and instead go anonymously to local medical providers, this can result in an additional burden on local health resources.

271. Unsanitary management of the camp sites and improper management of domestic solid wastes may cause the spread of vector-borne and water-borne diseases among the workers and local communities.

g. Disturbance and Structural Damages from Vibration

272. Vibration generated by construction activity and additional vehicular movement may cause disturbance and public inconvenience to the sensitive receptors such as hospitals, schools and mosques and to the households along the routes.

273. Vibration generated by construction activity has the potential to damage structures. This damage could be structural damage, such as cracking of floor slabs, foundations, columns, beams, or wells, or cosmetic architectural damage, such as cracked plaster, stucco, or tile.

h. Social Conflict

274. Conflicts may arise between the local community and the construction workers, which may be related to religious, cultural or ethnic differences, or based on competition for local resources. Ethnic and regional conflicts may be aggravated if workers from one group are moving into the territory of the other.

275. Depending on the number of incoming workers and their engagement with the host community, the composition of the local community, and with it the community dynamics, may change significantly. Pre-existing social conflict may intensify as a result of such changes.

i. Increased risk of GBV and SEA/SH

276. The influx of workers and service providers into communities may increase the rate of crimes and a perception of insecurity by the local community. Such

illegitimate behaviour and crimes can include theft, GBV, substance abuse, sexual assault and human trafficking.

6.2.5 Impacts related to Land Acquisition, Restrictions on Land Use and Involuntary Resettlement

277. The land within RoW is owned by the GoS and no land acquisition is required for the proposed project. However, the impact related to resettlement of moveable assets is identified at some stretches along the RoW of proposed project.

278. The proposed project will have impacts on livelihoods of 279 PAPs. Out of these 279 PAPs, 240 are movable small business operators (kiosks), whereas 35 PAPs will be affected due to possible access problems to their shops and business places and 4 PAPs are working as employees at these shops.

279. Based on the Commissioner's office, visual observations, and public consultations, it is concluded that no AED has been carried out in the RoW of the proposed project since October 2018. The PIU has obtained a formal certificate from the City Administration (Commissioner's Office) in this regard, stating that no AED has been carried out in the project area.

6.2.6 Impacts related to Biodiversity Conservation and Sustainable Management of Living Natural Resources

a. Tree Cutting

280. About 1,719 trees (175 trees in Route 1, 1,298 trees in Route 2 and 246 trees in Route 3) were identified within the 17-m RoW. Out of these 1,719 trees, 34 trees are known to be ecologically important as per IUCN.

281. It is estimated that about 1,685 trees within RoW are to be removed to make way for the proposed project. The 34 trees that were known to be ecologically important will be preserved.

b. Disturbance to Fauna

282. There are no threatened faunal species recorded within CoI of proposed route alignments during the field survey. The habitat values for fauna in the study area were observed to be generally limited. The vegetation is mostly composed of young native landscape plantings and the ground layer is heavily grazed or mown. As such, the overall condition of fauna habitat is considered poor, where only species that can tolerate human disturbance or thrive on human presence survive.

283. However, habitat of domestic fauna (avi-fauna, reptiles, rodents, etc.) is expected to be disturbed due to cutting of trees. These fauna species may also be affected due to noise pollution as a result of vehicular movement and installations of machinery during the construction phase.

6.2.7 Impacts related to Indigenous People (ESS 9)

284. There are no tribal or indigenous people within the CoI.

6.2.8 Impacts related to Cultural Heritage (ESS 8)

285. There are no ancient monuments and archaeological sites located within RoW. However, there are shrine, graveyards and mosques that are located within the CoI that may be exposed to the environmental and social impacts of the project.

286. During excavation, there is a chance of finding artifacts. In case of finding any artifact, the contractor shall immediately report through SC to Directorate General (DG) of Archeological Department, GoS to take further suitable action to preserve those antiques or sensitive remains.

6.2.9 Impacts related to Stakeholder Engagement and Information Disclosure

287. Before the start of project implementation, awareness shall be provided to the local population through Focus Group Discussions (FGDs), pamphlets etc. regarding the proposed project. Regular interaction shall be kept with the local population by the PIU, CSC and Contractor's Social Safeguard Teams throughout the construction period to keep them aware about the status of project activities. Important information needed to be disseminated to the people includes the following:

- Overview and objectives of the proposed project;
- Preliminary and/or final detailed design of proposed project components;
- Potential environmental and social impacts (positive and negative) of the project, and the proposed mitigation measures for the perceived negative impacts; and
- Grievance redress mechanism and contact details of the project.

7 Assessment of Cumulative Impacts

7.1 Identification of VECs

288. Identification of Valued Environmental and Social Components (VECs) that are highly relevant to KWSSIP-2 has been performed through: a) reviewing the strategic overview of potential water and environmental issues faced by Sindh performed under SWAT ESMF; b) addition of potential KWSSIP and K-IV related specific issues, and; c) robust discussions between the E&S Teams of the World Bank, KWSSIP and the Consultants.

7.1.1 Strategic Overview of Sindh's Water and Environmental Issues

289. SWAT ESMF provides detailed strategic overview of water and environmental issues faced by Sindh and with some project specific alterations as presented in Table 7-1. Some of these issues are directly or indirectly related with KWSSIP and KWSC projects and based upon these, potential VECs were been identified.

Table 7-1: Strategic Overview of Water and Environmental Issues

Issue	Strategic Overview
Water resources	• The water resources system of Sindh has become largely engineered; • Sustains a larger rural economy than planned; • Climate change is presenting a new set of conditions with erratic rainfall events; and • Increasing evapotranspiration and higher frequency of floods and droughts.
Surface water	• Increased water use, reduced storage capacity, larger diversions to flood plains and canal commands, change in cropping patterns; and • Scarcity has increased as seen in the increased number of days with zero outflow below Kotri.
Groundwater	• Groundwater use has increased since year 2000; and • The resources are precarious, isolated in either small aquifers in dry lands or freshwater pockets in saline areas.
Water logging	• Water logging began developing rapidly in the 1960s and still persistently affects 35-45% of the irrigated area on annual basis, with the problem most prevalent in the post-monsoon season.
Irrigation	• Sindh is home to the world's largest irrigation canals; • Management has been challenging, with frequent breaches and embankment overtopping and unauthorized diversions; • Major problem is the large number of direct outlets that have been sanctioned since the 1970s, creating inequity and complicating the management of the system; • Water allocations/irrigation duties for the canal commands are largely informal and sub-optimal; and • Crop water productivity, especially in the lower part of the system, is low.
Drainage	• Sindh's drainage network is not equipped to evacuate storm water, which has caused flooding and has foregone opportunities for recharge; and • Operation and maintenance of the drainage network is problematic. The Left Bank Outfall Drain has aggravated flooding problems around Badin. The Right Bank Outfall Drain is not completed: as a consequence drainage effluent is now deposited in Manchar Lake causing this huge water body to rapidly deteriorate.
Multi-functionality	• Due to increased population and diversification of the economy, the canal and drainage network became increasingly multifunctional; and • It became the basis for industrial water supply, waste disposal, and domestic services.

Issue	Strategic Overview
Surface / Sea / Ground Water Quality	• Water quality is a major concern due to the long term practice of disposing untreated industrial or municipal wastewater in the canals, drainage systems and surface water bodies; • Indus River and Arabian Sea have been affected due to the massive untreated discharge of municipal and industrial effluents which has contaminated the water bodies with high levels of BOD, COD, Pesticides along with other pollutants; • This has spread high levels of cadmium, lead, and mercury into the surface water system which is affecting ground water as well; and • Arsenic concentrations in ground water usually exceeds the SEQS and WHO guidelines.
Drinking water supply	• Drinking water supply not only in rural but also in urban Sindh is problematic; • Massive leakages in the water supply systems allow intrusion of sewerage resulting in the formation of Bacterial contaminations in tap water and due to inadequate handling, is the prime problem; • Microbiological pollution of shallow groundwater – the main source in rural areas – presents additional health risks. The other challenge is the high non-functionality of improved public systems that stands at 56%; this is high for any country; and • The situation is not much better in major cities, where 84% of samples have high coliforms and where there is a shift from taps to reverse osmosis plants and water tankers.
Wetlands	• Sindh has many wetlands, including ten with Ramsar status. While these wetlands harbor important biodiversity and contain unused potential, they have also been in decline due to reduced water supplies, poaching, pollution, invasive species, and encroachment.
Indus Delta	• The Indus Delta has witnessed a steady decline since the mid-1950s; • The development of hydraulic structures on the Indus (reservoirs, barrages, flood protection bunds) has deprived the Delta of fresh water supplies, flood pulses, and sediments; • The failure of the tidal link changed the configuration of the Delta further; • The decline of mangrove forests (now reversed) and sea-level rise have further affected the Indus Delta. Until now, no concerted effort has worked on protecting this once buoyant area; • Korangi creek is one of the major creek of Indus delta which receives both untreated industrial and domestic effluents; • Water is primarily polluted by organic load; • The concentration of oil and grease is exceptionally higher in water and sediment; and • The concentration of DO is not up to the mark.
Floods	• Over the last 15 years, Sindh has been the scene of several severe flooding events; • The higher depression over the Indian Ocean makes it likely that floods will occur more frequently; and • Though equipped with flood protection bunds along the Indus River, the management of the main hydraulic system (irrigation and drainage canals) is not equipped to mitigate the impact of flood events.
Dry lands	• The dry lands of Kohistan, Tharparkar, and Nara Desert are among the most densely populated deserts of the world; • Unlike similar dry lands elsewhere in the world, there has been little management of the specific resources of these areas beyond the construction of small dams; and • Groundwater resources are particularly fragile and under threat.

7.1.2 VECs Considered for KWSSIP-2

290. Based on the assessment, five VECs were identified that may be affected by the cumulative impacts of KWSSIP-2 and existing & planned KWSC projects that includes the following:

- Surface water resources;
- Groundwater resources;
- Indus Delta;
- Wetlands;
- Drinking water supply and water quality

7.2 Present Conditions of VECs

291. Present conditions of VECs are briefly discussed as follows, whereas Annex-XVII provides a more detailed review of the baseline conditions of VECs.

7.2.1 Surface Water Resources

292. Available water resources in Sindh are limited. Indus river runs as a large single channel through the province and ends up draining into the Arabian Sea. It is the major surface water source for the province. Mean annual rainfall in the province ranges between 100- and 200-mm. Users of water from Indus include municipalities for domestic users, agriculture, industries and the environment including wetlands, the Indus Delta, and natural habitats. Due to high average annual temperatures, semi-arid climate, sea water intrusion and high rate of evapotranspiration especially in the coastal areas of Sindh, shallow groundwater aquifers are highly saline. This is an added pressure, forcing the rural population to rely on supplies from the canal system fed by the Indus[9].

293. Over the past 60 years, the freshwater flow in Indus River has reduced from 150 to 1 MAF annually (Kazi, 2003), thus reducing deltaic ecosystem from 3000 km^2 to 250 km^2 (Inam et. al., 2007). Realizing this situation, based on a study, IUCN (2004a) has recommended an essential release of 27 MAF for the continued wellbeing of the deltaic ecosystem. Likewise, Water Accord in 1991 recommended at least 10 MAF perpetual water supply in the Indus River for the downstream deltaic ecosystem. These recommendations, however, have not materialized, to date. The flow of Indus River remains constantly below 2 MAF all over the year except between the months of July and September mainly because of monsoon season (Abbasi, 2002) or during peak floods[10].

294. Indus River is also the main water source for Karachi followed by supply from the Hub River. The Indus River currently supplies approximately 650 MGD via Keenjhar Lake, whereas Hub River contributes about 50 - 80 MGD.

295. To augment the city's daily water supply, K-IV project (Phase 1, 2 & 3) has been designed to add in total 650 MGD of water from the Keenjhar Lake in three phases. Meeting the needs of Karachi's water for human and industrial uses is challenging since supplies depend on the volume available in the Kotri barrage pond[11]. K-IV Phase-1 will supply 260 MGD and is in implementation stage for now, whereas Phase-2 and 3 shall supply 260 MGD and 130 MGD respectively. However, the details for these phases are not finalized yet.

296. K-IV Augmentation project supported under KWSSIP-2, i.e. this project, has been designed to provide connections for the 260 MGD water to be supplied through K-IV Phase-1 to the KWSC's water distribution network. Three reservoirs will be

[9] *Water Quality Assessment in Sindh, Pakistan: A Review (https://lupinepublishers.com/environmental-soil-science-journal/fulltext/water-quality-assessment-in-sindh-pakistan-a-review.ID.000156.php#:~:text=Indus%20basin%20is%20the%20major,in%20shallow%20aquifers%20%5B18%5D.)*

[10] *Effect of River Indus flow on low riparian ecosystems of Sindh: a review paper (http://wwf.org.pk/pwp/record/16.pdf)*

[11] *Karachi's water crisis by Meer M. Parihar – Former Sindh Secretary Irrigation and Power (https://www.dawn.com/news/1691253)*

established to receive the supply from main transmission system and three off-take points will be utilized for onward supply of this water to the city. The three points are labelled as reservoir 1, reservoir 2 and reservoir 3 respectively. Each reservoir will have its own distinct quantum and supply system.

7.2.2 Groundwater Resources

297. Groundwater and surface water resources in the Indus Basin are linked hydrologically as the seepage from river and irrigation canals contributes to recharging subterranean aquifers, while groundwater flows similarly enter and augment surface streams. Many water users in the basin rely on groundwater to supplement or supplant surface water supplies where these prove inadequate, intermittent, or unavailable[12]. Groundwater use in the Indus basin in Pakistan has steadily grown since the 1960s, and it supports as much as 20 percent of the irrigation requirements in Sindh. Access to groundwater has enabled farmers to compensate for shortfalls in canal water delivery, increase cropping intensity, and adapt to increasing rainfall variability. The ability to pump fresh groundwater on demand has also enabled tail-end famers to partially mitigate inequity in surface water distribution. For rural households, it has been an invaluable driver of improved livelihoods and food security[13]. Useable groundwater in the province is mainly found in the Indus Plain, which is recharged from the meandering river and from the irrigation network that has been developed in the area. The other source of recharge - rainfall, is quite scanty and its contribution to the resource is limited. Rainfall recharge was 1.96 MAF (2% of 265 mm per year) as worked out by ACE and Halcrow (2001). The recharge from return flows (22.5% of 38.2 MAF), irrigation returns (22.5% of 3.5 MAF) have been assessed as 8.58 MAF and 0.79 MAF respectively. The canal water losses have been estimated as 15 % of the total average canal supply of 45 MAF for the period 1988-2000. The recharge from canals is estimated to be 6.76 MAF. The recharge from the rivers is assessed as 0.3 MAF. The total available groundwater resource of the Sindh Province was assessed to be 18 MAF[14].

298. The situation downstream Kotri is not very ideal as ground water aquifers of the region have also degraded due to the reduction in Indus River flows, besides seawater intrusion. Studies have shown that the Indus Delta had slowly been degraded over the past half-century due to the gradual reduction of floodwaters downstream Kotri barrage and the improvement of shallow groundwater resources below Kotri is only dependent on good rainfalls. Saltwater intrusion has been witnessed inland up to 100 km north of the sea. The rising salt content of the groundwater has also made it unsuitable for irrigation and salt depositions in the land have affected their yields and overall production. Recent research at Sindh University revealed TDS in Indus at levels as high as 42,750 ppm below Kotri as opposed to 1,500 ppm WHO limit. The increase in the salinity levels in the ground water aquifers has also hit the Katcha area downstream of the Kotri Barrage as well as the areas where a perennial irrigation system is in practice. [15].

[12] *Connecting the Drops – An Indus Basin Study (https://www.stimson.org/wp-content/files/file-attachments/connecting_the_drops_stimson_1.pdf)*
[13] *Groundwater in Pakistan's Indus Basin Present and Future Prospects (https://documents1.worldbank.org/curated/en/501941611237298661/pdf/Groundwater-in-Pakistan-s-Indus-Basin-Present-and-Future-Prospects.pdf)*
[14] *Pakistan's Groundwater Reservoir and Its Sustainability (https://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.601.3132&rep=rep1&type=pdf)*
[15] *Indus Delta Devastation Due to Impacts of Degradation (https://www.linkedin.com/pulse/20140626085847-55719149-indus-delta-devastation-due-to-impacts-of-degradation-my-phd-notes/)*

7.2.3 Indus Delta

299. Indus Delta encompasses an area of 667,209 ha spread across Thatta and Sujawal districts of Sindh. The delta, a Ramsar site, is a vast complex of tidal river channels and creeks, low-lying sandy islands, mangrove forests and inter-tidal areas[16]. Indus Delta is the fifth largest delta in the world, formed under largely arid climatic conditions and characterized by high river discharge, moderate tides, and evidently the highest wave energy of any river in the world. The Delta provides habitat to many birds (including the threatened *Dalmatian pelican*), fish and shrimps, and dolphins (Plumbeous dolphin, Finless porpoise, and Bottlenose dolphin), humpback whale, and reptiles[17]. The delta's mangrove forests are unique in being the largest area of arid climate mangroves in the world.

300. **Mangroves:** The area covered with mangrove forests was 103,414 ha of tidal floodplains during 1990 which slowly decreased to 63,296 ha of tidal floodplains by 2005. It again increased to 81,324 ha by 2017. This increase in forest cover is due to massive mangrove plantation on vast tidal floodplains and successful mangroves conservation efforts by the NGOs and Sindh Forest Department. Still, the mangrove forests occupy only 12.6% of the total tidal floodplains or about 6.2% of the Indus delta.[18]

301. **Seawater Intrusion and Area Taken by the Sea**: About 42,607 ha are degraded due to surface seawater intrusion in the last 45 years (1972-2017) which corresponds to a 7.1% increase in the tidal floodplains of the delta. Out of total degraded land, 31,656 ha of land are now completely submerged in the seawater while 10,951 ha of new land is converted into tidal floodplain area. It has been noted that tidal floodplain area on the left bank of Indus is about 4, 208, 00 ha or about two times larger than that on the right bank side (2, 220, 00 ha)[19].

302. **Soil Salinity:** The vast area of the delta is under the influence of soil salinity especially the area along the coastline of the delta. The area intruded by seawater has increased significantly from 9% to 24% of the delta especially in the tidal floodplains during the last 45 years (1972 to 2017), whereas soil salinity has increased from 33 to 43%[20].

303. **Indus River Flows:** Studies on water flow downstream Kotri Barrage describe that about 36 MAF water passed annually to the sea from 1977-78 to 1991-93[21]. During super floods (e.g. flood of 2010), amount of water passing downstream of Kotri Barrage reached to 59 MAF[22].

304. The water releases from Kotri Barrage in terms of environmental flows [23] for the period 1st April 2018 to 3rd October 2022 have been analyzed and are shown in Figure 7-1**.**

305. The data reveals that during April-June 2018 (92 days) and during October-November 2018 (61 days) there were no downstream releases from the Kotri

[16] *Project Document - Delta Blue Carbon – 1, March 2021 (https://deltabluecarbon.com/document/)*
[17] *Ramsar Sites Information Service. https://rsis.ramsar.org/ris/1284. Retrieval 21-9-2022.*
[18] *Siyal, A.A. (2018). Climate change: Assessing impact of seawater intrusion on soil, water and environment on Indus delta using GIS & remote sensing tools. US. Pakistan Center for Advanced Studies in Water (USPCAS-W), MUET, Jamshoro, Pakistan*
[19] *ibid*
[20] *ibid*
[21] *Malik, B.A. (1999, November 14). The Case of Kalabagh Dam. Daily Dawn*
[22] *Bhatti M.N. 2011. The Problem of Water Management in Diverse Societies: Study of Kalabagh Dam Project in Pakistan. Journal of Public Administration and Governance. Vol. 1, No. 2. 240-255.*
[23] *https://irrigation.sindh.gov.pk/achieveib2018, 2019, 2020, 2021*

Barrage. Similarly, during February-April 2019 (89 days) and during June 2019 (30 days), no water was released downstream Kotri. Overall, 1084 out of 1736 (62%) were the flow days and for 653 days (38%) there were zero flows downstream Kotri. Moreover, the downstream flows remained less than 1200 cusecs (lowest discharge 100 cusecs) for 478 days (28% of total flow days). The low flows did not reach the delta but the released water seeps into the riverbed or used for agriculture practiced in the riverine area. An escapage of 5000 cusecs throughout the year is considered essential to check seawater intrusion, accommodate the needs for fisheries, environmental sustainability and to maintain the river channel[24].

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[24] *Gonzalez F. J., Thinus B., and Bart S. 2005. Final Report of IPOE for Review of Studies on Water Escapage below Kotri Barrage.*

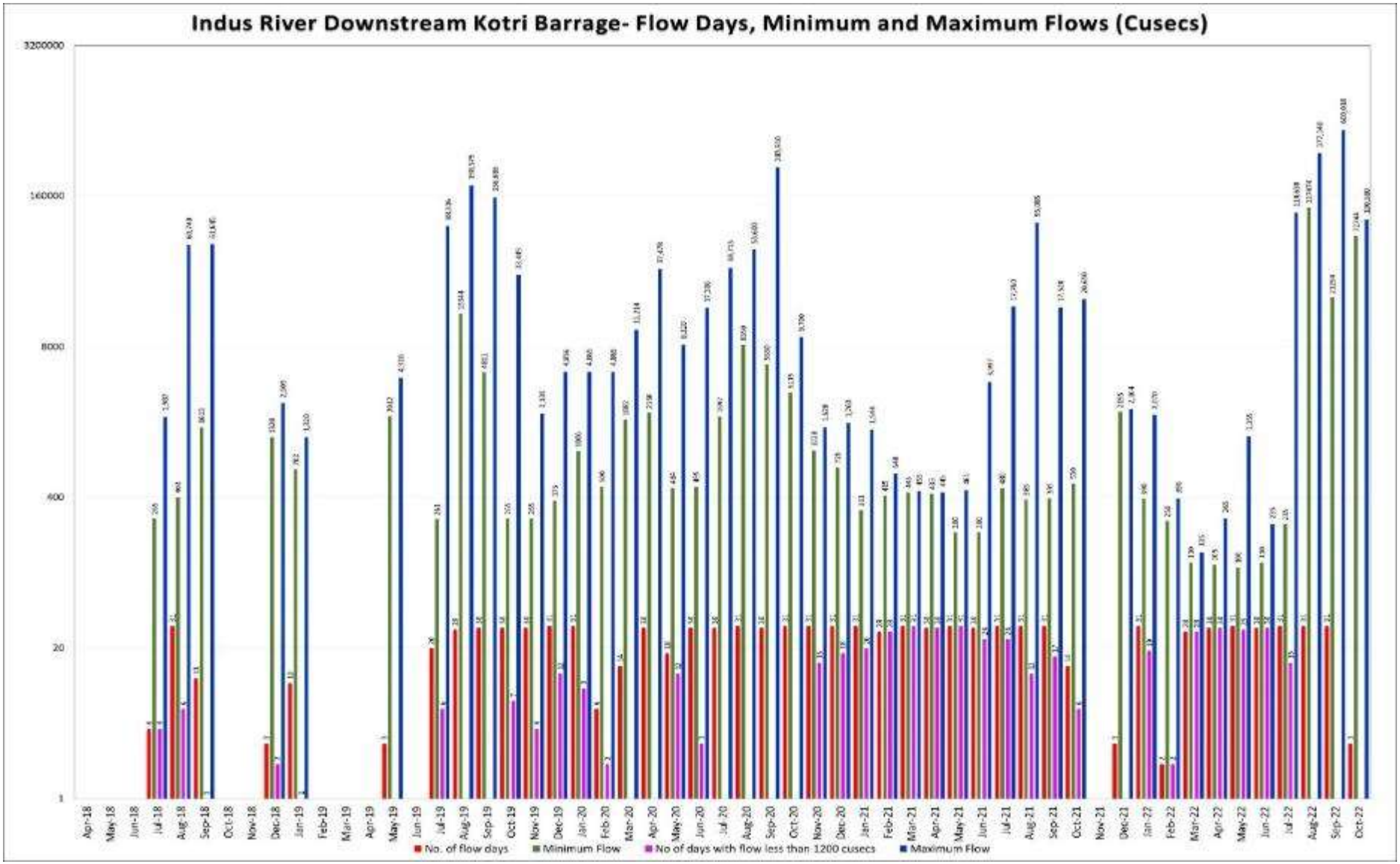

Figure 7-1: Downstream Water Releases from Kotri Barrage - 1st April 2018 to 3rd October 2022

7.2.4 Wetlands

Keenjhar Lake - Main Water Body

306. **Keenjhar** Lake also known as Kalri Lake is situated at 113 km from Karachi and about 20 km North and North – East of Thatta town between the longitude of 68 and 69° NE and latitude 24 and 25° N (Figure 7-2). The Lake, declared as a Ramsar Site on July 23, 1976, is a freshwater lake having an area of about 99 km^2 and is a perennial water body.

307. The lake is fed by the KB Feeder Canal originating from Kotri Barrage that enters at the northwest corners, and by many small seasonal streams entering on the western and northern shores. It is Pakistan's largest freshwater lake, with extensive reed beds and abundant submerged and floating flora. Keenjhar Lake is an important breeding and wintering and staging area for a wide variety of terrestrial and migratory birds, supporting as many as 140,000 birds, including European Wigeon, Black Coot and Common Pochard. The lake supports important fish habitats, such as for the fish species including *Labeo rohita* (Rohu, Dumbhro, Kurriro), *Catla catla* (Thailhi), *Cirrihina mrigala* (Morakhi), *Cyprinus carpio* (Gulfam), *Notopterus chitala* (Gandan), *Cirrina reha* (Suhni), *Puntius chola* (Popri), *Mystus seenghala* (Seenghari), *Channa striatus* (Shakur), *Channa puntatus* (Mukkur), *Mastacembelus armatus* (Gouge), *Heteroneustus fossilis* (Luhar), *Ompok bimaculatus* (Fabino), *Wallago attu* (Mullee), *Tilapia mossambicus* (Dayo, Tilpo)[25].

308. The lake features an abundance of submerged, floating, and emergent aquatic plants, including *Potamogeton spp.*, *Phragmites spp.*, *Cyperus spp.*, *Nelumbo nucifera*, *Najas minor*, *Nymphaea spp.* and *Typha spp.* These offer the fauna with both food and shelter. Numerous birds inhabit the dense Typha and Phragmites plants. The area surrounding the lake is composed of semi-aquatic and terrestrial plant species.

[25] *https://rsis.ramsar.org/ris/99*

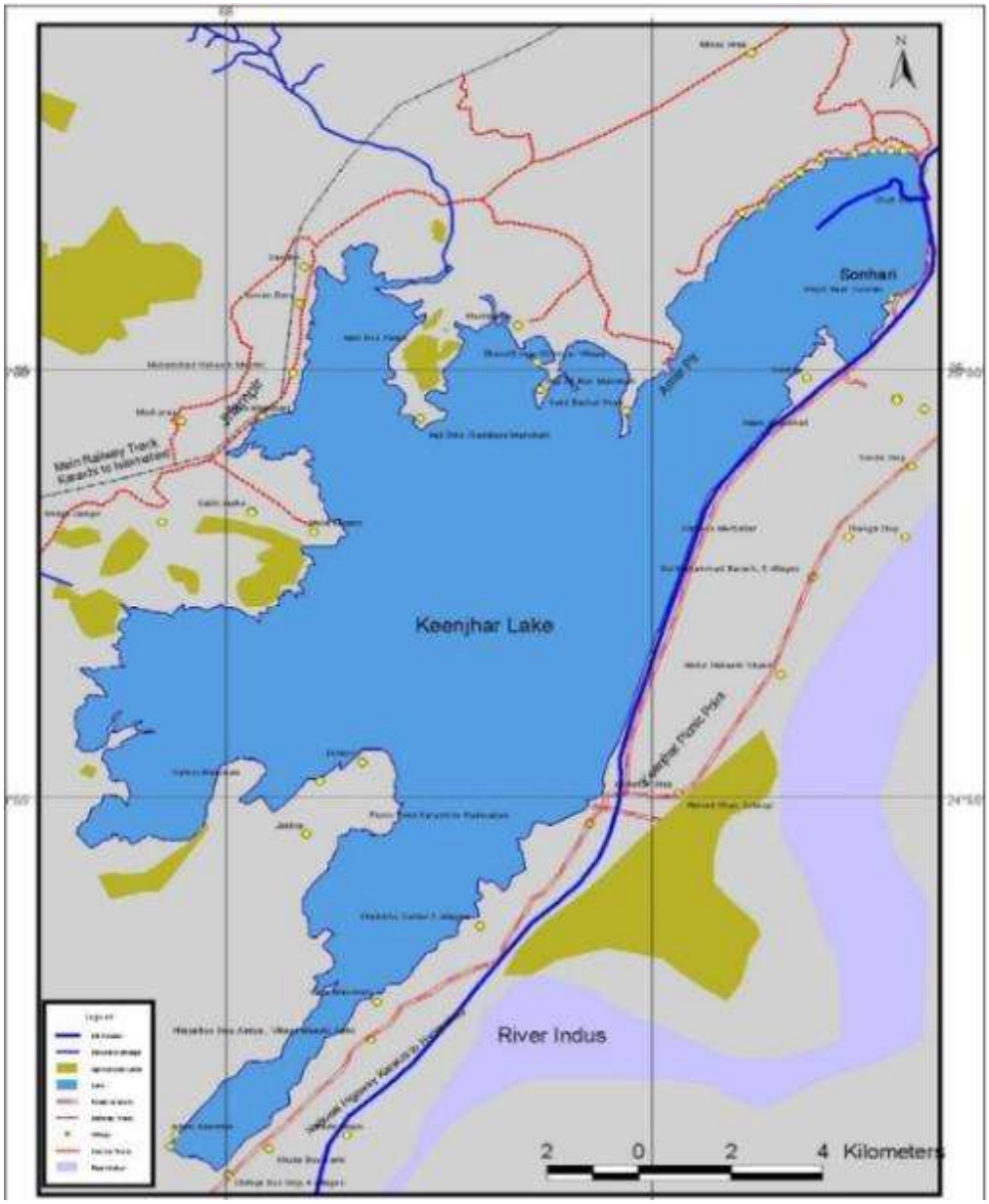

Figure 7-2: Topographic Description of Keenjhar and Its surrounding (Source: WWF)

Haleji Lake

309. Along with the Keenjhar, Haleji Lake is also an important wetland of Sindh. Haleji is a 6.58 km^2 (1,704 ha) earth-filled artificial lake with a maximum depth of about 5-6 m and a water level of about 1-1.5 m. It is located at 24°47'N and 067°46'E with 60 m elevation from mean sea level. It is a permanent freshwater lake surrounded by brackish seepage lagoons, related marshes, and a rocky desert of limestone and sandstone bedrocks.

310. Before 2006, water for Karachi was provided by Halej Lake. Haleji Lake used to receive water from the KB Feeder, which ultimately sent water to Karachi. The lake's water has been stagnant since a direct supply line from Keenjhar to Karachi

was built, which has caused the water quality to decline. There are no planned activities related to Haleji Lake under KWSSIP[26].

7.2.5 Drinking Water Supply and Water Quality

311. According to the survey conducted by Pakistan Council of Research in Water Resources (PCRWR) in 22 districts of Sindh, out of 1247 surveyed water supply schemes only 529 (42%) were functional with average duration of 5 hr/day water supply.[27]. There is an overall shortage of water supply in Karachi. Almost 81% of the households depend upon Karachi Water and Sewerage Board (KWSC) for water supply in most of the city area, out of which just 24% gets water daily, 15% at alternate day which is a bit bearable; rest of 60% out of that 81% area of the city got unscheduled or once or twice in a week or in ten days[28].

312. In next 20 years, Sindh is expected to undergo a demographic change and current population of 33 million is expected to increase to 52.6 million. Urbanization will increase from 50% to 64% in 2025. Currently, Karachi's demand for water supply is about 1,300 MGD against which has an allocation of 650 MGD from the Indus water. The demand is expected to increase to 1500 MGD with increased population to about 23 million in 2025. Likewise, water demand for other cities will also increase which will put burden on water resources. In addition to this, rural population of about 18.8 million will need an additional about 160 MGD for drinking purposes. Hence, total municipal water requirement of the province in 2025 will be of the order of 2130 MGD.

313. Water pollution is another major problem which is deteriorating the quality of remaining small portion of water. 80% samples from 14 different districts of Sindh have been found not safe for drinking. For Karachi, 90% of water has been found contaminated with bacterial contamination and not fit for drinking (PCRWR)[29]. According to the PCRWR survey in 22 districts of Sindh, only 25% of water samples were found fit for drinking while remaining were found contaminated with microorganisms and arsenic[30].

7.3 Assessing Cumulative Impacts and Evaluating their Significance

314. The following three scenarios have been considered for assessing the cumulative impacts:

- **Scenario 01** – Baseline Scenario – KWSC continue abstracting 650 MGD (No project);
- **Scenario 02** – Implementation of K-IV Phase–1 (260 MGD) - Resulting in withdrawal of 910 MGD from Keenjhar Lake, i.e. KWSSIP-2 Scenario: K-IV Augmentation under KWSSIP-2 provide connections for 260 MGD water to be suppled through K-IV Phase-1 to the KWSC's water distribution network from year 2024 onwards[31]; and

[26] *Zia uddin Abro, A. L. (2018). Enhanced Storage Capacity and Quality of Haleji and Hadero Lakes Connecting with Indus River for their Sustainable Revival. Pakistan Journal of Scientific and Industrial Research, 61A(1) 35-42.*
[27] *Technical Assessment Survey of Water Supply Schemes – PCRWR (https://pcrwr.gov.pk/wp-content/uploads/2020/Water-Quality-Reports/Technical_Assessment_Survey_(Sindh).pdf)*
[28] *Problems in the supply & distribution of Water in Karachi (https://www.researchgate.net/publication/336798612_Problems_in_the_supply_distribution_of_Water_in_Karachi)*
[29] *Water Quality Assessment in Sindh, Pakistan: A Review (https://lupinepublishers.com/environmental-soil-science-journal/fulltext/water-quality-assessment-in-sindh-pakistan-a-review.ID.000156.php)*
[30] *Technical Assessment Survey of Water Supply Schemes – PCRWR (https://pcrwr.gov.pk/wp-content/uploads/2020/Water-Quality-Reports/Technical_Assessment_Survey_(Sindh).pdf)*
[31] https://tribune.com.pk/story/2380379/phase-i-of-k-iv-project-to-be-completed-in-2024

- **Scenario 03** –Implementation of K-IV Phase-1 (260 MGD), Phase-2 (260 MGD) & Phase-3 (130 MGD) resulting in total withdrawal of 1300 MGD from Keenjhar Lake, i.e. KWSSIP-2 + 390 MGD Scenario from year 2034 onwards

7.3.1 Surface Water

315. For assessing the potential cumulative impacts of these scenarios on surface water resources, the proposed withdrawal figures have been compared with the lowest ever observed minimum flow of the Indus River at the point where it supplies Keenjhar Lake i.e. 5 MAF[32].

Scenario 01

316. In case of Scenario 01 i.e. continuation of the baseline conditions, the impacts related to climate change and mismanagement in the water sector etc. may continue to prevail, however there will be no additional impacts related to water abstraction from Indus River, as the baseline scenario involves abstraction of existing quota of 650 MGD. As far as the Hub River is concerned, no adverse impacts are anticipated at the Hub Dam and Hub River as the baseline scenario does not involve abstraction of water from Hub Dam/Hub River, which is already heavily rainfall-dependent and had considerably varied contributions in the Karachi's water supply mix over the past years.

Scenario 02

317. The additional bulk water abstracted will be 0.0009 MAF per day which constitutes only 0.019 percent of the lowest observed minimum flow of the Indus River at the point where it supplies Keenjhar Lake. No significant change in the hydrology downstream Kotri is anticipated.

318. No adverse impacts are anticipated at the Hub Dam / River as the scenario does not involve abstraction of water from Hub Dam/Hub River.

Scenario 03

319. The additional bulk water abstracted will be 0.002 MAF per day which constitutes only 0.048 percent of the lowest observed minimum flow of the Indus River at the point where it supplies Keenjhar Lake. No significant change in the hydrology downstream Kotri is anticipated.

320. No adverse impacts are anticipated at the Hub Dam / River as the scenario does not involve abstraction of water from Hub Dam/Hub River.

7.3.2 Groundwater Resources

Scenario 01

321. It may be concluded that with existing situation there is no change and 650 MGD continues to be withdrawn then on the one hand water will continue to seep in the ground raising the water level and on the other hand extraction of water from the ground via tube wells and pumping will lower the ground water and it will be difficult to balance this poor situation. Excess irrigation in areas where groundwater levels are high is contributing to widespread waterlogging. An increasing volume of

[32] -https://documents1.worldbank.org/curated/en/709751594235226019/text/Concept-Environmental-and-Social-Review-Summary-ESRS-Second-Karachi-Water-and-Sewerage-Services-Improvement-Project-KWSSIP-2-P171422.txt

unmanaged domestic and industrial wastewater is seeping into the ground, adding to the cocktail of contaminants affecting drinking water supplies. Improving groundwater management, however, is integral to Pakistan's economic development. According to the World Bank report Pakistan: Getting More from Water, without necessary reform and better demand management in the water sector, water scarcity will constrain Pakistan from reaching upper middle-income status by 2047.

Scenario 02

322. Keeping in view the withdrawal of 260 MGD, it is anticipated that the future groundwater levels will most likely behave much as they do currently and the change in the groundwater storage is likely to be minimal over the long term as the gap in demand and supply shall still be there and people will continue to rely on groundwater resources to fulfil the day to day needs[33].

Scenario 03

323. Karachi requires 1300 MGD of water, whereas currently 650 MGD is being supplied. Most of the remaining demand is met through unrecorded use of groundwater, resulting in groundwater depletion. Due to the implementation of KWSSIP and K-IV (all phases), the need of Karachi's population to indiscriminately rely on underground water shall decrease, which will have positive effects on the overall groundwater profile, level of groundwater aquifers and reduction in the salinization of land as well.

7.3.3 Indus Delta

Scenario 01

324. The main threat to the biodiversity in the Delta is habitat reduction through mangrove degradation and deforestation. Besides loss of forest which leads to habitat loss and fragmentation for some water-dependent species, other factors causing loss of habitat and wetland degradation include:

- A decline in freshwater flows due to upstream activities. This increases the salinity level in the wetlands areas and leads to sea intrusion into different terrestrial areas including fertile crop lands in the nearby vicinities;
- Excessive and indiscriminate harvesting of fisheries and other coastal resources beyond their regenerative capacities;
- Sea level rise; and
- Inadequate supply of sediments into the wetlands causing the delta front to be eroded.

325. Over a number of decades, mangrove forests in the Indus Delta have experienced massive-scale deforestation and degradation due to a number of contributing factors. These include their use by the local communities as a source of fuelwood, fodder and open range grazing by livestock. The situation has been exacerbated by the reduced supply of fresh water and sediments into the deltaic area due to upstream activity[34].

a) Mangroves vs Downstream Flow

[33] Sindh water outlook (CSIRO): Impacts of climate change, dam sedimentation and urban water supply on irrigated agriculture by Mobin-ud-Din Ahmad, Joel P Stewart, Jorge Peña-Arancibia, Mac Kirby – January 2020

[34] Project Document - Delta Blue Carbon – 1, March 2021.

326. Indus delta is famous for its productivity, where mangroves have pivotal and contributory role in its making. Indus delta for its health continuity greatly depends on Indus downstream flow. It's a dilemma that besides knowing this importance, downstream flow had been diverted erratically under numerous influences to transform rain-fed agriculture to irrigated one. This happened during the last couple of decades, resulting the transformation of flow from perennial to seasonal, greatly impacting the e-flow, i.e., respecting the minimum amount of water to retain the integrity of ecosystem.

327. Keenjhar Lake to the end of delta is around more than 100 Km, however, considering the sensitivity and likelihoods of influence. This study tried to find out a relation between the downstream flow and the growth of vegetation.

328. A group of GIS experts were engaged in analyzing the growth trend of vegetation in Indus delta, their focus was more on temporal changes, and the results were quite surprising, 3.13 times increase during the last 30 years (Gillani, H. 2021).

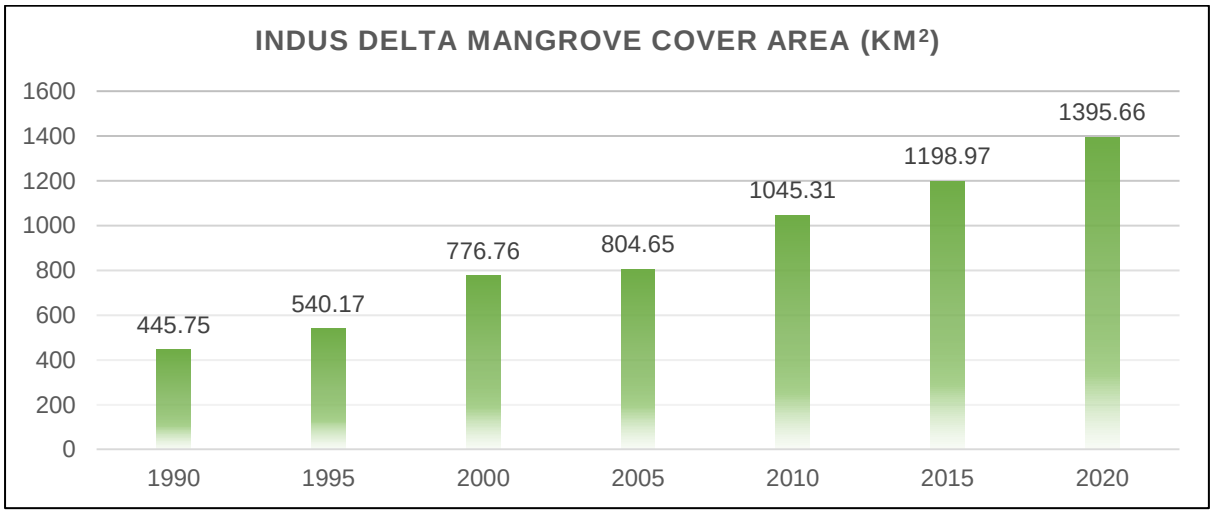

Figure 7-3: Quantitative Increase In Mangrove Cover Over Last 30 Years

329. The growth of mangrove showed consistent incremental variation, whereas the downstream discharge represents a non-uniform pattern, the increase of one variable does necessarily correspond to the increase in another variable. As per SFD, most of the e-flow is released by the Irrigation department during post monsoon flood season in which excessive water is available downstream. From that water, the mangroves regenerate and revive. For the rest of the months, the e-flow is almost negligible. The efforts to establish any direct relationship between the forest and the downstream flow was not supported by numerical data, the mangrove growth shows a consistent incremental pattern. Contrary to the downstream flow which seems erratic and not consistent.

330. The data collected, supported by independent verification, does not establish any direct or indirect relationship between growth of mangrove and discharge of water downstream . It is a fact that freshwater flow has an influence in easing the growth conditions, however, adoption of smart forestry techniques has resulted in substantial improvement compared to the pre-1980 situation , and the degradation process has slowed, if not completely stalled. This situation could further improve if the desired e-flow level could be maintained. Considering the quantum of flow, the value does not seem to be significant and apparently supports zero residual impact.

b) Change in Fish Abundance

331. The Delta's aquatic ecosystems are highly sensitive to flow reduction. Upstream dams have significantly altered downstream water flows, which has led to reduction in fish diversity and catch (Boon and Raven 2012). Connectivity of Palla fish (*Tenualosa ilisha*) has been restricted because of which they now travel 170 km to spawn (Panhwar and Liu 2013).

332. There is on-going uncontrolled and indiscriminate harvesting of fish and other marine resources in the delta as a result of which some valuable marine fish resources are declining rapidly. Harmful fine mesh nets installed in the creek areas catch large quantities of juvenile fish without any consideration of target or non-target species. These destructive activities and insufficient governance are leading to the depletion of some of the stocks.

333. A seasonal ban (June–August) on fishing to protect spawning fish coincides with monsoon rains that make fishing difficult. In this instance, nature provides some assistance to the aid of policy. However, while the prohibition applies to seagoing vessels, it does not prohibit local shore fishing, even in shrimp spawning areas[35]. Authorities, due to lack of budgetary provisions and low staff levels, also find it difficult to enforce the ban effectively.

334. Most settlements lie on the fringes of the Delta and are located within close proximity to one of the 17 major creeks that flow inland from the coast. There are also 18 smaller settlements of fishing communities that are permanently located within the creek system. Livelihoods and income sources for these communities are mostly natural resources based, with most households reliant on fishing[36].

c) Sea Level Rise (SLR) and Erosion

335. Significant effects of Sea Level Rise (SLR) on the Pakistan coast are anticipated to be distinct in the Indus Deltaic plains. Indus Delta, forms due to drainage of mighty Indus River into the Arabian Sea, comprises of tidal mudflats, in which erosion and accretion both occur frequently due to tidal fluctuations. A 2.0 m SLR in the delta can engulf an area of about 7,500 km^2 under the sea. The creeks within the Delta, including Kahhar, Ghoro, Hajamaro and Kaanhir are active erosion hotspots, with erosion rates ranging from 31-176 meters per year. From 2006 to 2009, the south bank of Ghoro Creek's mouth had the highest erosion frequency of 176 meters per year, with a retreat rate of 425 meters (WWF, 2012[37]).

Scenario 02

336. **Impacts on River Hydrology, Sea Intrusion, Mangrove and Fisheries**: The additional bulk water abstracted will be 0.0009 MAF per day which constitutes only 0.019 percent of the lowest observed minimum flow of the Indus River at the point where it supplies Keenjhar Lake. No significant change in the hydrology downstream Kotri is anticipated. Therefore, the additional abstraction will have no / minimal impact on sea intrusion, the mangrove forests and fisheries.

Scenario 03

337. **Impacts on River Hydrology, Sea Intrusion, Mangrove and Fisheries**: The additional bulk water abstracted will be 0.002 MAF per day MAF per day which

[35] *Khan S.R. and S.R. Khan. 2011. Fishery degradation in Pakistan: a poverty–environment nexus? Canadian Journal of Development Studies/Revue canadienne d'études du développement, 32:1: 32-47*
[36] *Project Document - Delta Blue Carbon – 1, March 2021*
[37] *WWF. (2012). Delta-Wide Hazard Mapping - A Case Study of Keti Bundar, Kharo Chann, and Jiwani. Karachi. WWF Pakistan*

constitutes only 0.048 percent of the lowest observed minimum flow of the Indus River at the point where it supplies Keenjhar Lake. No significant change in the hydrology downstream Kotri is anticipated. Therefore, the additional abstraction will have no/minimal impact on sea intrusion, the mangrove forests and fisheries.

7.3.4 Wetlands

338. It is to be noted that in the following sections discussing various scenarios around the Keenjhar Lake hydrology, the capacity of inlet regulator of Keenjar Lake has been taken as the water inflow volume as the reliable data on water supply volume was not available . The inlet regulator feeding capacity to the lake is 8,154 cusecs. It is pertinent to mention that hydrological balance based on the actual flow feeding Keenjhar from KB feeder could provide more accurate figures. However, KB Feeder recharges Keenjhar as well as provides water to KB Feeder Lower through the Link Canal (to meet the agricultural demands of Thatta District). The readily available data is only overall water intake from Kotri Barrage into the KB feeder, and not specifically the water inflow into the Keenjhar.

339. Besides, the flow in the KB feeder is erratic (its capacity is 9,000 cusecs), therefore, to solve the hydrologic equation, the capacity of the inlet regulator of the lake is taken as constant inflow[2] in this analysis. Also, there is a large watershed associated with the lake and recharges the lake during monsoon. The percolation factor is also present as the lake stands over sandstone and limestone bed. And finally, there is the factor of evaporation, due to large surface area and high temperatures. In the following calculations, the recharge through precipitation and percolation/evaporation factors are kept as constant, thereby simplifying the hydrologic equation. It is also assumed that the lake is in hydrologic balance (inflow=outflow), as shown from NDWI based remote sensing analysis **(Annex-XVIII)**.

340. In addition to the above assumptions for the calculations, the following analysis have taken into account that the K-IV project will draw water through a separate Head Regulator. The intake structure of the regulator by design cannot draw water below the minimum operating levels/ dead level of the Kheenjhar lake I.e., 12.5m/41ft reduced-level (RL) (datum is survey of Pakistan). It is also understood that the inlet and outlet(s) of the lake can also be regulated by the respective authorities (KB Feeder Upper/Lower by Irrigation Department and KG Regulator/ proposed New Regulator for K-IV project by KW&SB). If the additional water will not be supplied from Kotri, only available option to secure water supply to Karachi is reduction of irrigation, i.e. reduction of water supply to KB Feeder Lower and Link Canal.

Scenario 01

341. According to the review of baseline conditions of VECs, the ecosystems are already degraded and in the declining state. Only one environmental component which is required to replenish and sustain the ecosystems present for VECs is the water from Indus River which is the lifeline for Keenjhar Lake as well as downstream Kotri.

a) Hydrology of the Lake

342. A GIS based study had been conducted (Catherine, H. R. et al. 2021) to ascertain the vulnerability of the water body in terms of shrinkage in size. They also classified the habitat using different algorithms and found hybrid one as more convenient and practical. The major outcome of this exercise was the resilient nature

of this water body that did not show any decline in the size of this wetlands even during the noticed drought period of 1998-2002. Remote sensing and delineation of Lake's water area from 2013-2022 (the last 10 years) was used using Normalized Difference Water Index (NDWI) method, which concluded that the Lake's surface area has not changed substantially in the last 10 years.

343. The intake structure of the regulator by design cannot draw water below the minimum operating levels/ dead level of the Kheenjhar Lake, i.e. 12.5m/41ft reduced-level (RL) (datum is survey of Pakistan). It is also understood that the inlet and outlet(s) of the lake can also be regulated by the respective authorities (KB Feeder Upper/Lower by Irrigation Department and KG Regulator/ proposed New Regulator for K-IV project by KW&SB).

344. In view of this, it is evident that the Irrigation department and KW&SB are maintaining the hydrological balance of the Keenjhar Lake.

b) Hydrology of Other Wetlands

345. The baseline scenario shall have no impacts on the hydrology of Haleji lake.

c) Keenjhar Lake's Water Quality

346. The analysis of water quality has been conducted (Adnan, K. et al. 2017) and reported that all parameters in lake water are in compliance with the guideline values of WHO set for drinking water. The lake water is suitable for the survival and sustenance of aquatic life. Nizamani, M.A. et al. (2020) reported that KB feeder is the main point where pollution accumulates due to wastewater discharge of anthropogenic pollution sources. The sources are WAPDA colony, villages domestic wastewater and Kotri industrial area[38]. It is reported and also pointed out by some of the stakeholders that small degree of untreated wastewater was entered into the Lake through KB Feeder when the combined effluent treatment plant of Kotri Industrial Area was out of order. SEPA took action against the polluters and regulated the effluent streams at their source in response to the Chief Minister (CM) Sindh directions.

d) Siltation

347. Over the period of time, Keenjhar lake is silted at the point of intake. Historically, the depth of the lake at the intake was 30-35 ft, which is now reduced to 7-8 ft due to siltation. According to the data obtained from the Fisheries Department, the deposition of silt per year is found to be 4,335 acre-feet. The NDWI based assessment (Annex-XVIII) also indicates accumulation of silt at the inlet / head regulator area. Sindh Irrigation Department is planning to de-silt the lake and flushing of the accumulated silt.

Scenario 02

a) Hydrology of Keenjhar Lake

348. The additional bulk water abstracted from the lake in scenario 2 will be 402.3 cusecs (260 MGD) which is only 4.9% of the inflow, hence the abstraction shall be insignificant. Since minimum lake water level is rigorously regulated by the design of water intake facility as well as Sindh Irrigation Department and KW&SB as explained earlier, no water level decrease beyond 41 feet RL is expected. In addition, GoS also

[38] *Nizamani, M.A. Water Quality Assessment of Keenjhar Lake, Thatta. Pre-prints 2020, 2020070722 (doi: 10.20944/preprints202007.0722.v1)*

approved the PKR 41 billion scheme to line KB Feeder which, if implemented, can conserve water around 260 MGD, compensating the water for K-IV Phase 1 project.

b) Hydrology of Other Wetlands

349. Scenario 2 shall also have no impacts on the hydrology of Haleji Lake.

c) Keenjhar Lake's Water Quality

350. No deterioration of lake's water quality is anticipated from the additional abstraction of 260 MGD water from the lake. Instead, the contaminants will be diluted to some extent from the additional water flowing into the system as the result of KB Feeder lining.

d) Siltation

351. Considering the capacity of inlet regulator of the lake as constant inflow, the additional water i.e. 4.9 % of the inflow shall flow into the system and additional silt from River through KB feeder would enter the lake and deposited near the inlet of the lake. However, the quantity of the additional silt will not be significant.

Scenario 03

a) Hydrology of Keenjhar Lake

352. The additional bulk water abstracted from the lake in scenario 3 will be 1208 cusecs (650 MGD) which is 14.81% of the inflow. Because of water intake control by minimum lake water level as explained earlier, no water level decrease beyond 41 feet RL is expected. This quantity can be significant if compensatory water supply through KB feeder lining and additional water supply from Kotri Barrage are not provided as planned, and there would be potential partial decrease of irrigation water downstream Keenjar Lake to compensate the increased water supply to Karachi.

b) Hydrology of Other Wetlands

353. Scenario 3 will also have no impacts on the hydrology of Haleji lake.

c) Keenjhar Lake's Water Quality

354. No deterioration of lake's water quality is anticipated from the additional abstraction of 650 MGD water from the lake as long as the additional water supply to Keenjhar Lake is secured as planned. However, the contaminants will be far more diluted due to the inflow of the additional water provided that the level of contaminants in the lake remains the same.

d) Siltation

355. As mentioned earlier, the data obtained from the Fisheries Department mentions that the deposition of silt per year at Keenjhar Lake has found to be 4,335 acre-feet. Considering the capacity of inlet regulator of the lake as constant inflow, the additional water i.e. 14.81% of the total inflow shall flow into the system, subsequently substantial quantities of silt from Indus River through KB feeder will also enter into the lake and deposited near the inlet of the lake.

7.3.5 Water Supply and Water Quality

Scenario 01

356. In Karachi, only about 55 percent of water demand is being met, and Non-Revenue Water (NRW) is estimated to be 58 percent. Only 25 percent of industrial and commercial customers have metered supply, and there is no metering for retail customers. The water supply provided by KWSC is approximately 650 MGD against a demand of approximately 1200 MGD resulting in a shortfall of about 550 MGD[39]. Unfortunately, an estimated 35 per cent (230 MGD) of the supplied water is lost during conveyancing, thus decreasing the water availability to a mere 422 MGD, which is well short of the requirement, based on an assumed demand of 40 US gallons/person/day[40].

357. If the baseline scenario will continue to persist, the city will not get benefited from the positive impacts of KWSSIP projects such as; leakage free bulk water supply, metering of flows, restriction of non-revenue losses, improved water pumping infrastructure, improved treated potable water availability to citizens of Karachi and reduction in water borne disease, ultimately reducing the pressure on health care system of the city.

Scenario 02

358. K-IV Phase 1 is a vital project for Karachi and would help address the issue of water supply. The project shall serve large swathes of the population, which are currently deprived of piped water supply and relying on expensive tanker water or already deprived groundwater source. The project shall also enhance the water treatment capacity of the KWSC's existing infrastructure which will result in the improvement of water quality.

Scenario 03

359. The combined effects of KWSSIP and KWSC projects will be greatly positive as both projects will contribute towards meeting the city water demands as well as paving the way for generation of revenue, reducing water losses and enabling KWSC to supply treated drinking water to the residents of Karachi. All phases of K-IV Project are vital to augment the increasing water requirements of the city.

360. Under the KWSSIP, the priority areas of the network as well as KWSC's filtration plants will be rehabilitated, focusing on reducing major leaks, ensuring water metering, improving water treatment profile and developing additional intermittent chlorination facilities. 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 KWSC will be equipped with 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. A key intervention under this sub-component, which is expected to result in improved access to uncontaminated water for at least 2,000,000 consumers, is the installation of additional chlorination facilities within the existing network. Lower technical losses that increase supply to customers will make Karachi's citizens more resilient to extreme, climate-related water events. Reduction in physical losses will also improve energy efficiency and reduce greenhouse gas emissions as detailed in the project's GHG analysis. The project will improve water supply and sanitation in selected Katchi Abadis, including through the installation or upgrading of water automated teller machines, metered house connections and provision of bulk water supply, using various arrangements for their operation and

[39] *Situational Analysis of Water Resources of Karachi 2019 – WWF*

[40] *Sindh water outlook (CSIRO): Impacts of climate change, dam sedimentation and urban water supply on irrigated agriculture by Mobin-ud-Din Ahmad, Joel P Stewart, Jorge Peña-Arancibia, Mac Kirby – January 2020*

maintenance, in close consultation with the communities. The project will also reduce the energy consumption of KWSC pumping stations and water treatment plants, and thus reduce current high energy costs and KWSC's carbon footprint, reinforcing the impact of the asset management improvement program. The project will have two primary beneficiaries: Firstly, many inhabitants of Karachi will benefit from uncontaminated water and associated gains in health and economic prosperity. At least 2,000,000 people are expected to benefit from better access to improved water services. Secondly, KWSC will benefit from enhanced distribution capacity and service quality, as well as capacity building measures to translate these infrastructure improvements into higher revenues through improved billing and collections and greater accountability to customers.

7.4 Conclusion and Recommendation for full CIA under Sindh Strategic Water Plan

361. In this preliminary CIA, five VEC highly relevant to the proposed KWSSIP-2 were selected -Surface Water Resources, Groundwater Resources, Indus Delta, Wetlands, Drinking Water Supply and Water Quality, and cumulative impacts were analyzed as per the three scenarios. Among them, there would be potential adverse cumulative impacts on groundwater and irrigation water downstream Keenjar Lake under Scenario 03 while there will be positive cumulative impacts on water supply. However, this is a preliminary analysis based on secondary information and limited stakeholder engagement. Hence, full scale CIA will be undertaken as part of the Sindh Strategic Water Plan (SSWP) to be supported under Sindh Water & Agriculture Transformation Project (SWAT) as described below.

362. SWAT is another important initiative being currently undertaken by the Government of Sindh, in collaboration with the World Bank. To address key watershed level environmental and social cumulative impacts and risks, preparation of the SSWP is part of Component 1.2 of SWAT. This will be the first SSWP for the province and will be informed by a full-scale Cumulative Impact Assessment integrated in the SSWP planning process. The plan will address key water and environmental issues, including strategic directions on infrastructure development, water allocation, and water-related environmental and social ecosystem service priorities. SSWP will be prepared under the coordination of the Project Coordination and Management Unit PCMU (SWAT) and with support relevant departments, including the Irrigation Department and the Agriculture Department. Since the KWSSIP and KWSC projects shall require withdrawal of substantial volumes of water from Indus River Basin, KWSSIP and KWSC will be actively involved in the SSWP development process.

363. Engagement of stakeholders as early as possible and throughout the decision-making process will be crucial. Key Stakeholders proposed to be consulted during the main CIA studies include but not limited to the following:

- Planning and Development Department – Sindh;
- Sindh Water Commission;
- Sindh Irrigation & Drainage Authority (SIDA);
- Water Resource Management Unit -Irrigation and Water Resource Management Department;
- Indus River System Authority (IRSA);
- Water & Power Development Authority (WAPDA);
- Karachi Water and Sewerage Corporation (KWSC);
- Sindh Forest and Wildlife Department;
- Sindh Irrigation Department;

- Agriculture Supply & Prices Department;
- Livestock and Fisheries Department in Sindh;
- Provincial Disaster Management Authority (PDMA);
- Sindh Environmental Protection Agency (SEPA);
- Pakistan Meteorological Department;
- International Union for Conservation of Nature (IUCN);
- World Wide Fund for Nature (WWF);
- Bureau of Statistics; and
- Environment Departments of NED, Mehran and Other Relevant Academia where some research has been performed on Indus Water Abstraction / Shortage / Biodiversity etc.

364. It is expected that the SSWP will be institutionalized and prepared on a periodic basis (every 5 to 10 years). The VECs identified during the main CIA will require to be monitored and updated in line with the SSWP after each periodic review.

365. As mentioned earlier, the feeding capacity of inlet regulator to Keenjar Lake was used as the water inflow to Keenjar Lake through KB Feeder. To estimate more accurate water inflow and impacts on irrigation water supply and domestic water supply to Karachi, the measurement of actual inflow data considering the seasonal difference is required. It could be expected that if sufficient additional water is provided to fulfill water demand of Karachi, it is likely that water supply for irrigation would be partially reduced. Hence, the feasibility of change in agricultural practices as well as social impacts in the case of change in irrigation water supply should be examined in the full scale CIA which will be carried out through SSWP development process.

8 Environmental and Social Management Plan

8.1 Introduction

366. This chapter presents the Environmental and Social Management Plan (ESMP) which details the mitigating measures that will be implemented to avoid or minimize the potential adverse impacts of the project and the monitoring plan to monitor and evaluate the effectiveness of the actual implementation of the mitigating measures.

367. The main objectives of the ESMP are:

- To provide mitigation measures and a corresponding implementation phase for each impact identified;
- To ensure that all necessary corrective actions are carried out in time to counter any adverse environmental and social impact;
- To ensure the regular monitoring of factors which may affect the safety of the environment under a systematic monitoring approach;
- Define the roles and responsibilities of the project Proponent and Contractor(s) in order to effectively communicate environmental and social issues among them;
- Provide a procedure for timely action in the face of unanticipated environmental situation;
- Provide a monitoring mechanism in the form of an environmental and social monitoring program, which includes monitoring parameters, monitoring frequency to ensure that all the mitigation measures are completely and effectively implemented;
- Provides estimation of environmental and social cost for the implementation of ESMP;
- Define the requirements necessary for documenting compliance with ESMP and communicating it to all the concerned regulatory agencies; and
- Provide other plans considering the project specific requirements.

8.2 Environmental and Social Mitigation Plan

368. The mitigating measures for the identified environmental and social risks, including risks to vulnerable groups and sensitive receptors, were detailed in the environmental and social mitigation plan. In addition, the followings plans and procedures were also developed for the project to manage the social risks.

- Stakeholder Engagement Plan
- Labor Management Procedure
- Resettlement Action Plan

369. The contractors will be responsible for implementation of measures to avoid or minimize adverse environmental and social impacts during construction. Contractors are required to prepare a Construction ESMP (CESMP) demonstrating the manner in which they will comply with the requirements of ESMP before mobilization, and obtain approval from the ESC and SC.

370. The environmental and social management plan is presented in Table 8-1.

8.2.1 E&S Management Plans

371. In addition, the following guidelines for the development of management plans were developed and are attached as annexes of the ESIA.

- Guideline Resources Conservation Plan
- Tree Plantation Plan
- Guideline Waste Management Plan
- Guideline Slurry Management Plan
- Guideline Sanitation Plan
- Guideline Traffic Management Plan
- Chance Finds Procedure
- Guidelines to Combat with COVID-19
- Guideline Emergency Response Plan
- Guideline Occupational Health and Safety Plan
- E&S Code of Practices

a. Tree Plantation / Reforestation Plan

372. The basic purpose of reforestation/afforestation/plantation of suitable species in the project area is to reduce the risk been made due to cutting of trees for the proposed project and to enhance green cover and improve the overall environment of the area. The project area is not rich in natural vegetation. It is estimated that out of total 1,719 trees within the RoW, almost 1,685 trees will be cut down for laying of pipelines. Efforts will be made to ensure that the 34 species identified as ecologically important will be preserved.

373. The reforestation ratio of 1:10 for the tree cutting is recommended which equates to about 16,850 trees to be planted. The trees are proposed to be planted along the perimeter of the reservoirs (R1, R2 and R3) which is much suitable land for plantation and will help to provide security barrier as an additional benefit along the reservoirs in future. The KWSSIP, KMC, Parks and Horticulture Department and Forest Department will be consulted before the tree planting.

374. Based on the estimation, total cost of approximately 16,850 numbers of trees/plants will be 32.55 million PKR which include the purchasing of plant along with its four-year maintenance. The details are attached as **Annex-IX**.

b. Occupational Health and Safety Plan

375. During construction phase, the Contractor is responsible to manage all H&S related issues and are required to comply with national laws and international standards for OCHS. Guideline for contractor's OCHS sub-plan is attached as **Annex-XXIII**.

376. The following measures are identified for health, safety, and environment protection:

- All contractor staff will be well informed and trained on the OCHS policies and guidelines;
- Contractor will provide adequate health services as well as site first aid services for its workforce;

- The main priority of the contractor will be to prevent accidents during mobilization and construction phase of the proposed project. Prevention of workplace accidents during the construction activities will be achieved using approved work plan/instructions by the supervisors;
- Work safety measures and good workmanship practices will be followed by the contractor to ensure no health risks for workers;
- Provision of adequate sanitation, washing, cooking and dormitory facilities;
- Proper maintenance of facilities for workers will be monitored;
- Provision of protective clothing for labor handling hazardous materials, e.g. helmet, adequate footwear for bituminous works, protective goggles, etc. and contractor will ensure strict use of wearing these protective clothing during work activities;
- Elaboration of a contingency planning by the contractor at work site in case of major accidents will be carried out. A comprehensive emergency preparedness and response sub-plan should be developed and implemented at site;
- A site-specific fire-fighting sub-plan also needs to be developed and implemented by Contractor during construction phase;
- Accidents will be reported to and investigated by the Contractor. All personnel will be encouraged to report all accidents/incidents and to cooperate in the investigation of such occurrence. A comprehensive accident/incident report will be produced to PIU for its review and necessary action;
- Adequate signage, lightning devices, barriers, and persons with flags during construction to manage traffic at haulage and access roads will be conducted;
- The communicable disease of most concern during construction phase, like sexually-transmitted diseases such as HIV/AIDS, will be prevented by successful initiative typically involving health awareness, education initiatives, training heath workers in disease treatment, immunization program and providing health service;
- Reducing the impacts of vector borne diseases on long-term health effect of workers will be accomplished through implementation of diverse interventions aimed at eliminating the factors that lead to disease;
- All construction activities will be properly managed through careful planning and the applicable and relevant H&S policies; and
- Prior approval from E&S team of PIU KWSSIP-2 will be sought before starting any construction related activity.

c. Emergency Preparedness and Response Plan

377. The Emergency Preparedness and Response Plan is intended as a guide for the personnel during emergency situations to control and minimize the impact on community, on occupational H&S, on the environment and on the project. The plan should also include procedures on how to respond in life threatening situations usually occurring suddenly and unexpectedly during the construction and operational phases of the proposed project. The contractor will be responsible for the preparation of the plan and should be implemented at site after prior review and approval from the SC and PIU of KWSSIP-2. Guideline for contractor's ERP is attached as **Annex-XVI.**

d. Restoration and Rehabilitation Sub-Plan

378. The implementation of the proposed project would involve construction workers' camp for staff and labor, establishment of fences around construction site,

over usage of access roads for movement of heavy machinery / motor vehicles linking to various components of project, offices, etc. During construction, these activities could also result in accumulation of large amount of unused or spoil material at various sites such as at access roads, muck dumping sites, quarry sites, colonies, offices, etc. which will change the existing land cover in the project area. After completion of the construction work, it is required to restore the disturbed area to its original conditions wherever it is possible that is the sole responsibility of the Contractor. Various engineering and biological measures have been suggested for the restoration of these areas:

- Topsoil will be stored at designated areas before performing excavation activities at quarry sites (if these are agriculture land) and after the completion of all the construction activities, quarry sites (if applicable) and construction sites should be covered with the top soil to support the growth of plant species;
- The area will be planted with indigenous vegetation that will require the initial establishment of fast-growing grasses along with annuals and perennials, nitrogen fixing herbaceous legumes and non-legume shrubs to increase the soil conditioning and to stabilize the project site;
- Material stockpiles will be removed as soon as the construction work will be completed;
- All the construction, toxic and hazardous chemicals/materials will be completely removed from the site;
- All fencing and gates will be removed and pits will be backfilled;
- The reconstruction of interrupted drainage channels and pipes will be carried out;
- Rehabilitation of affected roads should be carried out to avoid any inconvenience to the road commuters; and
- A clearance certificate has to be taken by the Contractor in this regard.

e. Waste Management Plan

379. Solid and hazardous waste will be generated during construction and operation phases of the project. The following measures is recommended to be incorporated in the Waste Management Plan.

- All the anticipated solid wastes will be collected through a properly designed solid waste management system. Enough number of containers will be placed inside the camps and within the construction area for the collection of various types of waste;
- These containers will help the component separation of various types of waste at source. Classification will be based on organic waste, recyclable waste, reusable waste (for resource and recovery) and waste for disposal site. Based on the conditions of the region, organic waste will be frequently collected to avoid odor problems;
- Recyclable, reusable and waste for disposal site will be collected twice a week and on alternate days and will be transferred to a properly designed disposal site;
- The special strategy for safe handling, storage and use of hazardous substances / material will be developed and ensured at site;

- The sewage system for camps will be properly designed (pit latrines or, as required, septic tanks) to receive all sanitary wastewaters;
- Lined wash areas will be constructed within the camp site or at site, for the receipt of wash waters from construction machinery;
- Medical waste and construction waste will be handled with care;
- The pesticide use will not be allowed at site and for clearance of RoW;
- Construction waste i.e. waste concrete, bricks, cement, etc. will be disposed of at the designated areas; and
- Construction workers and supervision staff will be encouraged and educated to practice waste minimization, reuse and recycling to reduce quantity of the waste for disposal.

380. A guideline spoil and waste management plan is attached as **Annex-X**. The Contractor/s will be responsible for the preparation of waste and spoil management sub-plan before the commencement of construction activities and its implementation at site after the prior review and approval from SC and PIU of KWSSIP-2.

f. Drinking Water Supply and Sanitation Plan

381. Safe drinking water supply and sanitation facilities are required to be provided in the temporary facilities during construction including in the offices, labor camps and workshops in order not to cause shortages and/or contamination. A plan will be prepared by the Contractor on basis of the mitigation plans. The sub-plan will be submitted to the SC for their review and approval before contractor mobilization.

g. Traffic Management Sub-Plan

382. A comprehensive TMP will be developed by Contractor mentioning routes to be followed for transportation of construction machinery and materials e.g. cement, steel, gravels, sand, etc. TMP will comprise following contents necessarily:

- Goals and objectives of sub-plan;
- Purpose and Scope;
- Project specific traffic;
- Roles and responsibilities of contractors' environmental personnel;
- Routes to be followed along with necessary maps;
- Transportation timing; and
- Mechanism to address road accidents (if occurs).

383. Guideline for contractor's TMP is attached as **Annex-XVI.**

h. Chance Find Procedure

384. The purpose of these guidelines is to address the possibility of archaeological deposits, finds and features becoming exposed during earth removing and ground altering activities associated with the construction and to provide procedures to follow in the event of a chance archaeological find. The chance find procedure of archaeological deposits is attached as **Annex-XVII**.

8.2.2 Contractor's Obligation and Management

385. The contractor will be primarily responsible in ensuring the implementation of the mitigation measures proposed in the ESIA including ESMP. The provision of providing employment to the local people will be ensured in contract agreement and the contractor will prepare a Local Employment Plan within one month of award of contact for its implementation.

386. The requisite content of this ESMP will be incorporated in the bidding documents and this ESIA including ESMP will become a part of the contractor's contract documents.

387. In addition to this, the contractor will be responsible for the preparation and implementation of site specific ESMP also called as Contractor-ESMP, along with all the sub-plans based on the guidelines provided in this ESIA, with prior approval from SC and PIU KWSSIP-2.

8.2.3 E&S Codes of Practice

388. The Contractor will develop and implement the E&S Codes of Practice (Refer **Annex-XXVII**) for its staff and employees in order to ensure that the intrusion of workers in the project area does not result in any social and environmental and social issues between the workers and locals which can harm the project by causing unnecessary delays. These codes will be reviewed and approved by SC prior to start of the construction activities.

389. These codes will be based on the principles of environmental protection, OHS, good engineering practices, respect, integrity and sound ethical values. Each code should include, at minimum, the purpose and objectives, a policy statement from the in-charge explaining the importance of this code for the success of the project, and examples of such conduct. Guidelines for the code of practices are discussed below.

390. General code of conduct will be developed for the project and the following practices will be adopted:

- Rules and guidelines will be given to the workers regarding the use of common resources such as wood, plants, water sources etc. to ensure their sustainable use;
- The code will also include provisions of the waste management sub-plan to address solid waste collection and disposal in order to prevent unhygienic conditions and contamination of soil and water;
- The Contractor will make arrangements to avoid accidental risks such as traffic signs board and speed control measures for the safety of locals;
- In construction camps, amenities of life including clean food, water and sanitation facilities must be provided to these camps, and the workers will be provided with guidelines on how to dispose of their waste and maintain a sense of hygiene;
- The training of workers in the construction safety procedures, equipping all construction workers with PPEs i.e. safety boots, helmets, gloves, ear plugs, and protective masks also and monitoring their proper and sustained usage;
- The Contractor will ensure that the construction labor is trained in safety procedures for all relevant aspects of construction;

- Formal emergency procedures will be developed for construction site in case of an accident. First Aid Kits and other necessary equipment will be kept available at site along with the list of emergency phone numbers at the construction site to be contacted in case of any accident; and
- The safety of the public at all stages of the construction and operation will be ensured by appropriate public education and safety measures such as use of sign boards, barriers and flags and use of proper illumination at night.

391. Good engineering practices will be developed for the project and will include, at minimum, the following practices;

- Standard Operating Procedures for handling, storage and transportation of oil leakages, chemicals and other toxic materials will be strictly followed;
- Workers must be familiar with the Safety Data Sheets of each chemical used at site. Safety Data Sheets are provided with each chemical drum. Chemicals will be stored as per their Safety Data Sheets. Utmost care should be taken during the handling of these chemicals;
- Precautions should be taken to prevent spills and all workers will be trained in proper handling, storage and disposal of hazardous or toxic materials; and
- Proper disposal plans of excavated material.

392. Cultural Code of Practice should be developed for the project and will include, at minimum, the following practices:

- Self-respect and sensitivity to insult is an important trait of the locals. The poorest among them has his own sense of dignity and honor and he vehemently refuses to submit to any insult. In fact, every inhabitant considers himself equal if not better than his fellow tribesmen and an insult is, therefore, taken as scurrilous reflection on his character. Therefore, the contractor will be careful to avoid any unceremonious interaction with the locals and inform their staff to be humble and polite.
- The Contractor will also take care of the norms of local community and their sensitivity towards local customs and traditions;
- The Contractor will brief the staff about local culture and norms;
- As per local culture wearing of short shirts and short trouser is considered inappropriate attire, therefore the contractor informs the staff to avoid wearing short trousers and short shirt;
- Contractor will strictly warn the staff not to involve in any unethical activities and to obey the local norms and cultural restrictions particularly with reference to women;
- The Contractor will be required to maintain close liaison with the local elders and religious scholars of nearby local community to ensure that any potential conflicts related to common resource utilization for the project are resolved easily;
- Privacy of women is a major cause of concern for the communities of the project area. Due to the project activities local women may not be able to perform their daily outdoor chores. Women in the project are participate in other outdoor activities such as livestock rearing, bringing of potable water, and collection of firewood. that may be affected by the project activities;

- The Contractor will have to select the specific timings for the construction activities so as to cause least disturbance to the local population particularly women considering their peak movement hours; and
- The Contractor will warn the staff strictly not to indulge in any un-ethical activities and to obey the local norms and cultural restrictions particularly with reference to women.

393. If privacy of the nearby households is to be affected, the Contractor will inform the house owner in advance to make some alternative arrangements. Similarly, the Contractor will have to take great care that the construction activities should not affect the privacy particularly with reference to women.

Table 8-1: Environmental and Social Management Plan

Environmental Issues/Parameters	Environmental and Social Impacts	Mitigation Measures	Implementation Agency	Monitoring Agency
Pre-Construction Phase				
Land Acquisition and Involuntary Resettlement	Small business operators within RoW are to be relocated	A Resettlement Plan is being prepared and be implemented for the project-affected people.	Design Consultant and PIU KWSSIP	PIU KWSSIP
Relocation of utilities	Existing sewer lines, gas pipes, electricity and telephone lines within RoW will be relocated.	• Proper compensation and restoration mechanism of public utilities will be adopted. The relevant department will provide the estimate for the relocation of the utilities, and they will be provided compensation accordingly through PIU prior to implementation of the proposed project; • Complete rehabilitation of affected public utilities will be ensured; • The provision in the design and budget for the relocation of the existing utility infrastructures wherever required will be ensured in consultation with the concerned departments such as Karachi Electric Supply Company, Sui Southern Gas Pipeline Company, Pakistan Telecommunication Company Limited (PTCL), KMC National Highway Authority (NHA), Pakistan Railway, Pakistan Steel Mills, Port Qasim Authority, Sindh Infrastructure Development Company Limited. • All public utilities likely to be affected by the proposed project will be relocated well ahead of time before the actual commencement of the construction work; • Close coordination with the concerned departments to curtail inconvenience to the residents of the project area; • Timely public notification of unexpected disruption of services;	Design Consultant and PIU KWSSIP	PIU KWSSIP
Labor Risks	Contractors will hire skilled and unskilled workers. Labor risks may include child and forced labor, discrimination.	A Labor Management Procedure (LMP) was prepared for KWSSIP-2 to manage the identified labor risks such as child and forced labor, SEA/SH, labor disputes and others and also the community health and safety risks. The LMP details the approach that will be implemented to meet the national requirements and the objectives of the WB ESS 2: Labour and Working Conditions and WB ESS 4: Community Health and Safety. The key highlights of the LMP on how to address the issues of child and forced labour, labour influx, GBV, SEA/SH, occupational health and safety, and trafficking will be included in the bid documents.	CC	SC and PIU KWSSIP
Construction Phase				
Occupational health and safety	Workers are exposed to occupational health and safety risks of construction activities.	The contractors will be required to prepare and implement an OHS program for the construction activities which shall include safety protocols and SOPs for various construction activities, OHS personnel, training, OHS risk assessment and preparation of risk matrix, JHAs, inclusion of OHS aspects in method statements, safety audits, reporting, others. The following are to be considered in the OSH program. • Conduct a project H&S risk assessment for all the activities of the entire project prior to the commencement of the works focusing the OHS and CHS; • Designate an OHS officer(s) as per the working staff at site with specified responsibilities to supervise all the construction activities at the proposed project site; • Provide OHS training and basic medical training to specified work staff, and basic medical service and supplies to workers; • Layout plan for camp site, indicating safety measures taken by the contractor, e.g. firefighting equipment, safe storage of hazardous material, first aid, security, fencing, and contingency measures in case of accidents; • Work safety measures and good workmanship practices • Provision of PPEs to all the workers, visitor and staff in the vicinity of project area;	CC	SC and PIU KWSSIP

Environmental Issues/Parameters	Environmental and Social Impacts	Mitigation Measures	Implementation Agency	Monitoring Agency
		• Provision of sufficient and clean drinking water and sanitation facilities to workers; • Reduce the work hours of workers during extreme hot working environment and heat waves; • Proper fuel and chemical storage area will be provided; • Preparation of emergency response and recovery plan • The working hour and age of labor and staff will be in compliance with the Sindh Factories Act 2021. Overtime working shift will be allowed to the workers as per prevailing clauses of Sindh Factories Act 2021; • Feasible working conditions such as healthy environment, workplace safety, provision of recreational activities and adequate medical/first aid facility at site; • Ensure that the site will be restricted for the entry of irrelevant people particularly children, disabled and elderly peoples; • Adequate lightning devices, barriers, yellow tape and safety signage will be posted. • First aid medical facilities will be made available at the worksite		
	Exposure to asbestos-containing materials may pose health risks to exposed individual.	Screening and management procedures for asbestos-containing materials will be developed and implemented during construction. The procedures will detail the process on how to identify the presence of ACM and the proper handling, storage and disposal of ACMs. Only trained experts on asbestos handling should be allowed to remove and manage the transportation and disposal of ACMs.	CC	SC and PIU KWSSIP
Labor Conditions	Workers are exposed to labor risks such as the following: • GBV might arise due to discrimination made against women by unequal work distribution and unequal pay structure among others. • SEA/SH against women might occur from mixing of men and women at the construction site. • Labor exploitation such as unpaid and/or incorrect payment of wages by employer, poor working conditions	• A Labor Management Procedure (LMP) was prepared for KWSSIP-2 to manage the identified labor risks such as child and forced labor, SEA/SH, labor disputes and others and also the community health and safety risks. • The key highlights of the LMP on how to address the issues of child and forced labour, labour influx, GBV, SEA/SH, occupational health and safety, and trafficking will be included in the bid documents. • Gender Action Plan prepared for KWSSIP will be implemented. • A separate SEA/SH Action Plan will be prepared and implemented. • Training will be given to construction workers, alongside the implementation of strict measures and punishments in case of any sexual assaults, or GBV. • Provisions of gender disaggregate bathing, changing, and sanitation facilities	CC	SC and PIU KWSSIP
	Workers are exposed to health risks of labor relating to HIV/AIDS and other sexually transmitted diseases	• To prevent the spread of communicable diseases due to the temporary influx of workers during construction, the following are to be implemented: ○ Provide surveillance and active screening and treatment of workers ○ Undertake health awareness and education initiatives among workers ○ Train health workers in disease treatment ○ Immunization program and providing health service	CC	SC and PIU KWSSIP
	Exposure to vector-borne diseases at construction camp dues to unsanitary conditions	• Provision of hygienic and sanitary contractors' camp with access to safe drinking water and sanitation facilities • Proper and regular cleaning, housekeeping and management of the constructors' camp • To prevent the spread of vector-borne diseases, the following measures will be implemented: ○ Maintain the camp sites in sanitary conditions; ○ Implement solid waste management plan;	CC	SC and PIU KWSSIP

Environmental Issues/Parameters	Environmental and Social Impacts	Mitigation Measures	Implementation Agency	Monitoring Agency
		○ Elimination of unusable impoundment of water ○ Implementation of integrated vector control programs ○ Educating project personnel and area residents on risks, prevention, and available treatment		
Resource efficiency	Resources that will be used include construction materials, water and fuel. Construction material to be used for construction activities includes coarse aggregates, fine aggregates, asphalt, cementious materials, reinforced and structural steel. Almost all the materials to be used in the construction are non-renewable and therefore their sustainable use is necessary for the future use.	• The efficient and well-maintained equipment and machinery will be used; • Implement energy and water conservation measures • Train workers on energy and water conservation measures • Plan for reuse of construction waste materials can be formulated; • Use of solar panels at camp sites to conserve energy.		
Soil	Soil erosion from excavation activities. Soil can be contaminated due to • Improper management of wastes • Oil spill/leaks from heavy equipment and vehicles • Chemical leaks • Disposal of untreated wastewater Excavated material may also be contaminated.	• Stored excavated/fill material will be covered • The Contractor will be required to reuse the excavated soil for backfilling as much as possible unless the soil is considered not suitable for filling • Stockpile will have a side slope of 2:1 or flatter and will have a height lower than 2m; • Safety Data Sheets will be strictly followed during handling and storage of chemicals; • All maintenance activities of heavy equipment and vehicles will be done in a designated area with cement flooring; • Non-bituminous wastes from construction activities will be dumped in approved sites, in line with the guidelines for dump sites, and must be covered; • Washing yards will be paved to avoid seepage of runoff from the yard; • Controlling runoff volumes and intercept runoff before it leaves the site; • Confining excavations to the specified spots as per the approved engineering drawings and unnecessary excavations will be avoided;	CC	SC and PIU KWSSIP
Water sources (river, nullah, groundwater)	Surface run-off from excavated areas may increase suspended solids of nearby water bodies.	• Excavated materials/stockpile will not be placed adjacent to the rivers and nullahs; • Storm water runoff originating from stockpiles should be directed to, and/or controlled by a suitable sediment trap. Temporary silt traps or sedimentation basins along the drainage leading to the water bodies will be installed;	CC	SC and PIU KWSSIP
	Discharge of untreated wastewater from constructors' camp and construction site will contaminate the receiving water body	• Wastewater from washing of vehicles or equipment will not be directly discharged in any water source or the storm drainage • Provision of sanitary toilet facilities in the constructors' camp • All the effluents will be discharged into existing sewerage system as per the requirements of stringent environmental quality standards. • Septic tanks will be constructed to provide primary treatment after which the wastewater will be discharged into existing sewerage network system with the prior approval of KWSC. • Liquid waste from the concrete batching plant will be collected from source by a designated tanker, and taken off-site for proper disposal;	CC	SC and PIU KWSSIP
	Oil/chemical spills/leakage may impact	• Oils, fuel and chemicals must be stored at bunded storage areas;	CC	SC and PIU KWSSIP

Environmental Issues/Parameters	Environmental and Social Impacts	Mitigation Measures	Implementation Agency	Monitoring Agency
	the water quality	• Drainage from fuel storage tank locations, refuelling areas, and equipment service areas will be segregated from other runoff; discharge will be routed through an oil/water separator; and • All maintenance activities of heavy equipment and vehicles will be done in a designated area with cement flooring;		
Air	Earth-moving activities and excavation will generate dusts. Dust can cause nuisance, reduction of visibility and may cause respiratory diseases	• Regular water sprinkling on the site and access roads will be carried out to suppress excessive dust emission(s). The frequency of water sprinkling will be increased in summer season as per the requirement. • Material storage yards will be located at least 500 meter downwind from populated areas, nesting place of birds and contractor's camps to minimize the impact of dust emissions; • Storage pile activity (i.e. loading and unloading) will be confined to the downwind side of the storage pile. This practice applies to areas around the storage pile as well as the pile itself. Storage piles will also be located away from downwind site boundaries and sensitive receptors; • Excavated materials will always be covered; • Asphalt, hot mix and batching plants will be equipped with dust control equipment such as fabric filters or wet scrubbers to reduce level of dust emissions; • The vehicles carrying construction materials and the construction material storage areas will be covered with tarpaulin; • Vehicle speed in the project area will be prescribed not more than 20 km per hour and controlled accordingly especially near the sensitive receptors; • Tires of all the vehicles leaving the site will be washed at designated washing area in vehicle parking lots. No earth, mud and dust will be deposited on the public road; • A GRM will be put in place to receive and address complaints from the public on various aspects of environmental issues, including dust pollution	CC	SC and PIU KWSSIP
	Operation of heavy equipment and vehicles will generate gaseous emissions.	• All vehicles, machinery, equipment and generators used during construction activities will be kept in good working condition, properly tuned and maintained in order to minimize the exhaust emissions and subsequent impacts • Personal Protective Equipment's (PPEs) like masks, goggles which are suitable for specific jobs will be provided to workers and visitors.	CC	SC and PIU KWSSIP
Noise	Operation of heavy equipment and vehicles will generate noise. Exposure to too much noise is a hearing hazard to workers and communities.	• Stakeholders within CoI will be notified before commencement of excavation operations; • Regular maintenance of the machinery, equipment, and vehicles shall be carried out to minimize the noise levels. All machinery, equipment, and vehicles shall have a definite maintenance schedule and be maintained by the Contractor. • Environmental measures such as noise barriers, etc., shall be constructed for the identified sensitive receptors before commencement • Horns will not be used unless it is necessary to warn other road users or animals of the vehicle's approach; • Avoid construction activities during the nighttime near residential areas;	CC	SC and PIU KWSSIP

Environmental Issues/Parameters	Environmental and Social Impacts	Mitigation Measures	Implementation Agency	Monitoring Agency
		• Contractors will comply with submitted work schedule, keeping noisy operations away from sensitive receptors; implement regular maintenance and repairs; and employ strict implementation of operation procedures; • Sensitize truck drivers to avoid hooting, especially when passing through sensitive receptors such as mosques, churches, residential areas educational institutions and hospitals; • Locating the concrete mixing and materials shipment yards at least two kilometers away from sensitive receptors such as residential areas, schools, and hospitals, will also help reduce local noise levels; • The plants and equipment used for construction will strictly conform to noise standards specified in the stringent environmental quality standards;		
Construction waste	Improper disposal of construction wastes (hazardous and non-hazardous) may cause soil pollution and water bodies. Improper disposal of construction waste can also lead to nuisance and hazards towards environment and local population. Storing of kitchen and food wastes from construction camps can serve as breeding grounds for the disease spreading vectors and rodents.	As part of the CESMP, a general (non-hazardous) waste management plans should be implemented at the construction site and camps and should contain the following provisions. • Implementation of waste segregation (biodegradable and non-biodegradable) policy for all construction and operations personnel; • Provision of solid waste handling and storage facilities, such as color-coded trash cans in common areas and strategic locations; • Designate a temporary storage area for the domestic and construction wastes; • The recyclable wastes, such as paper, plastics, and metals, shall be sorted accordingly and maximum efforts will be made to recover and recycle excess concrete, spilled concrete dust, sand and aggregate; • The residual and other general solid wastes shall be disposed in their appropriate bins and in accordance with the local solid waste collection schedule • Wastes generated from the camp site will be disposed of at SSWMB and KMC approved sites; • Burning of waste will be prohibited; • Construction workers and supervision staff will be encouraged and educated to practice waste minimization, reuse and recycling to reduce quantity of the waste; • The contractor will develop specific environmental management plans for asphalt plants and concrete batching plants. These plans will incorporate the general measures as applicable to the entire project, but will also have focused mitigations for solid waste from these plants; A hazardous waste management plan should also be formulated and implemented: • Proper containers must be used for each type of hazardous waste that will be generated. The container must also be closed and sealed and be properly labelled. • Do not store incompatible hazardous wastes near each other. • Hazardous wastes storage and labeling shall comply to the national requirements. • The transport, treatment and disposal of the hazardous wastes shall only be done by licensed service providers.	CC	SC and PIU KWSSIP
Community Health and Safety	The crossing of the water pipes through major highways and roads may cause sever traffic congestion and possible road closure during construction.	• A traffic survey will be carried out by the contractor(s)/concessionaire(s) before mobilization to determine the existing traffic load and the possible traffic congestion during the construction phase.	CC	SC and PIU KWSSIP

Environmental Issues/Parameters	Environmental and Social Impacts	Mitigation Measures	Implementation Agency	Monitoring Agency
	Delivery of construction materials onsite will generate traffic within the CoI. Excavation, stacking of material and other construction activities along the congested intra city road will also cause traffic congestion during construction phase	• The contractor will be responsible for the submission of a final Traffic Management Plan (TMP) to SC for clearance, liaise with Traffic Police Department. The TMP must comprise the following: o Define scope of area that will be affected by construction activities; o Provide sequence of construction operations; o Describe when each phase will commence and finish; o Provide duration of work; and o Note proposed hours of work activity on the site. • The public will be informed early on any closure/diversions of the roads; • The prior notice will be publicized so that the heavy traffic will be managed in during this activity along the identified road crossings. The tunnel boring activity will be conducted in fast track and lane wise mode to avoid the complete and lengthy blockage of the roads; • All deliveries, either inbound or outbound of the construction site, may be done during off-peak hours and at designated delivery hubs located near the construction site to prevent blockage of traffic flow along public roads; • Construction vehicles, machinery and equipment will be parked at designated areas to avoid un-necessary congestions along the roads; • Earth material and pipes will be offloaded and stockpiled at designated areas to avoid unnecessary narrowing and disturbance along the roads; • The traffic control as devised in TMP will be implemented. These control measures will contain details of temporary diversions, details of arrangements for construction under traffic, details of traffic arrangement after cessation of work each day, safety measures for transport of hazardous material and arrangement of flagmen; • Special consideration will be given to the preparation of the traffic control plan for safety of pedestrians and workers at night; • The Contractor will ensure that the diversion and detour is always maintained in running condition, particularly during the intense rainfall events to avoid disruption to traffic flow; • Prior to creating diversions and detours the citizens will be consulted well in advance through electronic and print media and will be informed to the public through proper signs and displays; • All the construction activities including material, and waste and surplus soil stocking will be confined to the road carriageway by the Contractor, to the minimum possible extent. In addition to that proper barricading will be provided; • Contractor will adopt best construction practices i.e. vertical cutting approach with proper shoring and bracing, to limit the width of trench excavation; • Traffic controls and diversions marked with signs, lights and other measures (flags) will be provided		
	Construction activities and vehicular movement at construction sites and access service roads may result in roadside accidents and road damages.	• The construction activities will be planned and managed in close consultation with these stakeholders to minimize the vulnerability of above impacts on these sensitive receptors; • The working space will be shifted to other side of the sensitive receptor which are situated within 5-13m distance from the centre line of the proposed route; • Special arrangements will be ensured to the accessibility and safety of the educational institutes which cater to toddlers and young kids. • Workers will not be allowed to crowd together in the surroundings, and working during the peak time (school start and closure time) will be avoided; • The speed of the vehicles will be controlled (at 30 to 40 km/hr) to reduce the	CC	SC and PIU KWSSIP

Environmental Issues/Parameters	Environmental and Social Impacts	Mitigation Measures	Implementation Agency	Monitoring Agency
		probability of severe accidents, debris flows and dust emission which can harm the educational and health institutions; • Damages of roads due to construction vehicles will be instantly repaired and/or compensated after the completion of work and restore the disturbed area to its original conditions; • At work site, public information and caution boards will be provided including contact for public complaints. • Proper fencing will be provided around the working area and near the sensitive receptors (specifically educational institutes, religious places and hospitals) • Contractor will adopt best construction practices i.e. vertical cutting approach with proper shoring and bracing, to limit the width of trench excavation. • Community awareness programs will be implemented on construction-related hazards, including awareness programs in schools, mosques, health facilities, households		
	Quality of water resources available in the nearby local communities may get contaminated due to the construction activities, oil spillage and leakage.	• Oils, fuel and chemicals must be stored at bunded storage areas; • Drainage from fuel storage tank locations, refuelling areas, and equipment service areas will be segregated from other runoff; discharge will be routed through an oil/water separator; and • All maintenance activities of heavy equipment and vehicles will be done in a designated area with cement flooring;	CC	SC and PIU KWSSIP
	Exposure to dusts and air emissions from the construction site may cause respiratory distress most especially to the vulnerable groups such as children and the elderly. Exposure to hazardous materials and wastes	• Regular water sprinkling on the site and access roads will be carried out to suppress excessive dust emission(s). The frequency of water sprinkling will be increased in summer season as per the requirement. • Material storage yards will be located at least 500 meter downwind from populated areas, nesting place of birds and contractor's camps to minimize the impact of dust emissions; • Storage pile activity (i.e. loading and unloading) will be confined to the downwind side of the storage pile. This practice applies to areas around the storage pile as well as the pile itself. Storage piles will also be located away from downwind site boundaries and sensitive receptors; • Excavated materials will always be covered; • Asphalt, hot mix and batching plants will be equipped with dust control equipment such as fabric filters or wet scrubbers to reduce level of dust emissions; • The vehicles carrying construction materials and the construction material storage areas will be covered with tarpaulin; • Vehicle speed in the project area will be prescribed not more than 20 km per hour and controlled accordingly especially near the sensitive receptors; • Tires of all the vehicles leaving the site will be washed at designated washing area in vehicle parking lots. No earth, mud and dust will be deposited on the public road	CC	SC and PIU KWSSIP
	Pedestrians or vehicles passing by may accidentally fall in the excavated areas especially during at night	• Barricades will be provided to prevent public access to all areas where construction works are on-going; • Attach warning signs, blinkers to the barricading to caution the public about the hazards associated with the works, and presence of deep excavation; • Minimize the duration of time when the trench is left open through careful planning; plan the work properly from excavation to refilling and road relaying; • Ramps will be placed in front of schools and houses gates so that accidents	CC	SC and PIU KWSSIP

Environmental Issues/Parameters	Environmental and Social Impacts	Mitigation Measures	Implementation Agency	Monitoring Agency
		due to slips can be avoided; • During construction work, pedestrian and vehicular passages will be provided for crossing near settlement; • Consider guard rails at accident-prone stretches and sensitive locations • Lighting at night will be provided. • Preparation and implementation of emergency response plan		
	The local community may be at risk of contracting various communicable diseases.	• Labor camp will be established preferably at a reasonable distance from the residential area and labor management plan (as per the LMP of KWSSIP-2) will be formulated by Contractor to minimize the adverse impacts on local communities and workers. Preference will be given to any KWSC facility where the camp can be established without causing any hinderance or disturbance to the workers and residents of that facility; • Trainings, awareness and campaigns will be conducted for workers and surrounding communities on awareness and prevention of COVID-19 and HIV/AIDS. Guidelines to combat with COVID-19 • Provide proper and free HIV/AIDS and STDs health screening and counselling for site workers and community members	CC	SC and PIU KWSSIP
	Unsanitary management of the camp sites and improper management of domestic solid wastes may cause the spread of vector-borne and water-borne diseases among the workers and local communities.	• Provision of hygienic and sanitary contractors' camp with access to safe drinking water and sanitation facilities • Proper and regular cleaning, housekeeping and management of the constructors' camp • To prevent the spread of vector-borne diseases, the following measures will be implemented: o Maintain the camp sites in sanitary conditions; o Implement solid waste management plan; o Elimination of unusable impoundment of water o Implementation of integrated vector control programs o Educating project personnel and area residents on risks, prevention, and available treatment	CC	SC and PIU KWSSIP
	Vibration generated by construction activity may cause disturbance to the sensitive receptors such as hospitals, schools and mosques. Vibration may cause structural damage, such as cracking of floor slabs, foundations, columns, beams, or wells, or cosmetic architectural damage, such as cracked plaster, stucco, or tile	To minimize vibrations, machines should be mounted on shock-absorbing mountings, such as cork or reinforced concrete foundation or a floating isolated foundation set on piles, depending on the machinery. Reduction of working hours and/or introduction of short breaks during working days may also lessen the consequences of vibrations. • The construction activities will be planned and managed in close consultation with the stakeholders of social sensitive receptors to minimize the vulnerability of above impacts on these sensitive receptors; • The working space will be shifted to other side of the sensitive receptor which are situated within 5-13m distance from the centre line of the proposed route; • Schedule the major construction activities such as excavation, trenching and pipe laying during off-peak hours to avoid the disturbance on the educational institutes and hospitals. •	CC	SC and PIU KWSSIP
	During the construction phase of the project, conflicts may arise between labor force and local community. Use of local resources and products by the construction workers can generate stress on the local resources. Furthermore, difference in cultural values may also cause discomfort to	• Local labor especially from nearby communities will be given preference for the construction works • Communities will be informed and consulted before commencing works inside or near the communities • An effective GRM has been established for the project to resolve all issues related to the community. A separate Grievance Redress Committee for GBV cases has also been established.	CC	SC and PIU KWSSIP

Environmental Issues/Parameters	Environmental and Social Impacts	Mitigation Measures	Implementation Agency	Monitoring Agency
	local residents.	• Create awareness among workers on proper sanitation and hygiene practices to endorse proper health and maintain good housekeeping practices at all project sites • Prohibiting drugs, alcohol, weapons, and ammunition on the worksite among personnel		
	The influx of workers may increase the crime rate within the locality including GBV and SEA/SH.	• Special arrangements will be ensured to the accessibility and safety of the educational institutes which cater to toddlers and young kids. • Workers will not be allowed to crowd together in the surroundings and working during the peak time (school start and closure time) will be avoided; • During the construction phase, mobility of workers in the nearby areas will be strictly restricted by the contractor to avoid any inconvenience to the local communities especially women's; • Alternative routes for pedestrian will be provided to avoid mixing of women with workers	CC	SC and PIU KWSSIP
Biodiversity	About 1,685 trees within RoW are to be removed to make way for the proposed project.	• The contractor shall clearly mark each tree that is required to be removed; • The local population of these species of conservation importance will be recorded prior to construction and strict monitoring as well as record will be maintained to ensure that there is no illegal cutting and damage of these species due to the project interventions; • A tree plantation sub-plan (refer **Annex-IX**) has been formulated with the recommendations and technical support of concerned Departments (KMC, Park and Horticulture Department, Sindh Forest Department) which will be implemented during construction phase; • Trees that will be cut is limited to RoW only • Replacement of cut trees (1:10) • In case if vegetation removal is unavoidable, trees under 2m height will be translocated to a receptor site with appropriate soil conditions and growing conditions, as identified by a suitably qualified ecologist;	CC	SC and PIU KWSSIP
	Disturbance of fauna species due to noise generated and dust emissions.	• Implementation of noise and dust mitigating measures as discussed above. • In case of appearance of any endangered/threatened wildlife species respective regulatory authority must be informed as early as possible. • Prohibit hunting, poaching or trading of fauna within project site. • Raise awareness and install signages to remind workers on the prohibitions of hunting, poaching and trading. • Implement sanctions for non-compliant workers		
Operation				
Air	A standby diesel generator will be used during maintenance activities. The operation of the generator will have gaseous emission from fuel burning.	• Ensure proper maintenance of the genset • Provide stack with enough height to ensure the dispersion of gas emission • Use of genset with low emissions	KWSC	KWSC
Noise	The operation of the generator may generate noise.	• Ensure proper maintenance of the genset • If possible, provide enclosure to genset	KWSC	KWSC
Wastewater	Maintenance of the water pipes will include flushing of the water pipes to remove accumulated sediments or other impurities in the pipe. This will generate flushed water that may pollute the receiving water body if discharged	• Discharge the flushed water to existing sewerage system	KWSC	KWSC

Environmental Issues/Parameters	Environmental and Social Impacts	Mitigation Measures	Implementation Agency	Monitoring Agency
	directly.			
Community Health and Safety	Pipe leakages, bursts or blockages may cause localized and temporary flooding in the area.	• Conduct regular inspection and maintenance of the water pipes • Develop and implement emergency response plan • Implement leak detection and repair program	KWSC	KWSC
	Contaminants may enter the water conveyance due to pipe breakage or damage and from illegal water connections along the line.	• Develop and implement Water Safety Plan • Conduct regular inspection and maintenance of the water pipes • Implement leak detection and repair program	KWSC	KWSC
	In case there is a need to repair pipes, temporary traffic in the area may be experienced	• Develop and implement traffic management plan • Any closure of the roads (especially main roads) and deviations / diversions proposed will be informed to the riders through standard signs and displays; • Conduct repair activities during non-peak hours	KWSC	KWSC

8.2.4 Gender Action Plan

394. Considering the concerns and pressing needs of the women in project area, a Gender Action Plan (GAP) was prepared in accordance with World Bank Gender and Development Policy Framework (Bank Procedures 4.20).

395. The GAP is a systematic framework to ensure the women participation and benefits from development projects through detailed planning, implementation, monitoring and evaluation activities. The objectives of the GAP are as follows:

- To undertake preparatory work to address gender issues in the proposed project;
- To include special features in the project design to address gender impacts;
- To promote women's participation in project;
- To maximize women's access to project benefits;
- To ensure tangible benefits to women;
- To minimize social vulnerability of women arising due to the proposed project activities like securing land, security concerns during construction as well as O&M phases; and
- To ensure the implementation of actions as well as their monitoring and evaluation throughout the project life cycle.

396. GAP will safeguard the interest of the community women adjacent to the proposed project sites and will promote their participations in project planning and implementation. It will also contain actions that will be adhered by all the agencies (PIU, line agency (KWSC), supervision consultant(s), contractor(s)) involved for the implementation of the project during the project life cycle. The GAP illustrates the specific measures along with the monitoring indicators and responsible authority to address gender specific concerns and impacts associated with the proposed project. The project specific GAP is shown in Table 8-2.

Table 8-2: Gender Action Plan for the Proposed Project

Issues/Aspect	Mitigation Measures	Responsible Agency	Monitoring Indicators
Pre-Construction Phase			
Employment Announcement	Announce employment opportunities and recruitment notices widely, targeted at women as well as men.	CC and PIU KWSSIP-2	Notice of employment opportunity published in local newspapers, print media, offices, housing society, outside the construction site, etc.
Non-availability or non-engagement of Associations/ Organizations	Establishment or engagement of CBOs working specifically for women through synergetic development strategy of KWSSIP-2	PIU KWSSIP-2 and local NGOs/ CBOs	Commitment for establishing special offices for involvement/ engagement of NGOs/ CBOs.
Construction Phase			
Un-even Women Workforce	Preference will be given to women from project affected families to work as skilled or	CC, SC and PIU KWSSIP-2	Notice of employment opportunity published in local newspapers,

Issues/Aspect	Mitigation Measures	Responsible Agency	Monitoring Indicators
	unskilled workers/ labor (wherever feasible) during the construction phase and they receive equal wage for the work		print media, offices, housing society, outside the construction site. Inventory of staff hiring record and the gender proportion.
Unequal Wage for all Genders	Ensure equal pay for equal work (all genders) during construction and O&M works	CC, SC and PIU KWSSIP-2	Record of pay slips (wages inventory) for all workers (both women and men) and compare the wages of all gender working on same position / rank.
Restrictions on Women Mobility	Identify barriers in the women's mobility and take reforms to fix those barriers.	CC, SC and PIU KWSSIP-2	Monitoring audits and checks; Consultation records; and Grievance Redress/Social Complaint Register.
Safety and Security concerns	Construction camps to be established away from the residential areas. Presence of security personnel in the project site during project implementation. A private security personnel will be hired by the Contractor(s). Contractor(s) will also liaison with district security police / agency to manage the security related issues at site..	Contractor	Safety and security concerns of females during construction time Grievance Redress/Social Complaint Register,
Through the Project Lifecycle			
Women in Decision Making	Awareness will be created about the rights and women will be trained and empowered to become a part of decision–making and their involvement in income generation activities. Training for the involvement of all gender in decision making. Women will be trained and empowered to be part of decision-making processes – their understanding and knowledge about their households and business affairs.	PIU-KWSSIP-2 local NGO/ CBO	Training record; Monitoring audits and checks; Consultation records; Record of all gender involvement in decision making;
Area Safety and Security	Awareness campaign for enhancing safety and security	PIU-KWSSIP-2, NGO/CBO	Monitoring audits and checks;

Issues/Aspect	Mitigation Measures	Responsible Agency	Monitoring Indicators
	for women. Support the relevant departments in enhancing safety and security of women in public spaces, focusing on gender-based violence, harassment issues and female vulnerability and risk.		Consultation records; Grievance Redress/Social Complaint Register; Record of GBV and harassment issues
Prevalent Drug Usage Cases	Drug control arrangements in the communities in liaison with line departments and strict actions to be taken against drugs usage. Awareness campaign against drug usage.	CC, SC and PIU of KWSSIP-2	Monitoring audits and checks; Consultation records; Grievance Redress/Social Complaint Register,
Educational Attainment	Create awareness about importance of education among females. Contribute data and analysis to support reforms aimed at improving education system and increase human capital accumulation with links to skills acquisition and school to-work transition.	PIU-KWSSIP-2 and local NGOs/ CBOs	Monitoring audits and checks; Consultation records; Inventory check of new all gender enrolment in educational institutes
Occurrence of Diseases	Support health institutions to take reforms for improving health quality and provide safe and healthy environment	PIU of KWSSIP-2 and local NGOs/ CBOs	Monitoring audits and checks; Consultation records; Record of various diseases
Knowledge on Menstrual Hygiene	Built awareness programs and generate data to aware women about menstrual hygiene. Adequate water supply is necessary to maintain a hygienic environment.	PIU of KWSSIP-2 and local NGOs/ CBOs	Monitoring audits and checks; Consultation records; Improved female hygiene and health record
No Access to KWSC Offices/Customer Service Centers	KWSC offices / Customer Service Centers must be established for the registration of the complaints/grievances regarding water and sanitation related issues. There will be female staff in these offices to interact with females. Awareness among women about these centers and complaint	PIU of KWSSIP-2 and KWSC	Monitoring audits and checks; Consultation records;

Issues/Aspect	Mitigation Measures	Responsible Agency	Monitoring Indicators
	filing procedures.		
Gender Based Violence / Domestic Violence	Raise awareness among the communities of the potential risks of GBV Provision in GRM for GBV related issues. Awareness among women about registration of GBV related issues and complaint filing procedures. WB Guidelines on GBV will be adopted	PIU of KWSSIP-2 and local NGOs/ CBOs	Monitoring audits and checks; Consultation records; Grievance Redress/Social Complaint Register for GBV related issues
SEA/SH Issues	SEA/SH cases will be properly addressed and reported through notified GRM and GBV committee. Awareness among women about registration of SEA/SH related issues and complaint filing procedures. WB Guidelines on GBV will be adopted Provision related to SEA/SH will be incorporated in the bidding document	PIU of KWSSIP-2	Monitoring audits and checks; Consultation records; Grievance Redress/Social Complaint Register for harassment related issues

8.2.5 SEA/SH Prevention and Response Plan

397. SEA/SH is a global issue that affects women, men, girls and boys. Incidents of SEA/SH might be occurred in projects and as a result, the concerted measures to strengthen its approach to management and prevention of SEA/SH risks. The major terms which are being considered under this SEA/SH are Sexual Exploitation (SE), Sexual Abuse (SA), Sexual Harassment (SH), Whistleblower and Gender Based Violence (GBV). [41]

[41] *Sexual Exploitation (SE) is understood as any actual or attempted abuse of a position of vulnerability, differential power or trust for sexual purposes, including, but not limited to, profiting monetarily, socially or politically from the sexual exploitation of another (UN Glossary on Sexual Exploitation and Abuse 2017, pg. 6).*

Sexual Abuse (SA) is understood as actual or threatened physical intrusion of a sexual nature, whether by force or under unequal or coercive conditions (UN Glossary on Sexual Exploitation and Abuse 2017, pg. 5).

Sexual Harassment (SH) is understood as any unwelcome sexual advances, request for sexual favors, and other verbal or physical conduct of a sexual nature, or any other behavior of a sexual nature that might reasonably be expected or be perceived to cause offense or humiliation to another, when such conduct interferes with work, is made a condition of employment or creates an intimidating, hostile or offensive work environment.

Whistleblower, The International Labour Organization (ILO) defines it as "the reporting by employees or former employees of illegal, irregular, dangerous or unethical practices by employers."

Gender Based Violence (GBV) is an umbrella term for any harmful act that is perpetrated against a person's will and that is based on socially-ascribed (i.e., gender) differences between males and females. It includes acts that inflict physical, sexual or mental harm or suffering, threats of such acts, coercion, and other deprivations of liberty. These acts can occur in public or in private (2015 Inter-Agency Standing Committee Gender-based Violence Guidelines, pg. 5)

Objectives

- To discuss strategies and support mechanisms to mitigate the risk of and respond to allegations of GBV, including SEA/SH; and
- To provide guidance for adapting the Grievance Redress Mechanism (GRM) to allow for the safe and confidential uptake, management, and resolution of SEA/SH allegations

Project Risks Related to SEA/SH

398. It is expected that SEA/SH risks are mainly related to minimal risks of workplace sexual harassment under. The SEA/SH risks are related to possible exacerbation of SEA/SH risks due to the presence of workers, a possible shift in household power dynamics in cases where women may be hired by the project or otherwise benefit from the project, risks of abuse or violence related to harmful social norms in project implementation context, lack of access to support services, lack of information for female beneficiaries regarding the project and its potential risks due to lack of independent consultations with women in safe and enabling environments and lack of access by female beneficiaries to project benefits and services.

399. The influx of migrant workers into the project area may lead to risks of SEA/SH. The risk of sexual abuse of minors resulting from interactions with migrant workers can also increase.

Mitigation Measures

- Drafting and signing of code of conduct for project personnel and workers at rehabilitation or construction sites, which will include, at a minimum, the following attributes:
    - Prohibited actions or behaviors;
    - List of applicable sanctions; and
    - Reporting obligations and mechanism for receiving or reporting complaints.
- Specific procedures to handle SEA/SH-related complaints, including timeline and possible sanctions;
- Reporting procedures for SEA/SH-related complaints, including accessible channels for targeted communities and project personnel;
- Obligations regarding guiding principles for the ethical and confidential management of SEA/SH complaints;
- Skills strengthening for project personnel regarding SEA/SH-related risks, including code of conduct and GRM or another feedback mechanism receptive to SEA/SH complaints;
- Training of workers and supervisory personnel on SEA/SH, including code of conduct and GRM;
- Community consultations with women's groups or female beneficiaries in safe and enabling environments and with female facilitators regarding the potential impact of the project and its activities and associated risks, including consultation on community-based feedback mechanisms, available services, and complaint reporting channels that women consider to be safe, confidential, and accessible;

and

- Awareness-raising in targeted communities by the project regarding SEA/SH-related risks, prohibited conduct, and channels for reporting misconduct.

Monitoring and Supervision

400. Monitoring plan for SEA/SH risk mitigation, prevention, and response measures will be set forth under the SEA/SH Prevention and Response Action Plan, incorporating best practices concerning collection and management of SEA/SH complaint data and development of appropriate indicators in alignment with relevant international best practices.

8.2.6 Training and Capacity Building

401. To enhance the capacity of the Proponent as well as the Contractor, training will be imparted related to the environmental and social issues of the proposed project, implementation of mitigation measures and the monitoring protocols and reporting mechanism will also be carried out.

402. In-house training for the project staff including contractor, consultant and the supervision staff of the Proponent will be ensured through the provision of one-day basic training and one-day advanced training, covering environmental and social aspects of the development projects in general, and implementation requirements with emphasis on the roles and responsibilities of the PIU of KWSSIP-2 and the contractor staff while executing the environmental and social management and monitoring plan in particular. The training protocols will include the following aspects:

- Procedures for monitoring the air quality parameters and measures to be adopted for avoiding or minimizing air pollution, particularly from the concrete batching plant, haul-trucks, etc.;
- Procedures for monitoring water quality parameters and measures to be adopted for avoiding or minimizing water pollution, particularly from the wastewater effluent generated from the workshops, machinery washing yards, and other obnoxious chemicals;
- Safe waste management and disposal practices;
- Safe noise levels from the construction machinery etc.;
- General housekeeping and cleanliness;
- Communicable diseases;
- Safety measures against hazards for workforce and the local communities arising from the construction activities;
- Use of safety gadgets by the workforce; and
- Any other environment and social topic which are required to properly implement the ESMP.

403. Training plan along with the required trainer, trainee, schedule and content for the project staff at site during the construction phase of the proposed project is provided in Table 8-3**.**

404. A comprehensive training manual will be developed and implemented by the Contractor with prior consent of SC environmental staff.

Table 8-3: Training Plan for the Project Staff during Construction Stage

Sr. No.	Training Activity	Participants	Trainer	Mode of Training	Content	Scheduling
1.	Site Orientation and Induction	CC and SC	PIU KWSS IP-2	Presentation / Lecture	Awareness about Site, working protocols	Once for each individual
2.	ESMP and Environment Code of Practices	CC	SC and PIU KWSS IP-2	Presentation	Awareness and applicability of ESMP and environmental code of practices	Monthly
3.	Emergency Response and Use of Fire Extinguishers	CC	SC and PIU KWSS IP-2	Presentation	Potential natural and other hazard/emergencies and dealing with emergency and fire to minimize damage	Quarterly
4.	Resettlement Related Issues and Grievance Redress	CC	SC and PIU KWSS IP-2	Presentation	Awareness on ESS-5 (Involuntary Resettlement)	Quarterly
5.	Labor Management Procedures	CC	SC and PIU KWSS IP-2	Presentation	Awareness on ESS-2 (Labor and Working Conditions)	Quarterly
6.	Gender Aspects including GBV/SEA/SH/ Violence against children (VAC)	CC	SC and PIU KWSS IP-2	Presentation	Awareness on GBV, gender equality, gender related issues and their redress; awareness	Quarterly

Sr. No.	Training Activity	Participants	Trainer	Mode of Training	Content	Scheduling
					regarding GAP	
7.	Stakeholder Engagement	CC	SC and PIU KWSS IP-2	Presentation	Interaction with the PAPs and Other Interested Parties, Awareness on ESS-10 (Stakeholder Engagement)	Quarterly
8.	Awareness workshop regarding COVID 19 and other vector borne diseases	CC	SC and PIU KWSS IP-2	Presentation	Risk, Prevention and available treatment	Biannual
9.	First Aid and Cardiopulmonary resuscitation (CPR)	CC	SC and PIU KWSS IP-2	Presentation	Onsite first aid procedures	Biannual
10.	Compliance of SEPA NOC (Environmental Approval) and WB ESS	CC	SC and PIU KWSS IP-2	Presentation	Awareness on SEPA NOC, rules, guidelines, regulation and standards for satisfactory compliance	Biannual
11.	Community Involvement for Ecological Sustainability	Community and CC	KMC, Park and Horticulture Department, Forest Department, Agricul	Seminar and Workshop	Awareness on Plantation of beneficiary trees, protection of flora and fauna, ecological sustainabilit	Annual

Sr. No.	Training Activity	Participants	Trainer	Mode of Training	Content	Scheduling
			ture Department, SC and PIU KWSSIP-2		y	

8.3 Environmental and Social Monitoring Plan

405. The objectives of environmental and social monitoring plan during the construction and O&M phases are as follows:

- Monitor the actual project impacts on physical, ecological and socio-economic receptors;
- Recommend mitigation measures for any unforeseen impact or where the impact level exceeds the anticipated level in the ESIA;
- Ensure compliance with legal and community obligations including safety during construction and O&M phases;
- Ensure the safe disposal of excess construction materials, solid waste, water and wastewater and gaseous emissions;
- Appraise the adequacy of the ESIA with respect to the project's predicted long-term impacts on the area's physical, ecological and socio-economic environment;
- Evaluate the effectiveness of the mitigation measures proposed in the ESMP and recommend improvements in ESMP, if required; and
- Compile periodic incidents / accidents data to support analyses that will help to minimize future risks.

406. PIU of KWSSIP will be responsible for all the monitoring activities. All the findings and results in the form of monitoring report will be finally shared with respective SEPA as well as WB as per the reporting mechanism.

407. The environmental and social monitoring plan is in Table 8-4.

Table 8-4: Environmental and Social Monitoring Plan

Sr. No.	Parameters / Receptor	Monitoring Parameters / Performance Indicator	Location	Monitoring Mechanism	Monitoring and Reporting Frequency	Responsibility
Construction Phase						
1	Effluent Quality	pH, temperature, DO, Turbidity, TOC, Total P, TSS; BOD5, COD, Cd, Cu, Fe, Pb, Oil and Grease, fecal coliform	• Contractors camps • Concrete preparation plants • Fuel (Petrol, Oil and Grease) products storage areas • Vehicle and machines repairing and servicing yards	Grab sampling and laboratory testing of water samples by SEPA approved Laboratory for monitoring.	• Once before the start of construction by activity monitors and reported; and • On quarterly basis during the construction	• Contractor during Construction Phase • Compliance monitoring lies with SC during Construction Phase
2	Drinking Water	All parameters of drinking water as per stringent environmental quality standards.	Construction site, camps area and nearby residential areas within the RoW/CoI. Estimated sampling points will be verified at construction stage.	Discrete grab sampling and laboratory testing of drinking water samples by SEPA approved Laboratory for monitoring.	• Once before the start of construction by activity monitors and reported; and • On quarterly basis during the construction.	• Contractor during Construction Phase • Compliance monitoring lies with SC during Construction Phase
3	Soil Quality	Total Phosphate, Nitrate, Ammonia, heavy metals	• Construction Camp • Equipment washing yards. • Spillage points of fuel,	Sampling and laboratory testing for soil samples.	• Once before the start of construction by activity	• Contractor during Construction Phase

Sr. No.	Parameters / Receptor	Monitoring Parameters / Performance Indicator	Location	Monitoring Mechanism	Monitoring and Reporting Frequency	Responsibility
			chemicals and lubricants • Concrete batching plants		monitors and reported; and • On quarterly basis during the construction.	• Compliance monitoring lies with SC during Construction Phase
4	Dust Emissions	PM_{10} $PM_{2.5}$ as per stringent environmental quality standards	Sensitive receptors within the RoW/CoI, construction site, camps area. Estimated sampling points will be verified during construction stage.	Ambient Air Monitoring equipment (1-hr)	• Once before the start of construction by activity monitors and reported; and • On quarterly basis during the construction.	• Contractor during Construction Phase • Compliance monitoring lies with SC during Construction Phase
5	Noise Pollution	Day and nighttime noise monitoring in dBA Leq. as per stringent environmental quality standards	• Sensitive receptors within the RoW/CoI. Estimated sampling points will be verified during construction stage. • Construction camps • Equipment yards	Monitoring of noise level at site	• Once before the start of construction by activity monitors and reported; and • On monthly basis during the construction	• Contractor during Construction Phase • Compliance monitoring lies with SC during Construction Phase

Sr. No.	Parameters / Receptor	Monitoring Parameters / Performance Indicator	Location	Monitoring Mechanism	Monitoring and Reporting Frequency	Responsibility
					(spot measurement regular daily basis keeping in view the day-to-day application of different heavy noise causing equipment by the contractor).	
6	Air Pollution	CO, CO_2, SOx, NO_x, HC and $PM_{2.5}$ PM_{10} and compliance with stringent environmental quality standards	Major receptors within the RoW/CoI. Estimated sampling points will be verified during construction stage.	Ambient air quality monitoring.	• Once before the start of construction by activity monitors and reported; and • On quarterly basis during the construction.	• Contractor during Construction Phase • Compliance monitoring lies with SC during Construction Phase
		Vehicular emissions as per stringent environmental quality standards.	Emissions from trucks and other vehicles.	Emission tests	• On quarterly basis during the construction	• Contractor during Construction Phase

Sr. No.	Parameters / Receptor	Monitoring Parameters / Performance Indicator	Location	Monitoring Mechanism	Monitoring and Reporting Frequency	Responsibility
						• Compliance monitoring lies with SC during Construction Phase
7	Ecological Resources	Tree cutting	Proposed project routes along the RoW/CoI.	Visual checks to ensure that only marked trees are cut within the project corridor. Inventory of existing trees, cut trees, and planted trees.	• Once before the start of construction by activity monitors and reported; and • On quarterly basis during the construction.	• Contractor during Construction Phase • Compliance monitoring lies with SC during Construction Phase
8	Public Infrastructure	Disturbance or damage to public infrastructure	Public infrastructures within the RoW/CoI. These structures will be verified prior to the start of construction.	Random visits and consultations with vulnerable. Review of grievances raised, if any	Reporting will be done on the basis of RP recommendation.	• Contractor during Construction Phase • Compliance monitoring lies with SC during Construction Phase
9	Community around	Use of common	• Communities within the	Community	Reporting will be	• Contractor

Sr. No.	Parameters / Receptor	Monitoring Parameters / Performance Indicator	Location	Monitoring Mechanism	Monitoring and Reporting Frequency	Responsibility
	the project corridor	resources. Hindrance to mobility. CHS	RoW/CoI.	consultations Review of grievances raised, if any	done on the basis of RP recommendation.	during Construction Phase • Compliance monitoring lies with SC during Construction Phase
10	Waste Management	Inspection of waste and spoil disposal	• Main project area (RoW) • Construction camps and Offices. • Equipment yards. • Other project allied facilities	Visual Observations, Monitoring and Audits Record review	• Monitoring and reporting on monthly basis during the construction stage	• Contractor during Construction Phase • Compliance monitoring lies with SC during Construction Phase
11	Labor Management and Working Conditions	As per the LMP of KWSSIP-2 which include but not limited to OHS, hygiene facilities, appropriate camps area, etc.	• Main project area (RoW) • Construction camps and Offices. • Equipment yards. • Other project allied facilities	Visual Observations, Incident/accident register Monitoring and Audits ,	• Monitoring and reporting on monthly basis during the construction stage;	• Contractor during Construction Phase • Compliance monitoring lies with SC during Construction Phase

Sr. No.	Parameters / Receptor	Monitoring Parameters / Performance Indicator	Location	Monitoring Mechanism	Monitoring and Reporting Frequency	Responsibility
12	Traffic Safety and Management	As per the TMP which include but not limited to the observation of traffic congestion at bottleneck areas, provision of signs and signal, vehicular inspection, driving safety protocols, etc.	• Main project area (RoW and CoI) • Construction camps and Offices. • Equipment yards. • Other project allied facilities	Visual Observations, Vehicle Log Books, Monitoring and Audits	• Monitoring and reporting on monthly basis during the construction stage.	• Contractor during Construction Phase • Compliance monitoring lies with SC during Construction Phase
13	Social aspects including GBV and other Grievances	Social and cultural conflicts, SEA/SH complaints, grievances related to livelihood impacts, child abuse, etc.	• Main project area (RoW and CoI) • Construction camps and Offices. • Equipment yards. • Other project allied facilities	Visual Observations and consultations, Grievance Redress/Social Complaint Register, Monitoring and Audits	• Monitoring and reporting on monthly basis during the construction stag	• Contractor during Construction Phase • Compliance monitoring lies with SC during Construction Phase
14	OHS; CHS; accidents and incidents	As per O&CHS sub-plan which include but not limited to the inspection of working KWSSIPs, work permits,, provision and availability of	• Main project area (RoW and CoI) • Construction camps and Offices. • Equipment yards. • Other project allied facilities	Visual Observations and consultations, Grievance Redress/Social Complaint	• Monitoring and reporting on monthly basis during the construction stage	• Contractor during Construction Phase • Compliance monitoring lies with SC during

Sr. No.	Parameters / Receptor	Monitoring Parameters / Performance Indicator	Location	Monitoring Mechanism	Monitoring and Reporting Frequency	Responsibility
		mandatory PPEs, Community complaints on H&S		Register, Incident/accident register, Monitoring and Audits		Construction Phase
15	Chemical Storage and Handling	Safety Data Sheets, Leakage and spills, Segregated handling and storage of chemicals, availability of fire extinguishers	• Main project area (RoW and CoI) • Construction camps • Equipment yards. • Other project allied facilities	Visual Observations, Chemical Storage inventory, Incident/accident register, Monitoring and Audits	• Monitoring and reporting on monthly basis during the construction stage	• Contractor during Construction Phase • Compliance monitoring lies with SC during Construction Phase
16	AED Activities	Any AED activities carried out in the project area during the construction phase	• Entire project area	Visual observation; Official record of AED activities	• Monthly basis	• SC
O&M Phase						
1	Effluent	Monitoring of all parameters of effluent as per stringent environmental quality standards.	• O&M Offices and Buildings	Discrete grab sampling and laboratory testing of water samples by SEPA approved Laboratory for	• Bi-annually	• KWSC during O&M Phase

Sr. No.	Parameters / Receptor	Monitoring Parameters / Performance Indicator	Location	Monitoring Mechanism	Monitoring and Reporting Frequency	Responsibility
				monitoring.		
2	Drinking Water	Monitoring of all parameters of drinking water as per stringent environmental quality standards.	• O&M Offices and Buildings	Grab sampling and laboratory testing of drinking water samples by SEPA approved Laboratory for monitoring.	Quarterly	• KWSC during O&M Phase
3	Waste Management	Inspection of waste and spoil disposal in accordance with Waste Management Plan	• O&M Offices and Buildings • Maintenance sites	Visual Observations, Monitoring and Audits	Quarterly	• KWSC during O&M Phase
4	Social aspects including GBV and other Grievances	Social and cultural conflicts, SEA/SH complaints, grievances related to livelihood impacts, child abuse, etc.	• O&M Offices and Buildings • Maintenance sites	Visual Observations and consultations, Grievance Redress/Social Complaint Register, Monitoring and Audits	Bi-annually	• KWSC during O&M Phase
5	OHS; CHS; accidents and	As per O&CHS sub-plan which include	• O&M Offices and Buildings • Maintenance sites	Visual Observations	Bi-annually	• KWSC during O&M Phase

Sr. No.	Parameters / Receptor	Monitoring Parameters / Performance Indicator	Location	Monitoring Mechanism	Monitoring and Reporting Frequency	Responsibility
	incidents	but not limited to the inspection of working KWSSIPs, work permits,, provision and availability of mandatory PPEs, Community complaints on H&S		and consultations, Grievance Redress/Social Complaint Register, Incident/accident register, Monitoring and Audits		
6	Pipe leaks/damages	Leaks or damages of water pipes	Along water pipe routes	Visual inspection	As per leak detection and repair program	• KWSC during O&M Phase

8.4 Environmental and Social Monitoring Cost Estimation

408. The cost for ESMP will be part of the contract document with the Contractor. It must be noted that environmental cost will not be a separate entity because all of its components will be addressed in the bidding document under various heads of account. For instance, tree plantation will be a part of landscaping, etc. The annual estimated cost for the implementation of environmental monitoring for both sections of the proposed project is given in Table 8-5 along with sampling parameters and frequency during construction and operational phases. This cost will be included in PC-1 of the proposed project and will be approved from Executive Committee of National Economic Council - ECNEC (final financial approving authority for public sector developmental projects) as a part of ESMP implementation cost along with overall project cost.

409. The total estimated cost for the environmental and social management, monitoring and auditing during pre-construction, construction and O&M (annual cost and will be updated for next upcoming years accordingly) comes to about **PKR 136.08 million** excluding resettlement and compensation cost.

Table 8-5: Environmental and Social Monitoring Cost Estimate

Sr. No.	Parameter	Mechanism	Frequency	Unit Rate (PKR)	Quantity	Cost (PKRs)	Remarks
A	**PRE- CONSTRUCTION PHASE (at Start of project)**						
A-1	**Environmental Monitoring Cost**						
1	Water Resources/ Water Quality	Discrete grab sampling and laboratory testing of water samples by SEPA approved Laboratory for monitoring as per stringent environmental quality standards.	Once	30,000	09 (03 for Route-1, 03 for Route-2 and 03 for Route-3)	270,000	One-time monitoring will be carried out before the mobilization of Contractor.
2	Noise Levels	dBA Leq. as per stringent environmental quality standards	Once	5,000	09 (03 for Route-1, 03 for Route-2 and 03 for Route-3)	45,000	
3	Ambient Air Monitoring	Monitoring of CO, CO_2, SOx, NO_x, HC and $PM_{2.5}$ PM_{10} by SEPA approved Laboratory as per stringent environmental quality standards	Once	35,000	06 (02 for Route-1, 02 for Route-2 and 02 for Route-3)	210,000	
	Sub-Total (A-1)					**525,000**	
A-2	**Tree Plantation Cost**						
1	Tree Plantation Cost	16,850 numbers	32,554,200			32,554,200	Refer Section 10.11.1

Sr. No.	Parameter	Mechanism	Frequency	Unit Rate (PKR)	Quantity	Cost (PKRs)	Remarks
		of trees will be planted against the damage of 1,685 plants/trees excluding 34 species of ecological importance which will be preserved.					
Sub-Total (A-2)						32,554,200	
Sub-Total A ((A-1)+(A-2))						**33,079,200**	
B	**CONSTRUCTION PHASE**						
B-1	**Environmental Monitoring Cost**						
1	Water Resources/ Water Quality	Discrete grab sampling and laboratory testing of water samples by SEPA approved Laboratory for monitoring as per stringent environmental quality standards	Quarterly	30,000	09x04 (03 for Route-1, 03 for Route-2 and 03 for Route-3)	1,080,000	Quarterly monitoring cost for the one-year construction period and will be updated each year based on latest rates during construction timeline of the proposed project.
2	Noise Levels	dBA Leq. as per stringent environmental quality standards	Daily	5,000	09x04 (03 for Route-1, 03 for Route-2 and 03 for Route-3)	180,000	
3	Ambient Air Monitoring	Monitoring of CO, CO_2, SOx, NO_x, HC and $PM_{2.5}$	Quarterly	35,000	06x04 (02 for Route-1, 02 for Route-2	840,000	

Sr. No.	Parameter	Mechanism	Frequency	Unit Rate (PKR)	Quantity	Cost (PKRs)	Remarks
		PM_{10} by SEPA approved Laboratory as per stringent environmental quality standards			and 02 for Route-3)		
Sub-Total (B-1)						**2,100,000**	
B-2	**Environmental and Social Management Cost**						
1	Environment, Social, Medical and OHS specialist of contractor	E&S Personnel will monitor / conduct all environment, social and OHS related activities e.g. TBTs, PPEs, housekeeping, safety signage, emergency preparedness, etc.	Monthly	1,400,000		16,800,000	This is the tentative monthly cost for one-year period for one E&S Team leader, 03 environment specialists, 03 social specialists, one medical officer and 03 OHS specialists along with their monthly logistics.
2	OHS and CHS Management	OHS related activities e.g. TBTs, PPEs, housekeeping, safety signage, emergency preparedness, etc.	Lump sum			3,000,000	Cost for PPEs, extinguishers, emergency lights, housekeeping equipment, safety signage and barricade, emergency preparedness kit, first aid kit, etc.
3	Ecological and Biodiversity Monitoring and Management	Monitoring of disturbance of habitats through encroachment, noise and other	Quarterly	150,000		600,000	This is the tentative quarterly cost for one-year period for one senior expert along with their monthly logistics.

Sr. No.	Parameter	Mechanism	Frequency	Unit Rate (PKR)	Quantity	Cost (PKRs)	Remarks
		construction activities.					
4	Solid and liquid Waste Management	Collection, segregation, transportation, disposal and management of domestic, commercial, construction wastes (solid and liquid)	Lump Sum			1,000,000	Cost for Collection, segregation, transportation, disposal and management of domestic, commercial, construction wastes (solid and liquid)
5	Social Development Cost	Based on the regular consultations with stakeholders including affected and nearby community, through basic need assessment by the contractor and verified by PIU/PMU coordinating the district social welfare department.	Lump sum			5,000,000	Social Development of local community especially PAPs
6	Training Cost	Literature preparation, printed material such as posters and pamphlets	Monthly	200,000		2,400,000	This is the tentative cost for one-year period for one trainers along with logistics at site.

Sr. No.	Parameter	Mechanism	Frequency	Unit Rate (PKR)	Quantity	Cost (PKRs)	Remarks
		trainer(s), and venue, etc.					
7	Third Party Environmental Consultant	Auditor's checklists and proformas	Bi-annual	400,000		800,000	This is the tentative cost for one-year period for at least two auditors (E&S specialist) along with logistics, travels and accommodation charges.
8	Communicable Diseases	Tests should be performed by approved laboratory	Biannually	2,000,000		4,000,000	This is the tentative cost for one-year period for medical tests of kitchen staff at each camp site.
9	Environment, Social and OHS specialists of supervision consultant	E&S Personnel will monitor / supervise all environment, social and OHS related activities	Monthly	1,000,000		12,000,000	This is the tentative monthly cost for one-year period for one E&S Team leader, one environment specialist, one social specialist, one OHS specialist and 02 juniors along with their monthly logistics.
10	E&S Staff specialist of PIU	E&S Personnel will supervise all environment, social and OHS related activities	Monthly	1,000,000		12,000,000	This is the tentative monthly cost for one-year period for E&S staff as mentioned in 9.5.2 along with their monthly logistics.
Sub-Total (B-2)						**57,600,000**	
Sub-Total B ((B-1)+(B-2))						**57,600,000**	**Tentative for one year. The cost will be updated based on the current market prices during construction phase.**
Sub-Total B ((B-1)+(B-2))						**86,400,000**	**Tentative for 17 months' project construction period. The cost will be updated**

Sr. No.	Parameter	Mechanism	Frequency	Unit Rate (PKR)	Quantity	Cost (PKRs)	Remarks
							based on the current market prices during construction phase.
C	**OPERATION AND MAINTENANCE PHASE (One Year Cost)**						
C-1	**Environmental Monitoring Cost**						
1	Water Resources/ Water Quality	Discrete grab sampling and laboratory testing of water samples by SEPA approved Laboratory for monitoring as per stringent environmental quality standards.	Biannually	30,000	06x02 (02 for Route-1, 02 for Route-2 and 02 for Route-3)	360,000	Biannually monitoring cost for the one year O&M Phase and will be reproduced for next years of O&M based on updated rates.
2	Noise Levels	dBA Leq. as per stringent environmental quality standards	Biannually	5,000	06x02 (02 for Route-1, 02 for Route-2 and 02 for Route-3)	60,000	
3	Ambient Air Monitoring	Monitoring of CO, CO_2, SOx, NO_x, HC and $PM_{2.5}$ PM_{10} by SEPA approved Laboratory as per stringent environmental quality standards	Biannually	35,000	03x02 (01 for Route-1, 01 for Route-2 and 01 for Route-3)	210,000	
Sub-Total (C-1)						**630,000**	
C-2	**Environmental and Social Management Cost**						

Sr. No.	Parameter	Mechanism	Frequency	Unit Rate (PKR)	Quantity	Cost (PKRs)	Remarks
1	E&S Activities	PMU / KWSC	Monthly	300,000		3,600,000	This is the tentative monthly cost for one-year period for one E&S staff along with his site visit cost and logistics arrangements.
	Sub-Total (C-2)					**3,600,000**	
	Sub-Total C ((C-1)+(C-2))					**4,230,000**	**Tentative for one (01) year project O&M phase. The cost will be reproduced for next years of O&M Phase and updated based on the current market prices during O&M phase.**
	Grand Total (A+B+C)					**123,709,200**	
	Contingency Charges		10% of Grand Total			**12,370,920**	
	Grand Total with Contingencies					**136,080,120**	**Say 136.08 Million PKR excluding of RP Cost**

9 Information Disclosure, Consultation and Participation

9.1 Introduction

410. Public consultation and information disclosure is an essential component of the EA process and is recognized by development agencies and national governments. This activity provides a platform for project stakeholders to become part of the project development process. This process is in line with ESS-10: Stakeholder Engagement and Information Disclosure.

411. A stakeholder engagement plan (SEP) was prepared for the entire KWSSIP-2 to satisfy ESS-10. Relevant items such as stakeholders' identification and analysis are included in the SEP.

9.2 Objective of the Consultation

412. The main objective of consultations is to enhance the role of stakeholders as they are given a platform to contribute to the success and sustainability of the project. The specific objectives of the stakeholder engagement exercise carried out for the K-IV Augmentation project include:

- Inform all stakeholders about the K-IV Augmentation project, its context and objectives, salient design features and potential social and environmental consequences;
- Facilitate and encourage interaction with project's beneficiaries, including project-affected parties and other-interested parties to encourage project acceptance, sustainability and ownership;
- Adopt an inclusive, participatory, and transparent approach towards stakeholder engagement that provides opportunities for engagement with relevant stakeholders of all backgrounds, regardless of gender, race, ethnicity, income-class, and ability;
- Benefit from the local knowledge for enhancing strategic interventions for public space design and infrastructure improvement; and
- Identify specific community concerns and suggestions on the proposed designs and develop solutions to ensure satisfactory results.

9.3 Proposed Consultation Program and Stakeholders Workshop

413. Stakeholders' consultations shall be done during the construction and O&M phases of the project. Relevant stakeholders shall include, but are not limited to, concerned government departments, local administration, community representatives, and affected persons residing within the CoI of the proposed project. Consultations shall be done at least twice per year, depending on the number of concerns from stakeholders.

414. The framework for stakeholders' consultations during the construction and O&M phases is presented in Table 9-1. The consultations may be done in various locations within the project area, depending on the target stakeholders.

Table 9-1: Proposed Consultations Framework

Description	Target Stakeholders	Timing	Responsibility
Public awareness campaigns/ IECs to share the ESIA with the	Communities within project area, general	At the start of the site activities	PIU / SC

Description	Target Stakeholders	Timing	Responsibility
communities and other stakeholders.	public; and line departments/ agencies.		
Establishment of GRM and Grievance Redress Committees (GRCs)	Communities at/around project area	Before commencement of project activities.	PIU / SC
Consultations with the communities during ESMP implementation	Communities at/around project area	During project implementation	PIU and SC
Grievance redress/ resolution	PIU staff; consultants; relevant line departments; and communities.	Project implementation Stage	PIU and SC
Informal consultations and discussions.	Communities at/around project area	Project implementation Stage	PIU and SC; contractor
Consultations with the communities during internal monitoring	Communities at/around project area	Construction Stage	PIU and SC
Consultations with the Communities during independent monitoring	Communities at/around project area	Construction Stage	PIU and SC
Consultation workshops to review ESIA implementation, any outstanding issues and grievances, views and concerns of communities; and actions needed to address them.	Communities at/around project area; relevant line department; relevant NGOs	Six-monthly during implementation phase	PIU and SC
Consultations with the communities during the site visits by the World Bank Review Missions.	PIU; Communities at/around project area	Construction/ Operation Stage	PIU; WB and AIIB Mission

9.4 Public Consultations Conducted

415. Various consultation activities were conducted as part of the ESIA process. Below shows the summary of the consultation done while the concerns raised are summarized in annexures.

9.4.1 Key Informant Interviews (KII)

416. Stakeholders along the routes were interviewed and surveyed to solicit their concerns, questions or issues regarding the project during January, 2022 to June, 2022. Table 9-2 shows the location and number of participants interviewed. The photos and summary of issues and concerns raised are in Annex XIX.

Table 9-2: Location and Number of Stakeholders Interviewed

Sr. No.	Settlements	Number of Participants
1.	Easab Goth	22
2.	Nazimabad	18
3.	Steel Mill Chowrangi	14
4.	Y-Junction	12
5.	Dawood Chorangi	08
6.	Liyaqat Abad Town	10
7.	Ayoub Goth	05
8.	Gulshan e Sachal	16

Sr. No.	Settlements	Number of Participants
9.	Yousaf Goth	16
10.	Shah Faisal Colony	17
11.	Gulshan e Iqbal	20
12.	Hijri Road	14
13.	Bukhari Colony	08
14.	Qasba Colony	15
15.	Surjani Town	15
16.	Gulbai	06

9.4.2 Stakeholder Consultation Workshop

417. A stakeholder consultation workshop was conducted on April 28, 2022 at Marriott Hotel Karachi. All the key stakeholders were contacted though letter (attached as **Annex-XX**). The agenda of the workshop was also shared with the participants (attached as **Annex-XXI**). About 45 representatives (of 29 entities) participated in this workshop. PIU along with their E&S consultants presented the key aspects of the KWSSIP to the stakeholders and asked the participants to provide their valuable comments/suggestion to make the project most feasible and viable. The comments, concerns, and suggestions received from stakeholders during the stakeholder consultation session have been collated (attached as **Annex-XXI**). The comments received from stakeholders were helpful in the screening of the potential E&S aspects of the project. The list of participants invited in this session is attached as **Annex-XXI.**

418. Similarly, PIU - KWSSIP-2 with the support of E&S Consultants, organized another Stakeholder Consultation Workshop on July 28, 2022 at Regent Plaza in relation to information disclosure and stakeholder's engagement on KWSSIP-2. The relevant Government Departments, NGOs, Academia, SEPA, Pakistan Air Force (PAF), K-Electric, Transport and Mass Transit Department, World Wildlife Fund (WWF), PTCL, National Refinery Limited (NRL), KDA, Planning and Development Board and Local Community representatives were invited through letters. About 70 representatives (of 47 entities) took part in this second workshop. The stakeholders actively participated and provided comments, suggestions and shared their views based on their practical experience at different projects. The stakeholder consultation list of the participants, their concerns and suggestions are given as Error! Reference ource not found.**XXII**Error! Reference source not found..

9.4.3 Focus Group Discussions (FGD)

419. FGDs were undertaken to gain community feedback and insights on service provision with respect to water, wastewater, drainage, solid waste management and municipal services. Community perceptions and attitudes regarding availability, access, reliability, quality and use of water and sanitation services costs incurred, willingness to pay; suggestions and feedback on the anticipated social impacts of the proposed subprojects were sought as well as to gauge their level of satisfaction.

420. FDGs were carried with both men and women groups including vulnerable/disadvantaged groups such as the elderly, women and children, female headed families and people with special needs in selected low-income settlements in Karachi to understand social processes as well as to individual concerns and suggestions particularly those relating to the provision of water and sewerage services. FGDs were conducted with both male and female separately as end users of water supply and sanitation services with support from a male and female sociologist. The purpose of this exercise was to map out the access, availability and

quality service delivery implementation challenges on the ground in ensuring equitable and sustainable water supply and sanitation services. This exercise yielded valuable information, ideas, and insights into existing service delivery capacities and constraints at the local level in providing the services.

421. The specific areas covered in the discussions included access to clean and safe water, sewerage, solid waste management systems, current situation of drainage system and community perception about services. The aim was to gain a clearer understanding of water and sanitation issues from the perspective of the local communities and to ascertain whether or not they were satisfied with the current level of service delivery. Additionally, solutions to address the identified gaps were sought during the consultations. Table 9-3 lists the FGDs carried out for the project.

422. The major concerns raised during the consultations/focus group discussion were lack of water and sanitation services; irregular water supply; contamination in potable water supply mixed with waste water; health and hygiene issues; inadequate water draining system causing environmental and public health problems; inadequate sewage water service; no or irregular service for solid waste collection at the household level; lack of response and service attitude; water theft and corrupt practices; lack of sufficient pressure to supply water in the apartment buildings; and lack of piped water supply and drainage services in katchi abadis. The key concerns raised by men, women and institutional stakeholders and the photos are in Annex XXIII**.**

Table 9-3: Schedule of Focus Group Discussions Conducted for the Project

Sr. No	Date	Route	Location
1	25 January 2022	Route-1	Samandari Baba Goth, Steel Town and Bhais Colony
2	27 January 2022	Route-2	Taiser Town Sector 51, Gulzar-e-Hijri Scheme 33 and Gulshan-e-Iqbal Block 5
3	22 February 2022	Route-3	Lyari Basti, Gulshan-e-Fatima Society and North Nazimabad Block C

9.4.4 Gender Consultations

423. Keeping in view the important role of the female in the household as well as in the society, a total of nine gender consultations were also conducted during January, 2022 to June, 2022 (two settlements along Route-1, four settlements along Route-2 and three settlements along Route-3) to record views of the females and issues faced by female community related to the project implementation. There was a total of 89 participants in these consultation sessions. The details of the locations with number of participants are provided in the Table 9-4. The key concerns raised during these consultations and the photos are in Annex XXIV**.**

Table 9-4: Gender Consultations done for the Project

Sr. No.	Settlements	Number of Participants
Route - 1		
1	Esab Goth	09
2	Goth Abdul Rehman	18
Route - 2		
3	Gulbai	13

Sr. No.	Settlements	Number of Participants
4	Liyaqat Abad Town	15
5	Gulshan e Sachal	10
6	Ayoub Goth	09
Route - 3		
7	Bukhari Colony	12
8	Qasba Colony (Block-E, F, H and K)	8
9	Al Ghafoor Grand City Surjani Town,	9

9.5 Information Disclosure

424. This ESIA, as well as the Urdu version of the Executive Summary, will be posted at the KWSSIP website. Aside from the website posting, these reports will also be available at the PIU office and site offices of KWSSIP. Reports will be made available in any location if required.

10 Grievance Redress Mechanism

425. This Section outlines the policy and procedure for documenting, addressing, responding and employing methods to resolve project grievances and complaints that may be raised by the project-affected population or community members arising from environmental and social performance, the engagement process, resettlement and/or unanticipated environmental or social impacts resulting from project activities that are performed and/or undertaken by PIU. The Section describes the scope and procedural steps and specifies roles and responsibilities of the parties involved in addressing the grievances.

426. A GRM is established to address any complaints or grievances arising during the implementation period of the projects. People of the project area may perceive risks to themselves or their property or their legal rights or have concerns about the possible adverse environmental and social impact that a project may have. Any concerns or grievances will be addressed quickly and transparently, and without retribution to the project-affected population or community members or complainant.

427. The primary principle of GRM is that all complaints or grievances are resolved as quickly as possible in a fair and transparent manner.

10.1 Objectives

428. The following are the objectives of the GRM:

- develop an organizational framework to address and resolve the grievances of individual(s) or community(s), fairly and equitably;
- provide enhanced level of satisfaction to the aggrieved;
- provide easy accessibility to the aggrieved/affected individual or community for immediate grievance redress;
- ensure that the targeted communities and individuals are treated fairly at all times;
- identify systemic flaws in the operational functions of the project and suggest corrective measures; and
- ensure sustainability of the project.

10.2 Type of Complaints

429. The major complaints that may arise during the execution of the proposed project at site include but not limited to:

- E&S issues (dust, noise, air pollution, social and cultural issues);
- Damage and blockage of public utilities;
- Traffic inconvenience;
- Gender based violence (GBV) and harassment;
- Resettlement issues including loss of livelihood; and
- Issues related to compensation of resettlement impacts.

10.3 Disclosure of GRM

430. The GRM shall be disclosed in PIU-KWSSIP, KWSC head office, and the KWSSIP website. Establishment of GRM and Grievance Redress Committees (GRCs) shall be

part of the proposed consultation framework to ensure that the individuals and communities are aware of an existing GRM.

10.4 Structure of GRM

431. A three-tier GRM composed of community GRC, sub-project GRC, and PIU-GRC. The organization of the GRCs is presented in Figure 10-1.

432. Gender representation will be ensured by inducting a female member in all GRCs. The mechanism will ensure the access of project-affected population or community members to a GRM that openly and transparently deals with the grievances and makes decision in consultation with all concerned that are consistent with the WB ESF requirements.

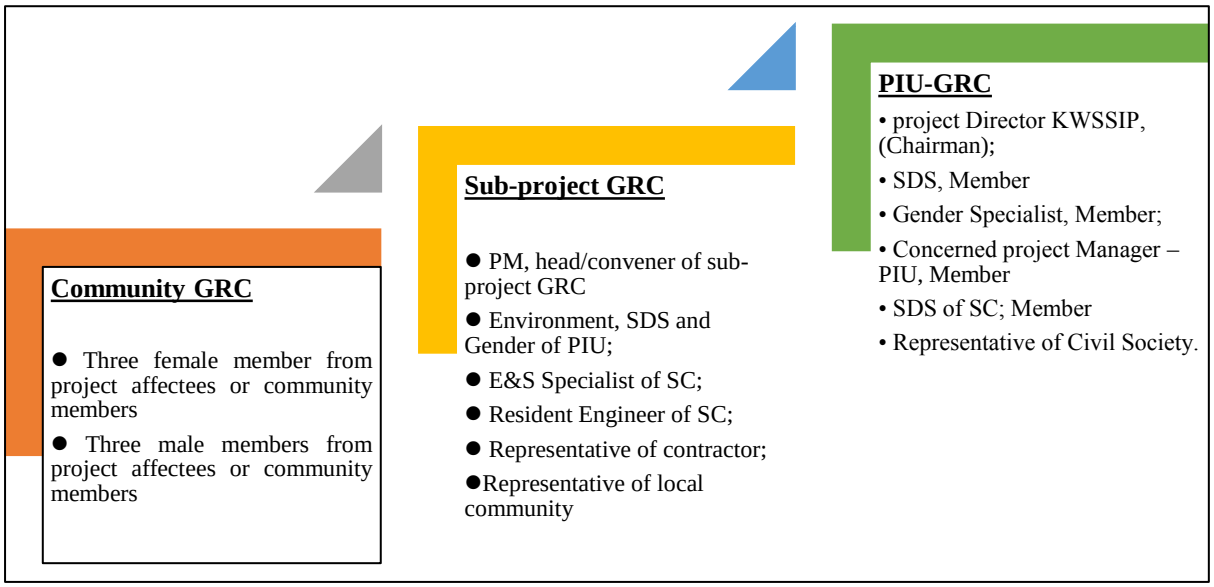

Figure 10-1: Organogram of GRC

10.4.1 Community GRC (Tier 1)

433. The community GRC shall provide a platform for project-affected people or communities to raise their concerns. Resettlement issues at the community level can also be resolved in this tier.

434. It is imperative to establish the community GRC to maintain a good rapport with the community. It will also provide a direct line of communication between the project management and the community members throughout the project implementation.

435. The social development specialist (SDS) of PIU with the assistance of SC will facilitate the establishment of community GRC, which shall be composed of three male and three female members from the project-affected communities.

436. The project E&S and engineering staff will coordinate with the community GRC to review and resolve issues and concerns, preferably within five working days upon receipt of grievances. Complaints that cannot be resolved at the community-GRC shall be forwarded to the next tier.

10.4.2 Sub-project GRC (Tier 2)

437. KWSSIP will constitute a GRC headed by the concerned Project Manager (PM) of each project site, including K-IV Augmentation Works, to resolve grievances that were not resolved by GRC Tier 1. The sub-project GRC will be composed of the following members:

- Project Manager (PM) as head of sub-project GRC;
- Environment, SDS and Gender specialists of PIU;
- E&S specialists of Supervision Consultant (SC)
- Resident Engineer of supervision consultant;
- A representative (E&S specialist) of contractor (if required); and
- A representative of local community.

438. Representatives from other district government departments may be contacted as required by the sub-project GRC. Environmental Specialists of PIU and SC will only join sub-project GRC meetings related to environmental issues.

439. The sub-project GRC shall meet once a month or when then need arises. Grievances involving all E&S issues, including resettlement issues, shall be reviewed. The sub-project GRC shall perform the following:

- Record, categorize, and prioritize grievances that need to be resolved by the committee and resolve them within ten (10) working days;
- Require aggrieved persons or parties to present evidence of their claims and;
- Communicate its decisions and recommendations on all resolved issues to PIU and the aggrieved persons;
- Forward the unresolved cases and complaints to PIU-GRC within an appropriate timeframe. Recommendations on unresolved cases must also be submitted to PIU-GRC;
- Develop an information dissemination system and provide updates to the aggrieved persons or parties regarding any developments on their grievance;
- Maintain a complaint register accessible to the project-affected community members with brief information about complaints and sub-project GRC decisions and status reports; and,
- Maintain records of all complaints received and corresponding actions taken by the sub-project GRC.

440. Any complaint that cannot be resolved by the sub-project GRC will be forwarded to the next tier – the PIU-GRC.

10.4.3 PIU-GRC (Tier 3)

441. The PIU has already constituted the PIU-GRC, which shall receive complaints that cannot be resolved in Tier 2. The committee is composed of the following:

- Project Director KWSSIP, (Chairman of PIU-GRC);

- SDS, Member
- Gender Specialist, Member;
- Concerned Project Manager – PIU, Member;
- SDS of SC, Member; and
- Representative of Civil Society.

442. Representatives from other district government departments may be invited when required. Environmental Specialists of PIU and SC will only join PIU-GRC meetings related to environmental issues.

443. The PIU-GRC, through the authorized representative, will hear the grievances of the complainant, review any records, explore possible solutions, and request any evidence from the complainant to support their claim. A filed visit may be conducted to validate the evidence and information presented. The PIU-GRC will give its decision within 20 working days upon receipt of the complaint. If the complainant is dissatisfied with the decision, the complaint may refer its grievance to the court of law.

10.4.4 Gender-Based Violence (GBV) Committee

444. Aside from the PIU-GRC, a GBV committee was also established within PIU. The GBV committee is composed of the following members:

- Concerned Project Manager, Head/ Convener of GBV Committee;
- Gender Expert, KWSSIP, Secretary; and
- SDS KWSSIP, Member.

445. GBV Committee will address the issues of GBV/SEA/SH that may have been caused by the project activities during resettlement and project implementation. Service providers and NGOs concerned will also be engaged if necessary.

10.5 Grievance Redress Procedure

446. The intention of GRM is to resolve a complaint as quickly and at as low a level as possible to avoid a minor issue becoming a significant grievance. Irrespective of the stage of the process, a complainant has the option to pursue the grievance through the court as is his/her legal right in accordance with law.

447. The GRCs will work at site, sub-project and PIU levels as described earlier. The E&S and engineering staff of PIU, in coordination with site staff will inform the project affected population and community members about the GRCs and its mechanism through consultations and by posting at prominent places. The complaints received through any media will be screened by type and category. These complaints will be registered in Community Complaints Register (CCR), where the name and address of complainant, date, description of complaint and action taken will be recorded. The following procedure will be used to redress the grievances:

- First, complaint resolution will be attempted to be addressed at community-GRC through the involvement of the field E&S/engineering staff. The community-GRC shall give decision within five working days of receipt of the complaint. If unsettled, grievance can be lodged to the sub-project GRC by the complainant or by the GRC;

- Sub-project GRC will acknowledge the receipt within two working days of lodging of complaint. Initial review and consultation with the sub-project GRC will be conducted within five working days of receipt of complaint. If required, sub-project GRC will advise the E&S/engineering specialists to conduct field visits in consultation with the aggrieved persons/parties and local community and submit a fact-finding report. Preferably, the fact finding will be completed within eight working days from receipt of complaints. sub-project GRC shall give decision within 10 working days of receipt of the complaint. If unresolved, a grievance will be lodged to the (PIU-GRC) by the complainant or by the GRC; and
- The PIU-GRC shall give decision within 20 working days of receipt of the complaint. If the complainant is still not satisfied, he/she can pursue further by submitting the case to the appropriate court of law.

448. All E&S issues will be dealt with according to the above GRM procedures. The GRCs will hear and clarify with the complainant (if required so) about the E&S issue and shall conclude and communicate their recommendations for further implementation in due course of time. Complainant will be kept informed during the process and the GRC decision will be communicated to him/her accordingly. In case of any delay, the complainant will be informed on the progress and process about his/her grievance. The GRC proceedings will be documented step by step and all records will be maintained and summarized in the project progress and internal monitoring reports.

10.5.1 Lodging of Complaints

449. Complainants may lodge their grievances through several channels, including online, mail, phone, WhatsApp, e-mail, and complaint boxes. Moreover, PIU has established an e-Portal for filing and tracking progress of complaints lodged online.

450. The PIU e-Portal is an application that may be used to lodge complaints. This will be accessible through a link provided on the PIU KWSSIP website. The e-Portal was made for easier and faster complaint lodging. Any project-affected person or community with access to the internet may use the e-Portal. Each complainant will receive a Grievance Number for easier tracking of their complaints. The complainants will be contacted to ensure that their issues are resolved. Additionally, the portal can differentiate types of complaints for targeted decision-making and action by PIU. The e-Portal allows monitoring of the entire complaint lodging and resolution process.

11 Institutional Arrangements

11.1 Institutional Setting and Implementation Arrangement

11.1.1 Institutional Arrangement for Implementation of ESMP during Pre-Construction Phase

451. The proposed project will be under the PIU of KWSSIP-2 during the pre-construction and design phase. The Project Director (PD) has the overall responsibility for the design and pre-construction requirements. The Project Manager of the proposed sub-project, along with the E&S Specialists of PIU will be responsible for the monitoring and compliance during pre-construction phase. The PIU staff will be responsible for the following:

a. Monitoring of environmental and social compliance during pre-construction;

b. Reporting the environmental and social compliance to PD, WB, and AIIB;

c. Assessment and mitigation of the long-term environmental and social impacts of the project; and,

d. Sustain a working partnership among the identified concerned agencies and departments.

11.1.2 Institutional Arrangements for Implementation of ESMP during Construction Phase

452. The key personnel involved during the construction phase are the PIU (proponent), SEPA, the supervision consultant, third-party environmental consultant (external monitoring), and the contractors. The organizational chart is presented in Figure 11-1.

453. The following staff will be involved in the implementation of ESMP:

a. PIU (PD) / Proponent / Employer;

b. PIU E&S Specialists;

c. Supervision consultant;

d. Third-party monitoring and evaluation consultant; and

e. Contractor's Staff.

454. The PIU KWSSIP-2 shall execute a contract with the contractor for the implementation of the ESMP and the conditions of the Environmental Permit issued by SEPA. Construction camps shall be established upon approval and submission of site-specific ESMPs.

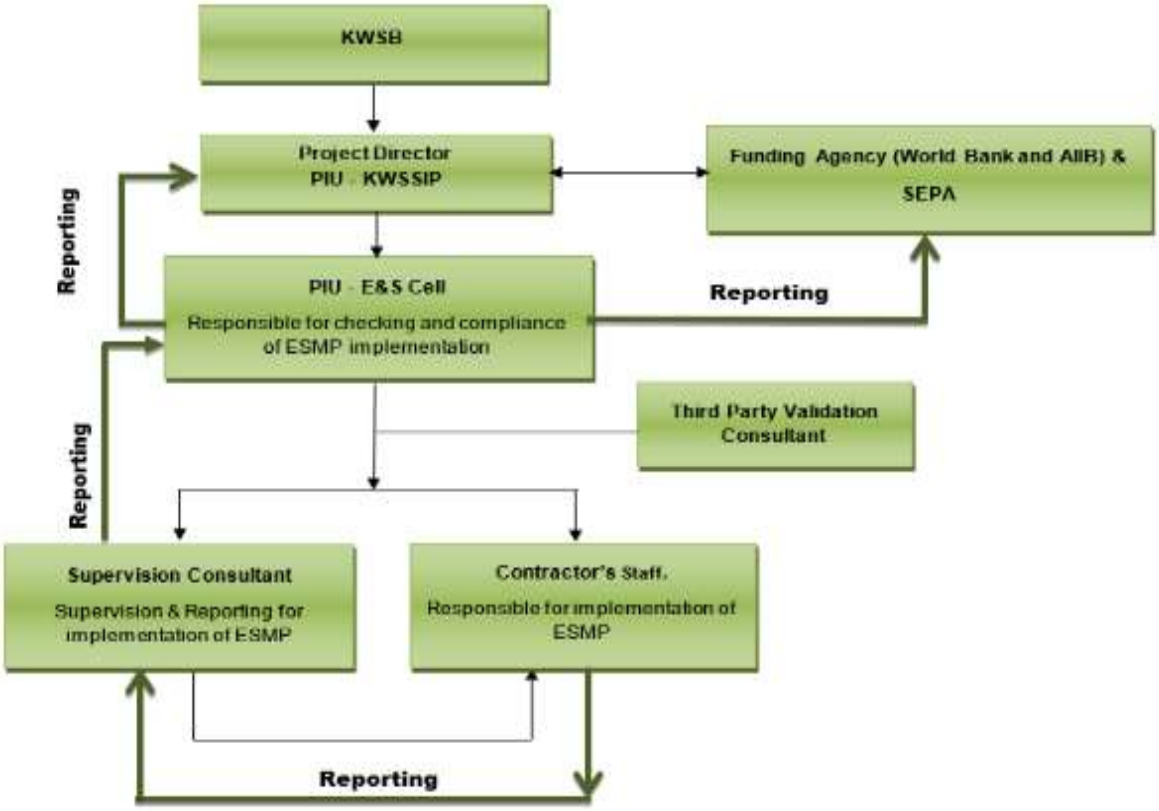

Figure 11-1: Organizational Setup for Implementation of ESMP at Construction Phase

Roles and Responsibilities

a) SEPA

455. According to the Sindh Environmental Protection Act (2014), SEPA is responsible for environmental protection and pollution control. Other responsibilities of SEPA include the approval of the EIA/ESIA and the IEE of all development projects under their jurisdiction. SEPA will undertake audits of the project activities, specifically the compliance to the protocols defined in the ESMP and environmental permits.

b) PIU (Project Director)

456. The PD of PIU is the executive head of the KWSSIP-2 Project, and is responsible for the policy, administrative, and financial decisions towards the effective and timely implementation of the project. The PD shall also be responsible for the overall implementation of the project, including the environmental and social management aspects and hiring of contractors and consultants.

c) Environment and Social Cell (ESC)

457. An ESC, which has already been established by the PIU, consists of five specialists: two environmental specialists, two social safeguards specialists, and one gender specialist. One OHS specialist, one gender officer, and four E&S officers will be engaged during the project implementation stage.

458. The ESC will be responsible for the overall implementation of the ESMP, RP, and other related requirements. The ESC shall ensure that the ESMPs are stipulated in the contract documents and shall supervise the implementation of the ESMP. The ESC shall conduct environmental and social monitoring and prepare compliance reports to be submitted to PD-PIU. The PIU shall acquire the services of an independent consultant for the third-party validation (TPV).

459. Other responsibilities of the ESC include:

- Provision of necessary environmental and social training to concerned staff;
- Ensure that all contractual obligations related to environmental and social compliance are met;
- Conduct regular site visits to monitor the environmental and social performance of the contractors;
- Monitor the status of ESMP implementation;
- Review monitoring reports on environment and social related activities;
- Ensure that the contractor implements relevant environmental and social measures suggested by the SC;
- Identify any corrective and preventive actions based on the monitoring reports;
- Assist in the assessment of livelihood loss and in negotiations with project-affected people;
- Assist in checking the validity of the property claims, and consult with the Revenue staff for prompt payment to the claimants;
- Assist contractor in facilitating payments of negotiated prices;
- Assist contractor in obtaining necessary approvals from concerned departments;
- Oversee the monitoring programs stipulated in the ESMP;
- Report to WB any incidents related to environmental and social aspect of the project;
- Liaise with other line departments and stakeholders; and,
- Report status of ESMP implementation to SEPA.

d) Third Party Validation

460. TPV shall be done by independent E&S specialists, who shall conduct field surveys to evaluate compliance to environmental and social requirements. Monitoring shall be conducted bi-annually and annually. They shall also evaluate the ESMP implementation and recommend any necessary changes.

461. Roles and responsibilities of third party environmental consultant will be:

- Conduct independent environmental and social monitoring at critical locations during the construction phase of the project;
- Monitor the implementation of ESMP at the project areas;
- Monitor GRM and resolution of complaints;
- Inform ESC, WB and AIIB of any significant environmental and social issues that may arise during construction;
- Observe and amend/prepare (if required) corrective action plans; and
- Monitor plan implementation along with project Implementation Consultant.

e) Supervision Consultant (SC)

462. The supervision consultant (SC) shall prepare monthly monitoring and evaluation reports, which shall be submitted to the ESC. In case of any non-compliance, the SC shall be authorized to halt construction activities and/or impose penalties according to the contract conditions.

463. The SC shall submit the final monitoring and evaluation reports to PIU as part of the periodic reporting mechanism. The PIU shall then submit these reports to WB for review and further action. The reports will also be submitted to SEPA, following the requirements stipulated on the environmental permit.

464. The roles and responsibilities of the SC shall include:

- Review and approval of the contractor's management plans;
- Supervise the contractor's compliance to the ESMP
- Ensure that the construction activities are carried out in an environmentally and socially sound and sustainable manner;
- Maintain close coordination with the contractor and ESC;
- Preparation and implementation of relevant training programs;
- Ensure the implementation of mitigation measures stipulated in the ESMP;
- Monitor environmental and social activities performed at the site;
- Organize periodic environmental and social training programs and workshops for the consultant and contractor staff;
- Periodic reporting as required in the ESMP; and,
- Suggest any additional mitigation measures, if required.

465. The E&S SC of the proposed project shall consist of the following personnel:

- E&S Team Leader: one specialist – M.Sc. in Environmental Engineering with more than 20 years of professional experience, worked in two implementation projects as SC.
- Environmental Specialist: one specialist – M.Sc. in Environmental Engineering with 10 years of professional experience, worked in one implementation project SC/
- OHS Specialist: one specialist – M.Sc. in Environmental Engineering with OHS Certification, 10 years of professional experience, worked in one implementation project as OHS – SC.
- Environmental Surveyors: two specialists – B.Sc. in Environmental Engineering with and three years of professional experience, worked in one implementation project SC.
- Social Safeguards Specialist: one specialist – M.Phil. in Sociology with 10 years of professional experience, worked on one implementation project SC.
- Gender Specialist: one specialist – M.Phil. in Sociology, Gender Study or equivalent with 10 years of professional experience, worked in one implementation project SC.

466. The same firm may qualify as SC for other sub-projects under KWSSIP-2. In such case, the above-mentioned staffing requirements will be applicable separately for each sub-project. The staffing requirement will be finalized alongside of the scope of SC.

f) Construction Contractor

467. Contractors shall appoint Environmental and Social Experts based in each site. The contractors shall implement measures to avoid or minimize adverse environmental and social impacts during construction. Contractors are required to prepare site-specific

ESMPs (SSESMP), which shall include actions to comply with the requirements of the ESMP prior to mobilization. The SSESMP shall be approved by the ESC and SC. The Environmental and Social Experts of the contractors shall conduct the following:

- Prepare SSESMP and obtain its approval from SC
- Implementation of the mitigation measures as detailed in the ESMP and SSESMP at each construction site;
- Contractors will be bound through contract to act on all the special and general provisions of the contract document;
- Provision of proper PPEs to the workers with corresponding training on proper use of PPE;
- Prepare and submit the monthly, quarterly, bi-annual, annual and final progress reports to SC;
- Immediate reporting of any environmentally and socially relevant accidents or incidents to the SC and ESC;
- Conduct the environmental and H&S training for workers and laborers; and,
- Coordinate with SC and ESC.

468. Each contractor is required to have qualified and experienced personnel as environmental, social, and OHS specialists. The following lists the personnel requirements:

- E&S Team Leader: one specialist – M.Sc. in Environmental Engineering with more than 10 years of professional experience in project implementation.
- Environmental Specialist: one specialist for each sub-project (Route-1, Route-2 and Route-3) – B.Sc. in Environmental Engineering with 5 years of professional experience in project implementation.
- OHS Specialist: one specialist for each construction site – B.Sc. in Environmental Engineering with OHS Certification and 5 years of professional experience in project implementation.
- Social Safeguard Specialist: one specialist for each sub-project (Route-1, Route-2 and Route-3) – M.Sc. in Sociology with 5 years of professional experience in project implementation.
- Medical Representative: one specialist for each sub-project (Route-1, Route-2 and Route-3) – Valid certificate/degree in first-aid and emergency medical treatment from Pakistan Safety Council approved Institution with 5 years of professional experience in project implementation site.

11.1.3 Institutional Arrangements for Implementation of ESMP during O&M Phase

469. The proposed K-IV Augmentation will be managed by the KWSC during the O&M phase. Based on the organizational hierarchy of KWSC, the Deputy Managing Director – Technical Services will be responsible for the O&M of water supply and sewerage infrastructure. The Chief Engineer of each district will be responsible for the utility services in each respective district.

470. Operation of the project will be under the direct jurisdiction of Engineers and Plant Managers, who shall also be responsible for the monitoring and compliance to the ESMP. The personnel will report the compliance and monitoring of ESMP to the DMDTS.

471. The staff will be responsible for the following:

- Coordination of environmental and social compliance monitoring;

- Supervisory and advisory roles on the progress of tree plantations along Route-1, Route-2, and Route-3;
- Report environmental and social compliance to the SEPA;
- Assess as well as mitigate any long-term environmental and social impacts of the proposed project operation; and
- Sustain a working partnership with the SEPA, Agriculture, Irrigation, Forest and Wildlife Departments of Sindh, NGOs, and other relevant public and private sector organizations.