Initial Environmental Examination

July 2017

PAK: Punjab Intermediate Cities Improvement Investment Project
Sahiwal City

Updated and revised by M J Edge from the initial draft prepared by the SaafConsult B.V., Netherlands, joint venture with Dev-Consult, Pakistan and NEC Consultants Private Limited, Pakistan, for the Asian Development Bank. This is the draft final version of the document originally posted in April 2017 available at https://www.adb.org/projects/documents/pak-46526-007-iee-0

Initial Environmental Examination

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PAK: Punjab Intermediate Cities Improvement Investment Program (PICIIP) – Sahiwal City

i) Water Supply Improvement
ii) Sewerage and Drainage Improvement
iii) Sewage Treatment Plant (STP)
iv) Urban Public Spaces Improvement

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ABBREVIATIONS

µg/m^3	Microgram per Cubic Meter
AAP	Asbestos Abatement Plan
AC	Asbestos Cement
ACM	Asbestos Containing Material
ACP	Asbestos Cement Pipe
ADB	Asian Development Bank
ADWF	Average Dry Weather Flow
AIR	Asbestos Investigation Report
AMF	Asbestos Management Framework
AMP	Asbestos Management Plan
AP	Affected Person
BOD	Biochemical Oxygen Demand
CAP	Corrective Action Plan
CCMR	Community Complaint Management Register
CDIA	Cities Development Initiative for Asia
CI	Cast Iron
CIU	City Implementation Unit
CO	Carbon monoxide gas
CO	Chief Officer
CO_2	Carbon dioxide gas
COD	Chemical Oxygen Demand
CPEC	China-Pakistan Economic Corridor
CPEMP	Construction Phase Environmental Mitigation Plan
CSO	Civil Society Organizations
CSP	Construction Safety Plan
DEO	District Environment Officer
DG	Director General
DH	Displaced Households
DMA	District Metering Areas
DMC	Developing Member Countries
DNI	Distribution Network Improvement
DO	Dissolved Oxygen
DP	Displaced Person
EA	Executing Agency
EHS	Environmental, Health and Safety
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
EPA	Environmental Protection Agency
EPD	Environmental Protection Department
ERP	Environmentally Responsible Procurement
FGD	Focus Group Discussion
FS	Feasibility Study
GI	Galvanized Iron
GIS	Geographic Information System
GoP	Government of Pakistan
GoPP	Government of Punjab Province
GRC	Grievance Redress Cell
GRM	Grievance Redress Mechanism
GRS	Grievance Redress System
GT	Grand Trunk
H_2S	Hydrogen Sulfide Gas
Ha	Hectare

HDPE	High Density Polyethylene
HSR	Hazardous Substance Rules
IA	Implementing Agency
IEE	Initial Environmental Examination
IFC	International Finance Corporation (World Bank Group)
IG	Imperial Gallon
ILO	International Labor Organization
ISO	International Standards Organization
km	Kilometer
LARP	Land Acquisition and Resettlement Plan
LBDC	Lower Bari Doab Canal
LED	Light Emitting Diode
LG&CDD	Local Government and Community Development Department
LGO	Local Government Ordinance
LHW	Lady Health Workers
LMQ	Lahore Multan Quetta
LPG	Liquid Petroleum Gas
m^3/d	Cubic meter per day
m^3/hr	Cubic meter per hour
M&E	Monitoring and Evaluation
MCU	Motor Control Unit
MGD	Million Gallon per Day
mg/l	Milligram per liter
mm	Millimeter
MO	Municipal Officer
MOU	Memorandum of Understanding
MPN	Most Probable Number
N_2	Nitrogen Gas
N5	National Highway 5
NEQS	National Environmental Quality Standards
NGO	Non-Government Organization
NH_3	Ammonia Gas
NO	Nitrogen Oxide Gas
NO_2	Nitrogen Dioxide Gas
NOC	No Objection Certificate
NOx	Oxides of Nitrogen
NRW	Non-Revenue Water
NSDWQ	National Standards for Drinking Water Quality
O&M	Operation and Maintenance
°C	Celsius Centigrade
O_3	Ozone
OHR	Over Head Reservoir
OHS	Occupational Health and Safety
PC	Public Consultation
PEPA	Pakistan Environmental Protection Act
PEQS	Punjab Environmental Quality Standard
PEQSAA	Punjab Environmental Quality Standard for Ambient Air
PFS	Pre-Feasibility Study
PICIIP	Punjab Intermediate Cities Improvement Investment Program
PM_{10}	Particulate Matter (Particle Size 10 micron)
$PM_{2.5}$	Particulate Matter (Particle Size 2.5 micron)
PMU	Project Management Unit
PPE	Personal Protective Equipment
PTA	Provincial Transport Authority
PVC	Poly Vinyl Chloride

REA	Rapid Environmental Assessment
RH	Relative Humidity
RTA	Regional Transport Authority
SCADA	Supervisory Control and Data Acquisition
SLCCI	Sahiwal Chamber of Commerce and Industry
SMC	Sahiwal Municipal Corporation
SO_2	Sulfur Dioxide Gas
SPS	Safeguard Policy Statement
STP	Sewage Treatment Plant
SUSC	Sahiwal Urban Services Company
SWSC	Sahiwal Water and Sanitation Company
TDS	Total Dissolved Solids
TMA	Tehsil Municipal Authority
TMO	Tehsil Municipal Officer
TO	Tehsil Officer
TOC	Total Organic Compound
TSPM	Total Suspended Particulate Matter
TSS	Total Suspended Solids
UC	Union Council
VESC	Valued Environmental and Social Component
WDM	Water Distribution Main
WHO	World Health Organization

Local Terminology

Chak:	Village
Koel:	Cuckoo
Nullah:	Natural water body, drain

Units

1 Marla	= 225 square feet	= 0.005165 acres
1 Square foot		= 0.0929 square meters
1 Acre	= 43,560 square feet	= 0.404685642 hectares
1 Square meter	= 10.76391 square feet	= 0.0002471 acres
1 Hectare	= 2.4710538 acres	= 10,000 square metres
1 Inch	= 25.4 mm	= 2.54 cm
1 Mile	= 5,280 feet	= 1.609344 kilometres
1 Kilometer	= 0.62137 miles	= 3,280.84 feet
1 Gallon (Imperial)	= 4.54609 liters	= 0.0045461 cubic metres
1 Cubic meter	= 1,000 liters	= 219.96925 gallon (imperial)
1 Cubic meter/second	= 3,600 cubic meters/hour	= 35.31467 cusec
1 Cusec		= 101.941 cubic meters/hour

CURRENCY EQUIVALENTS

(as of 15 March 2017)

Currency unit	–	Pakistan rupee/s (PRe/PRs)
PRs1.00	=	$0.0095
$1.00	=	PRs104.845

EXECUTIVE SUMMARY

A. Introduction

1. The Asian Development Bank (ADB) and the Cities Development Initiative for Asia (CDIA) are partnering with the Government of Punjab Province (GoPP), to undertake the Punjab Intermediate Cities Improvement Program (PICIIP). The PICIIP aims to improve the quality of urban services available in selected cities in Punjab Province (city populations between 250,000 and 1,000,000). The duration of the program will be six years. The PICIIP's overall budget is US$500 million, to be disbursed in two phases. The first phase will fund investments in the intermediate cities of Sialkot and Sahiwal.

2. Urban infrastructure development is an important component of the PICIIP. Major projects planned for Sahiwal City in Phase 1 of PICIIP are:

Sector	Sub-Projects
Water Supply	Rehabilitation of 19 No. existing tube wells
	Provision of 12 No. new Overhead Reservoirs
	Replacement of approximately 78 km water supply pipelines
	Provision of 8 No. new tube wells and pumps
	Provision of bulk metering, pressure gauges and Supervisory Control and Data Acquisition (SCADA) system at selected water production facilities
	Development of Distribution Network Improvement (DNI) zones and Non-Revenue Water (NRW) program in selected zones
	Installation of 6,400 postpaid and 600 prepaid water meters
Sewerage and Drainage	Rehabilitation of 10 No. existing disposal and pumping stations
	Replacement of 13 km sewers, including unblocking of local drains
	Provision of accessories for sewerage improvement and health and safety equipment for municipal staff
	Construction of trunk mains and gravity lines
	Construction of centralized sewage treatment plant
Urban Public Spaces	Railway Road improvement/upgrades (3 km length)
	General bus stand, improvement/upgradation (2 No.)
	Rehabilitation of 6 No. parks
	Upgrading and beautification of 2 No. greenbelts

3. This IEE study examines the environmental implications of the above subprojects.

B. Policy, Legal and Administrative Framework

4. All subprojects undertaken as part of PICIIP were screened, classified and assessed based on ADB's Safeguard Policy Statement (SPS) 2009, and GoPP environmental legislation. The proposed subprojects fall within the jurisdiction of the Environment Protection Department (EPD) of the Environmental Protection Agency (EPA), Punjab.

5. As per EPD EIA/IEE regulations, none of the water supply, sewerage and drainage, and urban public services (transport and green space) improvement subprojects fall under Schedule I or Schedule II of the Provincial Regulations, with the exception of the STP. Accordingly, as per local regulations, only the STP subproject under PICIIP in Sahiwal require an EIA or an IEE.

6. Based upon the Rapid Environmental Assessments (REAs) conducted at the commencement of the environmental assessment (refer to Annexure 1), one or more of the subprojects to be implemented in Sahiwal during Phase 1 of PICIIP have been classified as Category B. Accordingly, ADB require that an IEE is prepared covering all of the subprojects proposed in Sahiwal under PICIIP (Phase 1).

C. Environmental and Social Baseline Conditions

7. Sahiwal City is situated at a distance of about 18 miles from the left bank of the river Ravi, 187 km west of Lahore and 200 km east of Multan.

8. Sahiwal District's topography is a flat, remarkably homogeneous, semi-arid plain. The only noticeable relief is that of flood plain bluffs and belts of ravines and badland formed by gully erosion along the Lower Bari Doab and its distributaries. Generally, the natural slope is northeast to southwest. Geologically, the area does not have any outstanding features. Saltpeter, which is made from saline earth called kallar, is found where the water table is high.

9. The climate is semi-arid, and shares the basic natural and climate conditions that prevail elsewhere in Punjab. The climate is characterized by four district seasons: winter from mid-November to February; spring during mid-March and April; summer from May to mid-September; and autumn from mid-September to mid-November. Average annual rainfall ranges between 97 mm and 261 mm. The maximum rainfall (about 60% of the total annual rainfall) occurs during the monsoon season (July, August and September), while the period of minimum rainfall or drier period is October and November. The months of July, August and September are the most humid months in the area, whereas May and June are the least humid months.

10. Agriculture is supported through extensive canal irrigation. The Lower Bari Doab canal is the main source of irrigation in the area and it is fed by a link from the Chenab River.

11. The main source of domestic water is groundwater, which is abstracted through deep well turbines.

12. Sewage is conveyed through sewer lines and disposed of through minor and major disposal stations into the nullahs (surface water courses) and also used by farmers for irrigation.

13. There are no protected areas and no endangered species of either plants or animals at any of the project sites.

14. Agriculture is by far the main economic activity in the project area. The main crops during Rabi[1] are wheat, gram, rape, mustard, barley and oil seeds. In Kharif, cotton, jawar, sugarcane, bajra, maize and rice are grown. In addition, there are subsidiary crops known as Zaid Rabi (Kharbooza, tobacco and potatoes) and Zaid Kharif (potatoes and chilies).

[1] Rabi crops or Rabi harvest refers to agricultural crops sown in autumn and harvested in the winter season. Kharif crops are grown in the rainy season.

15. The main fruits grown are oranges, water and musk melon, guava, citrus, falsa, jaman and pomegranate. In the beginning of the cultivation era the inhabitants used to eat Pilu and Bair, the only wild fruits that grow intermittently. With the introduction of canal irrigation other fruits are being grown on a commercial basis.

16. Wheat, cotton, sugarcane and rice are the major crops.

17. Vegetables are grown in abundance as the water and soils are suitable for cultivation. Potato, carrot, lady finger, chilies, onion and cauliflowers are grown. Bitter gourd, turmeric and garlic are grown to meet public demand. Other vegetables i.e. radish, tinda (apple gourd), and bringal are also grown.

18. Livestock breeding is one of the main pursuits and means of livelihood for the rural and urban population of the project site. Sheep, goats and cows are common livestock animals and serve as an important source of income.

19. Sahiwal District had an estimated population of 2.37 million in 2014 which, if projected to 2035 at the provincial average growth rate of 1.93%, will result in a District population of 3.5 million. Of the current 2.37 million, an estimated 1 million (42%) is urban.

20. There are more than 200 industries in Sahiwal District. There are three industrial sites in the city area. Sahiwal has a number of higher secondary educational institutes and health facilities.

D. Potential Environmental Impacts and Mitigation

21. The potential environmental impacts of the proposed subprojects are summarized below. The majority of the proposed interventions relate to construction of new infrastructure, such as the STP, new trunk mains and new overhead reservoirs or the refurbishment and rehabilitation of existing water supply systems, existing sewerage systems and the rehabilitation and upgrading of urban public spaces.

22. The permanent footprint of the work is very limited and within existing developed land takes and utility corridors. The only proposed works on any greenfield site is the construction of the STP and the associated trunk mains.

Sector	Sub-Projects	Potential Environmental Issue
Water Supply	Rehabilitation of 19 No. existing tube wells	Construction noise and dust Traffic – construction materials Disruption in water supply Waste management Fuel spills and diesel storage
	Provision of 12 No. new Overhead Reservoirs	Construction noise and dust Traffic – construction materials Disruption in water supply Waste management Fuel spills and diesel storage
	Replacement of approximately 78 km water supply pipelines	Disruption of access to business and homes Public and worker safety issues Construction noise and dust Traffic – construction materials Release of mal-odors and gasses Disruption in water supply

Sector	Sub-Projects	Potential Environmental Issue
		Waste management Asbestos waste (asbestos cement pipes) Disruption in other utilities Disposal of silt and spoil Fuel spills and diesel storage
	Provision of 8 No. new tube wells and pumps	Construction noise and dust Traffic – construction materials Waste management Fuel spills and diesel storage
	Provision of bulk metering, pressure gauges and Supervisory Control and Data Acquisition (SCADA) system at selected water production facilities	Construction noise and dust
	Development of Distribution Network Improvement (DNI) zones and Non-Revenue Water (NRW) program in selected zones	Disruption of access to homes
	Installation of 6,400 postpaid and 600 prepaid water meters	Construction noise and dust Disruption of access to homes
Sewerage and Drainage	Rehabilitation of 10 No. disposal/pumping stations	Construction noise and dust Traffic – construction materials Release of mal-odors and gasses Disposal of silt and spoil Fuel spills and diesel storage
	Replacement of 13 km sewers, including unblocking of local drains	Disruption of access to business and homes Public and worker safety issues Construction noise and dust Traffic – construction materials Release of mal-odors and gasses Waste management Asbestos waste (asbestos cement pipes) Disruption in other utilities Disposal of silt and spoil Fuel spills and diesel storage
	Provision of accessories for sewerage improvement and health and safety equipment for municipal staff	No anticipated impact
	Construction of trunk mains and gravity lines	Disruption of access to business and homes Public and worker safety issues Construction noise and dust Traffic – construction materials Waste management Disruption in other utilities Disposal of silt and spoil Fuel spills and diesel storage
	Construction of centralized sewage treatment plant	Permanent loss of productive agricultural land Public and worker safety issues Construction noise and dust Traffic – construction materials Waste management

Sector	Sub-Projects	Potential Environmental Issue
		Disposal of silt and spoil Fuel spills and diesel storage
Urban Public Spaces	Railway Road improvement/upgrades (3 km length)	Disruption of access to business Temporary relocation of vendors and hawkers Public and worker safety issues Traffic disruption Construction noise and dust Waste management Disruption in other utilities Disposal of silt and spoil Fuel spills and diesel storage
	Main Bus Terminals (2 No.), improvement/upgradation	Disruption of access to business Temporary relocation of vendors and hawkers Public and worker safety issues Traffic disruption Construction noise and dust Waste management Disruption in other utilities Disposal of silt and spoil Fuel spills and diesel storage
	Rehabilitation of 6 No. parks	Public and worker safety issues Traffic disruption Construction noise and dust Waste management Disposal of silt and spoil Fuel spills and diesel storage
	Upgrading and beautification of 2 No. greenbelts	Public and worker safety issues Traffic disruption Construction noise and dust Waste management Disposal of silt and spoil Fuel spills and diesel storage

23. The potential environmental impacts during the construction phase include air pollution due to dust generation from excavation, transportation, mixing of construction materials, disposal of construction waste, vehicular emissions, soil, water and air pollution due to disposal of construction and domestic waste, noise impacts due to movement of vehicles, construction machines and construction activities, traffic congestion due to increased volume of traffic at roads and due to road blockage for construction, soil and water pollution due to generation of sanitary wastewater from workers' camps, and health and safety concerns for the workers.

24. The potential environmental impacts during the operational phase impacts include health impacts from mishandling and storage of liquid chlorine at water supply facilities, contamination of water reservoirs from algal growth and a range of potential environmental impacts if the STP is not managed properly. These potential impacts could include noise, dust and odor impacts to adjacent communities, as well as health and safety issues for plant staff.

25. The nature of the anticipated environmental impacts will be localized and temporary and reversible in nature, that is the impact is limited to the time of construction activity. No longer

term or irreversible impacts are foreseen except for the loss of a small parcel of agricultural land required for the development of the STP.

26. The potential environmental impacts during the construction phase can be readily managed through the implementation of appropriate mitigation measures set out in a Construction Phase Environmental Management plan (CPEMP) and by way of overall supervision by the Sahiwal Municipal Corporation (SMC).

27. The staff of the SMC will require training on the implementation of the EMP during the construction and operational phases of the project. The SMC will require the assistance of the Project Management Unit (PMU) and City Implementation Unit (CIU) Safeguard specialists for environmental training, implementing the EMP, compliance against EMP and generation of compliance reports.

28. A comprehensive EMP has been prepared in this IEE for the subprojects. It includes actions proposed for mitigation of negative impacts and effective monitoring of the implementation of proposed mitigation measures during construction and operational phases. The construction specific CPEMP will be prepared in the light of EMP and will be made part of the contract document for contractors. The contractors will be responsible for implementation of mitigation and monitoring measures. The SMC will also carry out external monitoring.

29. The following cumulative and induced impacts may occur as a result of project implementation:

    - Continued depletion of the groundwater table resulting from increased groundwater abstraction, as a consequence of improving the service provision (objective of 24/7 service supply). The significance of further depletion by enhanced abstraction is assessed to be low in the short-term, providing opportunities are explored for securing alternative potable water supplies in the long-term;
    - Increased water supply is likely to lead to an increase in sewage flow and sullage (wastewater from cooking and washing). This will, however, to be accommodated by the construction of a centralized sewage treatment plant;
    - Improvements to the bus terminal will increase the opportunities for commercial activities therein. In the context of Sahiwal, however, the increase in commercial activities is deemed to be insignificant; and
    - Enhanced traffic flows as a consequence of road improvements may result in increases in vehicle emissions to air, potentially resulting in a deterioration to urban air quality along main transport routes. This impact is, however, assessed to be insignificant given that it is offset by reductions in vehicle emissions consequent upon a reduction in traffic congestion.

30. As noted above the majority of construction projects will give rise to a number of impacts on environmental resources. Subprojects under Phase 1 of PICIIP are no exception; however, the great majority of the impacts are assessed to be temporary (short-term) and reversible, resulting in no discernible impact in the longer-term if the subprojects are implemented in accordance with an agreed and approved EMP.

31. The only exception is the permanent loss of agricultural land associated with the acquisition of a site for the STP. The land take is relatively small (of the order of 10 acres). Any adverse impacts of this will be addressed through compensation to affected parties as set out in the Land Acquisition and Resettlement Plan.

32. By comparison, there are a number of positive impacts arising from project proposals that are deemed to have a significant long-term benefit to the local community with access to the improved urban services. These positive impacts include:

- Enhanced and continuous supply of potable water;
- Improved quality of potable water, including increased provision of disinfection;
- Reduction in the occurrence of water borne diseases through a reduction in the potential for contamination of water supply lines, increased disinfection and removal of potential breeding areas for insects (areas of stagnant water) by redevelopment of public open spaces;
- Conveyance of wastewater to a centralized sewage treatment plant through rehabilitation of the sewer lines. There will be a significant reduction in the discharge of untreated wastewater to ground within urbanized areas;
- Reduction in traffic congestion, traffic conflicts and vehicle emissions to air;
- Improved public amenity in the main bus terminals; and
- Provision of recreational facilities in the City and overall enhancement of the aesthetics of public open spaces.

E. Public Consultations

33. Public consultations have been carried out at three stages:

- during the initial formulation of project proposals in the Pre-Feasibility Study;
- during the development of project proposals in the Feasibility Study, as part of the preparation of the IEE. Concerns expressed by stakeholders at this stage have been incorporated into final project design; and
- at the completion of the draft IEE, to inform stakeholders of the project components, the anticipated environmental impacts, proposed measures to mitigate these impacts and the scope and content of the preliminary EMP.

34. The Public Consultations have revealed that the overwhelming majority of stakeholders are in favor of, and supportive of, the proposed projects, due to many challenges experienced in the city with respect to water supply, sanitation and transportation services. Possible socioeconomic impacts are both positive and negative. Positive impacts include the creation of job opportunities for local people and provision of safe, continuous supply of services.

F. Conclusion and Recommendations

35. The water supply, sewerage, transport route improvements, and green spaces development projects proposed under PICIIP are feasible and sustainable from engineering, environmental, and socio-economic points of view.

36. The positive environmental and social benefits of the projects far outweigh any temporary, short-term potential negative impacts that might occur, primarily during construction stage activities.

37. Implementation of the EMP is required and the environmental impacts associated with the subprojects need to be properly mitigated. Existing institutional arrangements are available for the implementation of the EMP. Additional human and financial resources will be required by the SMC to comply with environmental safeguard requirements. The proposed mitigation and management plans are practicable but require additional resources.

I. INTRODUCTION

A. The Subprojects

38. In its Mid-Term Development Framework 2013-2016, the Government of Punjab Province (GoPP) included an urban sector development strategy, comprising 106 urban projects involving a variety of physical and nonphysical investments.

39. As part of the Mid-Term Development Framework implementation, GoPP requested the Asian Development Bank (ADB) and Cities Development Initiative for Asia (CDIA) to undertake a comprehensive urban sector assessment[2], the precursor to the Punjab Intermediate Cities Improvement Investment Program (PICIIP).

40. One key challenge identified in the urban sector assessment was the deficiency in adequate urban infrastructure which, despite various efforts by the government, has not been able to keep pace with the rapid population growth. Access to clean water, basic sanitation facilities, and good hygiene practices are essential for sustainable urban development. Without these basic services, the lives of millions of people, children in particular, are at risk.

41. The urban sector assessment identified improvements of water supply and sanitation services, as well as street management, as top priorities for making Punjab cities more livable and sustainable.

42. The PICIIP aims to improve the quality of urban services available in five selected cities in Punjab Province, the most populous province in Pakistan, with city populations ranging between 250,000 and 1,000,000. Five intermediate cities (Sahiwal, Sialkot, Sargodha, Rahim Yar Khan and Bahawalpur) have been proposed for inclusion in PICIIP because of their proximity to the China-Pakistan Economic Corridor, which provides economic opportunities for increased trade and regional cooperation, and because they encompass a mix of socio-economic growth models, ranging from well-established industrial cities to cities that grew embryonically from rural marketing centers to major service centers.

43. The duration of the program will be six years. The PICIIP's overall budget is US$500 million, to be disbursed in phases.

44. Phase 1 of PICIIP will fund investments in the intermediate cities of Sialkot and Sahiwal.

B. Subprojects Identified for Implementation in Sahiwal City

45. Urban infrastructure development is an important component of the PICIIP. Sectors identified during urban sector assessment (prefeasibility study) conducted in April 2016, for investment during Phase 1 of PICIIP, are water supply improvement, sewerage and drainage improvement, and improvements to urban public spaces, including transport routes and green spaces.

46. Work undertaken during the Feasibility Study has focused on the following main projects:

[2] *Medium Term Integrated Climate Resilient Urban Infrastructure Investment Program and Pre-Feasibility Study.* ADB, Manila. 2016

Water Supply Improvement Project: Rehabilitation of water supply tube wells, overhead reservoirs and water distribution pipelines will be carried out at different parts of the city. These projects will improve the water quality and water supply situation in the city. In some locations, new water supply infrastructure will also be installed. Implementation of a new Supervisory Control and Data Acquisition (SCADA) system and bulk metering of water supply will also be the part of water supply improvement project.

Sewerage and Drainage Improvement Project: Rehabilitation of sewerage and drainage network and disposal stations will be carried out throughout different parts of the city. The existing sewers will be replaced in some locations. In some places, the sewerage system will be extended and a trunk sewer will be constructed. The construction of a Sewage Treatment Plant (STP) will also be part of the sewerage and drainage improvement project. The purpose of the STP is to protect the environment and the health of the people by treating the wastewater, of Sahiwal city, at a combined effluent treatment plant prior to its disposal into the area's natural water bodies.

Urban Public Spaces Improvement Project: Improvements and upgrades to a 3 km length of Railway Road and two general bus stands will be carried out under this part of the project. In addition, rehabilitation and upgrading of six existing parks and provision of green belts in different parts of the city will be the green spaces development projects.

47. The sub-projects to be implemented in Phase 1 of PICIIP for Sahiwal City are summarized on Table 1.1, whilst an overview of the subproject components is illustrated on Figure 1.1. Further details of each of the sub-projects are provided in Section 3.

48. This Initial Environmental Examination (IEE) examines the environmental implications of the subprojects proposed for Sahiwal itemized on Table 1.1. A separate IEE examines the environmental implications of the subprojects proposed for Sialkot City.

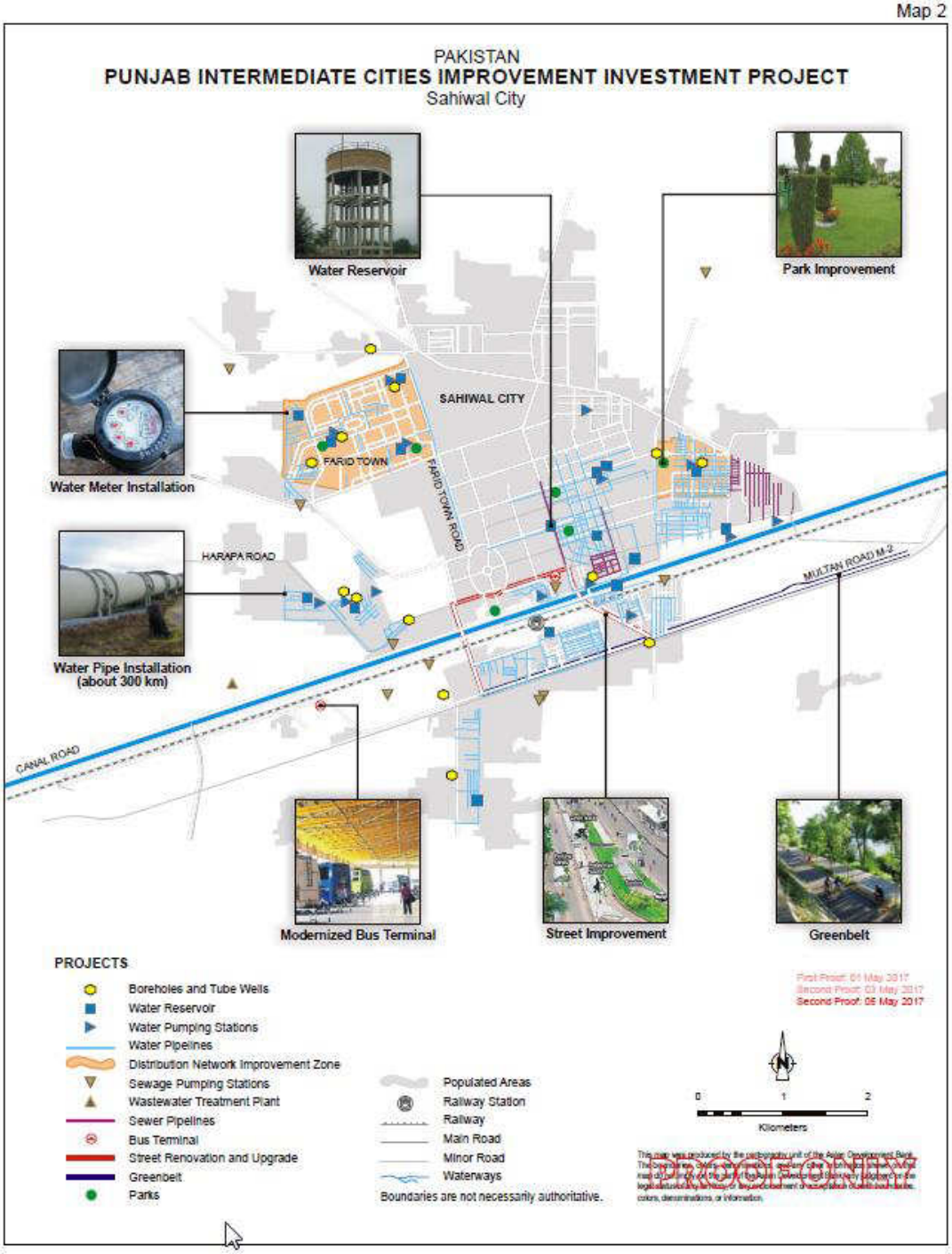
Table 1.1: Phase 1 Subprojects for Sahiwal City under PICIIP

Sector	Sub-Projects
Water Supply	Construction of new overhead reservoirs (12 No.)
	Efficiency improvement of 19 No. tube wells
	Construction of new pumping stations (8 No.)
	Rehabilitation of existing tube wells (19 No.)
	Replacement of approximately 78 km water supply pipelines
	Provision of disinfection units at tube wells and overhead reservoirs
	Provision of bulk metering, pressure gauges and Supervisory Control and Data Acquisition (SCADA) system at selected water production facilities
	Development of Distribution Network Improvement (DNI) zones and Non-Revenue Water (NRW) program in selected zones
Sewerage and Drainage	Replacement of 12.5 km sewers, including unblocking local drains
	Construction of Sewage Treatment Plant
	Installation of gravity trunk main from 4 disposal stations to STP

Sector	Sub-Projects
	Provision of accessories for sewerage improvement and health and safety equipment for municipal staff
	Rehabilitation of 4 major & 6 minor pumping and disposal stations
Urban Public Spaces	Railway Road improvement/upgrades (3 km length)
	General bus stand, improvement/upgradation (2 No.)
	Rehabilitation of existing parks (6 No.)
	Upgrading of existing green belting along canal (2 No.)

Figure 1.1: Overview of Subproject Components, Sahiwal

Map 2



C. Scope of the IEE

49. The ADB requires the consideration of environmental issues in all aspects of the Bank's operations. The requirements for environmental assessment are described in the ADB's Safeguard Policy Statement (SPS), 2009. Further details are provided in Section 2 of this IEE report.

50. The objectives of this IEE were to:

i) Assess the existing environmental conditions in the areas where the subprojects are located, including the identification of any environmentally sensitive areas;

ii) Describe and assess the proposed activities, identify and evaluate the potential impacts and assess their significance; and

iii) Propose appropriate mitigation measures that can be incorporated into the development activities to minimize any adverse impacts, whilst ensuring that any residual impacts, if any, are acceptable and monitored adequately.

51. This IEE was carried out based on the Prefeasibility Study (PFS) undertaken in 2016 and conceptual engineering designs prepared during the current Feasibility Study (FS) stage of PICIIP. It is anticipated that the IEE may be updated, as required, during the project's implementation stage in order to reflect any modifications arising from finalization of sub-project designs.

52. An environmental assessment using ADB's Rapid Environmental Assessment (REA) checklists for urban development, sewerage and water supply was conducted during the initial stages of this IEE. The REAs are reproduced in Annexure 1 and indicate that the proposed sub-projects are considered unlikely to cause any significant long-term, irreversible, adverse impacts (refer to Annexure 1).

53. The environmental assessment requirements of the Punjab Environmental Protection Act, 1997 (Amended 2012) vary from the requirements of the ADB. The Government of Punjab's environmental regulations categorize development projects into two schedules, according to their anticipated potential environmental impact. Projects with the potential for more adverse environmental impacts (as per Schedule II of the Act) are required to be assessed through an Environmental Impact Assessment (EIA), whilst those projects falling within Schedule I of the Act require only an IEE.

54. The sub-projects proposed for Sahiwal City under Phase 1 of PICIIP, with the possible exception of the Sewage Treatment Plant, do not fall within either Schedule I or Schedule II of the Punjab Environmental Protection Act, 1997 (Amended 2012) and, therefore, require neither an IEE or an EIA under current Pakistan legislation.

55. Notwithstanding local requirements, based upon the REAs, the proposed sub-projects have been classified as Category B (environment) as per ADB's SPS (2009). An IEE has, therefore, been prepared in accordance with ADB SPS's requirements for environment category B projects. The IEE provides mitigation and monitoring measures in order to ensure no significant adverse impacts as a result of the implementation of the subprojects.

56. Field studies were undertaken by a team experienced in conducting environmental assessments of development projects in Pakistan. This team conducted the preliminary scoping, survey and assessment activities, public consultations and coordinated the field sampling and analysis.

57. The study process began with scoping and field reconnaissance during which the REAs were prepared as a basis for establishing the potential impacts and categorization of project activities. The potential environmental impacts and concerns requiring further study in the IEE were then identified and the methodology elaborated in order to address all interests. Subsequently, both primary and secondary baseline environmental data were collected from the locations of the proposed works and the intensity and likely location of potential impacts assessed in relation to environmentally sensitive receivers based on the work expected to be carried out. The significance of impacts from the construction and operation of the projects was then assessed and, for those impacts requiring mitigation, measures were proposed to reduce impacts to within acceptable limits.

58. Public Consultations (PCs) have been carried out during both the PFS and FS stages in line with ADB guidelines. Under ADB requirements the environmental assessment process must also include meaningful public consultation during the completion of the draft IEE. To this end, a PC workshop has been held with interested stakeholders following completion of the initial draft IEE. The PC process included verbal disclosure of the subproject as a vehicle for discussion. Interviews were conducted with local families and communities. The results of these PCs have been included in this report.

D. Implementation Arrangements

59. The Local Government and Community Development Department (LG&CDD) of Punjab will be the executing agency (EA) of the project. A Project Management Unit (PMU) has been established to support LG&CDD. Under the guidance of the Project Steering Committee, LG&CDD will be responsible for the overall execution of the project.

60. The Sahiwal Municipal Corporation (SMC), under the City Government of Sahiwal, will be the implementing agency of the proposed projects. A City Implementation Unit (CIU) has been established to support SMC in day to day project implementation.

61. Consultants will be engaged to assist with project implementation, audit monitoring, and institutional strengthening.

62. A new urban services company in Sahiwal will operate and maintain the urban services.

63. The executive branch of SMC is divided into five departments and a Municipal Officer (MO) heads each of the departments (Finance, Planning and Coordination, Regulation, Infrastructure and Services) to carry out its functions.

64. The MO Infrastructure and MO Services are responsible for water, sewerage, drainage, sanitation, roads, streets and street lighting, firefighting and park services.

E. Structure of Report

65. This IEE reviews information on existing environmental attributes of the study area. Geological, hydrological and ecological features, air quality, noise, water quality, soils, social and economic aspects and cultural resources are included.

66. The report assesses the probable impacts on the environment due to the proposed subproject.

67. This IEE also proposes various environmental management measures.

68. Details of all background environmental quality, environmental impact/pollutant generating activities, pollution sources, assessed environmental quality and related aspects have been provided in this report. References are presented at the end of the report.

69. Following this Introduction, the report generally follows ADB guidelines and includes:

- Policy, Legal and Administrative Framework;
- Description of the Subprojects;
- Description of the Environment;
- Assessment of Potential Environmental Impacts and Mitigation Measures;
- Assessment of Alternatives to the proposed sub-projects;

- Institutional Arrangements and Environmental Management and Monitoring Plans;
- Information Disclosure, Public Consultation and Participation;
- Findings and Recommendations; and
- Conclusions.

II. POLICY, LEGAL, AND ADMINISTRATIVE FRAMEWORK

70. Several statutes contain direct legislation on environmental protection in Pakistan, namely the Pakistan Environmental Protection Act (1997), the Punjab Environmental Protection (Amendment) Act (2012), the Forest Act (1927), and the Punjab Wildlife Act (1974). In addition, the Land Acquisition Act (1894) also provides powers in respect of land acquisition for public purposes. There are also several other items of legislation and regulations that have an indirect bearing on the sub-projects or general environmental measures.

A. Statutory Framework

71. The Constitution of Pakistan distributes legislative powers between the federal and provincial governments through two 'lists' that are attached to the Constitution as Schedules. The Federal List covers the jurisdictions over which the federal government has exclusive legislative power, while the Concurrent List contains jurisdictions over which both the federal and provincial governments can enact laws.

72. "Environmental pollution and ecology" is included in the Concurrent List; hence, both the federal and the provincial governments can enact laws in this jurisdiction. However, to date, after the 18th Constitutional Amendment, the Federal Ministry of Environment was dissolved and the provincial governments are now authorized to formulate environmental laws and regulations. The key environmental laws affecting the subprojects are discussed below.

i. Pakistan Environmental Protection Act, 1997

73. The Pakistan Environmental Protection Act, 1997 (PEPA) is the basic legislative tool empowering the government to frame regulations for the protection of the environment. The act is applicable to a wide range of issues and extends to air, water, soil, marine, and noise pollution, and to the handling of hazardous wastes. The key features of the law, in as far as it has a direct bearing on the proposed subprojects, relate to the provisions setting out any requirement for an IEE and an EIA for development subprojects. Section 12 (1) requires that: "No proponent of a sub-project shall commence construction or operation unless he has filed with the Federal Agency an Initial Environmental Examination (IEE) or, where the subproject is likely to cause an adverse environmental effect, an Environmental Impact Assessment (EIA), and has obtained from the Federal Agency approval in respect thereof." The Pakistan Environmental Protection Agency (EPA) has delegated the power of review and approval of environmental assessments to the provincial environmental protection agencies, in this case the Punjab EPA.

ii. Punjab Environmental Protection (Amendment) Act, 2012

74. After the 18th Constitutional Amendment in the Constitution of Pakistan, the Federal Ministry of Environment was dissolved and the provinces were accorded jurisdiction over the environment. The Punjab EPA has formulated its own Act, the major content of which is the same as the PEPA, 1997. Minor amendments/changes have been made, as follows:

a. The name of the Act has been changed to "Punjab Environmental Protection (Amendment) Act, 2012".

b. For the words "Federal Government", wherever they occur, the word "Government" shall be substituted; For the words "Federal Agency", wherever they occur, the words "Provincial Agency" shall be substituted;

c. For the word "National", wherever it occurs, the word "Punjab" shall be substituted; and

d. All the other clauses, sub-clauses, sections and sub-sections are almost identical.

75. Since these subprojects fall within Punjab province, any approval required would need to be obtained from Punjab province.

iii. Punjab Environmental Protection Agency Review of IEE and EIA Regulations

76. The Punjab Environmental Protection Act provides for two types of environmental assessments: IEEs and EIAs. EIAs are carried out for subprojects that have the potential for 'significant' environmental impacts, whereas IEEs are conducted for relatively smaller sub-projects with relatively less potential for significant impacts. The Punjab Environmental Protection Agency Review of the IEE and EIA Regulations categorizes the subprojects that require an IEE and an EIA. Schedules I and II, attached to the Regulations, list these types of subprojects.

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

a. To determine whether a sub-project is categorized as requiring an IEE or EIA, use the two schedules attached to the Regulations.

b. An EIA or IEE is conducted as per the requirements outlined in the Pakistan EPA guidelines.

c. If the project is located in the provinces, then the EIA or IEE is submitted to the concerned provincial EPA; if it is located in Islamabad and federally administrated areas, then it is submitted to the Pakistan EPA. The Fee (depending on the cost of the sub-project and type of report) is submitted along with the EIA or IEE document.

d. The IEE/EIA is also accompanied by an application in the format prescribed in Schedule IV of the Regulations.

e. The EPA conducts a preliminary review of the report and replies within ten (10) days of the submission. It either a) confirms completeness, or b) asks for additional information, if needed, or c) returns the report and asks for additional studies, if necessary.

f. If the issue is confirmation of completeness, then the EPA is required to make every effort to complete the IEE and EIA review process within forty-five (45) and ninety (90) days, respectively.

g. The EPA accords their approval, subject to certain conditions:

- ✓ Before commencing construction of the sub-project, the proponent is required to submit an undertaking accepting the conditions.
- ✓ Before commencing operation of the sub-project, the proponent is required to obtain from the EPA a written confirmation of compliance with the approval conditions and requirements of the IEE.

h. An Environmental Management Plan (EMP) is to be submitted with a request for obtaining confirmation of compliance.

i. The EPAs are required to issue confirmation of compliance within fifteen (15) days of receipt of the request and complete documentation.

j. The IEE/EIA approval is valid for three years from the date of operational phase No Objection Certificate (NOC).

k. After completion of construction, a monitoring report is to be submitted to the EPA, followed by annual monitoring reports, during operations.

78. The water supply, sewerage and drainage, and urban public services (transport and green space) improvement subprojects, with the possible exception of the STP, do not fall under either Schedule I or Schedule II of the Provincial Regulations. Therefore, none of these subprojects require an EIA or an IEE as per local regulations.

iv. Other Relevant Laws

79. A number of other federal and provincial laws are important in the context of environmental management. The main laws that potentially affect the sub-projects proposed for Sahiwal are listed below:

a. **The Punjab Wildlife Protection Ordinance, 1972,** empowers the government to declare certain areas to be reserved for the protection of wildlife and to control activities within in these areas. It also provides protection to endangered wildlife species. As no activities are planned in these areas, no provision of this law is applicable to the proposed sub-projects.

b. **The Forestry Act, 1927,** empowers the government to declare certain areas as reserved forests. As no reserved forests exist in the vicinity of the proposed sub-project, this law will not affect to the proposed sub-projects.

d. **The Antiquities Act of 1975** ensures the protection of Pakistan's cultural resources. The act defines 'antiquities' as ancient products of human activity, historical sites, or sites of anthropological or cultural interest, and national monuments, etc. The Act is designed to protect these antiquities from destruction, theft, negligence, unlawful excavation, trade, and export. The law prohibits new construction in the proximity of a protected antiquity and empowers the Government of Pakistan to prohibit excavation in any area that may contain articles of archaeological significance. This project site is not in the proximity of a protected antiquity.

e. **Safety Regulations** directly or indirectly govern occupational health and safety (OHS) issues during the currently studied production activities. These regulations mainly include three laws and regulations: (i) PEPA Laws, 2000; (ii) Labor Laws; and (iii) Electricity Rules,1937.

B. ADB Requirements

80. ADB safeguard policies require that:

iv) impacts are identified and assessed early in the project cycle;

v) plans to avoid, minimize, mitigate, or compensate for the potential adverse impacts are developed and implemented; and

vi) affected people are informed and consulted during project preparation and implementation.

81. The policies apply to all ADB-financed projects, including private sector operations, and to all project components.

82. ADB's environmental policy guidelines are as follows:

a. Use a screening process for each proposed project, as early as possible, to determine the appropriate extent and type of environmental assessment so that appropriate studies are undertaken commensurate with the significance of potential impacts and risks.

b. Conduct an environmental assessment for each proposed project to identify potential direct, indirect, cumulative, and induced impacts and risks to physical, biological, socioeconomic (including impacts on livelihood through environmental media, health and safety, vulnerable groups, and gender issues), and physical cultural resources in the context of the project's area of influence. Assess potential transboundary and global impacts, including climate change. Use strategic environmental assessment where appropriate;

c. Examine alternatives to the project's location, design, technology, and components and their potential environmental and social impacts and document the rationale for selecting the particular alternative proposed. Also consider the no project alternative.

d. Avoid, and where avoidance is not possible, minimize, mitigate, and/or offset adverse impacts and enhance positive impacts by means of environmental planning and management. Prepare an EMP that includes the proposed mitigation measures, environmental monitoring and reporting requirements, related institutional or organizational arrangements, capacity development and training measures, implementation schedule, cost estimates, and performance indicators. Key considerations for EMP preparation include mitigation of potential adverse impacts to the level of no significant harm to third parties, and the polluter pays principle.

e. Carry out meaningful consultation with affected people and facilitate their informed participation. Ensure women's participation in consultation. Involve stakeholders, including affected people and concerned nongovernment organizations, early in the project preparation process and ensure that their views and concerns are made known to and understood by decision makers and taken into account. Continue consultations with stakeholders throughout project implementation as necessary to address issues related to environmental assessment. Establish a Grievance Redress Mechanism (GRM) to receive and facilitate resolution of the affected people's concerns and grievances regarding the project's environmental performance.

f. Disclose a draft environmental assessment (including the EMP) in a timely manner, before project appraisal, in an accessible place and in a form and language(s) understandable to affected people and other stakeholders. Disclose the final environmental assessment, and its updates if any, to affected people and other stakeholders.

g. Implement the EMP and monitor its effectiveness. Document monitoring results, including the development and implementation of corrective actions, and disclose monitoring reports.

h. Do not implement project activities in areas of critical habitats, unless (i) there are no measurable adverse impacts on the critical habitat that could impair its ability to function, (ii) there is no reduction in the population of any recognized endangered or critically endangered species, and (iii) any lesser impacts are mitigated. If a project is located within a legally protected area, implement additional programs to promote and enhance the conservation aims of the protected area. In an area of natural habitats, there must be no significant conversion or degradation, unless (i) alternatives are not available, (ii) the overall benefits from the project substantially outweigh the environmental costs, and (iii) any conversion or degradation is appropriately mitigated. Use a precautionary approach to the use, development, and management of renewable natural resources.

i. Apply pollution prevention and control technologies and practices consistent with international good practices as reflected in internationally recognized standards, such as the World Bank Group's Environmental, Health and Safety Guidelines (EHS Guidelines). Adopt cleaner production processes and good energy efficiency practices. Avoid pollution, or, when avoidance is not possible, minimize or control the intensity or

load of pollutant emissions and discharges, including direct and indirect greenhouse gases emissions, waste generation, and release of hazardous materials from their production, transportation, handling, and storage. Avoid the use of hazardous materials subject to international bans or phaseouts. Purchase, use, and manage pesticides based on integrated pest management approaches and reduce reliance on synthetic chemical pesticides.

j. Provide workers with safe and healthy working conditions and prevent accidents, injuries, and disease. Establish preventive and emergency preparedness and response measures to avoid, and where avoidance is not possible, to minimize, adverse impacts and risks to the health and safety of local communities.

k. Conserve physical cultural resources and avoid destroying or damaging them by using field-based surveys that employ qualified and experienced experts during environmental assessment. Provide for the use of "chance find" procedures that include a pre-approved management and conservation approach for materials that may be discovered during project implementation. ADB's safeguard policies require that both ADB's and developing member countries' (DMCs') safeguard requirements are complied with.

83. ADB uses a classification system to reflect the significance of a project's potential environmental impacts. A project's category is determined by the category of its most environmentally sensitive component, including direct, indirect, cumulative, and induced impacts in the project's area of influence. Each proposed project is scrutinized as to its type, location, scale, and sensitivity and the magnitude of its potential environmental impacts. Projects are assigned to one of the following four categories:

Category A. A proposed project is classified as category A if it is likely to have significant adverse environmental impacts that are irreversible, diverse, or unprecedented. These impacts may affect an area larger than the sites or facilities subject to physical works. An EIA is required.

Category B. A proposed project is classified as category B if its potential adverse environmental impacts are less adverse than those of category A projects. These impacts are site-specific, few if any of them are irreversible, and in most cases mitigation measures can be designed more readily than for category A projects. An IEE is required.

Category C. A proposed project is classified as category C if it is likely to have minimal or no adverse environmental impacts. No environmental assessment is required although environmental implications need to be reviewed.

Category FI. A proposed project is classified as category FI if it involves investment of ADB funds to or through a Financial Institution.

84. Based upon the REAs conducted at the commencement of the environmental assessment (refer to Annexure 1), one or more of the sub-projects to be implemented in Sahiwal during Phase 1 of PICIIP have been classified as Category B. Accordingly, ADB require that an IEE is required covering all of the subprojects proposed in Sahiwal under PICIIP (Phase 1).

C. Environmental Standards

i. National Environmental Quality Standards (NEQS)

85. The National Environmental Quality Standards (NEQS) were first promulgated in 1993 and were amended in 1995 and 2000. The standards have been adopted in Punjab where they are known as the Punjab Environmental Quality Standards (PEQS).

86. Standards for the following types of effluent and emissions are specified in the NEQS and may be relevant to the specified projects:

a. Municipal and liquid industrial effluent parameters (32) for discharge to inland waters, sewage treatment facilities, and the sea;
b. Industrial gaseous emissions (16) into the atmosphere;
c. Motor and vehicle exhaust and noise (3);
d. Ambient air quality (9);
e. Drinking water quality (33); and
f. Noise for residential, commercial, industrial, and silence zones.

ii. World Bank Group Environmental, Health and Safety (EHS) Guidelines

87. ADB advocates adherence to environmental standards set out in the World Bank Group (IFC) Environmental, Health and Safety Guidelines (EHS Guidelines).

88. Of relevance to the sub-projects proposed for Sahiwal applicable standards have been developed for air emissions for general application, ambient air conditions at property boundaries for general purpose, limits for process wastewater, domestic sewage and contaminated storm water discharges to surface water and ambient noise levels.

89. ADB's SPS requires that the most stringent standards are applied as far as practicable.

90. Table 2.1 to Table 2.3 summarize applicable standards from the EHS Guidelines. The National/Punjab Environmental Quality Standard (NEQS and PEQS) values are also given against each value for comparison to the local requirements. The standards (most stringent) to be applied for PICIIP subprojects are highlighted in green on each Table.

91. Noise level guidelines for noise levels measured outdoors are given on Table 2.1.

Table 2.1: Comparison of International and Local Noise Level Guidelines

Category of Area/Zone	Limit in dB(A) One Hour L_{Aeq}			
	WHO/IFC		NEQS/PEQS	
	Day Time (07:00 – 22:00)	Night Time (22:00 – 07:00)	Day Time (07:00 – 22:00)	Night Time (22:00 – 07:00)
Residential area (A)	55	45	55	45
Commercial area (B)	70	70	65	55
Industrial area (C)	70	70	75	65
Silence zone (D)	55	45	50	45

Source: Guidelines for Community Health, World Health Organization (WHO), 1999

92. Noise impacts should not exceed the levels highlighted in green on Table 2.1 or result in a maximum increase in background levels of 3dB at the nearest receptor location off-site.

93. Occupational Health and Safety requirements with respect to noise are contained in the relevant EHS Guidelines which can be found at: www.ifc.org/ehsguidelines.

94. Guidelines for wastewater and ambient water quality apply to projects that have either direct or indirect discharge of process wastewater, wastewater from utility operations or storm water to the environment. Process wastewater may include contaminated wastewater from utility operations, storm water and sanitary (domestic) sewage.

95. Discharges of process wastewater, wastewater from utility operations or storm water to surface water should not result in contaminant concentrations in excess of the local ambient water quality criteria. Such criteria (PEQS) are set out on Table 2.2, together with the more stringent criteria normally stipulated by international agencies.

Table 2.2: Comparison of International and Local Limits for Process Wastewater, Domestic Sewage, and Contaminated Storm Water Discharged to Surface Waters, for General Application

(milligrams per litre, except for pH, bacteria, and temperature)

Pollutant or Parameter	Typical Limit	PEQS
pH	6–9	6-9
BOD	30	80
COD	125	150
Oil and grease	10	10
Total Suspended Solids	50	200
Metals, Heavy metals, total	10	-
Arsenic	0.1	1.0
Cadmium	0.1	0.1
Chromium, Hexavalent	0.1	-
Chromium, Total	0.5	1.0
Copper	0.5	1.0
Iron	3.5	8.0
Lead	0.1	0.5
Mercury	0.01	0.01
Nickel	0.5	1.0
Selenium	0.1	0.5
Silver	0.5	1.0
Zinc	2.0	5.0
Cyanide, Free	0.1	-
Cyanide, Total	1.0	1.0
Ammonia	10	40
Fluoride	20	10
Chlorine, total residual	0.2	1.0
Phenols	0.5	0.1
Nitrogen, total	10	-
Phosphorus, total	2.0	-
Sulfide	1.0	1.0
Coliform bacteria	< 400 MPN/100 ml	-
Temperature increase	< 3°C	< 3°C

Note: MPN, most probable number

96. The effluent should not exceed the levels highlighted in green on Table 2.2 and should result in a temperature increase of no more than 3° C at the edge of the zone where initial mixing and dilution take place. Where the zone is not defined, use 100 metres from the point of discharge.

97. Air quality guidelines issued by the IFC apply to facilities or projects that generate emissions to air at any stage in the project life-cycle.

98. Emissions of air pollutants can occur from a wide variety of activities during project implementation, including construction, operation and decommissioning stages in the project life cycle. Sources of pollution to air can include point sources, fugitive sources and mobile sources and can arise either from process activities or materials handling and storage.

99. Guideline values for specific pollutants are set out on Table 2.3, derived from World Health Organization (WHO) Guideline values and NEQS/PEQS. US EPA air quality standards are less stringent than WHO standards and have not, therefore, been considered further.

100. WHO recognizes interim targets above the guideline values for most pollutants with the exception of NO_2.

101. Air emissions from sub-project activities should not exceed the levels highlighted in green on Table 2.3.

Table 2.3: Comparison of International and Local Ambient Air Quality Guidelines

(micrograms/m^3, except CO which is milligrams/m^3)

Pollutant	Averaging Period [2]	WHO Guideline Value [1]	NEQS/PEQS
Sulphur dioxide (SO_2)	Annual mean	-	80
	24 hours	20	120
	10 minutes	500	-
Carbon Monoxide (CO)	8 hours	-	5
	1 hour	-	10
Oxides of Nitrogen as NO_2	1 year/Annual mean	40	40
	24 hours	-	80
	1 hour	200	-
Ozone (O_3)	8 hour daily max	100	-
	1 hour	-	130
Particulate Matter TSPM	Annual mean	-	360
	24 hours	-	500
Particulate Matter PM_{10}	1 year/Annual mean	20	120
	24 hours	50	150
Particulate Matter $PM_{2.5}$	1 year/Annual mean	10	15
	24 hours	25	35
Lead	1 year/Annual mean	-	1
	24 hours	-	1.5

- Source: WHO, Air Quality Guidelines Global Update, 2005
- Averaging period is stated to be 1 year for WHO guideline values and annual mean for NEQS/PEQS.

III. DESCRIPTION OF THE SUBPROJECTS

102. Under the first phase investments of the PICIIP it is proposed to implement urban development sub-projects in Sahiwal in the following sectors:

- Water supply;
- Sanitation; and
- Urban public spaces improvements, with respect to transportation infrastructure and the development and upgrading of green spaces.

103. This Section provides an overview of the existing situation in Sahiwal, and outlines the subproject proposals designed to address some of the current deficiencies in the provision of urban services. Where applicable, solutions and approaches which are alternative to the proposed subprojects are considered and discussed further in Section VI.

A. Water Supply Improvement Projects

i. Current Status

104. Water for the Sahiwal Water Supply system is obtained from deep tube wells with depths below 152 m. Currently, there are 54 tube wells in the service area, 44 of which are operational. The rated capacity of all 54 tube wells is 63 cusecs (6,426 m^3/hr), but the current operating installed capacity is 53.5 cusecs (5,457 m^3/hr).

105. The water table is between 12 and 15 m below ground level, but it has been reported to be dropping by about 0.3 m per year or by from 4.6 to 5.5 m over the past 10 to 15 years. Data from the Irrigation Department confirms this drop in the water table. The source of natural recharge for the tube wells is the Ravi River and Lower Bari Doab canal.

106. The tube wells either pump directly into the distribution system or fill the overhead reservoirs. Based on the average number of pumping hours per day (between 8 and 13 hours), the current operation's installed production is about 15 million gallons per day (MGD), which is only about 75% of current demand (including water loss).

107. An initial assessment of the condition of the tube wells suggests that eight are non-functional, five operate inefficiently, the motors and pumps of 14 need either replacement or repair, 26 need new Motor Control Units, and 14 pump houses need to be repaired.

108. Chlorination facilities at the tube wells are currently out of order, so the water is not subjected to any form of disinfection before it is distributed to the consumers. Given the reported contamination of the water supplies from sewage, due to the water supply being proximal to sewerage pipes and, at times, due to negative pressure in the water pipes, this clearly represents a health risk.

109. According to the information collected during the survey, there are twelve overhead storage reservoirs within the water distribution network, eight of which are operational. The total storage capacity is reported to be 480,000 gallons, of which 320,000 gallons is functional storage. This represents 0.72 hours at current demand and 0.47 hours at the projected demand for 2035. The reservoirs are an important element of the operational strategy of the water supply system, with specific times being allocated to filling the reservoirs so they can meet the demand for water during peak demand periods.

110. In addition to the dysfunctional reservoirs, a number of the functional reservoirs are also in poor condition and require repairs. There are currently thirteen existing water supply zones in

Sahiwal (within the current MC boundary), eight of which contain overhead reservoirs. Even within these eight zones, there is still direct pumping from SMC tube wells into the distribution system. This indicates the inadequate capacity of the available reservoirs, such that direct pumping is required to cater to demand and to maintain pressure during supply. The remaining five zones are entirely dependent on direct pumping because they have no overhead reservoir.

111. Pipe materials used in the water distribution system are cast iron, galvanized iron, asbestos cement (AC), and PVC. Pipe diameters range from 76 to 406 mm, and the total length of the network is 153 km. This includes about 89 km of asbestos cement pipe work (ACP).

112. The rate of coverage of the distribution network, within the municipal boundary, is almost 90%, but the pipe network is poor and outdated, and sewage intrusion occurs during non-supply hours, when the system is not pressurized.

113. Currently, there are 14,734 active connections out of a total of 41,209 households, suggesting that much of the population either has an illegal connection or a private well. However, given the low water tariff of PKR 400 per annum, there seems to be little benefit in having a private well. As a result, revenue is low and this has an impact on operations, maintenance and system rehabilitation.

114. The system is operated intermittently (8 hours per day), with times allocated to filling the reservoirs and other times to supplying consumers from the reservoirs, during which the tube wells are kept running until the supply cycle is completed. There are no valves within the system, so supply is regulated by opening and closing the tube well pumps.

115. There are twelve filtration stations located around the town that supply consumers with drinking quality water. People tend to not drink water supplied through the distribution network, but rather they obtain bottled water or water from the filtration plants.

Ii. Proposed Projects

116. The current water supply infrastructure is confined to 13 water supply zones within the existing Tehsil Municipal Authority (TMA) area of jurisdiction. Given the poor condition of this infrastructure, its rehabilitation will comprise the priority investments.

117. Current estimated daily water production falls well short current estimated water demand; as a consequence, many areas are not catered for adequately and the system is not able to provide a 24 hours, 7 days per week service at present. The water supply system is beset with a number of issues, as noted above, and which may be summarized as follows:

- Inefficient tube wells operating at below design discharge. Actual discharge from the tube wells is significantly less than the rated capacity, since the pumps are old and apparently in poor condition. In addition, since the water table is reported to have dropped over the past year, this will have increased the pumping heads;
- The tube well installations pump both directly into OHRs and the distribution system, with a fixed daily operation. The pumps are operated at certain times to fill the tanks and, at times, they are switched off, while the tanks supply the distribution system. This a manual operation, based on fixed timings;
- Absence of control and monitoring of tube well operations, the pipe network and customer consumption. Production facilities lack an integrated control system, such as a SCADA, for the tube well installations or pressure gauges at the sites, which would enable some pumps to be switched off when not required;
- Inadequate and non-continuous supply, on account of high system losses, potentially as high as 50%, resulting from damaged and rusted pipes;

- Lack of maintenance of the piped network;
- Significant potential for contamination from the ingress of sewage or contaminated surface water and groundwater, given that the sewage pipe network and the piped clean water supply network are laid in close proximity to each other;
- Lack of monitoring of water quality, including chlorination dosing; and
- Lack of storage capacity in the system – the system is direct discharge from tube wells. Failure of a well or pump, or in the event of load shedding, impacts the overall capacity of the supply system.

118. The following sub-projects are proposed to address these issues:

a. Rehabilitation of Tube Wells

119. The objective of this sub-component is to restore the 54 tube wells to their original design rating such that a total capacity of 62.5 cusecs (6,375 m3/hr) can be achieved. The rehabilitation works required at the 54 tube wells within the existing service area are as follows:

    - There are eight existing tube wells in the city whose bores have been clogged and not producing sufficient water. Eight new bores (203 mm) will be developed and new tube wells will be installed at the locations indicated on Figure 3.1;
    - There are 19 tube wells whose civil, electrical and mechanical condition is not good. These 19 tube wells will be rehabilitated to improve their electrical, mechanical and civil condition at the locations indicated on Figure 3.2 and Figure 3.3;
    - There are 27 tube wells whose efficiency is low because either their water discharge is low or they have a relatively high energy consumption. Efficiency improvements will be undertaken, comprising either replacement of motor/pump or impeller adjustment/repair and maintenance; and
    - Chlorination facilities will be provided at all tube wells and OHRs to ensure appropriate water quality is provided to consumers.

120. The outcome of this sub-component is that the 54 tube wells will be able to provide sufficient water to meet the projected 2035 water demands within the existing service area. Instrumentation will be in place to enable central control of the production facilities resulting in more efficient operation and cost savings.

b. Rehabilitation of and Provision of Storage Reservoirs

121. The objective of this component is to provide three hours' storage in all zones of the distribution system in order to allow for diurnal variations in water demand and provide some security during load shedding periods.

122. This will provide for more efficient operation of the distribution system and reduce pumping costs by eliminating direct pumping into the distribution system.

Figure 3.1: Locations of New Tube Wells

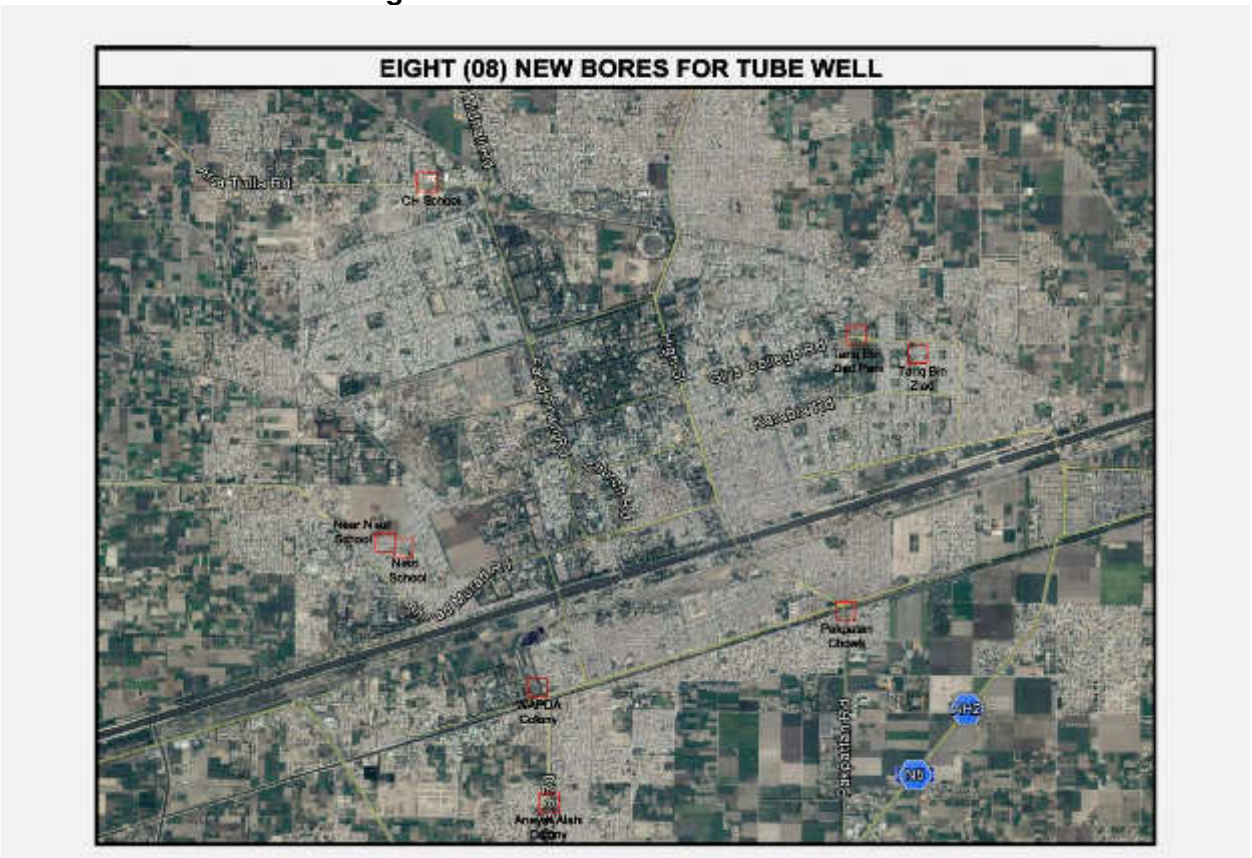


Figure 3.2: Locations of Tube Wells to be Repaired

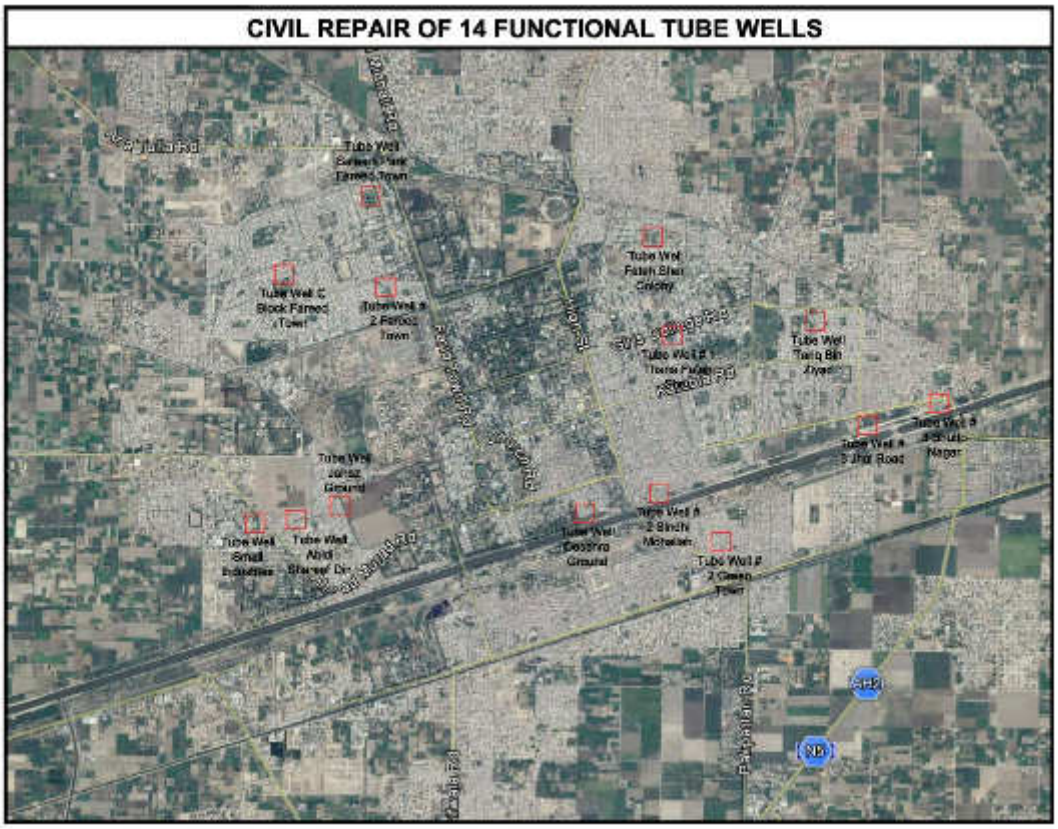
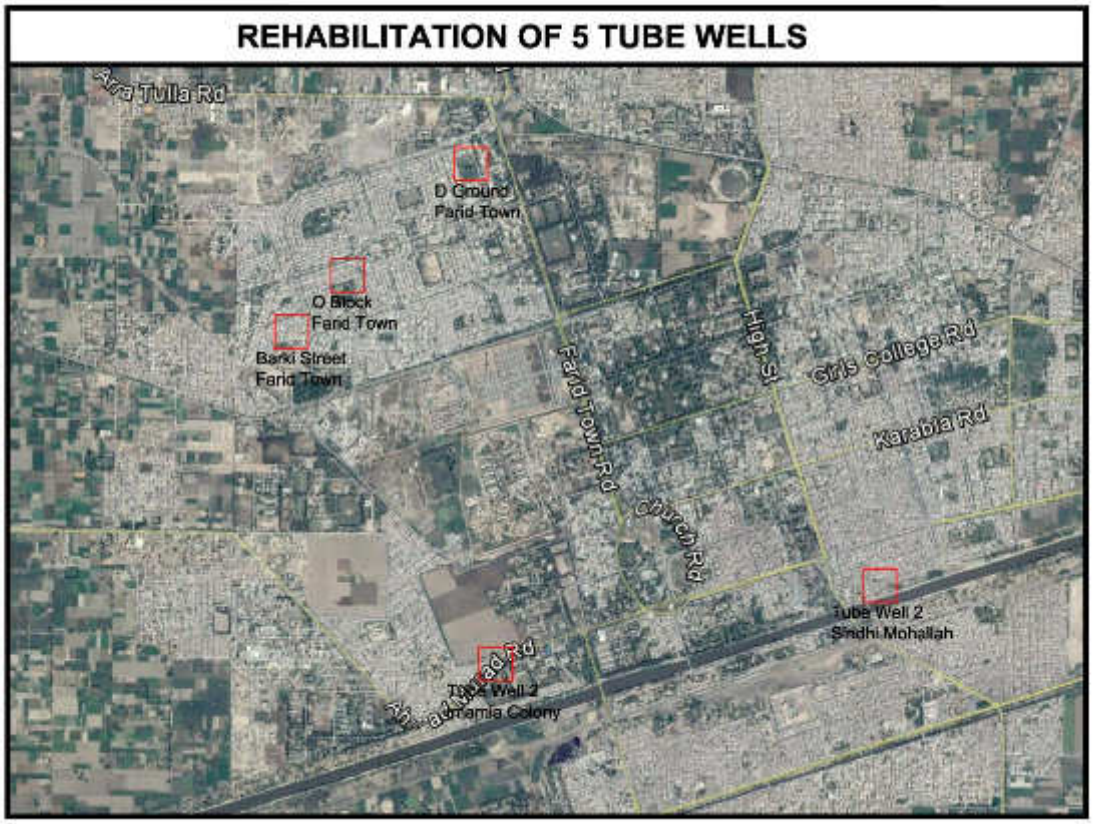


Figure 3.3: Locations of Tube Wells to be Rehabilitated



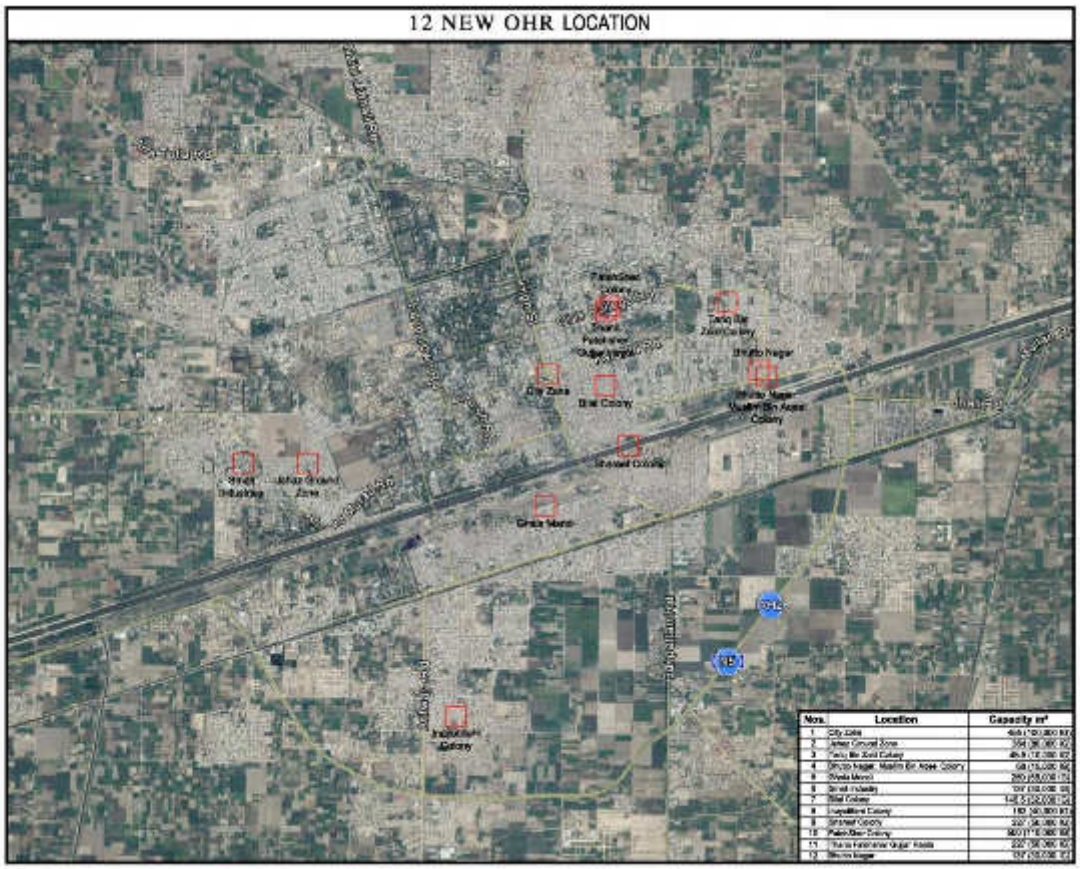
123. The works to be undertaken under this component are:

- Provision of 520,000 gallons of additional capacity, through the construction of 10 new OHRs (Table 3.1) and the demolition and reconstruction of 2 existing OHRs. The locations of the 12 OHRs to be constructed are shown on Figure 3.2.

Table 3.1: New Overhead Reservoirs to be Constructed

Zone	Additional Storage Capacity Provided (Imperial Gallons)
City Zone	100,000
Jahaz Ground Zone	80,000
Tariq Bin Ziad Colony	10,000
Bhutto Nagar, Muslim Bin Aqeel Colony	15,000
Ghala Mandi	55,000
Small Industry	30,000
Bilal Colony	32,000
Inayat Illahi Colony	40,000
Shareef Colony	50,000
Fateh Sher Colony	110,000
Thana Fateh Shair Gujjar Haata	50,000
Bhutto Nagar	30,000
Total	**602,000**

Figure 3.4: Locations of New Overhead Reservoirs to be Constructed



- Rehabilitation of three non-functional OHRs, of 130,000 gallons capacity, including replacement of filling pipes, distribution main pipes and overflow pipes, replacement of valves and civil repairs. The three reservoirs to be rehabilitated are Tariq bin Ziyad Colony, Scheme 2 Fareed Town and Ghala Mandi.
- Repair of seven OHRs, including replacement of valves & pipe sections and civil repairs. In total 10 OHRs will be rehabilitated at the locations indicated on Figure 3.5.

c. Rehabilitation of Water Distribution System

124. The objective of this component is to replace the damaged/rusted pipes that result in excess leakage. It is also proposed to discontinue the use of the asbestos cement pipes (ACP), In view of the proven detrimental effects of asbestos on health, and replace them with PVC pipe as part of the medium-term investment plan.

125. A total of approximately 54 km of damaged/rusted pipeline needs to be replaced by PVC pipes of following diameter and lengths:

- 305 mm diameter, of 0.46 km;
- 254 mm diameter of 0.86 km;
- 203 mm diameter, of 1.56 km;
- 152 mm diameter of 11 km;
- 102 mm diameter of 2 km; and
- 76 mm diameter, of 38 km.

126. In addition, 24 km of ACP will be replaced in phases.

127. The locations of the pipes to be replaced are shown on Figure 3.6.

Figure 3.5: Locations of Overhead Reservoirs to be Rehabilitated

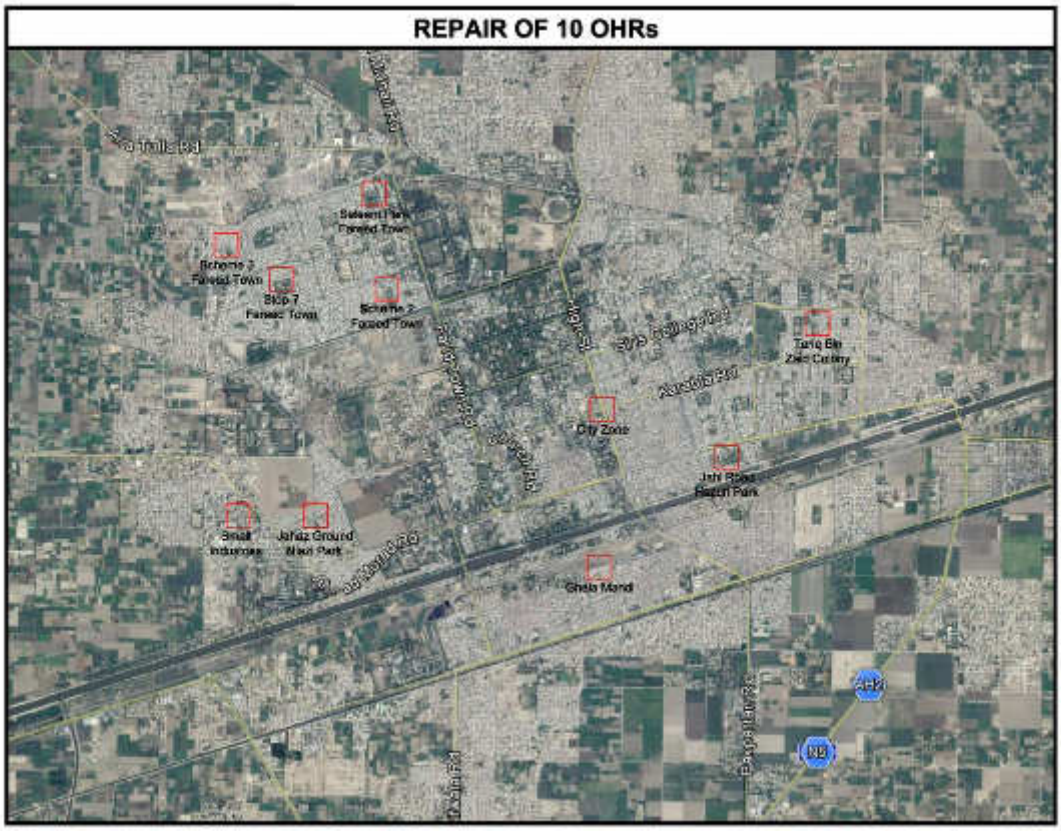
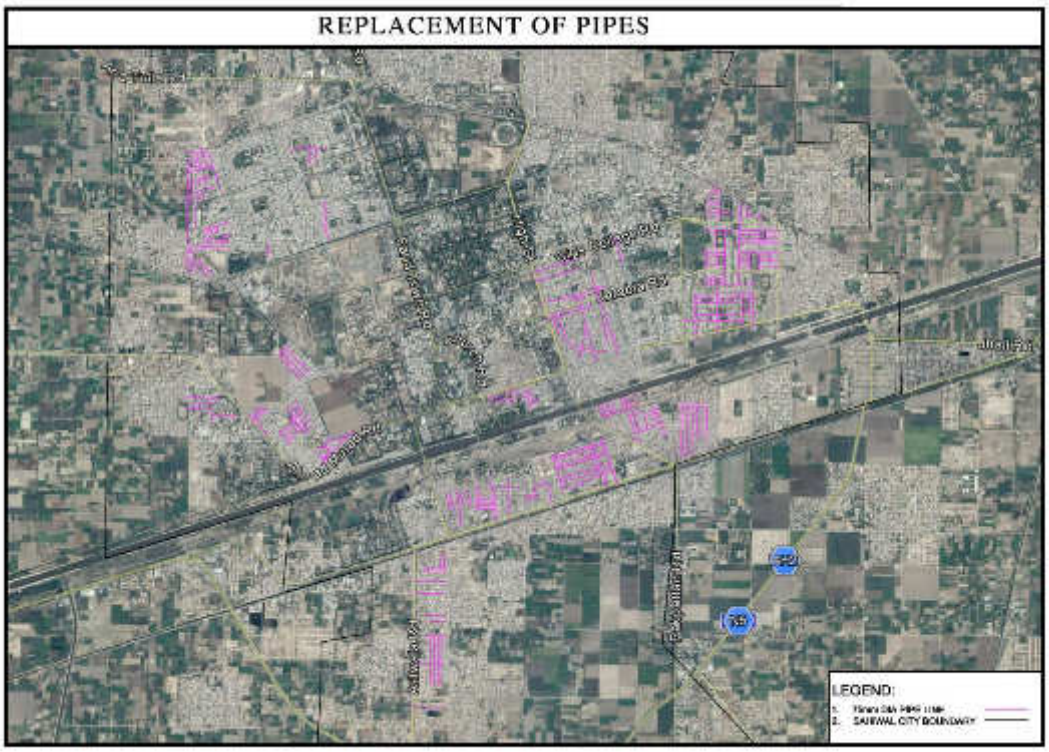


Figure 3.6: Locations of Water Supply Pipes to be Replaced



128. The asbestos content of the ACP is not known currently, but is unlikely to be sufficiently high as to warrant the pipes being classified as hazardous waste. Subject to confirmation of the asbestos content, and the *in situ* condition of the ACP, it is proposed that two methods of management may be adopted:

- Where the ACP are in good condition and have not degraded or weathered, the pipes would be left *in situ*, buried, disconnected and undisturbed, since there is normally sufficient space to lay new pipe adjacent to the existing pipework. This is a commonly adopted method of management of redundant pipes, both in Pakistan and in developed countries (for example, United States); and
- If the ACP have been exposed and are weathered, severely degraded and/or broken, or, because of space constraints require removal, the ACP would be extracted under strict procedures (as set out in an Asbestos Management Framework) and disposed to an approved secure landfill, at a location yet to be confirmed. It is anticipated that a sanitary landfill capable of receiving ACP waste will be developed in Phase 2 of PICIIP.

129. In the absence of a suitable disposal facility currently, the second approach is not considered to feasible at present. Accordingly, the only safe and viable approach in the short-term is to leave all ACP buried *in situ* regardless of its condition and to ensure that the locations of all ACP is recorded accurately. Once a suitable disposal facility has been developed, it would then become feasible to remove and dispose of degraded ACP.

130. Replacing the pipework will improve service delivery by maintaining adequate pressures, reducing water losses and eliminating the risk of contamination from sewage when the pipes are not pressurized. The reduction in water losses from an improved piped network will also reduce the stress on the aquifer that has resulted in lowering of the water table through reducing the quantity of water being abstracted from the tube wells.

d. Installation of SCADA System, Bulk Metering and Pressure Gauges

131. Supervisory Control and Data Acquisition (SCADA) will be installed to facilitate more efficient water supply system operation in DNI (Distribution Network Improvement) zones. It will allow automatic operation of tube well pumping stations based on the reservoir levels and system pressure. It will enable real time measurement of flows and pressures throughout the system, and will enable accurate assessment of water losses. SCADA is essentially a real-time industrial process control system used to centrally monitor and/or control remote or local industrial equipment such as valves, pumps, sensors, etc.

132. SCADA is a combination of telemetry and data acquisition, which will perform the functions of (i) data acquisition; (ii) networked data communication; and (iii) data presentation. Bulk meters and pressure gauges will be installed at all the tube wells.

e. Development of DNI Zones

133. In Sahiwal city, water metering is not carried out at household level and not charged accordingly. As a pilot scheme, two Union Councils, Fareed Town and Tariq Bin Zayd, will be declared as DNI (Distribution Network Improvement) Zones where water meters will be installed at all households and the cost of service provision will be charged based on actual water consumption. The two DNI zones will be supplied water for 24/7.

134. The existing pipe layout in the two UCs is shown on Figure 3.7, whilst the proposed pipe replacement and proposed extension of the network are shown on Figure 3.8 for Fareed Town and Figure 3.9 for Tariq Bin Zayd respectively.

Figure 3.7: Existing Pipe Network in Fareed Town and Tariq Bin Zayd

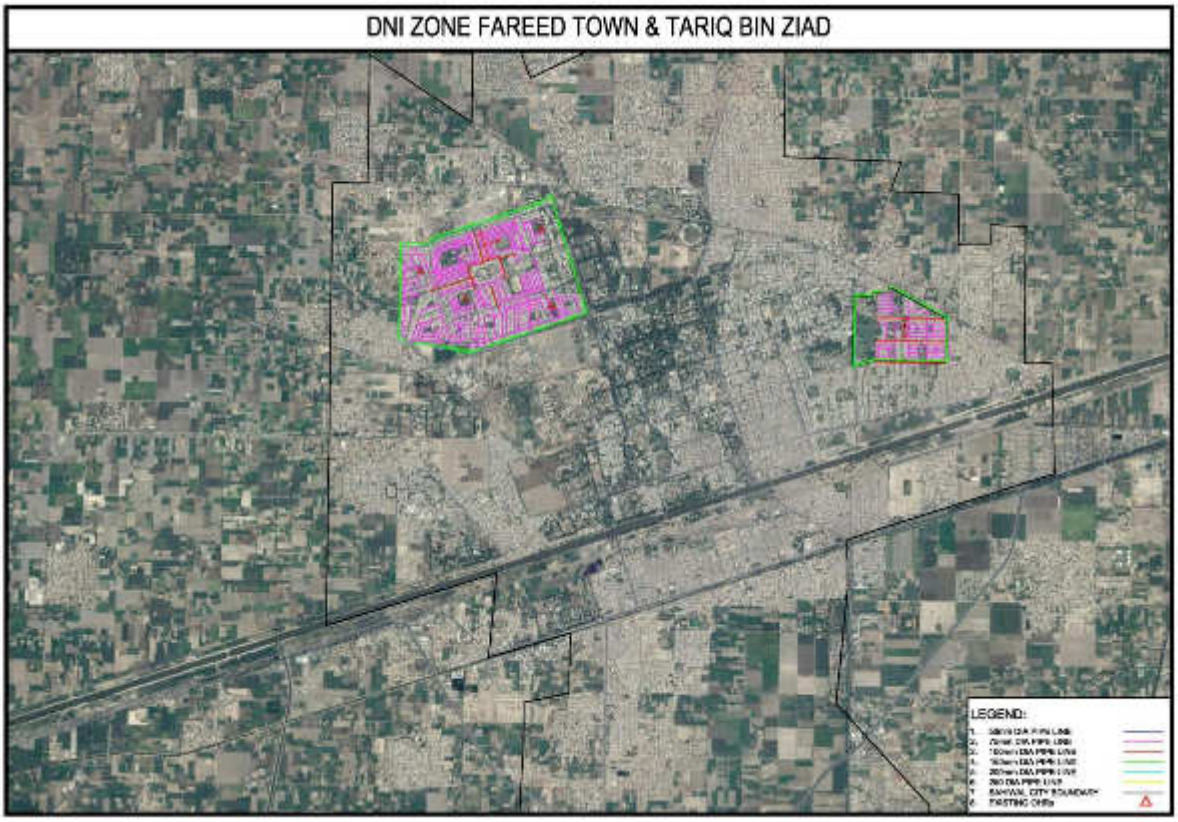


Figure 3.8: Proposed Pipe Network in Fareed Town

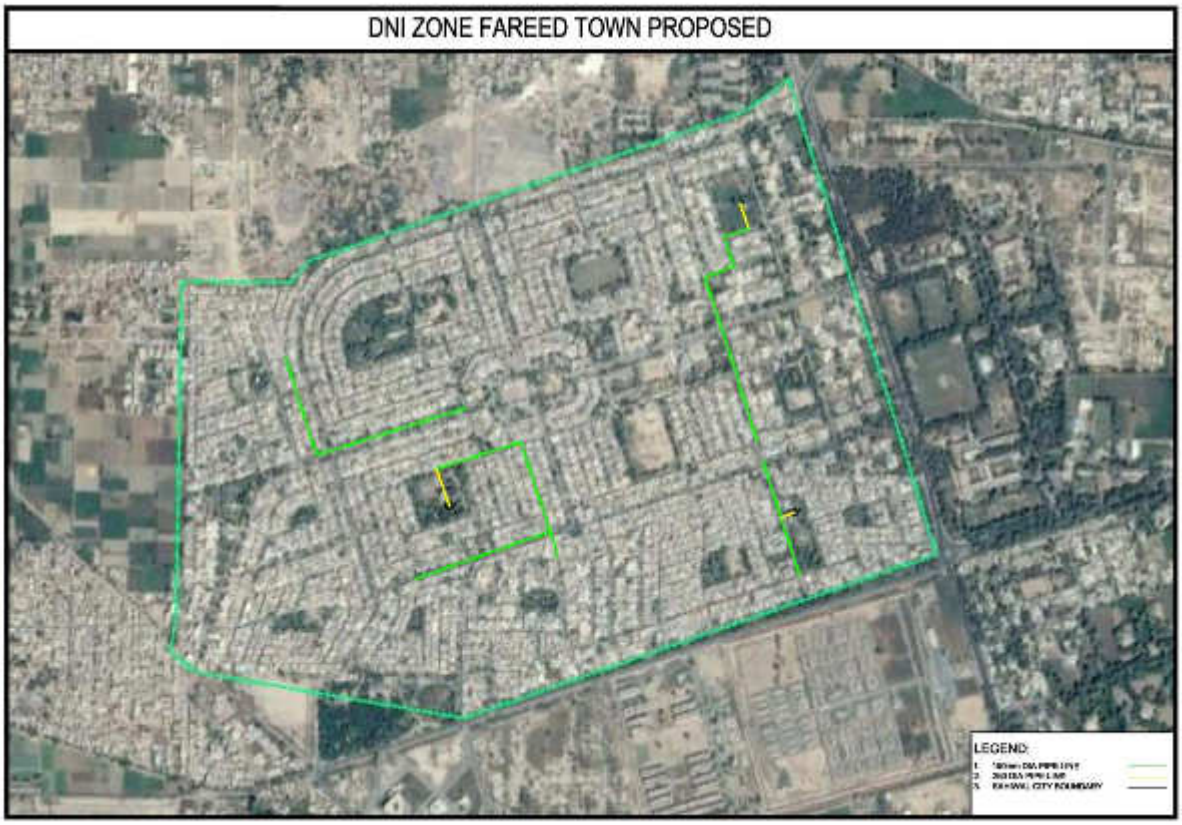


Figure 3.9: Proposed Pipe Network in Tariq Bin Zayd

B. Sewerage Improvement Projects

i. Current Status

135. The sewerage collection system for Sahiwal comprises 250 km of 229 mm to 1,219 mm diameter sewers. This system serves 90% of the city population and covers 80% of the city area. This is a combined system carrying both storm water and wastewater and there are no separate major drains inside the city boundaries.

136. Despite the reported high coverage, there are only 15,406 sewerage connections out of 41,209 households, with other wastewater and storm water being conveyed through open drains into the sewerage system or through manholes, which are opened during heavy rain to assist in relieving local flooding.

137. The pipe network is reported to be old, in poor condition and suffers from frequent blockages and collapsed sewers. There is reported to be contamination of the water supply system from sewage due to the poor condition of both the water and sewerage network, the proximity of the water supply and sewerage pipes, and since the water supply pipelines are at times not pressurized.

138. Current domestic wastewater generation from Sahiwal city is about 48 million gallon per day (MGD) (Peak Wet Weather Flow). The wastewater is conveyed from the city through six minor and four major disposal stations. It is ultimately disposed either into the Nullahs (natural wastewater drains) or is used by farmers to irrigate their crops.

139. In one case, the wastewater from a major disposal station is discharged directly into the canal (L-9) that passes along the Grand Trunk Road. The EPA has already filed a case against the Sahiwal MC for discharging untreated wastewater from the Manzoor Colony

Disposal Station to the L-9 canal. In another case, wastewater is discharged into a scarp drain.

140. Since Sahiwal is not as industrialized as many other intermediate cities in Punjab, industrial effluent is not currently a serious issue. However, in the future, Sahiwal is expected to become the hub of the main trade route coming from the Economic Corridor with China (CPEC). Industrialization in Sahiwal can be foreseen; however, it is not possible to predict the scale of its future industrialization and the nature of its future industries.

141. At present, a minor quantity of industrial effluent is mixed with domestic wastewater, due to the presence of few small-to-medium-sized industries in the city. This is untreated wastewater. There is no wastewater treatment plant at the city to treat both domestic and industrial effluent.

142. At present, Sahiwal has no separate storm water drainage infrastructure to deal with rainfall runoff. However, given that rainfall is minimal for 9 to 10 months of the year, the MC administration does not believe that a separate storm water drainage system is required.

ii. Proposed Projects

a. Sewer Network Improvement

143. The sewerage collection system requires sewer replacement in areas where leakages or settlement of the sewer line has been experienced. The areas of proposed sewer replacement are shown on Figure 3.10 and summarized on Table 3.2:

Figure 3.10: Proposed Sewer Network to be Replaced

Table 3.2: Proposed Sewer Replacements

#	From	To	Diameter (mm)	Length (km)
1	Jogi Town	Mission Hospital	600	1.50
2	Mazdoor Pulli	Dr. Daud Chowk	450	1.00
3	Ghausia Colony		229	1.66
4	New Mohalla Fareed Gunj		229	2.36
5	Muslim Bin Aqeel Colony & Labour Colony		229	6.35
	Total			12.87

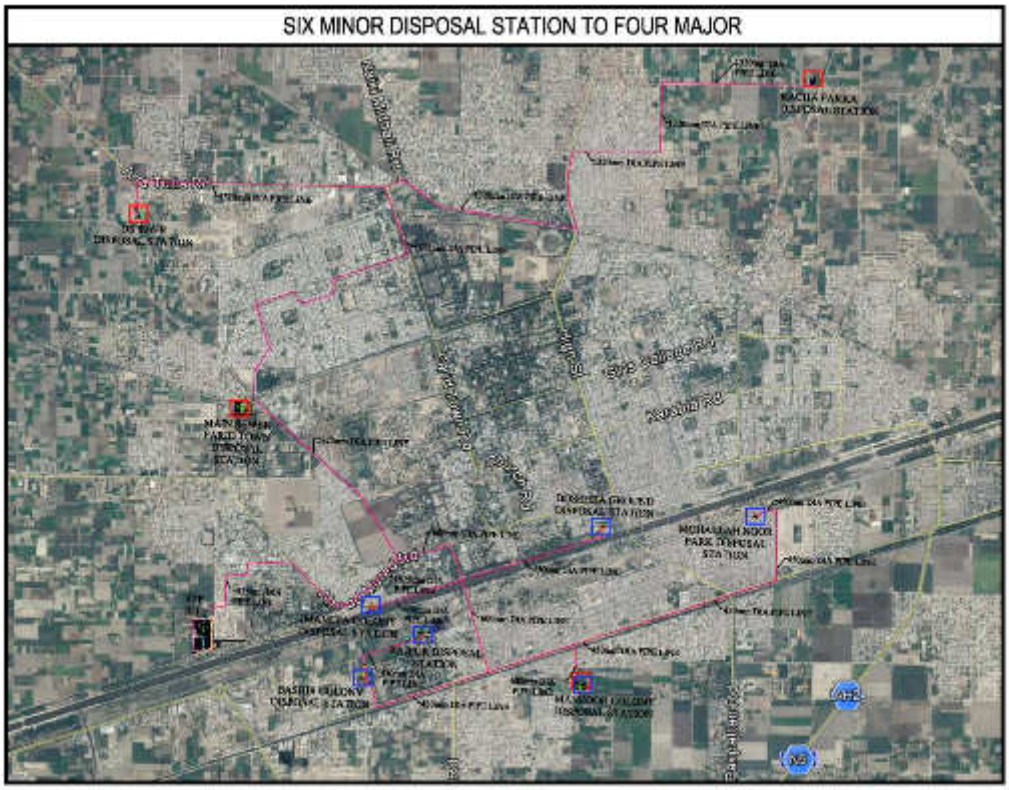
b. Rehabilitation of Disposal Stations and Construction of Trunk Main

144. There are four major disposal stations, at 89/6R, Fareed Town, Manzoor Colony and Kacha Pacca Noor Shah (Figure 3.11). It is proposed to convert these into pumping stations. From these main pumping stations sewage will be conveyed through a new trunk main to the new centralized wastewater treatment plant.

145. Six minor disposal stations will be rehabilitated to act as overflows in case of emergency; however, these will not function during normal operation. The sewerage conveyance system will be modified to enable sewage to flow to the four main Disposal Stations (Pumping Stations) and only in emergencies flow to the minor Disposal Stations Improvements and renovation of the minor disposal stations will include provision of new pumps, motors and Motor Control Units (MCUs) and civil repair of the stations.

146. Under routine operating conditions, the six minor disposal stations will connect with the four major disposal stations through new gravity sewers (refer to Figure 3.11). It is proposed to install a trunk main from the four major disposal stations to the new STP for the conveyance of wastewater for treatment at the centralized STP.

Figure 3.11: Revised Sewage Conveyance Network



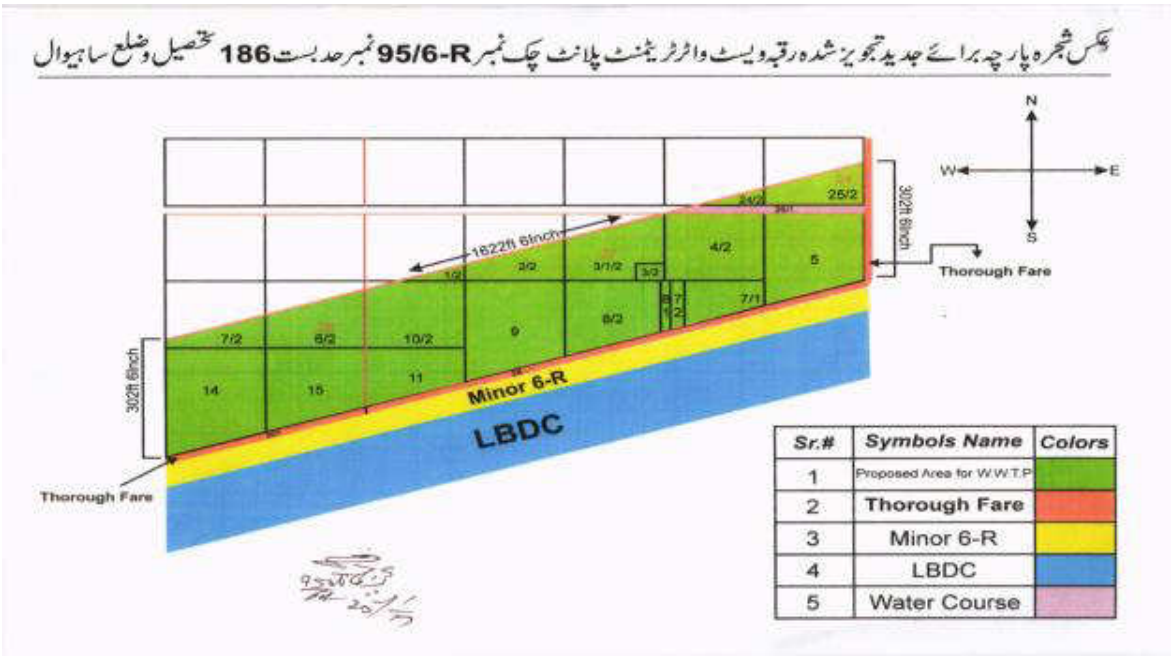
c. Proposed Sewage Treatment Plant

147. The PFS carried out under PICIIP recommended the construction of a centralized sewage treatment plant for the treatment of city wastewater prior to its disposal into the canal. A site for the STP site has been identified, with the STP design carried out under the FS.

148. The site proposed for the STP is located towards the southwest outskirts of Sahiwal city (Figure 3.11). As noted above, the existing disposal stations will be converted into pumping stations to pump sewage from the collection system into the trunk mains conveying sewage to the STP.

149. The STP site is located about 500 m west and south-west of the newly developing residential scheme called Three Marla Scheme of MC Sahiwal. After surveys and consideration of alternatives, government selected a parcel of agricultural land, extending to 4.5 Ha (45,621 m^2) in Chak No. 95/6-R (Figure 3.12). The proposed site runs parallel to the Lower Bari Doab Canal.

Figure 3.12: Location of the Proposed Site of the Sewage Treatment Plant



150. Three sides of the site are surrounded with agricultural land (East, West, North) and one side is along the unpaved passage adjacent to the right bank of canal (South) i.e. Lower Bari Doab (LBDC).

151. The Three Marla Housing Scheme is located about 500 m east and north-east of the eastern boundary of the site. A view of the proposed site, looking east, is presented in Figure 3.13, which shows the current agricultural nature of the site, as well as the Three Marla Housing Scheme at some distance in the background. The LBDC is to the right of the track on the right side of the photograph.

152. There are two other villages, 95/6-R and 94/6-R, located about 1 km from the northern boundary of the site.

153. The average design flow of the STP is 20–27 MGD (90,909–123,636 m^3/day). The peak flow will be 40 MGD (181,182 m^3/day). This compares to the current estimated domestic wastewater generation of 48 MGD.

Figure 3.13: Current View of the Proposed Site of the Sewage Treatment Plant

154. The adopted design characteristic of the wastewater to be treated in STP is summarized on Table 3.3.

Table 3.3: Adopted Sewage Design Characteristics

Parameter	Unit	Design Value
Total Suspended Solids (TSS)	mg/L	200
5-Day Biochemical Oxygen Demand, BOD_5	mg/L	250
Chemical Oxygen Demand, COD	mg/L	500
Total Dissolved Solids (TDS)	mg/L	1,100

Source: STP Design Report

155. The influent and effluent characteristics of the STP are presented in Table 3.4.

Table 3.4: Raw and Treated Wastewater Characteristics

Parameter	PEQS	Design Concentration		Required Efficiency (%)
		Influent	Effluent	
BOD_5 @ 20°C (mg/L)	80	250	50	80
COD (mg/L)	150	500	150	70
TSS (mg/L)	200	200	100	50

Source: STP Design Report

156. After comparing all the suitable treatment technologies, it was established that a Trickling Filter with Primary Settling is the most efficient biological process. Accordingly, the STP design has been undertaken on this basis.

157. In the trickling filter process, the settled wastewater is allowed to trickle down over a circular deep bed of coarse aggregates filter or plastic media filter. The microbial film, developed on the surface of filter media over time, treats the wastewater. A part of this film, washed away by the hydraulic action of trickling wastewater, is separated in a secondary clarifier, in form

of humus sludge, disposed of after sludge treatment, or returned for digestion into the upflow anaerobic sludge blanket (UASB) reactor, if applicable.

158. The key components of the treatment system and facilities proposed for STP comprise.

Water Line

- Wastewater Screen Chamber (Coarse);
- Wastewater Pumping Station;
- Wastewater Screen Chamber (Fine);
- Grit Chamber;
- Primary Sedimentation Tank;
- Primary Sludge Pumping Station;
- Trickling Filters;
- Secondary Sewage Pumping Station;
- Secondary Sedimentation Tank; and
- Secondary Sludge Pumping Station.

Sludge Line

- Sludge Thickening in Combined Sludge Thickeners;
- Thickened Sludge Pumping Station;
- Sludge Digester;
- Digested Sludge Pumping Station; and
- Sludge Dewatering (Conventional Sand Drying Beds).

159. A process flow diagram of the sewage treatment process is presented in Figure 3.14.

160. A preliminary layout plan of the proposed STP is presented in Figure 3.15.

161. In STP, the sludge will be generated from the primary and secondary sedimentation tanks. Primary and secondary sludge will be thickened in Combined Sludge Thickeners. The thickened sludge then needs to be digested in an Anaerobic Sludge Digester, in order to stabilize the sludge, i.e. minimize microbial activity.

162. Once digested and stabilized, the sludge would then be dewatered, in order to reduce its volume and to render it suitable for transportation for disposal or land application, as the case may be.

163. The most appropriate method of sludge dewatering and drying, under local conditions, is Sludge Drying Beds. It is estimated that about 7.9 tons of dry sludge will be produced daily.

C. Transport Routes Improvement Projects

i. Current Status

164. Sahiwal is traversed by a main railway line and the Lower Bari Doab canal, running parallel in a east-west direction. The road network is well laid out in a grid-iron pattern. The inter-city roads are wide enough with sufficient right of ways; however, some of the laterals have marginal widths and pose problems of congestion in the presence of poor and inconsiderate driver behavior, diverging traffic mix, poor traffic supervision and road space management issues.

Figure 3.14: Process Flow Diagram of the Proposed Sewage Treatment Process

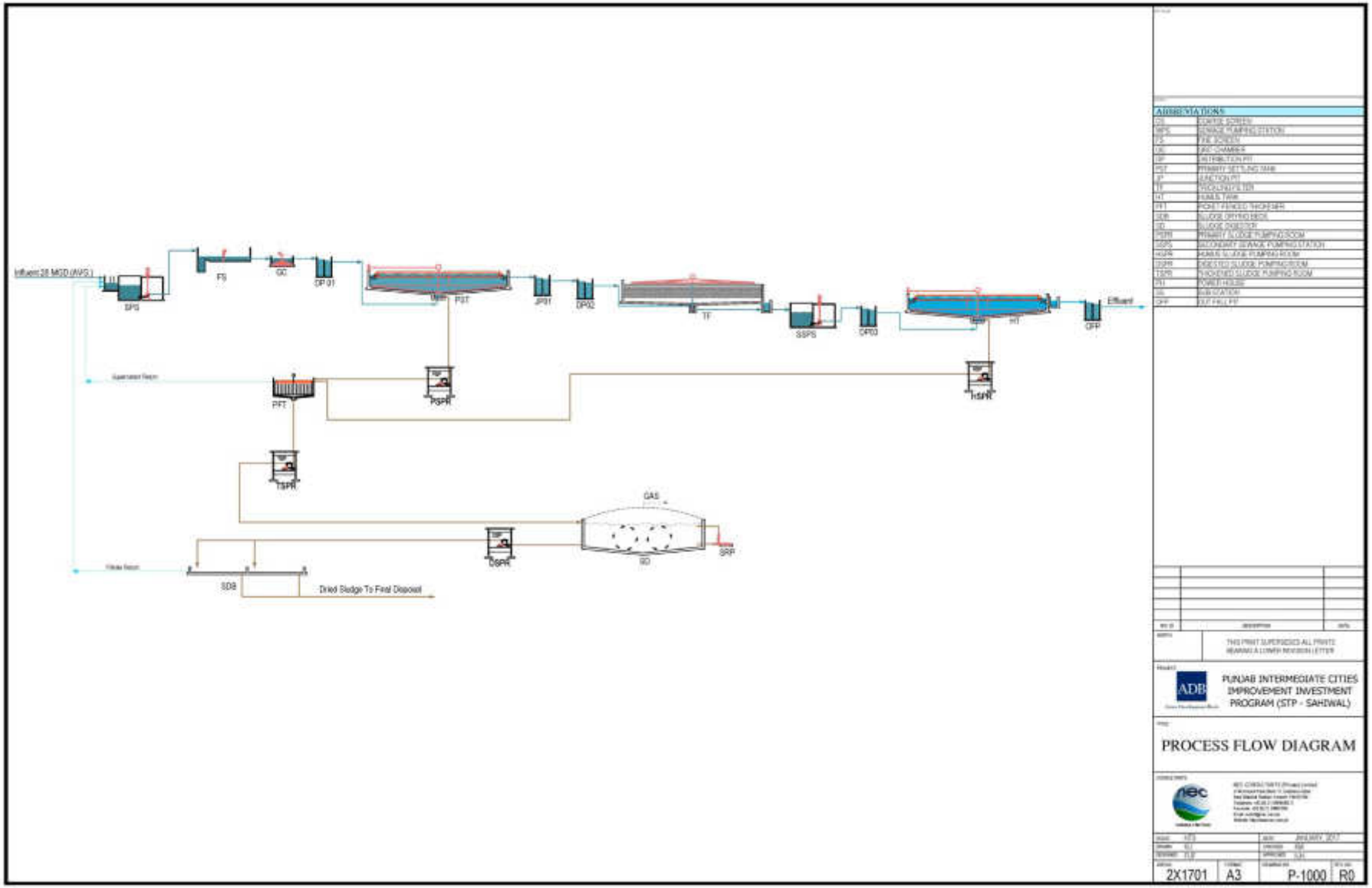
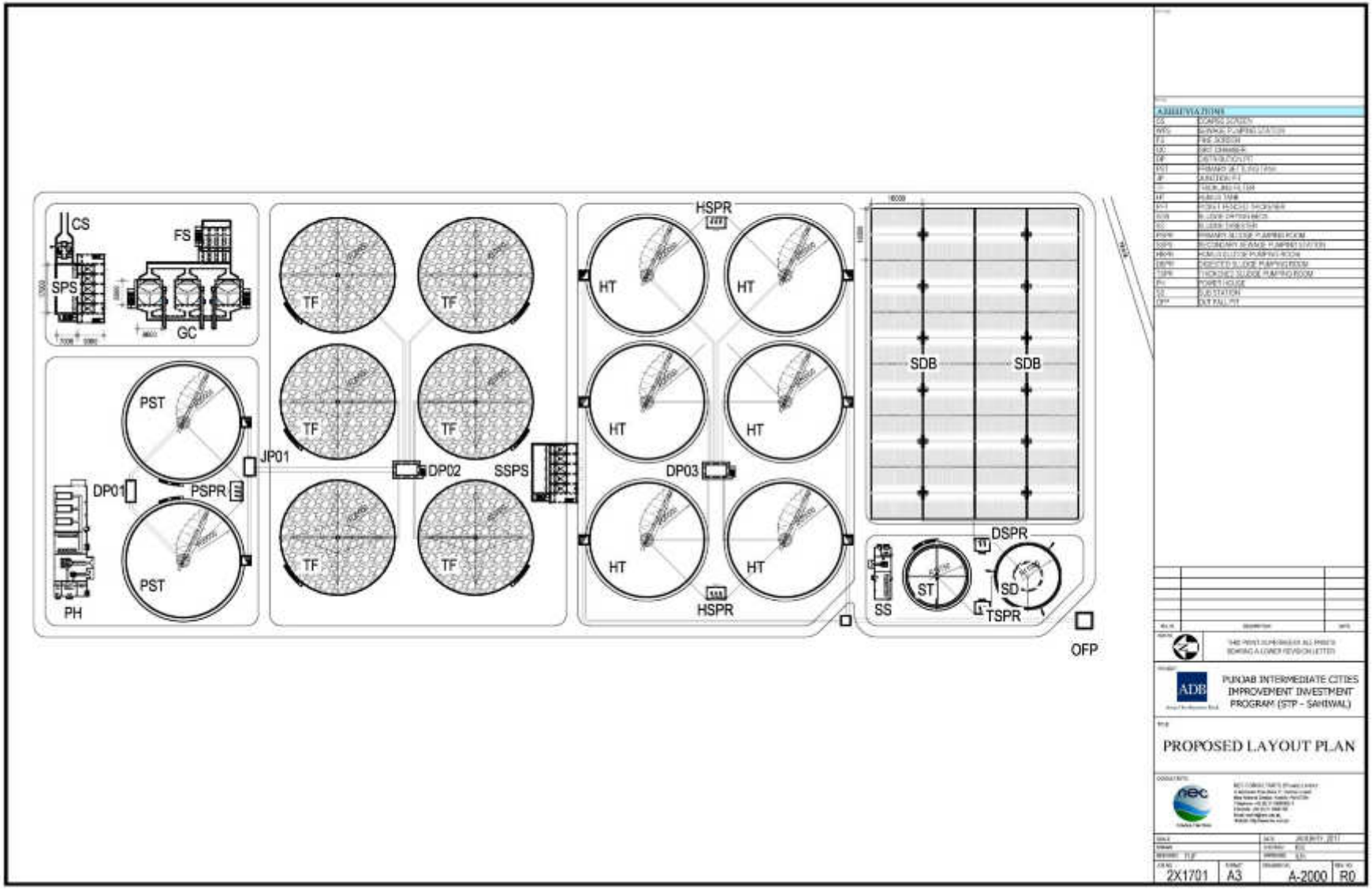


Figure 3.15: Preliminary Layout Plan of Proposed Sewage Treatment Plant



165. The general roads situation in Sahiwal may be summarized as follows:

i) The length of the roads in the city is around 40 km;
ii) The length of the provincial roads in the city is around 10 km;
iii) About 12 roads are in a good condition and have good accessibility;
iv) Around 30% of roads in the city are in a poor condition and have poor accessibility;
v) Road maintenance and upgrades are undertaken in patchwork by the MC; otherwise for the larger road projects provincial assistance is sought; and
vi) There are only two traffic signals on the High Street.

166. All arterial/primary roads, with a few exceptions, and some of the secondary roads, which carry significant traffic volumes, are dual carriageway with substantial road width, narrow central medians and footways.

167. The footways usually are usually encroached, occupied by the roadside merchandisers, and rarely available for the pedestrian to walk. The substantial carriageway widths, together with ill-defined provision for roadside parking and the absence of traffic control/ management measures, allied with complex traffic mix, lead to traffic conflicts and delays.

168. Junctions and crossings are left open and without few, if any, controls. In many cases where relatively new works are undertaken, junction details remain missing, as well as traffic control devices and road markings/signage.

169. The road network in the older parts of the city, where major commercial activity takes place, is congested. Traffic management measures are non-existent and traffic flows suffer from vehicle-pedestrian conflicts.

170. The vehicle population in Sahiwal District and within the city has shown high growth, because of:

- the industrial growth in the city;
- higher usage and ownership of vehicles; and
- increased consumption spending by a bourgeoning middle-class.

171. Vehicle registration in Sahiwal shows an average annual growth rate of 10% during the last three years. Currently more than 230,000 vehicles are registered in the district. The majority of these, nearly a quarter of a million vehicles, are operating within the confines of the city. Road space has not kept pace with the increased reliance on automobiles, and this has resulted in congestion and a lack of adherence to rules and regulations. This has also created congestion on the city streets and has put pressure for investments on road infrastructure improvements.

172. The primary cause of congestion on city roads, however, is not due to excessive traffic volumes but is as a result of the irrational use of the road space, poor roadway management, absence of clear delineation for roadside parking and lack of enforcement.

173. There is no urban/intra-city transport for the city of Sahiwal. There are no affordable wagons and buses for the inhabitants of the city, and this has a detrimental impact on the economic productivity of the population.

174. There is little scope for privately financed public transport systems for Sahiwal, as the majority of routes have not proved to be commercially viable without some form of cross-

subsidy. Most of the city operations are through informal modes, namely two stroke, three wheelers/Chingchi and rickshaws. These are not documented. Urban public transport is infested with unregulated operators creating excessive traffic hazards.

175. Public transport at present is dismal and poorly regulated. It requires improved management on a prudent and financially sensible basis. This is likely to require an additional move towards utilization of two-wheeled vehicles over other forms of motorized transport. There is a sufficient demand to organize bus operations to reduce road congestion and help improve to urban transport services.

176. There are two, inter-city bus terminals within Sahiwal: The C-Class as well as the General Bus Stands on the G. T. Road and also near the Railway Station. The MC is responsible for the maintenance of these C-Class stands. There are 18 D-class stands in the district, managed by a private provider. The Rapid Transit Authority (RTA) from January 2015 through July 2015, issued/renewed around 2,194 route permits for inter-city buses.

177. The Daewoo Bus service has only an inter-city halt-over point in Sahiwal, and there could be significant opportunities to expand these at some point in the not-too-distant future.

178. The terminal operation is also poorly managed. The layout of the terminal areas in general is not conducive to high levels of utilization. There is excessive noise and environmental pollution, it is unclean and unhygienic, and there is considerable encroachment of other traffic in the area, causing congestion and poor vehicular circulation.

179. The SMC has a responsibility for planning and development activities, but is constrained to improve delivery because of lack of competency and non-availability of the technical manpower. Public transport regulatory control is managed by the Provincial Transport Authority (PTA) and the District Regional Transport Authority (RTA). The PTA and RTA need reforms for improved and efficient service delivery.

ii. Proposed Projects

a. Road Improvement/Upgrade

180. The design concept for road network upgrades is based on the objective of road space sharing through the adoption of an inclusive design that accommodates and caters for pedestrians, public transport operations, an improved level of traffic control, efficient mobility and reinforced road safety and access management for all modes of transport. Improved road design includes provision for the following:

- Footpaths having bare minimum width of 1.52 m on both sides of all roads, after upgrading the road side drainage underneath the footpaths.
- Controlled road side parking in any excess space available between footpaths and main carriageways;
- One-way cycle lanes having a width of 1.52 m, to be provided at the outer edge of the outer lane of the main carriageway;
- For crossing routes/intersections, traffic signals are proposed where road widths are not adequate and traffic volumes are high enough. For locations offering wide road space and adequate weaving lengths, roundabouts are proposed;
- Priority crossings are to be identified for intersections on minor streets where traffic volumes are low;

- At signalized junctions, primary and secondary signal heads and normal and overhead gantry poles are proposed to be installed to follow normal British practice; and
- National road marking and road signage standards should be followed and maintained.

181. To demonstrate the viability of modern multiuse public space management to urban transport route planning in Sahiwal, it is proposed that a 3 km long section of Railway Road, considered to be the main road in the City, is upgraded in Phase 1 of PICIIP. The following specific interventions are proposed:

i. Road pavement (rehabilitation);
ii. Intersections improvement;
iii. Traffic signals;
iv. Storm water drainage;
v. Walkways;
vi. Regulatory signage;
vii. Markings and cat eyes;
viii. Curbstones;
ix. Bicycle track;
x. Parking;
xi. Bus stops;
xii. Street furniture; and
xiii. Face uplifting of buildings.

b. General Bus Stand/Terminals, Improvement / Upgrade

182. Two bus terminals operate in the city. The General Bus Stand/terminal is situated on the N-5 (G. T. Road) on the eastern side at the Arif Wala Chowk for long distance operations. This terminal is spread over an area of 1 acre (4,047 m^2).

183. A second terminal is located in the city center on Railway Road and provides services to smaller Mandi Towns situated around the city.

184. The following items have been proposed for the improvement/upgradation of the two terminals, such as:

i. Upgrade of bus terminals/sheds;
ii. Demarcation of Bus bays;
iii. Installation of security cameras,
iv. Installation of lighting (LED/solar panel);
v. Provision of regulatory signage and marking;
vi. Development/re-development of commercial areas;
vii. Installation of cat eyes and curbstones; and
viii. Provision of yellow/black paint on curbstone.

185. The proposed layout of the two bus terminals is illustrated on Figure 3.16 and Figure 3.17 for Multan Road and Railway Road respectively.

Figure 3.16: Proposed Layout of Multan Road Bus Stand

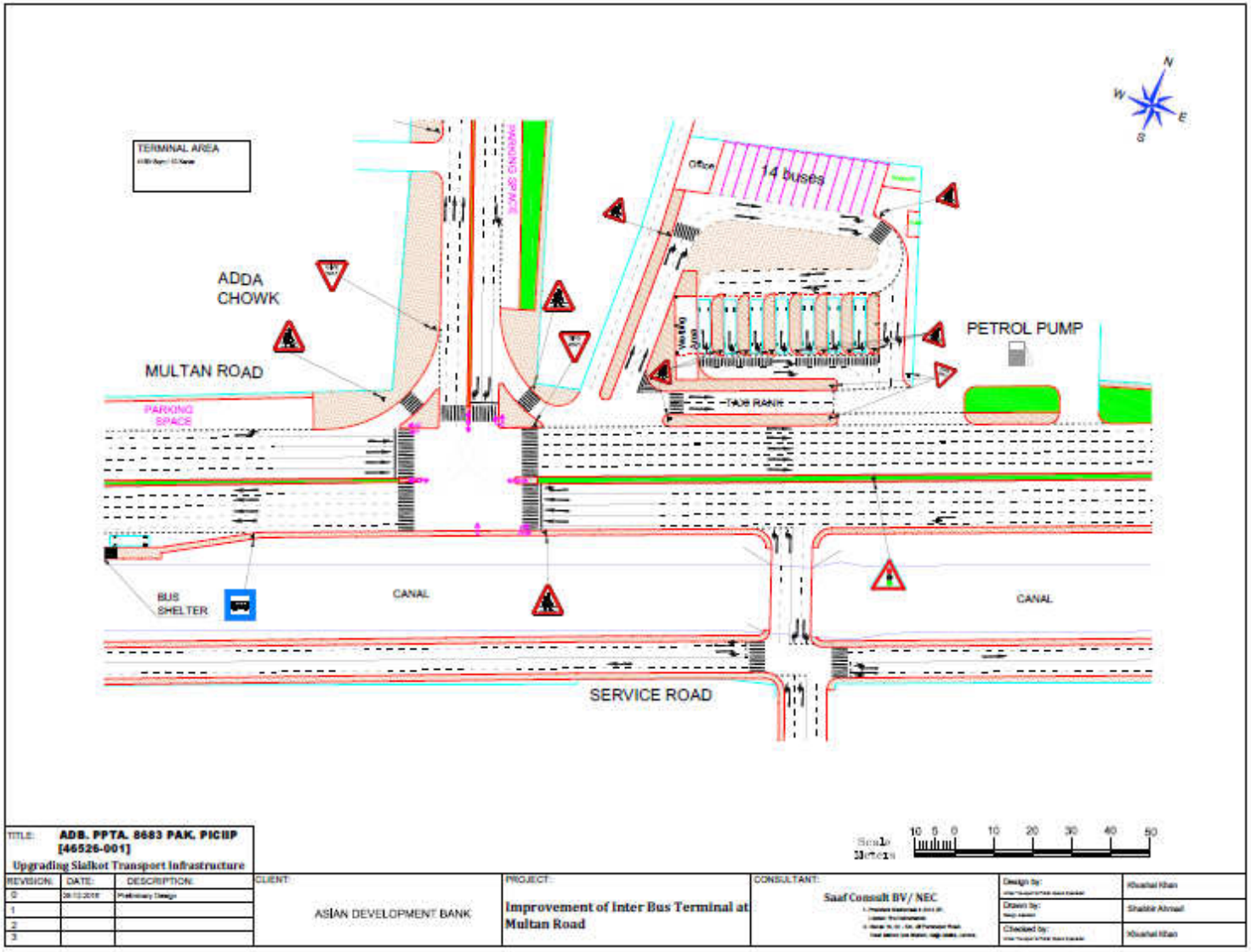
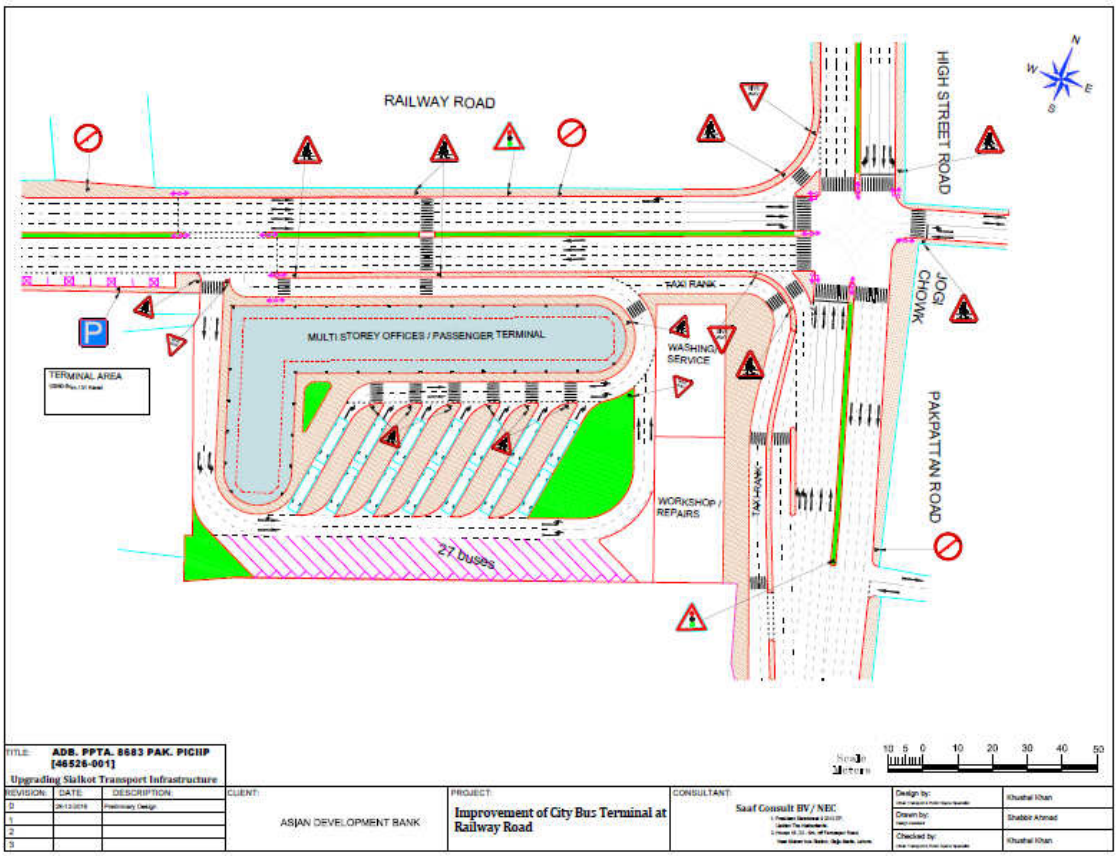


Figure 3.17: Proposed Layout of Railway Road Bus Stand



D. Green Spaces Development Projects Improvement Projects

i. Current Status

186. There is lack of green spaces in Sahiwal city. The existing parks are not well maintained.

ii. Proposed Projects

187. The canal that crosses through the city of Sahiwal provides an excellent opportunity to develop a multi-functional green wedge in the middle of the city that can provide ample green and recreational facilities for the inhabitants. However, presently the canal borders have been left unattended and they have become an area avoided by the public. The canal borders will be developed into a multi-functional green open area with pedestrian ways, running routes, and sporting facilities in combination with commercial activities such as small-scale shops and cafes.

188. The following green space development projects are proposed:

1. Majeed Amjad Park;
2. Chamanzar Park;
3. Faridia Park on Tariq Bin Ziad Colony;
4. Exchange Park;
5. Basket Ball Complex, Stop No.10, Fareed Town;
6. Main Market Park, Fateh Sher Colony;
7. Green Belt area between GT Road and Canal; and

8. Green Belt In the median of Bund Road.

189. The proposed conceptual designs for three of these areas are set out below. They serve as templates for the types of improvements and developments to be implemented at other locations in Sahiwal.

a. Development of Majeed Amjad Park

190. Majeed Amjad Park is located along the canal bank and opposite the Canal Park. This park contains a large car park and a landscaped green park.

191. A zebra crossing will be developed for safe access from the Canal Park car park to the Majeed Amjad Park and vice versa.

192. The Horticultural Department of Sahiwal would prefer the Majeed Amjad Park to be developed with a mini zoo for children. Therefore, a mini zoo (Figure 3.18) will be developed of 1300 m^2. Domesticated and farmyard animals suitable for a mini zoo are rabbits, guinea pigs, hamsters, chickens, goats, sheep, pigs, ponies and donkeys.

193. Animals need proper housing, food and care. Both parents and children must be made aware of animal needs and informed of the risks of interaction. Adequate care of the animals should be part of a training program for government employees with the task to maintain this park.

194. Proper care takers and signage will have to be provided in the park.

195. A childrens' play area, 1300 m^2 in extent, will be developed next to the mini zoo, with various play structures and benches under shady trees. A waste bin will be located adjacent to each bench. Waste bins will also be placed at each access gate. Lights will be provided at each access gate and at regular intervals along the walkways.

196. Separate washrooms will be developed for male and female users with the size and accessibility for wheelchair users.

Figure 3.18: Proposed Development of Majeed Amjad Park

b. Proposed Development of Chamanzar Park

197. Chamanzar Park is a neighborhood park, like the Exchange Park, Basket Ball Complex, Stop No.10, Fareed Town, and Main Market Park, Fateh Sher Colony. The proposed design can be replicated for these parks. Special emphasis should be on the Main Market Park, Fateh Sher Colony, which is located opposite a girls' school, that sufficient sporting and meeting facilities will be developed especially for girls.

198. The Chamanzar Park upgrading will provide for a variety of sporting, relaxing and meeting areas for all ages in the community (Figure 3.19).

Figure 3.19: Proposed Development of Chamanzar Park

199. An essential feature of the park is that it provides separated areas for boys and girls older than 12 years. Both multi-functional sporting areas have a surface of 6000 m^2 and allow for the playing of cricket, hockey, basket ball and tennis, each sport indicated with its own colour and lineage. A sign will indicate the use of each sportfield.

200. A 2000 m^2 grassy area with flowerbeds and benches under shady trees will be provided as a special area for girls only.

201. Furthermore, the park consists of a 2000 m^2 childrens' play area surrounded by shady trees, under which benches will be placed for the children's care takers to sit in the shade. A waste bin will be located adjacent to each bench.

202. A grassy hill of 500 m^2 and an amphitheatre of 1000 m^2 are proposed to be developed for the youth to play and relax. The amphitheatre can be used as meeting place and as place to perform on stage.

203. A combined walking and jogging track around the park provides for walking space for elderly and a jogging track for adults. A sign should indicate the times for walking, early morning until the afternoon, and jogging, in the afternoon until the evening.

204. Proper lightning will be provided at the access gates and at regular intervals along the walking routes and jogging track and next to the washrooms. Special areas should have adequate lightning and special sporting lights should provide for the possibility to play sports in the evening.

205. Washrooms (24 m^2) will provide for sufficient space for wheelchair users. Two washrooms for male and two for females will be provided.

c. Green belt development: Sahiwal Waterfront Park

206. A green belt between the canal and GT Road presently divides the city and hinders access for residents living opposite the canal from entering the city. Therefore, a waterfront park with two pedestrian bridges over the canal will be developed. The Horticultural Department would prefer a jogging track along the canal and facilities for the city's residents.

207. With the development of the Sahiwal waterfront park, the city will create a green access route to the city centre, where the residents can recreate and grow their own vegetables in community gardens.

208. The green belt will be developed into a multi-functional area for all. Car parking will provide for easy and safe access to the facilities, which are proposed to include a childrens' play area of 2000 m^2, a food stall area of 50 m^2 and a picnic area with benches under shady trees of 2000 m^2.

209. Community gardens will give the inhabitants the opportunity to grow their own vegetables, herbs and flowers.

210. In a separate part of the green belt, a jogging track will be developed with fitness features along the track. At the end a small café of 100 m^2 with covered terrace will be created along the canal bank.

211. Opposite the canal the narrow green belt will be developed with a walking route with benches under trees and a small childrens' play area.

212. Waste bins will be placed next to each bench. Lights placed at regular intervals will provide safety and comfort.

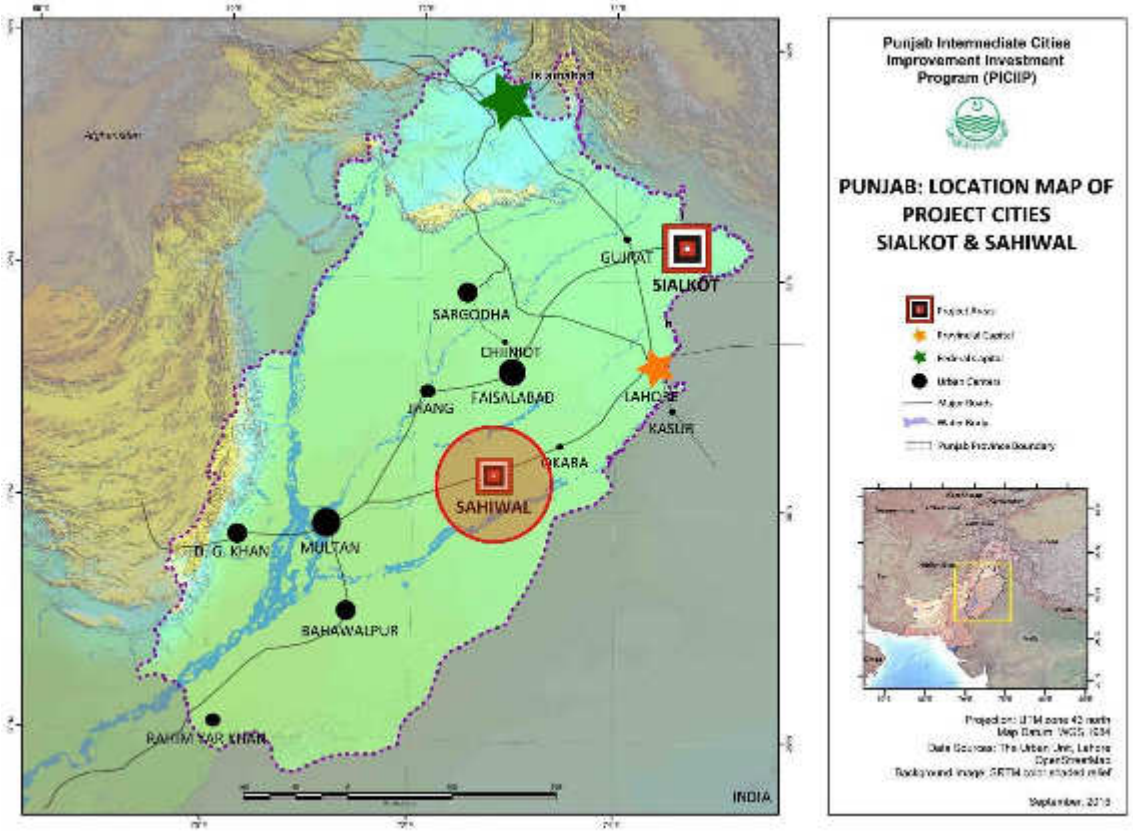
IV. ENVIRONMENTAL & SOCIAL BASELINE CONDITIONS

213. This Section describes the overall baseline environmental and social conditions of the area in which the subproject sites are located. The Section describes pertinent aspects of the physical resources, ecological resources and social resources of Sahiwal City and adjacent areas.

A. Physical Resources

214. Sahiwal town is situated about 29 km from the left bank of the river Ravi, 187 km west of Lahore, and 200 km east of Multan. (Figure 4.1) The Grand Trunk Road and the main railway line pass through the town; they also connect Peshawar and Lahore with Karachi.

Figure 4.1: Location Map of Sahiwal



i. Geography and Topography

215. Sahiwal is situated at 30°39'52.16" North latitude and 73°6'30.54" East longitude, at an approximate height is 152 m above sea level.

216. The Lower Bari Doab Canal separates the town into two parts.

217. Punjab's terrain is one of relatively low-lying plains, with several rivers that traverse the area from the northeast to the southwest and feed into the Indus River. The Ravi River is closest to Sahiwal, but it is still nearly 20 km away

218. There is no history of the city being threatened by floods.

219. The topography of Sahiwal is one of a flat semi-arid plain that is fertilized through the use of its extensive irrigation canal. The Lower Bari Doab is the main source of irrigation in the area and it is fed by a link from the Chenab River.

220. From a topographical point of view, the semi-arid plain is remarkably homogeneous. The only noticeable relief is that of the flood plain bluffs and the belts of ravines and bad land that were formed by gully erosion along the Lower Bari Doab and its distributaries. Generally, the natural slope runs northeast to southwest. On the whole, the area is flat

221. Geologically, the area does not have any outstanding features. Saltpeter, which is made from saline earth called kallar, is found when the water table is high. In the east of the town, there can be found common salt mixed with a lesser quantity of sulfate of soda and a very small quantity of lime and magnesium salt.

ii. Climate

222. Sahiwal has the same basic natural and climatic conditions that prevail elsewhere in Punjab. The climate in most of the area is arid to semi-arid, characterized by four distinct seasons in a year: winter from mid-November to February; spring from March to April; summer from May to mid-September; and autumn from mid-September to mid-November.

223. The most challenging weather phenomenon in Sahiwal are the winds called 'Loo', which blow during the day in the predominately hot and dry summer.

224. The dust from the dry parched earth rises, the air becomes laden with it, and out-door work is difficult. Trees shed their leaves to avoid the loss of moisture and where there is no canal or well, the countryside presents a very dreary aspect. Occasionally, the hot weather is broken by thunderstorms and dust storms. The heavy rainfall, which the thunderstorms bring, and light rain, which follows the dust storm, produces a slight decrease in temperature.

225. June is the hottest month with a mean daily maximum temperature of 42.4 ^{o}C. January is the coldest month with the mean daily minimum temperature of 4.4 ^{o}C. Table 4.1 details the mean monthly maximum and minimum temperatures of Sahiwal District.

Table 4.1: Mean Monthly Maximum and Minimum Temperature of Sahiwal District

Month	Mean Monthly Maximum (^{o}C)	Mean Monthly Minimum Temperature (^{o}C)
January	19.7	5.4
February	22.8	8.4
March	28.3	13.5
April	35.2	19.2
May	40.4	24.4
June	41.4	27.7
July	38.4	28.1
August	37.8	27.2
September	36.2	24.4
October	34.6	18.1
November	28.6	10.8
December	22.4	6.4
Annual	**32.2**	**17.8**

Source: Initial Environmental Examination, Pak: MFF Power Transmission Enhancement Investment Program Tranche 4

iii. Rainfall

226. Average annual rainfall ranges between 97 mm and 261 mm. The maximum rainfall (about 60 percent of the total annual rainfall) occurs during the monsoon season (July, August and September), while the period of minimum rainfall or drier period is October and November. Table 4.2 shows the mean monthly rainfall data for Sahiwal District.

Table 4.2: Meteorological Data, Mean Monthly Precipitation of Sahiwal District

Month	Mean Monthly Precipitation (mm)
January	12.0
February	12.0
March	17.0
April	6.0
May	7.0
June	23.0
July	74.0
August	75.0
September	25.0
October	1.0
November	2.0
December	7.0
Annual	**261.0**

Source: Initial Environmental Examination, Pak: MFF Power Transmission Enhancement Investment Program Tranche 4

iv. Relative Humidity

227. July, August and September are the most humid months in the area. May and June are the least humid. Table 4.3 shows the average monthly relative humidity in Multan District (close to Sahiwal District).

Table 4.3: Meteorological Data, Mean Monthly Relative Humidity of Multan District

Month	Mean Monthly Relative Humidity (%)
January	62.3
February	56.3
March	51.6
April	40.0
May	33.2
June	39.9
July	56.0
August	59.7
September	56.3
October	51.6
November	61.4
December	66.6
Annual	**52.9**

Source: Initial Environmental Examination, Pak: MFF Power Transmission Enhancement Investment Program Tranche 4

v. Wind Direction

228. Sahiwal is situated in southwest Punjab and is influenced by monsoon winds throughout the year. In winter, the wind blows from the north and east. In summer, the wind direction is

southwest. However, these wind directions are usually disturbed by cyclones, which cause the temperature to drop and low-pressure systems to set in. This situation prevails in autumn.

229. Wind rose for Sahiwal city, for the year 2016, is provided in Figure 4.2 (morning) and Figure 4.3 (late afternoon/early evening).

Figure 4.2: Annual Wind Rose (morning), Sahiwal

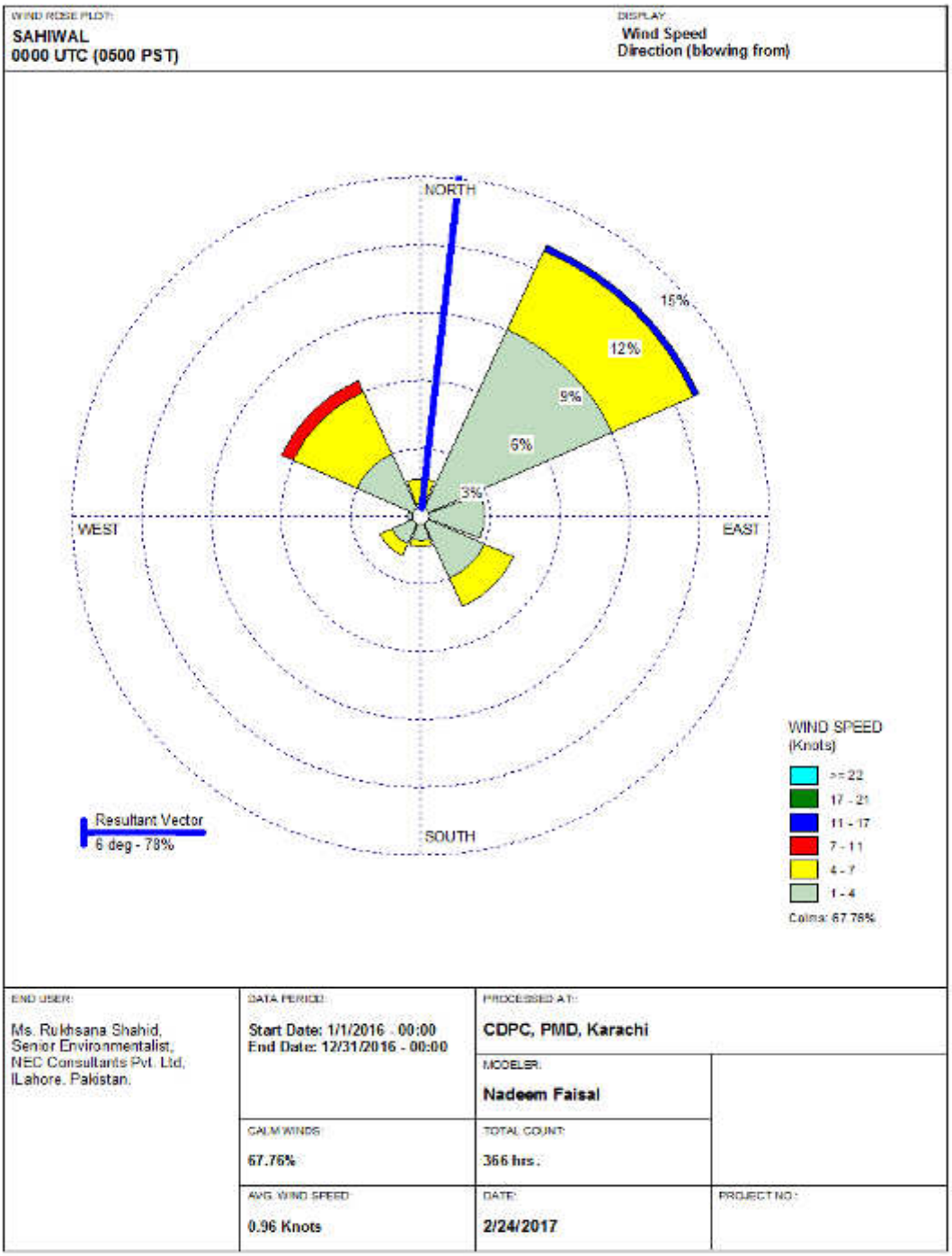
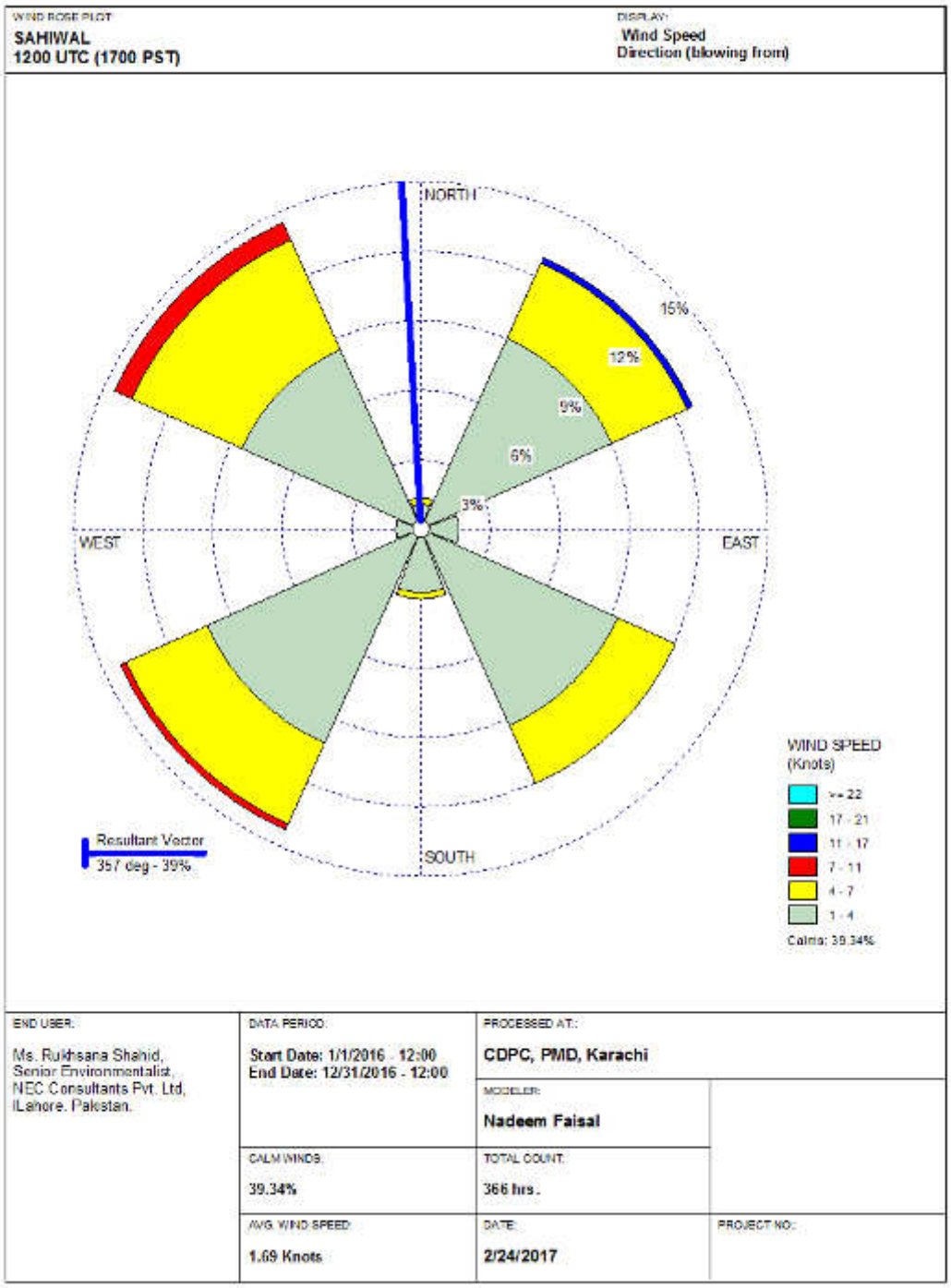


Figure 4.3: Annual Wind Rose (evening), Sahiwal



vi. Ambient Air Quality

230. Ambient air quality was monitored continuously for 24 hours, adjacent to the STP site, in order to establish the present concentrations of the following parameters:

- CO;
- $SO_{2;}$
- NO;
- $NO_{2;}$
- Particulate Matter (PM_{10}); and
- Particulate Matter ($PM_{2.5}$)

231. Measurements were made over the period 22-24 November 2016 inclusive and comprised readings taken every hour over a period of forty-eights.

232. Test reports are reproduced in Annexure 2 and the average concentrations of the tested parameters summarized on Table 4.4.

Table 4.4: Average Concentrations of Tested Parameters, Ambient Air Quality

Parameter	Unit	Monitoring Duration	Average Concentration	PEQSAA
Nitrogen Oxide (NO)	µg/m^3	24 Hours	7.95	40 µg/m^3 (For 24 Hours)
Nitrogen Dioxide (NO_2)	µg/m^3	24 Hours	11.4	80 µg/m^3 (For 24 Hours)
Nitrogen Oxides (NOx), $NO+NO_2$	µg/m^3	24 Hours	19.35	120 µg/m^3 (For 24 Hours)
Sulfur Dioxide (SO_2)	µg/m^3	24 Hours	14.4	120 µg/m^3 (For 24 Hours)
Carbon Monoxide (CO)	µg/m^3	24 Hours	2.33	05 mg/m^3 (For 08 Hours)
Particulate Matter (PM_{10})	µg/m^3	24 Hours	291.3	150 µg/m^3 (For 24 Hours)
Particulate Matter ($PM_{2.5}$)	µg/m^3	24 Hours	27.8	35 µg/m^3 (For 24 Hours)

233. The ambient air quality data, when compared with Punjab Environmental Quality Standards for Ambient Air (PEQSAA), indicate that the area's ambient air quality is generally good, since the measured values of the pollutants is below the recommended values, with the exception of PM_{10}.

vii. Baseline Noise at Sewage Treatment Plant Site

234. Baseline noise monitoring was carried out for proposed STP site at seven locations on 14 February 2017. Each set of measurements was recorded for 2 minutes.

235. The test report is reproduced in Annexure 2 and the measured baseline noise measurements recorded summarized on Table 4.5.

236. The baseline noise condition recorded is considered to be quiet. The daytime noise levels, at the STP site, are in the range of 48.5 to 66.7 dBA.

237. As per the PEQS, the surrounding area noises for residential, commercial, industrial and silence zones are 55, 65, 75 and 50 respectively.

Table 4.5: Noise Monitoring at STP Site

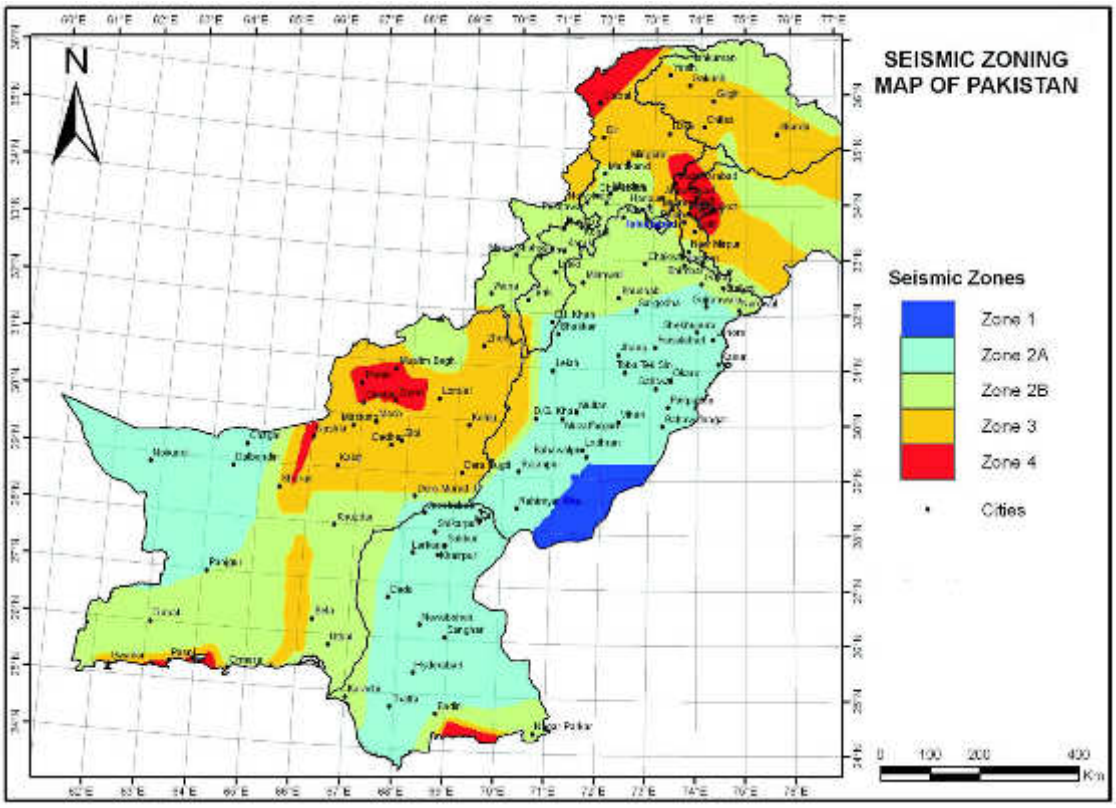
Location	Noise (dBA)
East-South Side (Facing Canal Side)	51.3 – 66.0
East-North Side (Facing 95/6-R Village)	52.4 – 63.0
West-South Side (Facing Agriculture Fields)	49.8 – 63.0
West-North Side (Facing Agriculture Fields)	49.4 – 62.5
Centre Point	48.5 – 63.6
Near Village 95/6-R	50.2 – 62.5
Near Three Marla Housing Scheme	51.3 – 66.7

Source: Test Report of Laboratory of Environmental Sciences, February 2017

viii. Seismicity

238. Pakistan lies in a seismically active zone. Seismic observations indicate that hundreds of shocks occur in the region every year. According to the seismic zoning map of Pakistan (Figure 4.2), included in Pakistan Building Code Seismic Provisions (2007), the project area falls under seismic zone 2A, with a peak horizontal ground acceleration of from 0.08 to 0.16.

Figure 4.4: Seismic Zoning Map of Pakistan



ix. Groundwater Quality

239. Groundwater is the sole source of potable water exploited in Sahiwal. The water table averages about 12 to 15 m below ground level and the upper levels produce limited quantities of mineralized water. At a depth of between 137 and 152 meters, greater quantities of good quality groundwater are available and this is the source of City's water supply.

240. In recent years, the water table has been dropping at a rate of 0.30 meter per year. This is because of pumping, and decreased rainfall and recharge. It is not clear whether the aquifer is being overexploited but, in view of the wide dispersal of the tube wells, this is unlikely at the present level of abstraction.

241. The quality of groundwater of Sahiwal is shown in Table 4.6. Compared to the National Standards for Drinking Water Quality (Pakistan EPA, 2010) and WHO Guidelines current groundwater quality does not meet all the standards required for potable water. Turbidity is on the high side, whilst there is ubiquitous contamination by coliforms

Table 4.6: Groundwater Quality Analysis of Sahiwal City

Parameter	Value	NSDWQ/WHO
pH	7.98 – 8.20	6.5 – 8.5
Turbidity, NTU	0.4 – 9.5	< 5
Total Dissolved Solids (TDs), mg/l	175 - 610	< 1,000
Fluoride, mg/l	0.06 – 0.49	≤ 1.5
Nitrate, mg/l	0.9 – 2.1	≤ 50
Arsenic, mg/l	0.025	≤ 0.05
Total Coliform, MPN/100 ml	5.1 – 16	Nil
Fecal Coliform, MPN/100 ml	5.1 -12	Nil

[1] Source: PICIIP Feasibility Study Report, December 2016, * **BDL** Below Detection Limit

242. The quality of groundwater has also been investigated at the site of the STP, from two shallow hand pumps and two deeper tube wells.

243. The results obtained from a single sampling on 8th February 2017 are summarized on Table 4.7. Laboratory test reports are reproduced in Annexure 2.

244. The recorded results are similar to those reported for the wider Sahiwal District in that turbidity is on the high to very high side and the groundwater is contaminated with fecal coliforms.

x. Surface Water Quality

245. The Lower Bari Doab Canal (LBDC) passes within 300 m to the south of the STP project site. The LBDC will be the receiving water for any treated effluent discharged from the STP.

246. Three sets of samples were obtained from the middle of the LBDC on 14th February 2017 and analyzed for a range of parameters.

247. The quality of the water from LBDC is summarized on Table 4.8. Laboratory test reports are reproduced in Annexure 2.

248. The water in the canal is reported to have relatively low levels of BOD, COD and metals. It does, however, have high very levels of coliforms and relatively high levels of dissolved and suspended solids, grease and oil, indicative of the fact that untreated wastewater is currently discharged into the canal.

249. Table 4.9 provides an indication of the quality of the wastewater flowing in the Sahiwal sewerage system based on data obtained and reported in the PFS.

Table 4.7: Groundwater Quality Analysis at STP Site

Parameter	Value				NSDWQ/WHO
	Agri Tube Well (Depth 76 m)	Deep Well Turbine (Depth 107 m)	Hand Pump (Depth 30 m)	Hand Pump (Depth 21 m)	
pH		7.59	7.66	8.12	6.5 – 8.5
Color (PtCo)		13	82	191	≤ 15 TCU
Turbidity (NTU)		84	64	14.8	< 5
Taste		Tasteless	Tasteless	Tasteless	None
Odor		Odorless	Odorless	Odorless	None
Total Hardness (mg/l)		356	212	220	< 500
Conductivity (µs/cm)	751				-
Bicarbonate (mg/l)	284				-
Calcium (mg/l)	48				-
Magnesium (mg/l)	35				-
Chloride (mg/l)	50	164	84	118	<250
Total Suspended Solids (mg/l)	4	2	3	2	-
Total Dissolved Solids (mg/l)	520	1,380	1360	1,110	<1,000
Nitrate (mg/l)	3.4	0.7	1.5	0.7	≤ 50
Nitrite (mg/l)		0.013	0.004	0.002	≤ 3
Sulfate (mg/l)	145				-
Fluoride (mg/l)		0.04	0.42	0.08	≤ 1.5
Copper (mg/l)		0.03	0.04	0.05	2
Chlorine (mg/l)		0.05	0.04	0.06	-
Iron (mg/l)		0.06	0.62	2.28	-
Arsenic (mg/l)		0.01	BDL	BDL	≤ 0.05
Lead (mg/l)		0.012	0.015	0.023	
Total Coliform (MPN/100 ml)	>23	2.2	<1.1	>23	Nil
Fecal Coliform (MPN/100 ml)	5.1	2.2	<1.1	9.2	Nil

Source: Testing Report of Laboratory of Environmental Sciences

Table 4.8: Surface Quality Analysis from the Lower Bari Doab Canal

Parameter	Value		
Time of sampling	11:00 am	2:00 pm	5:00 pm
pH	7.36	7.65	7.60
Biochemical Oxygen Demand (BOD_5) mg/l	6.0	6.0	6.0
Chemical Oxygen Demand (COD) mg/l	14	12	12
Total Suspended Solids (TSS) mg/l	70	90	60
Total Dissolved Solids (TDS) mg/l	240	280	200
Copper mg/l	0.06	0.09	0.15
Chromium Total mg/l	0.02	0.03	0.02
Chloride mg/l	38	36	32
Fluoride mg/l	0.02	0.04	0.03
Sulfate mg/l	34	40	33
Sulfide mg/l	0.018	0.013	0.001
Oil & Grease mg/l	7	6	3
Lead mg/l	0.03	0.02	0.02
Arsenic mg/l	BDL	BDL	BDL
Chlorine mg/l	0.07	0.16	0.15
Total Iron mg/l	0.08	0.06	0.03
Total Coliform MPN/100 ml	9,200	16,000	16,000
Fecal Coliform MPN/100 ml	3,500	9,200	2,400
Ammonia	1.4	1.31	1.52
Cadmium	BDL	BDL	BDL
Mercury	BDL	BDL	BDL
Zinc	0.37	0.08	0.025

Source: Laboratory Report (Laboratory of Environmental Sciences, February 2017)

BDL (Below Detection Limit) for Arsenic is <0.01 mg/l

Table 4.9: Wastewater Quality Analysis

Parameter	Value
pH	
Biochemical Oxygen Demand (BOD_5) mg/l	111 – 334
Chemical Oxygen Demand (COD) mg/l	212 - 782
Total Suspended Solids (TSS) mg/l	70 - 460
Total Dissolved Solids (TDS) mg/l	900 – 1,380
Oil & Grease mg/l	4 - 20

Source: PICIIP Feasibility Study Report, November 2016

B. Ecological Resources

i. Flora of the Area

250. In Sahiwal District, the most important species of trees are Kikar (Acacia Arabica), Shisham or Tahli (Delbergia sissoo), Beri (Zizyphus jujube), Toot (Morus alba), Sharin (Albizzia lebbek), Dherek (Melia azeharach), Phulai (Acacia modesta), Pipal (Ficus religiosa), and Bohr (Ficus bengalansis), which are planted for shade.

251. The trees in Rakhs mainly consist of three species: Jand (Prosopis spicigera), Karir (Capparis aphylla), and Wan (Salvadora oleoides). Occasionally, Rero (Acacia ieucophhloea) and Farash (Tamarix articulata) are also found.

252. The Pilchhi (Tamarix dioica) is found on moist sandy soils along riverbanks and is used for wicker work, and basket making, etc. Mesquite bushes and some Eucalyptus trees grow wild in the areas along the canals, roads and barren land, but natural forest cover has been significantly reduced.

253. Sahiwal is a green and fertile town with 11,522 forested acres.

254. The area's main crops are wheat, cotton, sugarcane, maize, sorghum forage and rice. Main fruits grown are citrus, mangoes and guava.

ii. Fauna of the Area

255. Most of the Punjab is under intensive irrigated cultivation. Livestock rearing is also extensively practiced, and milk animals are common. The use of chemical fertilizers and pesticides is also very common.

256. Several species of wildlife have adapted to the changed habitat. These include the jackal, jungle cat, Bengal fox, small Indian mongoose, shrew, hog deer, ravine deer, black buck, blue bull, wild hare and rodent pests, including porcupine, fruit bats and wild boar.

257. The avifauna that has survived the modified habitat include doves, black partridge, cuckoos, koel, woodpeckers, parakeets, bulbuls, babblers, black drongo, bee eaters, finches, owls, hawks and house sparrow.

258. The reptilian species of this modified habitat include krait, cobra, saw scaled viper, rat snake and monitor lizard.

259. In these modified habitats, due to the extensive use of pesticides in these areas, the winter bird species from the Himalayas have been reduced, since these species feed on the insects. These birds play an important role in controlling insects, particularly in the forests.

260. Scavengers, such as jackals, are attracted to garbage dumps and human feces for food. House sparrows breed in houses. Bank mynas and cattle egrets feed on grasshoppers that are present in the rangelands that also support cattle and buffalos. Banyan and peepal trees still grow in the villages. Green pigeons and barbets feed in these trees.

261. Some of the oldest trees still stand in the old British-era colonies. Some rare species of birds, such as hornbills, green pigeons, and barbets still live on these trees.

262. Large populations of pigeons breed in urban houses. Kites, crows, mynas, house sparrows and alexandrine parakeets breed in urban areas.

263. Shisham and acacia trees are usually planted along the roads and canals. Doves mainly breed on these types of trees.

iii. Ecology of the STP Site

264. An ecological study of the STP site area has been conducted using standard ecological assessment techniques based on primary and secondary information. Additional information collected during site visits through discussion with locals living in and around project area, coupled with expert visual observations, has also contributed to the survey.

265. The project site primarily falls within revenue jurisdiction of Chak No. 95/6-R, Tehsil and District Sahiwal, on the left-hand side of Lower Bari Doab Canal (LBDC). Project area spreads over about 12 acres of land with its length stretching along Canal direction with an

elevation of about 152 meters (500 feet) above sea level. The land is fertile with alluvial deposits and is under agricultural cultivation by utilizing LBDC and tube well water.

266. The Sahiwal District of Indus basin plain falls under Tropical Thorn Forest type and has a hot semi-arid climate intermediating between Desert climate and Humid climate in ecological characteristics with agricultural potential. The climate tends to have hot, sometimes extremely hot, summers and mild warm winters. The soil and climatic characteristics support short or scrubby vegetation which can be termed as open and pronouncedly of xerophytic nature, in which thorny leguminous species predominate.

267. Commonly found vegetation (Trees, Shrubs, Grasses) of the project as well as study area include the species itemized in Table 4.10 to Table 4.12 inclusive.

Table 4.10: Trees Found in STP Area

S. No.	Common Name	Scientific Name	IUCN Status
1	Kikar	*Acacia nilotica*	NA
2	Shisham	*Dalbergia sisso*	NA
3	Simal	*Bombax ceiba,*	NA
4	Sufeda	*Eucalyptus species*	NA
5	Frash	*Tamarix articulate*	NA
6	Neem	*Azedarachta indica*	NA
7	Jaman	*Syzygium cumini*	NA
8	Bakain	*Melia azedarach*	NA
9	Ber	*Zyziphus mauritiana*	NA
10	Toot	*Morus alba*	NA
11	Lasura	*Cordia myxa*	NA
12	Sukh Chaen	*Pongamia glabra*	LC
13	Mesquite	*Prosopis juliflora*	NA
14	Date Palm	*Phoenix dactylifera*	NA

NA= Not Assessed LC= Least Concern

Table 4.11: Shrubs and Herbs in STP Area

S. No.	Common Name	Scientific Name	IUCN Status
1	Akk	Calotropis procera	NA
2	Phog	Calligonum polygonoides	NA
3	Jantar	Sesbania aculeate	NA
4	Bathu	Chenopodium botrys	NA
5	Lana	Suaeda fruticosa	NA
6	Arind	Ricinus communis	NA
7	Piazi	Asphodelus tenuifolius	NA

NA= Not Assessed

Table 4.12: Grasses Found in STP Area

S. No.	Common Name	Scientific Name	IUCN Status
1	Khabbal	*Cynodon dactylon*	NA
2	Dab	*Desmotachya bipinnata*	NA
3	Khawi	*Cymbopogan jwarancusa*	NA
4	Kana	*Saccharum munja*	NA
5	Gorkha	*Elionorus hirsutus*	NA
6	Kai	*Saccharum spontaneum*	LC

NA= Not Assessed LC= Least Concern

268. The STP site is flat agricultural land which supports trees of various species on the boundary of agricultural fields as well as individually scattered growth. Trees (girth 61 cm and above) and pole crop (girth 20 to 58 cm) standing within the project area were enumerated along with their kind of species. The detail of trees present in the project area is given in Table 4.13.

Table 4.13: Species Wise Tree Distribution at STP Site

Sr. No.	Species	No. of Trees		
		Poles (girth 20 to 58 cm)	Trees (girth 61 cm and above)	Total
1	Kikar	5	12	17
2	Shisham	8	10	18
3	Toot	7	13	20
4	Miscellaneous	5	7	12
	Total	**25**	**42**	**67**

Miscellaneous includes Sukh Chaen, Lasura, Jaman, Neem, Date Palm

269. The extent of fauna presence is related to the availability of vegetative cover in an area. Since the project area is basically agricultural without any dense forested area nearby, it lacks richness in natural fauna. No conspicuous wildlife was observed in the area during the field visits. However, mammals, reptiles and amphibians reported in the project area are itemized on Table 4.14 to Table 4.16 inclusive.

Table 4.14: Mammals at STP Site

S. No.	Common Name	Scientific Name	IUCN Status
1	Jackal	*Canis aureus*	LC
2	Fox	*Vulpus bengalensis*	NA
3	Porcupine	*Hystrix indica*	LC
4	Squirrel with strips	*Funambulus pennanti*	NA
5	Mouse	*Mus musculus*	LC
6	Mongoose	*Herpestes auropunctatus*	NA
7	Indian Hare	*Lepus nigricollis*	LC

NA= Not Assessed LC= Least Concern

Table 4.15: Reptiles at STP Site

S. No.	Common Name	Scientific Name	IUCN Status
1	Cobra	*Naja naja*	NA
2	Spiny tailed Lizard	*Uromastyx hardwickii*	NA
3	Fringed Toed Lizard	*Acanthodactylus cantoris*	LC
4	Indian Krait	*Bungarus caeruleus*	NA

NA= Not Assessed LC= Least Concern

Table 4.16: Amphibians at STP Site

S. No.	Common Name	Scientific Name	IUCN Status
1	Common Frog	*Rana tigrina*	LC
2	Common Toad	*Bufo bufo*	LC

LC= Least Concern

270. The area is comparatively dry and does not support a wide variety of birds. The common species found in the project area are listed on Table 4.17.

Table 4.17: Birds at STP Site

S. No.	Common Name	Scientific Name	IUCN Status
1	House Sparrow	*Passer domesticus*	LC
2	Mynah	*Acridotheres tristis*	LC
3	House Crow	*Corvus splendens*	LC
4	Pigeon	*Columba livia*	LC
5	Koel	*Eudynamys scolopacea*	LC
6	Red-Wattled Lapwing	*Vanellus indicus*	LC
7	Gray Partridge	*Francolinus Pondicerianus*	LC
8	Quail	*Coturnix coturnix*	LC
9	Red Vented Bulbul	*Pycnonotus cafer humayuni*	NA
10	Little Bittern	*Ixobrychus minutus*	LC
11	Hoopoe	*Upupa epops*	LC
12	Ring Necked Dove	*Streptopelia decaocto*	LC
13	Little Egret	*Egretta garzetta*	LC

NA= Not Assessed LC= Least Concern

271. On account of anthropogenic interventions mainly agriculture, no habitat is left to support a wide diversity of wildlife in the STP area. None of the existing (remaining) species of plants or animals, therefore, are of endangered category.

272. The fishery sector is not rich in District Sahiwal on account of precious fertile land for agriculture production. There is little fish diversity in the LBDC and other nearby water bodies except for Gulfam fish (Cyprinus carpio), which is basically a cold water species but which has adapted to harsh conditions. There are no large fish farms in the area.

273. Agriculture is the main source of income of the inhabitants of the project area. District Sahiwal being the land of three rivers is considered as one of the most fertile land zones of the Punjab. Therefore, due to a sophisticated canal irrigation system and supporting ecological and climate characteristics, this area has a good potential for producing almost all kinds of food commodities. The area has a diverse cropping pattern because of its heterogeneity in agro-climatic conditions.

274. Sugarcane, wheat, rice, maize and cotton are the main crops grown in the area. Besides guar seed, bajra, moong, mash, masoor, jawar, oil seeds are also grown in minor quantities in the Sahiwal area. The average yield of important crops in the area of is summarized on Table 4.18.

Table 4.18: Average Yield of Agricultural Crops

Sr. No.	Crop Name	Average Yield/Acre (kg)
1	Cotton	1,000
2	Sugarcane	20,600
3	Maize (Spring)	3,400
4	Maize (Autumn)	2,800
5	Rice	800
6	Wheat	1,400
7	Potato	9,600

275. Citrus, guavas and mangoes are the main fruits grown in the district. Pomegranate, litchi, falsa and banana are also raised on minor scale.

276. Potatoes, onion, cauliflower, tomato and turnip are main vegetables grown in the area. Peas, garlic, chilies and lady finger are grown on a smaller scale.

iv. Protected areas / National Sanctuaries

277. There are several areas of land in Pakistan devoted to the preservation of biodiversity through the dedication of national parks and wildlife sanctuaries.

278. There are no protected areas or national sanctuaries near the area of works and subproject sites.

C. Economic Development

279. Before the introduction of the canal system, Sahiwal was an area of barren land. However, owing to irrigation it has become very fertile. The real achievement occurred when the Lower Bari Doab Canal was constructed in 1913. Later, the Deepalpur and Pakpattan canals brought almost the entire district under irrigation. Now, the District is one of the most fertile areas of the province and a leading grower of cotton.

280. In the early days, the town had been declared a congested area. Due to an influx of refugees from India and also to recent industrialization, it has attracted a considerable number of people. Consequently, two new sub-towns have cropped up beside the old part of the town.

281. There is a new Abadi on the eastern side of the old town and also a modern satellite town, known as Fareed Town, on the northwestern corner. At the time of its establishment, the area of the original town of Sahiwal was small. However, it grew with the passage of the time, and is now its total area is about 19 square kilometers.

282. The city's major growth took place during the post-1947 period. However, the trend of this growth, even during this period, has largely been in a northerly direction. The city could not grow to the south, perhaps due to the obstruction of Railway line, and the Lower Bari Doab Canal and its distributaries. The city has also spread out toward the east in what appears to have been the result of forced development.

283. Because of this industrial development and the land's fertility the city began to flourish and emerged as a place that attracted in-migration. In short, Sahiwal became a place where people wanted to reside. During the decades of 1911-1921, and 1921-1931, the city attracted the highest ever percentage of people. During these decades, the population growth rate was 79.7 percent and 79.3 percent, respectively.

284. The city also became important from a business point of view. It is situated at the point from where all types of communication are available to connect it and its people with the rest of the province and with the larger country as well. A great change has occurred in its economic structure, as it transitioned from an agricultural to an industrial economy. The town is now a commercial one, with a shopping center that caters to both the town people and also to those living in nearby localities.

i. Land Use and Settlement Patterns

285. Land use includes residential, commercial, industrial, recreational, and institutional activities, among others. A suitable arrangement of the physical elements of land use ensures that a town offers convenience, health and a better quality of life. The city

comprises buildings, transportation channels, utilities, social services, and also vacant land, which may be used for agricultural purposes.

286. In August 1972, the Punjab's Housing and Physical Planning Department began a land-use study of Sahiwal city, which it completed in September the same year. Out of the total area surveyed, the largest portion of the city consisted of undeveloped area that accounted for 41.70 percent of the total area surveyed. The scattered pockets of development exist within the built up areas and also in open strips of land that were situated between various built-up belts of development that ultimately abutted the agricultural land around the city.

287. Since the undeveloped area made up a substantial percentage of the city's surveyed area, it was considered desirable to not take this percentage into account when calculating the percentage of area given to various land uses in the city. Consequently, the survey only included the built-up area, revealing that 31.31 percent was for residential use. The transportation system was second largest user of land, occupying 18.58 percent of the total built up area. Other uses include, industry (occupying 3.85 percent); open spaces (8.54 percent); commerce (1.76 percent), and health (0.74 percent). Other important users of land are canals, distributaries, transport terminals, and Government buildings, which occupy 9.64%, 7.07% and 5.28% of the built-up area, respectively.

288. Originally the city was designed to be a planned colony town, covering an area of only about 307 acres (1,242,429 m^2). The city was designed with the oval as the main focal point. The road network radiated from its center toward a city space that consisted of a mixture of residential and commercial uses. Major bazaars and residences were established in the small streets that ran off the major arteries. Functions, such as administration, education, and transportation, were situated around the commercial and residential parts of the old town.

289. After independence, the city further developed and emerged into a major administrative industrial and commercial town. Since no comprehensive plan was devised, land in the town was given to various uses, irrespective of its suitability. These uses were mostly based on expediency rather than the principles of the land development. As a consequence, the present-day city is a mixture of various and, quite often, incompatible uses. Except for the new planned colony, there has been an intensive mixing of land use, particularly among small-scale cotton factories, etc. However, for an overall pattern of land use, the city can be divided into following major zones:

a. Zone of Central Commercial Activities

290. This is limited to the old city and is surrounded by High Street, Railway Road, Hall Road, Masood Shaheed Road, the Deepalpur Bazar, and the few scattered roads that join this area. Development in this area of is of a ribbon type, along with its major bazaars, i.e., Pakpattan, Sadder, Deepalpur Sori Galli, and Sua Bazars, and is further extended up to Jinnah Chowk. The development of the commercial activities within this area is mainly due to historical reasons rather than to any planned effort.

291. A variety of commercial activities take place here, namely wholesale, and large specialized retail, etc., which cater to the needs of the entire city and the surrounding rural and urban areas that are concentrated in this zone. The shops usually have residential quarters, either attached to or above them, where the owner might be living. There is hardly any exception to this practice. The areas between the main streets form pockets that are filled with residential uses but, even here, it is common to see small shopping facilities scattered here and there. These bazars have developed, over the years, into their present form and will also retain this form in the future.

b. Zone of Mixed Land

292. The vegetable and fruit markets are also located in this area. They cause the usual nuisance to the residents and make it unattractive for living. The other uses are for restaurants, hotels, bus stands, and commercial offices. Among these, the bus stands, which cater to the needs of the city and the adjoining chaks (villages), create hindrances and chaos in the area.

c. Zone of Industrial Complexes

293. This zone is unlike those in the other cities of the Punjab, and is located on and across the Lahore Multan Quetta (LMQ) road. The majority of the large industrial units are found in this zone; however, a few small units are also scattered throughout the city.

294. The reasons for setting up large-scale industry here, between the railway line and the LMQ road and across the LMQ Road, are neither deliberate nor due to any planning criteria. It is the result of the cheap rates for the land and the cheap communications that serve it. However, this development is also ribbon-like, similar to the development along the LMQ road, starting from chowk Pakpattan up to the Arifwala Chowk, and further up to new powerhouse and the grid station. The presence of a 9L water distributary has further helped this area develop for industrial purposes.

d. Zone of Administrative and Educational Buildings

295. This zone comprises the civil lines areas, the canal colony, the Government Boys College complex and the hospital. It further extends up to the Batala School and the Government Girls College. From its beginning, the civil-lines area was at the center of the administrative functions of the city, the district and the region. It extends up to the Boy's Degree College, and the canal colony, and covers a substantial part of the built-up area of the entire city. In addition to being the center of administrative functions (almost all of the government offices are situated in this area), the city's main open spaces are situated in this zone, i.e., the stadium and the race course.

e. Zone of Planned Colonies

296. The zone of the planned colonies comprises the area of the satellite town known as "Fareed Town." Its land-use character is very distinct and different from the old city. Comparatively, its residential density is very low. Both the planned colony and the canal colony were situated in their present locations due to the availability of government land.

297. To sum up, the land use of the city, as a whole, can be described as having developed out of sprawl and without any preconceived plan that could have coordinated the land of one area with that of another or with the transportation system. The result is the prevalence of chaos and unpleasant living conditions.

298. Table 4.19 presents the areas and proportions of various land uses in Sahiwal based on data from the Urban Unit.

Table 4.19: Land Use Distribution in Sahiwal

#	Land Use	Area		% of Total Area
		Acre	Sq. km	
1	Residential	1,143.14	4.63	36.1
2	Commercial	139.97	0.57	4.4
3	Agricultural	520.35	2.11	16.4
4	Public Buildings	357.86	1.45	11.3
5	Religious	23.32	0.09	0.7
6	Education	416.14	1.68	13.1
7	Health	18.72	0.08	0.6
8	Industry	55.97	0.23	1.8
9	Graveyard	53.34	0.22	1.7
10	Parks/Open Spaces	160.46	0.65	5.1
11	Vacant Area	175.70	0.71	5.6
12	Mixed Land use	99.97	0.40	3.2
Total Area		**3,164.94**	**12.81**	**100**

Source: Urban Unit

ii. Agriculture and Livestock

299. Agriculture is by far the main economic activity in the project area. The main crops, during Rabi, are wheat, gram, rapeseed, mustard, barley and oil seeds. During Kharif, crops include cotton, jawar, sugarcane, bajra, maize, and rice. In addition, there are subsidiary crops known as Zaid Rabi, such as Kharbooza, tobacco and potatoes, and also Zaid Kharif crops, such as potatoes and chilies.

300. The main fruits grown are oranges, watermelon, muskmelon, guava, citrus, falsa, jaman, and pomegranate. When cultivation began, the inhabitants ate pilu and bair, the only wild fruits that grow, intermittently, in the region. With the introduction of canal irrigation, other fruits are now being grown on a commercial basis. However, wheat, cotton, sugarcane and rice remain the major crops.

301. Vegetables are grown in abundance, as the water and soil are suitable for cultivation. Crops include potatoes, carrots, ladyfingers, chilies, onions and cauliflower. Bitter gourd, turmeric and garlic are also grown to meet public demand. Other vegetables include radish, tinda (apple gourd), and bringal.

302. Livestock breeding is one of the main pursuits and means of livelihood among the rural and urban population in the project area. Common livestock are sheep, goats and cows, which serve as an important source of income.

iii. Power

303. In keeping with the rest of the country, Sahiwal does not have an adequate, reliable and uninterrupted 24/7 power supply. Interruptions are frequent, forcing industries, other businesses, and many of the residents who can afford it to rely on back-up diesel generators and Uninterrupted Power Supply systems. These are costly, environmentally degrading and generally a poor second option.

304. Power generation and primary distribution are generally beyond a single urban center's capacity, so it is necessary to rely on provincial and national government support. Any city with reliable power enjoys an immediate competitive advantage. Solar options for institutional and residential use are increasing in popularity, but the technology has not reached the stage where it can provide the major energy source for heavier industry.

iv. Industrial Activity

305. There are three industrial sites in Sahiwal District, and more than 200 industries. There is also a small industrial estate, developed by the Punjab Small Industrial Corporation. It consists of 188 plots situated on about 52 acres land.

306. Sahiwal is famous for its cotton ginning and pressing, its tannery, textiles, leather products, garments, pharmaceuticals, flourmills, and food industry.

307. Sahiwal is also one of Pakistan's major multi-crop areas, and many pesticide companies do business here. Major industries include Mitchell's Fruit Farms Limited, Engro Foods Limited, Beakers Land and Sweets Factory, Ittefaq Sugar Mills Limited, Baba Farid Sugar Mills Limited, Lackson Tobacco, Philip Morris Tobacco, Fauji Fertilizer Company, Habib Oil Mill and Aziz Leather Craft, etc.

308. Most of the larger industries, such as Engro Food, Philips Morris Tobacco, dairy product plants, and other agro-based industries are situated along Multan Road, south of the canals, and along the ribbon developments outside the municipal limits.

309. The business community of Sahiwal District earnestly felt the need to establish a Chamber of Commerce & Industry, in Sahiwal. A group of traders and Industrialists succeeded in obtaining a license from the Government of Pakistan's Ministry of Commerce. After incorporation with Security Exchange Commission of Pakistan, under Companies Ordinance 1984, the Chamber became affiliated with the Federation of Pakistan Chambers of Commerce & Industry.

310. The primary objective in establishing the Sahiwal Chamber of Commerce & Industry (SLCCI) was to provide businessmen in the area with an opportunity to strengthen the economic growth of Sahiwal, in particular, and the country, in general. Industrial growth will certainly reduce unemployment in the area.

311. The SLCCI acts as a bridge between the government and the business community. It plays an important role in policy formulation by maintaining a constant interaction with the relevant authorities.

v. Water Supply Service

312. The water supply is obtained from ground water and 46 tube wells. The water supply network covers 90 percent of the town and serves 90 percent of the total population. The distribution system consists of eight overhead reservoirs with a 450,000-gallon capacity. The distribution consists of a looped network made of different types of materials, including asbestos cement, PVC, mild steel, and duct Iron pipes. Pipe sizes vary from 76 to 305 mm in diameter.

vi. Sewerage System Service

313. The sewerage and drainage system covers 90 percent of the total area of Sahiwal through a 40 km sewerage network. Wastewater is disposed of in a nearby sewer system, which pollutes the surrounding environment and causes waterborne diseases.

314. The residential areas are rapidly expanding to the north side of the town, and slower expansion is taking place toward the east, reducing the coverage of the facility to between approximately 20 and 30 percent.

315. Municipal wastewater is used for irrigation purposes, according to farmers' demand, and the remaining wastewater is disposed of into rivers through drains and nullahs.

vii. Solid Waste Management

316. The solid waste generation from Sahiwal city is overwhelmingly domestic and primarily organic in composition. Some industrial solid waste varies in different parts of the city. The main problems with refuse collection and disposal are old machinery, polythene bags, anti-social habits, lack of supervision, and the encroachment of open sewers.

317. Currently, there is no proper system of waste disposal in Sahiwal. Collected waste is dumped at designated dump sites, at Ratti Tibbi, without any environmental safeguards, such as segregating infectious hazardous waste produced by tanneries, slaughter houses, and hospitals. Presently, only 32 percent of solid waste is being collected and disposed of. However, with increasing economic activity in agriculture and manufacturing, the environmental and health situation will continue to worsen in the absence of proper disposal mechanisms.

318. The Sahiwal Municipal Corporation (SMC) manages Sahiwal's existing solid waste management system. The existing solid waste collection, in general, is divided into a primary and secondary system. The amount of waste generated and the extent of pollution varies from union council to union council. The allocation of sanitary staff in the union councils is not commensurate with the workload, thereby resulting in large heaps of waste piling up on the streets and in open places.

319. Presently, the SMC's primary waste collection is carried out by the use of handcarts and is taken to open places of heaps on roadsides, followed by secondary collection through tractor trolley, and final dumping at the Ratti Tibbi dump side.

viii. Transport

320. Sahiwal city has a total road length of 40 km, of which the regional road/highway is 10 km long. There are 12 km of major roads and 18 km of branch roads. In addition to that, there are numerous streets, which crisscross the city. Also there are about 11 important junctions in the network, out of which six are roundabouts and the remaining function as chowk.

321. Out of the total urban area of 1,652 hectares (16,515,870 m^2), 55 percent offer good vehicular accessibility, 25 percent are fair, and 20 percent offer poor vehicular accessibility. Since the city is basically a planned town, numerous roads in the network are fairly wide. About 9 percent of roads are 37 m wide, 22 percent are 34 m wide, 20 percent are 24 m wide, and 49 percent are 18 m wide or less.

322. The transport infrastructure in Sahiwal is generally adequate for its existing requirements; however, there are relatively few circumferential links. This results in extended journey times for many trips and the misuse of minor roads by through traffic. There is little provision for off-street car parking. There are no signals on any of the chowks and no available urban bus or van services. Mostly motorcycle rickshaws or auto rickshaws are being used as urban transport services on all roads.

323. The Pakistan-China Economic Corridor (CPEC) is an ongoing mega project that aims to connect Gwadar Port in southwestern Pakistan to China's autonomous northwestern region of Xinjiang, via a network of highways, railways and pipelines that transport oil and gas. Other

than the transport infrastructure, the economic corridor will provide Pakistan with telecommunications and energy infrastructure.

324. Sahiwal lies within this corridor and, thus, would be a direct beneficiary. In this corridor, two coal power plants are to be built in Qadirabad, which is located on Multan Road (N5), around 19 km from Sahiwal, in the direction of Lahore. Work on this project has already begun. it will generate 1,320 MW of electricity.

D. Social and Cultural Resources

325. In 2014, the estimated population in Sahiwal District was 2.37 million. Of this 2.37 million, an estimated 1 million (42 percent) was urban. At an average provincial fertility rate of 1.93 percent, the District's population to is projected to rise to 3.5 million by 2035.

326. Socio-economic and other relevant information was obtained from the Multiple Indicator Cluster Survey (MICS) 2007-08. One of the survey's main objectives was to establish a credible baseline for the socio-economic status of each District and at the Tehsil level.

327. Table 4.20 shows a summary of socio-economic indicators for Tehsil Sahiwal. No further segregated information is available from the Bureau of Statistics, Planning and Development Department, Punjab. The population's rural-urban ratio within Tehsil can help estimate the urban proportion of the region's population.

Table 4.20: Social Economic Indicators Summary

Social Indicators	Punjab	Tehsil Sahiwal
Children have had diarrhea within the last two weeks	7.8	10.6
Had acute respiratory infection	7.2	21.2
Water treatment methods have not been used in the household	93.8	97.2
Boiled water is used in the household	2.8	1.4
Piped water is the main source in the dwelling	16.5	2.5
Improved sanitation facility is available through a piped sewer system	20.9	32.2
Percentage of household population using improved sources of drinking water	96.8	99.6
Percentage of household population using sanitary means of sewage disposal	69.5	67
Percentage of household population using improved sources of drinking water and using sanitary means of sewage disposal	67.5	67
Solid waste disposal in open fields	78.1	69.3
Literacy rate (10 years and older)	59.3	57.9
Literacy rate (15 years and older)	55.6	53.6
Literacy rate (15-24 years)	73.3	68.6
Percentage of children aged 3-4 years currently attending preschool	13.5	10.8
Percentage of children of primary school entry age (5 years) currently attending grade 1	18.9	23.6
Percentage of children of primary school entry age (6 years) currently attending grade 1	38.4	38.5
Primary school gross attendance ratio (5-9 years)	97.2	103.6
Physical access to primary schools, Boys government school <2 km	93	95.7
Physical access to primary schools, Girls government school <2 km	91.4	91.1
Physical access to middle schools, Boys government school <2 km	62.6	67.6
Physical access to middle schools, Girls government school <2 km	62.8	74.5
Physical access to secondary schools, Boys government school <2 km	50.6	48.9
Physical access to secondary schools, Girls government school <2 km	46.9	47.9
Child labor, working outside of the household	5.1	12.4
Physical access to the nearest Government health facility	57.2	53.4

Social Indicators	Punjab	Tehsil Sahiwal
Employed	93.2	94.3
Unemployed and seeking work	6.8	5.7
Household Utilities		
Electricity	92.5	94.3
Gas	26.4	15.7
Radio	40	26.9
TV	63.2	63.0
Cable TV	20.8	14.4
Telephone	15.9	14.0
Mobile phone	71.0	-
Computer	8.5	7.7
Internet	4.8	5.7
Fridge/Freezer	40.3	32.6
Air conditioner	6.6	4.9
Washing machine	48.8	38.6
Cooler/ Fan	86.4	85.7
Cooking range/ microwave	6.0	4.9
Sewing machine	72.7	60.9
Iron	80.2	78.7
Water filter	3.4	1.9
Donkey pump or turbine	54.5	66.2
Household possessions, bicycle	53.9	64.4
Household possessions, motorcycle/scooter	26.9	24.7
Owned houses	84.2	81.9
Receiving remittance as Zakat	1.4	0

Source: Govt. of Punjab MICS Report, 2007-2008

i. Employment and Unemployment

328. The unemployment rate is measured as the ratio of those laid off and seeking employment, and the total number of unpaid family helpers to the total number of those employed among the economically active population. This number is generally represented as a percentage. In 1998, the unemployment rate in the District was 20.6 percent, which was mainly due to unemployment among males, which represented 20.9 percent, while the female unemployment rate was only 2.8 percent, because of the small number of women active in the labor force. The unemployment rate was slightly low in rural areas, as compared to urban areas, representing 20.2 percent and 22.5 percent, respectively

329. The last formal, detailed employment statistics for Sahiwal date to the 1998. The population census is quoted in several publications, including the Sahiwal Urban Profile, 2010. A number of related and more current employment figures that are indicative of Sahiwal's urban situation include:

a. The labor force participation in Punjab of 55.4 percent, which is the highest of all four provinces;

b. Industry engages 23.9 percent of the formally employed;

c. In 2013, there were 220 reported factories in Sahiwal District, employing about 8,200 workers;

d. Of these workers, 76.5 percent participated in the informal economy. Based on statistics of other employment sectors, this suggests that a proportion of those formally employed also engage in informal economic activity, a situation that is common in most emerging economies;

e. Approximately 26 percent were employed as service workers, in shops and market sales workers;

f. Another 27 percent were employed as in crafts and related trades;

g. Approximately 14 percent were employed as unskilled workers;

h. Just over 6 percent were employed as professionals; and

i. Another 6 percent were employed as plant machine operators.

330. The main source of formal employment is 220 factories, of varying size, located in Sahiwal and its environs. These provide some 8,200 jobs. Agro-related industry is of particular importance as an employment generator.

ii. Educational Services

331. Sahiwal has a number of higher post-secondary educational institutions, including:

a. Thirteen arts and science degree colleges have over 15,000 students enrolled, including the Sahiwal Medical College and the Government College of Technology;

b. Four vocational institutes have over 500 students enrolled;

c. One technical/polytechnic institute has almost 3,000 students; and

d. Six commercial training Institutes have over 3,000 students enrolled.

332. Additional institutes of higher education are always desired, particularly those directly targeting the employment needs of local industry. These also become important means of keeping youth from migrating to the major cities.

iii. Health Facilities

333. Sahiwal District has nine hospitals, with a total number of beds of slightly under 1,300. In addition, there are six regional health centers and 42 basic health units. As in most secondary urban centers, retaining qualified staff, in both the health and education sectors, is one of the challenges. Staff often migrate to a major city to take advantage of the amenities it offers. The better the overall urban environment, quality of life, and social and economic amenities, the more likely they are to stay.

iv. Harappa Archaeological Site as a Tourist Attraction

334. Harappa is one of the two main cities of the Indus culture, and is located about 20 km west of Sahiwal. It is a major tourist attraction and contains ruins of a fortified Bronze Age city. The city is believed to have had as many as 23,500 people living there as early as 2,500 BC, which can be considered a large population for that time.

335. The Harappa civilization was rediscovered in the 1920s. It was found to have had its own script, urban centers, and a diversified social and economic system. In 1857, the archaeological site at Harappa was partially damaged. Sadly, its current state is not satisfactory.

336. Harappa is generally characterized as having differentiated living quarters, flat-roofed brick houses, and fortified administrative or religious centers. Although copper and bronze were in use, iron was not yet employed. Cotton was woven and dyed for clothing, wheat, rice, and a variety of vegetables and fruits were cultivated and a number of animals were domesticated, including the humped camel.

v. Socioeconomic Condition at the STP Site

337. This section covers the socio-economic conditions of the population that may be directly or indirectly affected by the construction and operation of the proposed STP project.

338. The socio-economic profile focuses on the sources of livelihood, income levels, and accessibility to social services like health, education etc. The socioeconomic survey was divided into a settlement profile and a socio economic household survey. Residents were interviewed with the help of semi structured questionnaire.

a. Settlements Profile

339. There are four settlements namely 95/6R, 94/6R, 135/6L and Three Marla Housing Scheme within immediate surroundings of proposed project site. These settlements fall under the administrative jurisdiction of Union Council (UC) 11, 42, 24 and 11 respectively.

340. The project site is predominantly an agricultural area interspersed with settlements inhabited by the local population. The population of the area resides in the villages of varying sizes. The basic information regarding infrastructural characteristics, total households and population of the village was collected from chairman of respective UC. Total population and households of four settlements is 32,000 and 5,460 respectively. Some parts of these settlement are located within one kilometer radius from the boundaries of the STP site.

341. The existing community reflects rural culture with its characteristic norms and values. Women do all the household work by themselves. The majority of the population follows Islamic tradition. Common food is wheat bread. Yogurt, Lassi and milk are also used. The common dress for males is Shalwar Qameez and for females Shalwar Qameez and Dupatta/Chadar. Marriages are celebrated in traditional manners.

b. Conflict Resolution Mechanism

342. The people of the area were found to be loving, caring and hardworking. They reported that for petty conflicts resolution, they involve the influential people, Nazim or Naib Nazim or Councilor of the village, who after listening statements of both the parties, tries to reach to an unbiased decision which is acceptable to the aggrieved. Generally, the people accept the decisions of the influential.

c. Public Health

343. The major diseases that afflict the residents of the village are seasonal. There are no adequate health care facilities in the surveyed settlements. Rural Health Centre and Basic Health Unit (BHU) are 4 to 5 km away from settlement.

344. There are no qualified doctors in the surveyed settlements. The only medical services in the villages are provided by Lady Health Workers (LHW).

d. Sanitation and Drainage

345. There is no sewerage system in the village. Domestic wastewater is disposed of into the agricultural fields and stagnant water ponds through a network of open drains.

346. Septic tanks are present in all the surveyed houses. All the sewage carrying drains of the area are concreted or kachcha (made of mud) but uncovered. The open drains, in addition to breeding sources of mosquito, insect and flies, also produce unpleasant odor. This situation may cause health hazards to the local community.

e. Educational Facilities

347. There are four government primary schools in the area. These include two middle schools, one each for boys and girls, and two primary schools, one each for boys and girls.

348. Matric level education is also provided by the private coeducation schools. There are nine private Middle and Matric schools in the area, both for boys and girls. Students wishing to continue their study after matriculation go to Sahiwal and Faisalabad city. The village madrassas provide religious education to young male and female students.

f. Transport and Travel Mode

349. The modes of transport among the local villagers are buses and wagons, but this facility is available only on the main roads. Personal transport includes bicycles, motor cycles and cars owned by the residents of the surveyed settlement. The proposed project site is located at 0.4 km from National Highway N5. Public transport is easily available to access the site. Pakistan railway also connects the area with all parts of the country.

g. Civic Amenities

350. There is no government water supply scheme in the area. Ground water is the only source of water for the area being used by the community for all domestic purposes. Inhabitants have installed electric motors within their premises. No precautionary measures are undertaken before the consumption of water. Furthermore, there is no filtration plant available for the residents of the village.

351. Multan Electricity Supply Company provides electricity to the area. Inhabitants of the area face 8 hours/day load shedding of electricity.

352. Natural gas is only present in 135/9L. Other settlement including 95/6R, 94/6R and Three Marla Housing Scheme use LPG and wood as cooking and heating fuel in their houses.

353. The majority of the residents use cellular phone for communication.

354. The nearest post office facility is located at 3 km from the area, where the residents of the settlement go for posting and receiving mail.

355. The nearest police station is located in Fareed Town about 3 km away from the area.

h. Cultural and Religious Resources

356. Religious sites include shrine, mosques, graveyards and historical buildings.

357. There are ten mosques, one shrine, five graveyards, four imam bargah and three churches in the area.

358. Mosque has been built in the recent past and has no historical or architectural significance.

359. Shrine is regarded as a sacred place and receive devotion from the locals of nearby populations but is not well known outside the area.

i. Demographic Characteristics of the Study Area

360. Based on socioeconomic survey, the population of 147 households is calculated as 1,100 as given in the Table 4.21. Average household size is calculated as 7.0. The male and

female proportion is about 54% and 46% respectively. Male to female ratio is 1.18. The percentage of younger population (81%) is higher than above 40 years of age.

Table 4.21: Gender Wise Population

Gender	Number	Sex Ratio (Male to Female)	Household Size
Male	595	1.18	07
Female	505		
Total	**1,100**		

Source: Socio economic Survey, February 2017

361. According to the sample based socioeconomic survey, population of the area live under nuclear, joint and extended family system. The distribution of households with respect to the type of family is given in the Table 4.22.

Table 4.22: Type of Family

Type of Family	Distribution	Percentage (%)
Nuclear	85	58
Joint	62	42
Extended	-	-
Total	**147**	**100**

Source: Socio economic Survey, February 2017

362. The population of the village resides largely in nuclear families e.g., family unit consisting of parents and their dependent children.

j. Religion

363. The main religious groups in the area are Muslims and Christians. The population of the surveyed settlement is predominately Muslim (98%) followed by Christian (2%).

k. Language Spoken

364. Punjabi is the most common language spoken by majority of population in the area. Urdu is spoken as secondary language.

l. Castes and Minority Groups

365. The project area is inhabited by the people of various castes including Bhutta, Bhatti, Mughal, Rajpoot, Araen, Rae, Sayyed, Malik, Dogar, Rajpoot, Rana, Jat, Rehmani and Chaudhry. Amongst these, Araen is the dominant caste. Reportedly, lower castes associated with hereditary menial professions are also the part of the village population.

m. Educational Status

366. Educational facilities in any area predict the educational level and the interest of the people towards the education. Educational status of the respondents of surveyed village is shown in Table 4.23**.** Excluding 149 children in the age group 1-3, the majority of the respondents had a middle level education. It is also evident that the ratio of the masters is very low, as compared to those having education up to primary, middle and matriculation.

Table 4.23: Educational Level of the Respondents

Education Level	Male	Female	Male (%)	Female (%)
Primary	115	103	21	25
Middle	130	127	24	31
Matriculation	118	24	22	6
Intermediate	51	22	9	5
Graduation	34	16	6	4
Masters	08	14	2	3
Deeni Taleem	04	08	1	2
Illiterate	78	99	15	24

Source: Socio economic Survey, February 2017

n. Economic Conditions of the Study Area

367. Various income generating activities are practiced in the village. Apart from the categories of housework and students, which mainly pertains to the house wives and children, the major earning occupations are business and private servant. Residents of the village are also engaged with the small industries, as skilled or unskilled labor.

368. Based on the sample-based socio-economic survey of the project area, Table 4.24 presents the distribution of the household members by occupation.

Table 4.24: Distribution of Household Members by Occupation

Occupation/ Source of Income	Number	%age
Agriculture	33	03
Housewives	248	23
Domestic Work	33	03
Students	302	27
Wage labor	67	06
Business	77	07
Private Servant	69	06
Government Servant	62	06
Retired Servant	11	01
Unemployed	18	02
Overseas	37	03
None	11	01
Babies	132	12
Total	**1,100**	**100**

Source: Socio economic Survey, February 2017

369. The distribution of households with respect to their reported average monthly household income is summarized on Table 4.25. It is evident from the table that the income level of most of the respondents is reasonable and economic conditions are well off.

Table 4.25: Distribution of Households by Average Monthly Household Income

Income Group (Rs./month)	Number	%age
<10,000	11	08
10,001-20,000	52	35
20,001-30,000	30	20

30,000+	54	37
Total	**147**	**100**

Source: Socio economic Survey, February 2017

370. Housing condition is an important indicator for determining the economic conditions of the population, as it reflects the financial position and living standards of the inhabitants. Most of the houses in the study area are built with cement and bricks and permanent roofing structures. All the respondents (100%) are living in their own houses and none was found to live in a rented house.

371. The nature of the housing conditions of the study area is summarized on Table 4.26.

Table 4.26: Housing Type

Categories	Number	%age
Pucca (bricks, cement)	127	86
Katcha (bricks, mud)	-	-
Semi Pucca (bricks, cement, mud)	20	14
Total	**147**	**100**

Source: Socio economic Survey, February 2017

372. In the surveyed settlements, livestock is normally raised for food and farming purposes. Livestock has market potential and is sold at the time of need. Major livestock of the area are cows, buffalos, goats, sheep, donkeys and poultry birds. Poultry birds are only kept for meeting the household's eggs and meat requirements.

V. ASSESSMENT OF ENVIRONMENTAL IMPACTS & MITIGATION MEASURES

373. This Section identifies and describes the potential impacts, both positive and negative, on the environment and public health of the construction and operation stages of the proposed projects.

374. In assessing the impacts of project proposals, it should be noted that the overall environmental impacts of the subprojects are deemed to be strongly positive since the objectives of the projects are to:

- provide continuous safe water to the residents;
- improve the management and disposal of sewage to reduce the exposure of pollutants to local residents; and
- improve roads and landscaping of the city.

375. Overall these projects are designed to prevent or alleviate the effects of pollutants on the human and natural environments.

A. Assessment of Risk – Environmental Aspects

376. The impact significance is categorized by considering the severity of the risk on the environment and human health and the probability of occurrence.

377. To assess the threat posed by a hazard (*i.e.* risk), the principal factors to be considered are:

a) the likelihood that the threat may be realised; and

b) in the event of realisation of the threat, the nature and extent of the consequences.

378. A qualitative risk assessment methodology has been adopted for this project, comprising the Likelihood and Consequence values detailed in Table 5.1 and Table 5.2.

Table 5.1: Qualitative Likelihood Values

Likelihood Indicator	Likelihood Description	
A	Almost Certain	Is expected to occur in most circumstances
B	Likely	Will probably occur in most circumstances
C	Possible	Might occur at some time
D	Unlikely	Could occur at some time
E	Rare	May only occur in exceptional circumstances

Table 5.2: Qualitative Consequence Values

Consequence Indicator	Consequence Description	
1	Insignificant	Negligible, reversible, requires very minor or no remediation / minor injury with slight negative health impact
2	Minor	Reversible, requires minor remediation / major, non-fatal health impact to one or more individuals
3	Moderate	Reversible, short-term effect, requires moderate remediation / severe, non-fatal health impact to one or more individuals
4	Major	Serious impact, medium term effect, requires significant remediation / single fatality or severe irreversible disability or impairment
5	Catastrophic	Disastrous impact, long term effect, requires major remediation / multiple fatalities, major permanent health impacts on a large number of individuals

379. On the basis of a likelihood and consequence matrix (Table 5.3), each hazard may be categorised into broad 'risk categories' and the required management approach for each risk category can be defined.

Table 5.3: Risk Matrix – Risk Categories and Management Response

		Consequence				
		1	**2**	**3**	**4**	**5**
Likelihood	**A**	M	M	H	H	H
	B	L	M	H	H	H
	C	L	L	M	H	H
	D	L	L	L	M	H
	E	L	L	L	M	M

H = High Risk – Proposed works methods not acceptable and must be altered.
M = Moderate Risk – Detailed management action plan to be prepared, including monitoring program.
L = Low Risk – Routine management procedures to be defined and monitoring requirements to be specified.

B. Anticipated Environmental Impacts

i. Anticipated Environmental Impacts due to Project Location

380. The environmental impacts related to the location of the projects are mostly in the areas of physical setting, socioeconomic setting, ecological setting and special areas (archaeological sites etc.).

381. The proposed project components are described in Section III. Field inspections and consideration of the project locations indicate that the adverse impacts of the projects due to their locations are mostly in the category of 'insignificant', given that:

- With the exception of the acquisition of the site for the STP, no other subproject components involve the development of greenfield sites;
- all of the water supply, sewerage and drainage, green spaces development and transport routes improvement projects will be implemented within the already heavily urbanized, and hence degraded, developed areas of the city of Sahiwal; and
- there is no permanent displacement or impact on any inhabitants and local communities in the vicinity of the project proposals.

382. The proposed project site for the STP is on agricultural land and is located close to the newly developing residential scheme called the Three Marla Scheme. Three sides of the site lies adjacent to agricultural land (East, West, North), whilst the fourth side is adjacent to the unpaved passage adjacent to the right bank of the LBDC. At its closest to the site the Three Marla Housing Scheme is located at about 500 m away from east margin of the STP site, whereas two further small villages, 95/6-R and 94/6-R, are located at a distance of about 1 km from the northern margin of the STP site.

383. The area required for the STP facility is relatively small (< 5 Ha.). Consequently, the lifetime loss of agricultural land and produce linked to the land acquired for this project is assessed to be 'Insignificant'.

384. The land has been developed intensively for agricultural production. Therefore, there will be no loss of distinctive habitat or fauna and flora as a consequence of the development of the STP.

385. The site for the STP was selected owing to its assessed minimal potential environmental and socio-economic impacts. The plant site will not create any noise impacts to the adjacent communities, nor is it expected to create any offensive odors if managed properly. Nevertheless, it is worthwhile to create a buffer zone (minimum 15 m, along with trees) on the periphery of the plant site to safeguard the community from the likely dispersion of odor and noise. This will also enhance the visual impact.

386. In the case of the STP, the residents of the Three Marla Scheme and two villages (the nearest community) will incur the least amount of disturbance due to vehicular movement to transport personnel and maintenance supplies, and for the removal of sludge, etc. because the transport route is designed in such a way that it does not pass through these residential areas.

ii. Anticipated Environmental Aspects and Potential Hazards – Construction Phase

387. The potential hazards posed by construction activities are presented by environmental aspect in Table 5.4 to Table 5.10 inclusive.

388. Appropriate management actions for all of the potential environmental hazards shall be developed during project implementation on the basis of the level of risk assessed for each hazard identified. The potential hazards and assessment of risks are identified for the following elements:

- Soil;
- Air quality;
- Noise;

- Traffic;
- Solid waste;
- Sanitary wastewater; and
- Health & Safety.

Table 5.4: Subprojects Activities, Potential Hazards and Assessment of Risk – Soil

Subprojects/Activities	Potential Hazard	Assessment of Risk
Water Supply		
Rehabilitation of existing OHRs (replacement of doors/windows, plastering, minor structural repair, cleaning, valves and pipeline connection)	Temporary and localized soil contamination for short period of time at specific place due to spillage of solvent/paint/chemicals on soil during repair and maintenance activities	B1 – Low
Construction of 12 No. new OHRs including demolishing 2 No. existing OHRs	Temporary and localized soil contamination for short period of time at specific place due to spillage of solvent/paint/chemicals on soil during construction activities	B2 – Moderate
Replacement of rusted/damaged pipelines (54 km)	Temporary and localized soil pollution for short period of time due to spillage of fuel/lubricant from construction camps, maintenance of vehicles and machines and excavation and construction activities	C2 – Low
Replacement of asbestos pipelines (24 km)	Temporary and localized soil pollution for moderate period of time due to spillage of fuel/lubricant from construction camps and maintenance of vehicles and machines Deposition of asbestos to soil if degraded pipes or broken pipes exposed.	C2 – Low
Sewerage		
Sewerage Pipes Replacement (12.87 km)	Temporary and localized soil pollution for short period of time due to spillage of fuel/lubricant from construction camps, maintenance of vehicles and machines and excavation and construction activities	C2 – Low
Trunk main line to STP	Temporary and localized soil pollution for short period of time due to spillage of fuel/lubricant from construction camps, maintenance of vehicles and machines and excavation and construction activities	B2 – Moderate
Sewage treatment plant (STP)	Temporary and localized soil pollution for short period of time due to spillage of fuel/lubricant from construction camps, maintenance of vehicles and machines and excavation and construction activities. Loss of productive agricultural soil.	A3 – High
Transport		
Improvement of 3 km of Railway Road	Temporary and localized soil pollution due to spillage of fuel/lubricant from	B2 – Moderate

Subprojects/Activities	Potential Hazard	Assessment of Risk
	construction camps, maintenance of equipment and excavation and construction activities	
Improvement/upgradation of 2 No. bus stands	Temporary and localized soil pollution for short period of time due to spillage of fuel/lubricant from construction camps, maintenance of vehicles and machines and excavation and construction activities	B2 – Moderate
Green Spaces		
Improvement/upgradation of public spaces and parks	Temporary and localized soil pollution for short period of time due to spillage of fuel/lubricant from construction camps, maintenance of vehicles and machines and excavation and construction activities	C2 - Low

Table 5.5: Subprojects Activities, Potential Hazards and Assessment of Risk – Air

Subprojects/Activities	Potential Hazard	Assessment of Risk
Water Supply		
Development of DNI zones (Installation of water meters at houses, replacement of pipelines, disposal of old pipes)	Temporary and localized dust emissions due to excavation and refilling activities for laying the pipelines for moderate period of time	B1 – Low
Rehabilitation of existing OHRs (replacement of doors/windows, plastering, minor structural repair, cleaning, valves and pipeline connection)	Temporary and localized dust emissions due to repair and maintenance work for short period of time	B1 – Low
Construction of 12 No. new OHRs including demolishing 2 No. existing OHRs	Temporary and localized dust emission due to excavation and refilling activities for laying pipes and movement of construction vehicles for moderate periods of time	B2 – Moderate
Replacement of rusted/damaged pipelines (54 km)	Temporary and localized dust emission due to excavation and refilling activities for laying pipes and movement of construction vehicles for moderate periods of time	B2 – Moderate
	Release of mal-odors from exposure and removal of pipes for moderate time period	B2 – Moderate
	Localized and low intensity vehicular emissions due to transportation of pipes and accessories to the sites	B1 – Low
Replacement of asbestos pipelines (24 km)	Temporary and localized dust emission due to excavation and refilling activities for laying pipes and movement of construction vehicles for moderate period of time	B2 – Moderate
	Release of mal-odors from exposure and removal of pipes for moderate periods of	B2 – Moderate

Subprojects/Activities	Potential Hazard	Assessment of Risk
	time	
	Localized and low intensity vehicular emissions due to transportation of pipes and accessories to the sites	B1 – Low
Sewerage		
Sewerage Pipes Replacement (12.87 km)	Temporary and localized dust emission due to excavation and refilling activities for laying pipes and movement of construction vehicles for time period of time	B2 – Moderate
	Localized and low intensity vehicular emissions due to transportation of pipes and accessories to the sites	B1 – Low
Trunk main line to STP	Temporary and localized dust emission due to excavation and refilling activities for laying pipes and movement of construction vehicles for moderate period of time	B2 – Moderate
	Localized and low intensity vehicular emissions due to transportation of pipes and accessories to the sites	B1 – Low
Sewage treatment plant (STP)	Temporary and localized dust emission due to stripping and excavation of soil, mixing of material and movement of construction vehicles and machines for moderate period of time	B2 – Moderate
	Localized and low intensity vehicular emissions due to transportation of construction material and accessories to the site	B1 – Low
Transport		
Improvement of 3 km of Railway Road	Temporary and localized dust emission due to construction activities for short period of time	B1 – Low
Improvement/upgradation of 2 No. bus stands	Temporary and localized dust emission due to construction activities (demolition of structures, mixing of material, movement of machines and vehicles) for moderate period of time	B2 – Moderate
	Localized and low intensity vehicular emissions due to transportation of construction material and disposal of construction debris	B1 – Low
	Localized and low intensity generator emissions	B1 – Low
Green Spaces		
Improvement/upgradation of public spaces and parks	Temporary and localized dust emission due to construction activities	B1 – Low
	Localized and low intensity vehicular emissions due to transportation of	B1 – Low

Subprojects/Activities	Potential Hazard	Assessment of Risk
	construction material and disposal of construction debris	

Table 5.6: Subprojects Activities, Potential Hazards and Assessment of Risk – Noise

Subprojects/Activities	Potential Hazard	Assessment of Risk
Water Supply		
Rehabilitation of 19 No. tube wells	Low intensity localized noise generation due to dismantling and placement of pumps and motors activities in enclosed structures for short period of time	B1 – Low
Installation of 8 No. new pumps	Low intensity localized noise generation due to boring and installation of pumps and motors in enclosed structures for short period of time	B1 – Low
Improving efficiency of 27 No. tube wells (repair/maintenance of pumps and motors)	Low intensity localized noise generation due to repair and maintenance activities in enclosed structures for short period of time	B1 – Low
Development of DNI zones (Installation of water meters at houses, replacement of pipelines, disposal of old pipes)	Low intensity localized vehicular noise due to movement of pipes and accessories carrying vehicles and construction machineries for short period of time	A1 – Moderate
Rehabilitation of existing OHRs (replacement of doors/windows, plastering, minor structural repair, cleaning, valves & pipeline connection)	Low intensity localized noise generation due to repair and maintenance work for short period of time	B1 – Low
Construction of new 12 No. new OHRs including replacement of 2 No. existing OHRs	Low to moderate intensity localized noise generation due to construction activities (excavation, mixing, movement of vehicles and machines, demolish of structures) for moderate period of time	B2 – Moderate
Replacement of rusted/damaged pipelines (54 km)	Low intensity localized noise generation due to pipe laying activities and movement of vehicles and machineries for moderate period of time	A2 – Moderate
Replacement of asbestos pipelines (24 km)	Low intensity localized noise generation due to pipe laying activities and movement of vehicles and machineries for moderate period of time	A2 – Moderate
Sewerage		
Sewerage Pipes Replacement (12.87 km)	Low intensity localized noise generation due to pipe laying activities and movement of vehicles and machineries	A2 – Moderate
Rehabilitation of 10 No. Disposal Stations (Replacement of pumps, motors, improvement of electrical panels, repair and maintenance of pumps and motors and civil work)	Low intensity localized noise generation due to repair and maintenance work at disposal station (enclosed structures) for short period of time	B1 – Low
Trunk main line to STP	Low to moderate intensity localized noise	B2 –

Subprojects/Activities	Potential Hazard	Assessment of Risk
	generation due to excavation, pipe laying activities and movement of vehicles and machineries for moderate period of time	Moderate
Sewage treatment plant (STP)	Low to moderate intensity localized noise generation due to excavation, construction activities and movement of vehicles and machineries for moderate period of time	B2 – Moderate
	Low intensity localized noise from generator for short period of time	B1– Low
Transport		
Improvement of 3 km Railway Road	Low to moderate intensity localized noise generation due to construction activities for short period of time	A1 – Moderate
Improvement/upgradation of 2 No. bus stands	Low to moderate intensity localized noise generation due to construction activities (demolition of structures, mixing of material, movement of machines and vehicles) for moderate period of time	A2 – Moderate
	Low to moderate intensity localized noise from generator for short period of time	B1– Low
Green Spaces		
Development of green belt canal	Low intensity localized noise generation due to movement of machines for short period of time	B1 – Low
Rehabilitation of 6 No. parks	Low intensity localized noise generation due to movement of machines for short period of time	B1 – Low

Table 5.7: Subprojects Activities, Potential Hazards and Assessment of Risk – Traffic

Subprojects/Activities	Potential Hazard	Assessment of Risk
Water Supply		
Rehabilitation of 19 No. tube wells	Low traffic volume increase by vehicles carrying pumps, motors and accessories	B1 – Low
Installation of 8 No. new pumps	Low traffic volume increase by vehicles carrying pumps, motors and accessories	B1 – Low
Improving efficiency of 27 No. tube wells (repair/maintenance of pumps and motors)	Low traffic volume increase by vehicles carrying pumps, motors and accessories	B1 – Low
Development of DNI zones (Installation of water meters at houses, replacement of pipelines, disposal of old pipes)	Low traffic volume increase by vehicles carrying pipes and accessories	B1 – Low
Rehabilitation of existing OHRs (replacement of doors/windows, plastering, minor structural repair,	Low traffic volume increase by vehicles carrying construction material and accessories	B1 – Low

Subprojects/Activities	Potential Hazard	Assessment of Risk
cleaning, valves & pipeline connection)		
Construction of new 12 No. new OHRs including replacement of 2 No. existing OHRs	Low to moderate traffic volume increase for a short period of time by vehicles carrying construction material and accessories	B2 – Moderate

Subprojects/Activities	Potential Hazard	Assessment of Risk
Replacement of rusted/damaged pipelines (54 km)	Low traffic volume increase due to transportation of construction material and accessories	B1 – Low
	Localized traffic congestion at pipe laying area for short period of time Temporary blocking of access	B2 – Moderate
Replacement of asbestos pipelines (24 km)	Low traffic volume increase due to transportation of construction material and accessories	B1– Low
	Localized traffic congestion at pipe laying area for short period of time Temporary blocking of access	B2 – Moderate
Sewerage		
Sewerage Pipes Replacement (12.87 km)	Low traffic volume increase due to transportation of pipes, construction material and accessories	B1 – Low
	Localized traffic congestion at pipe laying area for moderate period of time	B2 – Moderate
Rehabilitation of 10 No. Disposal Stations (Replacement of pumps, motors, improvement of electrical panels, repair and maintenance of pumps and motors and civil work)	Low traffic volume increase due to transportation of pipes, construction material and accessories	B1 – Low
Trunk main line to STP	Low traffic volume increase due to transportation of pipes, construction material and accessories	B1 – Low
	Localized traffic congestion at pipe laying area for short period of time Temporary blocking of access	B2 – Moderate
Sewage treatment plant (STP)	Low traffic volume increase due to transportation of construction material and accessories	B1 – Low
	Localized traffic congestion at pipe laying area for short period of time Temporary blocking of access	B2 – Moderate
Transport		
Improvement of 3 km Railway Road	Localized traffic congestion due to construction and maintenance activities for short period of time Temporary blocking of access	B1 – Low
Improvement/upgradation of 2 No. bus stands	Low traffic volume increase due to transportation of construction material and accessories and disposal of debris	B2 – Moderate
	Localized traffic congestion for moderate period of time	B2 – Moderate

Subprojects/Activities	Potential Hazard	Assessment of Risk
	Temporary blocking of access	
Green Spaces		
Improvement/upgradation of public spaces and parks	Localized traffic congestion for moderate period of time Temporary blocking of access	B1 – Low

Table 5.8: Subprojects Activities, Potential Hazards and Assessment of Risk – Solid Waste

Subprojects/Activities	Potential Hazard	Assessment of Risk
Water Supply		
Development of DNI zones (Installation of water meters at houses, replacement of pipelines, disposal of old pipes)	Low volume localized generation of domestic solid waste from construction camps for short period of time	B1 – Low
Replacement of rusted/damaged pipelines (54 km)	Low volume localized generation of domestic solid waste from construction camps for moderate period of time	B1 – Low
Replacement of asbestos pipelines (24 km)	Low volume localized generation of domestic solid waste from construction camps for moderate period of time	B1 – Low
Construction of new 12 No. new OHRs including replacement of 2 No. existing OHRs	Low volume localized generation of domestic solid waste from construction camps for moderate period of time Moderate generation of construction debris from demolition activities	B2 – Moderate
Sewerage		
Sewerage Pipes Replacement (12.87 km)	Low volume localized generation of domestic solid waste from construction camps for moderate period of time	B1 – Low
Rehabilitation of 10 No. Disposal Stations	Low volume localized generation of domestic solid waste from construction camps for moderate period of time Moderate generation of debris from construction activities	B2 – Moderate
Trunk line to STP	Low volume localized generation of domestic solid waste from construction camps for moderate period of time	B1 – Low
Sewage treatment plant (STP)	Low volume localized generation of domestic solid waste from construction camps for moderate period of time Moderate generation of debris from construction activities	B2 – Moderate
Transport		
Improvement/upgradation of 2 No. bus stands	Low volume localized generation of domestic solid waste from construction camps for moderate period of time	B2 – Moderate

Subprojects/Activities	Potential Hazard	Assessment of Risk
	Low volume generation of construction waste for moderate period of time	B2 – Moderate
Green Spaces		
Improvement/upgradation of public spaces and parks	Low volume localized generation of domestic solid waste from construction camps for moderate period of time	B1 – Low
	Low volume generation of construction waste for moderate period of time	B1 – Low

Table 5.9: Subprojects Activities, Potential Hazards and Assessment of Risk – Sanitary Wastewater

Subprojects/Activities	Potential Hazard	Assessment of Risk
Water Supply		
Development of DNI zones (Installation of water meters at houses, replacement of pipelines, disposal of old pipes)	Low volume localized generation of sanitary wastewater from construction camps for short period of time	B1 – Low
Replacement of rusted/damaged pipelines (54 km)	Low volume localized generation of sanitary wastewater from construction camps for moderate period of time	B2 – Moderate
Replacement of asbestos pipelines (24 km)	Low volume localized generation of sanitary wastewater from construction camps for moderate period of time	B2 – Moderate
Construction of new 12 No. new OHRs including replacement of 2 No. existing OHRs	Low volume localized generation of sanitary wastewater from construction camps for moderate period of time	B2 – Moderate
Sewerage		
Sewerage Pipes Replacement (12.87 km)	Low volume localized generation of sanitary wastewater from construction camps for moderate period of time	B2 – Moderate
Rehabilitation of 10 No. Disposal Stations	Low volume localized generation of sanitary wastewater from construction camps for moderate period of time	B1 – Low
Trunk line to STP	Low volume localized generation of sanitary wastewater from construction camps for moderate period of time	B2 – Moderate
Sewage treatment plant (STP)	Low volume localized generation of sanitary wastewater from construction camps for moderate period of time	B2 – Moderate
Transport		
Improvement/upgradation of 2 No. bus stands	Low volume localized generation of sanitary wastewater from construction camps for moderate period of time	B2 – Moderate
Green Spaces		

Subprojects/Activities	Potential Hazard	Assessment of Risk
Improvement/upgradation of public spaces and parks	Low volume localized generation of sanitary wastewater from construction camps for moderate period of time	B1 – Low

Table 5.10: Subprojects Activities, Potential Hazards and Assessment of Risk – Health & Safety

Subprojects/Activities	Potential Hazard	Assessment of Risk
Water Supply		
Rehabilitation of existing OHRs (replacement of doors/windows, plastering, minor structural repair, cleaning, valves and pipeline connection)	Minor nature health and safety concerns for the construction workers for short period of time Temporary disruption of water supply	B1 – Low
Construction of new 12 No. new OHRs including replacement of 2 No. existing OHRs	Minor nature health and safety concerns for the construction workers for short period of time Temporary disruption of water supply	B2 – Moderate
Replacement of rusted/damaged pipelines (54 km)	Minor nature health and safety concerns for the construction workers for moderate period of time Temporary disruption of water supply	B2 – Moderate
Replacement of asbestos pipelines (24 km)	Minor nature health and safety concerns for the construction workers for moderate period of time Temporary disruption of water supply	B2 – Moderate
Sewerage		
Sewerage pipe replacement (12.87 KM)	Minor nature health and safety concerns for the construction workers for moderate period of time	B2 – Moderate
Rehabilitation of 10 No. Disposal Stations	Minor nature health and safety concerns for the construction workers for moderate period of time	B2 – Moderate
Trunk main to STP	Minor nature health and safety concerns for the construction workers for moderate period of time	B2 – Moderate
Sewage treatment plant (STP)	Minor nature health and safety concerns for the construction workers for moderate period of time	B2 – Moderate
Transport		
Improvement/upgradation of 2 No. bus stands	Minor nature health and safety concerns for the construction workers for moderate period of time	B2 – Moderate
Green Spaces		

Subprojects/Activities	Potential Hazard	Assessment of Risk
Improvement/upgradation of public spaces and parks	Minor nature health and safety concerns for the construction workers for moderate period of time	B2 – Moderate

389. All of the subprojects and related project activities will generate environmental impacts during the construction phase. However, in all but one instance, the construction phase impacts are assessed to be in the category of low to moderate risk and are reversible in nature and of generally short-term duration, only occurring during periods of active construction.

390. The exception relates to the permanent loss of productive agricultural soil and land at the site of the proposed STP. This loss is unavoidable. The impact on the landowners and farmers, however, has been addressed in the Land Acquisition and Resettlement Plan (LARP) conducted for this component and appropriate compensation identified for the Affected Persons (AP).

391. No other construction phase impact is assessed to be high risk, assuming that all ACP are left buried *in situ* or, if removed, are done so under strict procedures and protocols in accordance with an Asbestos Management Framework (refer to Annexure 3).

iii. Construction Phase Impacts and Mitigation Measures

392. It is an established fact that almost all construction projects will give rise to a number of impacts on environmental resources. These impacts, which cannot be avoided, may create significant temporary (short-term) hazards to the environmental resources of the project area during the project construction phase.

393. For the sub-projects under Phase 1 of PICIIP the assessed moderate construction phase impacts, as itemized on Tables 5.4 to 5.10, are as follows:

- Generation of dust due to excavation activities (for example, trenches for new pipes), transportation of construction material, mixing of building materials and dumping of excavated construction waste;
- Noise, vibration and air pollution due to excavation works, the removal of old pipe work, and the construction and erection of electrical and mechanical equipment;
- Increased traffic volume in the area due to haulage of building material, equipment, construction machinery and transportation of workers at site;
- Potential localized soil pollution due to spillage and leakage of fuel and lubricants during cooking, fueling and maintenance activities;
- Sanitary wastewater and solid waste generation from residences of construction crew; and
- Communicable disease hazard to workers from lack of sanitation facilities.

394. Construction activities affect the quality of the local environment. In particular, noise, odor and fugitive dust emissions due to construction and transportation, traffic congestion, and improper management of solid waste are the primary sources of nuisance for the local community.

395. The main construction phase potential impacts are assessed to be in the range of low to moderate risk. Most construction activities impacts can be mitigated by adopting appropriate mitigation measures during the construction phase as discussed below and in further detail in Section VII.

396. The main responsibilities for mitigation measures during the construction phase of the projects rest with the contractors appointed to carry out the individual project contracts. The SMC Engineers will, however, have the responsibility for monitoring the implementation of mitigation actions by the contractors and will need to implement their own system of internal checks to ensure that mitigation actions are carried out satisfactorily. In exceptional circumstances, the SMC may need to use its authority to call a halt to construction activity, if the contractors refuse to adhere to the requirements of the mitigation plan contained in the contract documents.

397. In order to avoid creation of misunderstandings regarding who is responsible for particular mitigation activities recommended for the construction phase, the Construction Phase Environmental Mitigation Plan (CPEMP) should be appended to tender documents. This will ensure that contractors include the cost of mitigation actions in their bids and will provide a reliable mechanism for enforcement. In fact, most of the recommended actions involve no or very little capital investment, but it depends on the contractor's management to adopt a responsible attitude to environmental protection, ensuring that construction activity is properly planned and mitigation actions are correctly implemented.

398. The mitigation actions recommended during the construction phase have the following principal objectives:

Dust Suppression

399. Excavation of ground for laying pipelines and construction of the new OHTs and STP will generate dust. Regular water sprinkling is recommended at the dust generation points during the construction activities.

400. Construction activities should be suspended in periods of high wind, and materials in transit and stockpiles of construction materials should be covered, to avoid the escape of fugitive dust.

401. Appropriate personal protective equipment (PPE) such as dust masks, goggles, hats, gloves and safety shoes should also be made available to the construction workers at the site to avoid potential health hazards and accidents.

Management of Construction Waste

402. At bus terminal revamping activities, and for the upgrading of OHRs and disposal stations, construction debris will be generated because of the demolition of existing structures or the replacement of existing materials. Similarly, for the replacement of water supply and sewerage pipes, new trenches will be excavated, potentially generating excess spoil materials.

403. In all cases, debris produced during construction should preferably be screened and as much as possible of the material re-used for alternative activities, such as land reclamation. Materials suitable for recycling should be recovered and presented for recycling.

404. No construction debris should be dumped unattended, nor should any leftover material be dumped into any of the storm water drains or water courses, because such practices can clog these drainage systems and cause many other problems for the local residents. Unwanted materials should be disposed only to an approved landfill site.

Noise

405. Construction activities, movement of construction vehicles and machines, and demolishing of structures will generate noise and affect nearby communities and construction workers.

406. High noise levels may result in various health impacts, such as nuisance, hearing loss and number of physiological and other effects.

407. To attenuate noise impacts on workers and nearby community, the following measures should be taken:

- Carry out regular inspection and maintenance of the construction vehicles and equipment;
- Timely replacement of worn and noise producing parts of the construction machinery;
- In case of severe noise, use of sound barriers to avoid dispersion of sound waves into the nearby community; and use of noise protection equipment by the workers, working in noisy area; and
- Scheduling the timing of noisy activities to have the least impact on adjacent communities.

Traffic Management

408. Construction activities for laying pipelines, street improvement works on Railway Road, revamping of the bus terminal and upgrading public green spaces will cause traffic issues. Traffic management measures should be implemented as a means of reducing road congestion, maintaining traffic flows, maintaining access for the local communities, improving the residential living environment, and reducing the chance of collisions between vehicles, pedestrians and cyclists and traffic congestion.

409. Vehicles transporting construction materials shall be instructed to have operate at a maximum speed of about 20 km per hour in residential areas, with covering of the material from the top to avoid dispersion of fugitive dust to the surroundings. In case of large number of vehicles arriving at the site, it should be planned in such a way that these vehicles arrive at the site at different timings of the day to avoid traffic congestion and nuisance for the nearby community. As a measure to streamline heavy traffic in the area, proper road marking and signboard posting for safety and speed limit should also be undertaken, particularly at nearby residential and commercial areas.

410. For excavation activities within the road corridor, the proper cordon off of the digging site and traffic planning for moving traffic to alternate routes will be part of traffic management.

411. Vehicle drivers should be apprised of the local customs and values, and be advised to remain courteous to the local population. The construction material transport activities scheduling should be such that most of the tasks are executed and scheduled in a manner so as to minimize traffic congestion in the area.

Disposal of Domestic Wastewater

412. During major periods of construction activity (for example, bus terminal revamping and pipe laying activities) it is considered probable that the construction crew will stay at a construction campsite. These workers shall generate sanitary wastewater. Typical characteristics of untreated domestic wastewater are set out on Table 5.11.

Table 5.11: Typical Characteristics of Untreated Domestic Wastewater

#	Contaminants	Concentration (Medium Strength)
1	Total Dissolved Solids (TDS) - mg/L	500
2	Total Suspended Solids (TSS) - mg/L	210
3	Biochemical Oxygen Demand (BOD_5) - mg/L	190
4	Chemical Oxygen Demand (COD) - mg/L	430
5	Chlorides – mg/L	50
6	Sulfate - mg/L	30
7	Oil & Grease - mg/L	90
8	Total Coliform - No./100 mL	10^7-10^9
9	pH	7

Source: Wastewater Engineering - Treatment and Reuse by Metcalf & Eddy, 2003

413. Generally, in Pakistan, during the construction phase, proper disposal of sanitary wastewater is not practiced. However, it is recommended that sanitary wastewater should be disposed of into the nearby drain or sewers after passing through a temporary septic tank.

414. The potential impacts of the discharge of untreated domestic wastewater are summarized on Table 5.12.

Table 5.12: Potential Environmental Impacts of Wastewater

Parameter	Impacts
pH	Growth inhibition of bacterial species (responsible for removing organic pollution) under highly acidic or alkaline conditions
	Corrosion of water carrying system and structures with acidic wastewaters having low pH
	Malfunctioning and impairment of certain physico-chemical treatment processes under highly acidic or alkaline conditions
Organic Pollutants	Depletion of dissolved oxygen (DO) levels, of the receiving water body, below limits necessary to maintain aquatic life (4-5 mg/l)
Suspended Solids	Sedimentation in the bottom of water bodies leaving adverse impact on flora and fauna
	Localized depletion of dissolved oxygen in the bottom layers of water bodies
	Reduced light penetration in natural waters and consequent reduction in photosynthesis
	Aesthetic nuisance
Oil and Grease	Reduced re-aeration in the natural surface bodies, because of floating oil and grease film and consequent depletion in dissolved oxygen levels
	Reduced light penetration in natural waters and consequent reduction in photosynthesis
	Aesthetic nuisance

415. Notwithstanding that these impacts are potentially significant, in the context of Sahiwal these are already being experienced in the absence of an existing wastewater treatment facility and the routine disposal of untreated wastewater to land. The presence of a temporary campsite may serve only to introduce some short-term pollutant loading to an area not currently experiencing such discharges.

Domestic Solid Waste Management

416. Any construction campsite will also generate domestic solid waste. Such waste should be segregated and any recyclable materials sold on.

417. Residual waste should be packed and disposed of at the designated municipal solid waste disposal facility.

Occupational Health and Safety

418. The contractor should be responsible for the provision of safe drinking water, maintenance of occupational health and safety equipment, maintenance of hygienic sanitation conditions, together with supplying nutritious and hygienic food for the construction team at the site.

419. The major beneficial impact of the construction phase of the project is employment for local people during construction.

Air Pollution

420. The sources of air pollution at the construction sites are excavation activities, mal-odors and gasses released from buried pipework and the construction vehicles and generators.

421. Diesel oil is used as fuel in the generators used for standby electricity generation. Diesel-based generators generally emit pollutants such as CO, NO_x, SO_2 and particulate matter. Excavation activities and vehicle movements will generate fugitive dust and vehicular emissions. The major pollutants present in emissions include oxides of nitrogen and carbon, particulate matter and un-burnt hydrocarbons. For well-maintained vehicles, air emissions will remain within the PEQS.

422. The potential impacts of air emission on environment (E) and human health (HL) are summarized on Table 5.13.

Table 5.13: Impacts of Air Pollutants on Environment, Human Health and Life

Carbon Monoxide	HL	Heart attack, by reducing the oxygen carrying capacity of blood
		Birth defects including mental retardation and impairment of fetus growth
		Dizziness, headache, and nausea
		Increase in reaction time of the drivers, a threat to the road safety
Oxides of Nitrogen	E	Formation of photochemical oxidants
		Damage to materials and property, by acid rains, resulting from oxidation of oxides of nitrogen to nitric acid, after reacting with water vapors
		Retardation of growth in plants
	HL	Reduction in oxygen carrying capacity of blood
		Impairment of olfactory sense and night vision
		Dryness and roughness of the throat
Particulate Matter	HL	Respiratory diseases
	E	Choking of plant leaves restricting photosynthesis process
		Global cooling of earth by reflecting back the solar radiations
		Impairment of atmospheric visibility affecting the transportation safety
		Deterioration of aesthetic quality of atmosphere, land and water
Oxides of Sulfur	HL	Respiratory diseases, eye and throat irritation
	E	Precursor for acid rain, damage of property, plant and soil

Carbon Dioxide	E	One of the major greenhouse gases, contributing to global warming

Soil Pollution

423. Soil pollution can take place during cooking, fueling, lubrication and maintenance of vehicles and machines. It can also occur from the exposure of asbestos cement pipes and the discharge of contaminated wastewater directly to ground.

424. The following mitigation measures are recommended for soil pollution control:

- Placement of secondary containment under fuel/lubricant containers and generator fuel oil tank to collect spillage and leakage;
- Placement of fuel/lubricant container on paved floor at enclosed place;
- Properly collect and dispose waste lube oil/oily rags after maintenance;
- Avoid spill and leaks of oil, lubricants on floor during maintenance activities;
- Immediate cleaning the spillage and leakage from the ground with saw dust/cloth and dispose of as solid waste; and
- Avoid exposure of asbestos cement pipe work; and
- Drain all pipes by vacuum pump prior to extraction of old pipes from the ground.

iv. Environmental Aspects and Potential Operational Phase Hazards

425. The potential hazards posed by operational activities are presented by environmental aspect in Table 5.14 to Table 5.17 inclusive. Appropriate management actions for all of the potential environmental hazards are available and shall be developed and implemented on the basis of the level of risk assessed to exist for each hazard identified.

426. The potential hazards and assessment of risks are identified for following elements:

- Noise;
- Health and safety;
- Air quality; and
- Waste.

Table 5.14: Subprojects Activities, Potential Hazards and Assessment of Risk – Noise

Subprojects/Activities	Potential Hazard	Assessment of Risk
Water Supply		
Operation of tube wells	Low intensity localized noise generation from tube well operation in enclosed structures	B1 – Low
Operation of OHRs (operation of tube wells)	Low intensity localized noise generation from tube well operation in enclosed structures	B1 – Low
Sewerage		
Operation of disposal stations	Low intensity localized noise generation due to operation of disposal pumps in enclosed structures	B1 – Low

Subprojects/Activities	Potential Hazard	Assessment of Risk
Operation of sewage treatment plant (STP)	Medium intensity noise generation from operation of STP (pumps, compressors, vehicles). Most of the noise producing equipment will be in enclosed structures	B2 – Moderate

Table 5.15: Subprojects Activities, Potential Hazards and Assessment of Risk – Health & Safety

Subprojects/Activities	Potential Hazard	Assessment of Risk
Water Supply		
Operation of chlorine facilities for disinfection at tube wells and OHRs	Medium level localized health and safety concerns associated with chlorine storage and handling facilities	B2 – Moderate
Algal growth in OHRs	Moderate impact on community health due to growth of algal in OHRs and contamination of water	B2 – Moderate
Operation of sewage treatment plant (STP)	Minor nature health and safety concerns for the workers working at plant	B2 – Moderate
	Spreading of diseases due to breeding of mosquito, insects and flies at STP site	B2 – Moderate
	Health concerns for works due to aerosols from aeration tanks and drying beds	B2 – Moderate

Table 5.16: Subprojects Activities, Potential Hazards and Assessment of Risk – Air

Subprojects/Activities	Potential Hazard	Assessment of Risk
Operation of sewage treatment plant (STP)	Low intensity air emissions from generator for short period of time during electricity shut down	B1 – Low
	Low intensity vehicular emissions from staff and sludge carrying vehicles	B1 – Low
	Odor from sludge drying beds	B2 – Moderate
	Health concerns due to generation of gases of low concentration from biological tanks	B1 – Low
	Generation of fugitive dust emissions from periodic excavation of sludge drying beds	B2 – Moderate

Table 5.17: Subprojects Activities, Potential Hazards and Assessment of Risk – Waste

Subprojects/Activities	Potential Hazard	Assessment of Risk
Operation of sewage treatment plant (STP)	Low volume generation of domestic solid waste	B1 – Low
	Generation of sludge, trash and grit	B2 – Moderate
	Low volume generation of liquid waste (lube oil)	B1 – Low

427. Operational phase impacts are related primarily to the handling and storage of liquid chlorine solution (Sodium Hypochlorite) at tube wells and OHR facilities and algal growth in the OHRs, as well activities associated with the operation of the STP.

428. Potential noise impacts are considered not to be significant since these will occur only at the immediate site of each facility, generally within enclosed structures. Periodic excavation of sludge drying beds will be of short-term duration and are not anticipated to impact adjacent communities located at some distance from the boundaries of the STP.

429. Mishandling of liquid chlorine (Sodium hypochlorite) and its exposure to the tube well operators may cause burns to the mouth and throat, gastrointestinal irritation, nausea, vomiting and diarrhea. Inhalation and ocular exposure to chlorine gas, produced when sodium hypochlorite is mixed with acidic or alkaline solutions, results in burning of throat and lungs, eye and nose irritation, chest tightness, coughing and sore throat. Exposure to higher concentrations of chlorine may lead to tachypnoea, cyanosis, swelling of the airway and, in severe cases, pulmonary oedema and respiratory failure. Sodium hypochlorite is corrosive and may irritate the skin or cause burning pain, inflammation and blisters.

430. Procedures for the safe handling and storage of liquid chlorine, as for any other hazardous material or substance, must be implemented, to include:

- Transportation: Sealed containers of chlorine will be transported at site;
- Storage: Closed and locked storage of chlorine containers, placement of labels, precautions/instructions at storage place in Urdu language, secondary containment for chlorine container, use of spill kit and proper ventilation at storage place; and
- Handling: Only authorized person for the dispensing of chlorine through pump under secondary containment, use of face mask, gloves and apron during chlorine handling activities. Strict monitoring is required from SMC for ensuring that the safe handling and storage practices are adopted at water supply sites.

431. Algal growth takes place in the water reservoir over time which may lead to contamination and cause the water to change its taste. It is proposed the reservoirs shall be cleaned and disinfected on a yearly basis.

v. Potential Operational Phase Impacts of Sewage Treatment Plant

432. The following types of environmental problems could occur during the operation of Sahiwal's STP if not managed and operated properly:

a. Untreated sanitary wastewater;
b. Air pollution;
c. Solid waste;
d. Liquid waste;

e. Noise and vibration;
f. OHS issues;
g. Odor problems;
h. Mosquito/insects breeding and disease transmission;
i. Possible emergencies and plant failure;
j. Socioeconomic impacts;
k. Impacts of trunk sewer line;
l. Increase in roadside traffic of the area; and
m. Impacts on ecology.

a. Untreated Sanitary Wastewater

433. The administration building is the source of sanitary wastewater from the STP. This sanitary wastewater will be generated from the toilets installed in the STP administration building, such as in the laboratory, management building, and guardroom. This wastewater will be discharged directly to the STP. The total estimated quantity of sanitary and laboratory wastewater generated will be about 2.0 m^3/d. This is negligible when compared with the sewage coming from Sahiwal city to the STP (90,909–123,636 m^3/d) and it will not affect the concentration of the flow coming from the whole of Sahiwal city.

434. The impacts of sanitary wastewater generation from the STP office building are in the range of 'no impact' to 'insignificant'. Treating this wastewater in the existing STP will mitigate these impacts.

b. Air Pollution

435. The possible sources of air pollution from the STP include the following:

- Generators;
- Biological tanks and drying beds; and
- Vehicles.

436. Diesel oil is normally used as fuel in the generators used for standby electricity generation, but now gas-fired generators are also being used. The gas-fired generator is preferred for the STP because its emissions are relatively clean. Diesel generators generally emit pollutants, such as CO, NO_x, SO_2 and particulate matter. However, due to the low frequency of operation of generators (only in case of electric shut down) the impact on air pollution generated from this source is deemed to be practically 'insignificant'.

437. Air emissions generated from the aeration tank/biological tanks for the activated sludge process will comprise inert gases, such as CO_2 and minor concentrations of N_2, NH_3 and H_2S. The environmental impacts of these gases are in the category of 'insignificant'. The low concentration and dilution effect will not cause any significant impact on workers.

438. Fugitive dust may be generated during the excavation and clean-out of the sludge drying beds. Such activity is of very low frequency and of short duration. The potential impact is considered to be insignificant, particularly if the timing of clean-out is scheduled for periods when the prevailing wind is from a northerly or north-easterly direction. Any fugitive dust would be carried away from local communities in these circumstances.

439. With the commencement of the STP, traffic will increase, thereby causing increases in dust and vehicle exhaust emissions throughout the area. The traffic from the STP will mainly comprise office cars and trucks carrying sludge to the disposal site.

440. The major pollutants present in the vehicular emissions will be oxides of nitrogen and carbon, particulate matter, and unburned hydrocarbons. For well-maintained vehicles, air emissions will remain within the PEQS. The environmental impacts of vehicular emissions in the area are in the category of 'insignificant'. The traffic volume will not be more as sludge will be carried away twice a week only (2-3 trucks every three days). The staff vehicles will not cause any impact since they will be only 5-10 in number.

441. The project site is rural agricultural area and currently has a very good standard of air quality. As there are very few existing traffic movements and few other air pollution sources nearby, and given that the baseline levels of pollutants are low, the additional emissions from the STP are highly unlikely to raise the level of air pollutants to acute levels.

c. Solid Waste

442. Solid waste will generally comprise empty containers of lube oil and chemicals, scrap metal, discarded mechanical parts, and domestic solid waste. The other major solid waste streams are as follows:

- Trash; and
- Sludge and grit.

443. A bar screen and an automatic fine screen will be installed before the lift station is installed at the site of the inlet of the STP wastewater. This will protect the pumps, valves, pipelines, and other parts and equipment from damage or clogging from rags and large objects, such as sticks, plastic bags and debris. This trash will be disposed along with the sludge.

444. The proposed system for the STP includes primary and secondary treatment. The grit chamber is proposed for primary treatment; it will remove grit, such as sand and heavy particles of silt. The trickling filter, a biological treatment process, is proposed as a secondary treatment for compliance under the PEQS.

445. From the above-stated treatment process, grit will be produced at the primary level and sludge from the secondary treatment level. The quantity of dry sludge produced from the primary and secondary treatment system is estimated to be about 7.9 tons per day.

446. The impact of solid waste, which includes trash, grit and sludge, is assessed in the range of 'Minor' to 'Insignificant', given that such waste materials are currently discharged into surface water courses or directly onto land.

447. The treatment of the STP sludge can be undertaken using one or more of the following approaches:

- Re-use;
- Product development; or
- Disposal.

448. The sludge can be reused for application on agricultural or forestry land. The only limiting factor is the presence of any toxic chemicals or heavy metals.

449. It is assumed that the STP sludge will not contain hazardous chemicals and toxic metals and can be used by farmers to fertilize their fields. In the case where industrial effluent mixes with STP influent, the respective industry should have its effluent pretreated so as to remove toxic metals and chemicals prior to discharging into the sewerage system and to avoid adding toxicity to the STP sludge. This requirement should be strictly controlled.

450. The sludge may also be processed to convert it into a commercial product (compost). Composting will produce valuable nutrients that can be recycled back to nature. This is cost effective, easy to manage, and marketable. The limiting factors are toxic chemicals and heavy metals.

451. It is assumed that the sludge will be transferred to Sahiwal's solid waste treatment facility, which is currently under construction, where it may be converted to compost.

452. Disposal options for the STP sludge include mainly sanitary landfill and incineration. Neither is considered a viable option at present for Sahiwal in the absence of a sanitary landfill or suitable incineration facility.

d. Liquid Waste

453. Liquid waste generally comes from the lube oil used in the various machines and from the STP vehicles. However, at this stage it is not possible to estimate what the quantity of this waste stream will be. The improper disposal of liquid waste can cause air, water, and soil pollution. The impact of liquid waste on the environment is in the category of 'Insignificant' to 'Minor'. As the quantity of this liquid waste is expected to be small, these impacts can be easily mitigated by proper collection, storage and appropriate re-use and/or disposal.

e. Noise

454. There are two potential sources of noise sources, i.e. plant noise and vehicular noise.

455. At the STP, plant noise is normally generated from the pumps. The pumps will be placed in enclosed buildings which will attenuate the dispersion of noise to nearby areas. The plant operators working at pump station will be required to wear ear plugs and ear muffs for personal safety.

456. The vehicular noise could be one of the added nuisances for the nearby community, especially during the night hours. Generally, well-maintained vehicles create noise within the PEQS level of 85 dBA, which is considered acceptable. There will be no vehicular movement at night time. Also, due to low number of vehicles and low frequency of movement, vehicular noise impacts are considered not be significant.

f. Occupational Health and Safety (OHS)

457. The key OHS concerns in STP operations are as follows:

- Use and operation of equipment;
- Aerosols around the aeration tank and sludge drying beds.

458. There are a number of potential safety issues at the STP site. For this, there is a need for a comprehensive study on the likely hazards and risks posed. The general impression of industrial operations in Pakistan is that workers hesitate to use appropriate safety equipment. Therefore, measures will need to be implemented to encourage workers to use safety equipment and procedures on all project sites.

459. Aerosols refer to tiny particles or droplets in the air, such as dust, mist, or fumes. These particles may be inhaled or absorbed through the skin, and can sometimes cause adverse health effects for workers.

460. Aerosols widely differ in terms of particle size and density, and their significance as pollutants. They generally range in diameter from 0.01 to 100 μm. Ultrafine particles smaller

than 1 μm in diameter have a higher potential to be inhaled and cause inflammation to the lungs. Charged particles result in electrostatic precipitation. Poly-aromatic hydrocarbons are of great concern because of their carcinogenicity and pro-mutagenicity.

461. Suspended particulate matter below 10 μm in size can exacerbate respiratory diseases, and increase daily hospitalizations and mortality due to respiratory and cardiovascular diseases. Moreover, the indirect effects of smoke can result in a reduction in photosynthesis and a diminution of UVB radiation. The latter can result in increases in infectious airborne pathogens, with corresponding increases in infectious and mosquito-transmitted diseases.

462. The health impacts of aerosols consist of short term acute symptoms, such as asthma, and bronchitis, etc., and long-term chronic irritation and inflammation of the respiratory track, the development of lung cancer, and an overall reduction in the quality of life.

463. With regard to the STP, there will be a light dispersion of minute water droplets in the atmosphere, around the aeration/biological tank and sludge drying beds. The impact is in the category of 'Insignificant' to 'Minor'. Workers will be instructed to use face masks while working at, and in the vicinity of, the aeration tanks and sludge drying beds.

g. Odor from STP

464. Odor from the STP can be a nuisance for the residents of the Three Marla Housing Scheme and 95/6-R, 94/6-R villages. The impact significance of this nuisance will be in the category of 'Minor' as the distance of Three Marla Housing Scheme and villages is 500 m and 1,000 m respectively. There will be a buffer zone between the STP and the residential areas created by planting trees along the boundary of the plant so as to avoid the dispersion of odor in case the wind direction moves toward these residential areas.

465. Sludge will be dried on sludge-drying beds. There will be a potentially small odor problem from this operation, because the sludge will be stabilized through natural processes. However, the prevailing winds and the site's relatively isolated location should further reduce the already low probability of adverse impacts on the local population.

h. Mosquito/Insect Breeding and Disease Transmission

466. Mosquito larvae generally live in small, relatively stagnant, shallow water bodies, where disturbance of the surface layer is uncommon. In the biological tanks, there is an increased chance that mosquitos and insects may breed. There is also potential for fly, mosquito or insect breeding at the sludge-drying site. However, once the sludge is dry, it is relatively inert and odorless.

467. The will be regular anti-mosquito and insecticide spray at the plant facility to address any potential mosquito and insect problem.

468. Fly and mosquito breeding in the polishing pond and sludge-drying beds can be controlled by the addition of chemicals (for example, calcium hypochlorite or chlorine). The impact significance is assessed to be "Minor".

i. Possible Emergencies and Plant Failure

469. Operational difficulties may be experienced at plant startup or when there equipment malfunctions. The effluent discharged under these emergency conditions would still be an improvement over the existing condition, where raw sewage is discharged directly into the Nullahs. If the need for chlorination is demonstrated, then chlorination of the effluent could be increased so as to kill any pathogenic organisms.

470. The frequency of such incidents is likely to remain low as long as the personnel are adequately trained, the equipment is maintained, and supplies of spare parts are kept available and utilized, as recommended, to keep all units operational at close to design-efficiency levels.

471. The most likely adverse impact scenario would be that large quantities of sludge would accumulate and would undergo anaerobic processes. Untreated wastewater would only need to bypass the STP and go directly into the canal. This would produce localized adverse impacts on the environment.

472. In the case of a power failure or shut-down, standby generators will be provided so that the plant can operate as long as possible. In the case of plant failure, chlorination of the effluent could also be increased to reduce the incidence of pathogenic bacteria.

473. Maintaining equipment in good operating order is of paramount importance in preventing equipment failure. Training programs for plant operation and maintenance activities should be the part of plant operations. This means that, after the project's contractors have completed their obligations, local authorities will need to make funds available for training and also new equipment parts. Any adverse impact, here, is assessed to be in the "Moderate" to potentially "Significant" category.

j. Socioeconomic Impacts

474. Positive socio-economic impacts of the STP will be the creation of job opportunities for the local community, and improvements to environmental conditions and the health of the community. Sludge in raw form or as compost will be available at cheaper rates to the local farming community. This organic fertilizer will enhance the fertility of the farmland.

475. Farmers will not find wastewater to irrigate their fields, which is current practice in the area. This means the operation of the STP will have a significant (negative) impact on the availability of irrigation water, unless treated effluent from the STP was made available. However, even though the quantity of wastewater available for irrigation may pose a short-term problem to farmers, in the long run it will be beneficial to the community health. Irrigating with polluted water transfers pollutants into the food chain and causes the types of carcinogenic and other chronic diseases that might not occur after the STP is in operation.

476. With the operation of the STP and an end to using wastewater for irrigation, farmers might try to divert and capture untreated wastewater from the sewerage pipelines. This will require strict monitoring so as to avoid such practices.

k. Impacts of Trunk Main Sewer Line

477. Trunk main sewer line will be laid down for the conveyance of city sewage to the STP. This main line will connect minor disposal stations to major disposal station and to the STP. This main sewer will pass through the whole city as shown in Figure 5.1.

Figure 5.1: Routing of Trunk Mains from Four Major Pumping Stations to STP Site

478. The minor disposal stations will be abandoned and used only in case of emergency. The major disposal stations will act as pumping stations for STP.

479. The impacts associated with the sewer line mainly comprises of construction phase impacts, traffic congestion at points where roads will be excavated and the loss of any built structures (not anticipated).

480. Any structures, roads and natural features should be protected during construction and then rehabilitated to their original condition. Any trees that are impacted by construction works should be replanted at twice the number.

l. Increase in Roadside Traffic of the Area

481. Traffic will be increased due to movement of sludge carrying vehicles and staff cars at, and around, the site. However, the volume of these vehicles will not be much. Traffic management will be carried out by equally distributing the traffic volume during the day shift time to avoid congestion at nearby connecting roads. The sludge will be carried away from the plant twice a week.

m. Impacts on Ecology of the Area

482. The impact on flora, fauna and geologic conditions is assessed through the loss or damage to vulnerable or protected plant and animal species. There are no protected or endangered species, plants or animals at the site of the STP and., as a consequence, there will be no impact in this regard.

483. As there are no natural reserves or important ecosystems in the vicinity of the site, no severance of wildlife corridors will occur.

vi. Operational Phase Mitigation Measures Proposed at the STP

484. During the operation phase, the plant manager will have the primary responsibility of exercising good and proper management of the STP. Most of this activity should be covered in the management manuals devised for the plant's operations. These manuals will outline procedures for managing or otherwise responding to the following:

a. Operational failure resulting from obstructions in pipelines, screens, etc.;

b. Pump failures, equipment malfunctioning, and treatment process failures, etc., of any kind in the plant;

c. Operational failure resulting from fuel, oil, and volatile chemicals arriving at the plant;

d. Plant emergencies, such as general power failures, storms, etc.;

e. Safety measures, including fire protection equipment, procedures for access to confined spaces, limiting hazardous and toxic gas exposure, training personnel in the proper and safe operation of all equipment, training to avoid exposure to hazardous situations, such as encountering high voltage electrical gear, training for safe driving and for general safety procedures to avoid personal injury, such as muscle strain or damage to eyes, ears, hands, feet, head, etc.;

f. Dealing with noxious conditions, such as odors from the inlet structure and related equipment, and the sludge-management facilities;

g. Handling dangerous or corrosive chemicals, such as acid and lime;

h. Handling other special chemicals, such as polymers;

i. Cleaning sludge trucks to avoid the accumulation of offensive deposits;

j. Handling operational problems, such as spills or overflows of chemicals, sludge, pump stations, etc.;

k. Influent and effluent monitoring of the STP for operational control and for the preparation of monitoring reports for submission to the EPA;

l. Periodic monitoring of air emissions and noise from all vehicles being used for the STP and comparing the noise with acceptable levels established by the PEQS;

m. Maintaining a barrier of trees in the buffer zone to reduce the dispersion of air pollutants;

n. Preparing and implementing a traffic management plan for vehicles moving to and from the STP.

o. Enforcement of the PPE for the staff working in the laboratory and chemical stores;

p. Use of gloves, safety shoes and masks by the operators of pumps, aerators, scrappers and sludge belt press;

q. Noise control measures for the equipment, including proper maintenance and greasing of noise-producing equipment (pumps), the enclosure of noise-producing equipment, tree planting at the boundary of the project site to reduce the noise level;

r. Disposal of domestic waste at the officially designated municipal solid waste dumping site;

s. Disposal of containers, mechanical parts, and discarded material by selling them to downstream recyclers and re-users; and,

t. Safe disposal of liquid waste (e.g. entering into agreements with the major suppliers of lube oil to take them back after use).

485. In addition, it will be essential for the plant manager to be appropriately motivated and trained to manage the plant and its operators, so as to achieve high quality plant performance. This will entail keeping equipment working properly through regular maintenance and repair, the regular monitoring of effluent quality, and the monitoring of influent for general water-quality parameters. The plant manager will also need to liaise with the general public and the SMC, and deal with complaints to the community's satisfaction.

vii. Cumulative and Induced Impacts

486. Cumulative impacts are deemed to occur when the effects of project components, other projects, and/or other land use activities overlap with each other by affecting the same Valued Environmental and Social Component (VESCs). That is, cumulative impacts are

the incremental impact of the project when combined with the cumulative effects of other past, present and reasonably foreseeable future projects.

487. Cumulative impacts can also be due to the induced actions of projects and activities that may occur if the action under assessment is implemented, such as growth inducing impacts and other effects related to induced changes to the pattern of future land use or additional road network, population density or growth rate. Induced impacts are those that arise indirectly as a consequential effect of the project. They usually have no direct relationship with the action under assessment and represent the growth-inducing potential of an action. For example, new roads leading from those constructed for a project, increased recreational activities, and construction of new service facilities are examples of induced actions.

488. For the project components under consideration in this IEE, the following considerations are pertinent:

- With the exception of the STP site, all upgrades to existing infrastructure and new works are proposed within existing landholdings, existing structures or existing rights of way. There are accordingly no cumulative impacts on physical, ecological or social resources in any of the areas subject to development or redevelopment, since all of these areas have been intensively developed in the past and are highly urbanized in the main;
- None of the water supply or sanitation components are designed to cater for an increase in served population or an extension to an existing service area. Rather, the project components are designed to improve the existing service provisions, be it in terms of availability of service or quality of service. In itself, improvements in service provision are not expected to lead to any growth-induced impacts. Similarly, improvements in service provision are not considered likely to result in any significant increase in net inward migration to the City;
- Wastewater discharges to land and surface watercourses will not continue unabated, as at present, since a new STP facility is proposed for Sahiwal as part of Phase 1 of PICIIP. Therefore, there will be a significant positive change to environmental conditions in the receiving environment ;
- Road improvements are designed to reduce traffic congestion and to manage urban road spaces more effectively and with less potential conflict between different modes of road users, notwithstanding that such improvements may increase overall traffic flows;
- Bus terminal upgrades are designed to improve facilities for passengers and commercial vendors at the bus terminal. Although improved facilities may result in a slight increase in the throughput of vehicles, this will be minor and is not the driving force for the project proposals; and
- Implementation of the projects will result in a short-term increase in employment opportunities for construction-related activities. However, none of the sub-projects will lead to a permanent increase in employment, with the exception of the STP operation which will likely require a small number of trained operatives; hence, the projects are not considered likely to result in any significant increase in net inward migration to the City

489. The following cumulative and induced impacts may occur as a result of project implementation:

- Continued depletion of the groundwater table resulting from increased groundwater abstraction, as a consequence of improving the service provision (objective of 24/7 service supply). As noted in Section IV above, the groundwater table has been

experiencing a decline of 0.30 m per year, although the precise cause of this has not been established. It may be a consequence of over exploitation or a reduction in recharge or a combination of the two. The significance of further depletion by enhanced abstraction is assessed to be low in the short-term, providing opportunities are explored for securing alternative potable water supplies in the long-term, as discussed in Section VII;

- Increased water supply is likely to lead to an increase in sewage flow and sullage (wastewater from cooking and washing). This will be accommodated by the construction of the STP and the new sewage gravity mains;
- Improvements to the bus terminal will increase the opportunities for commercial activities therein. In the context of Sahiwal, however, the increase in commercial activities is deemed to be insignificant; and
- Enhanced traffic flows as a consequence of road improvements may result in increases in vehicle emissions to air, potentially resulting in a deterioration to urban air quality along main transport routes. This impact is, however, assessed to be insignificant given that it is offset by reductions in vehicle emissions consequent upon a reduction in traffic congestion.

viii. Positive Impacts of Project Proposals

490. As noted above the majority of construction projects will give rise to a number of impacts on environmental resources. Subprojects under Phase 1 of PICIIP are no exception; however, all of the impacts (except for land acquisition at the site proposed for the STP) are assessed to be temporary (short-term) and reversible, resulting in no discernible impact in the longer-term if the subprojects are implemented in accordance with an agreed and approved Environmental Management Plan (refer to Section VII).

491. By comparison, there are a number of positive impacts arising from project proposals that are deemed to have a significant long-term benefit to the local community with access to the improved urban services. These positive impacts include:

- Enhanced and continuous supply of potable water;
- Improved quality of potable water, including increased provision of disinfection;
- Reduction in the occurrence of water borne diseases through a reduction in the potential for contamination of water supply lines, increased disinfection and removal of potential breeding areas for insects (areas of stagnant water) by redevelopment of public open spaces;
- Conveyance of wastewater to the STP through rehabilitation of the sewer lines and reduction in seepage to ground within urbanized areas;
- Treatment of the wastewater at the STP and the discharge only of treated effluent, thereby avoiding the pollution of agricultural land and surface water courses from untreated wastewater;
- Reduction in traffic congestion, traffic conflicts and vehicle emissions to air;
- Improved public amenity in the main bus terminals; and
- Provision of recreational facilities in the City and overall enhancement of the aesthetics of public open spaces.

VI. PROJECT ALTERNATIVES

A. Water Supply

492. The water supply strategy for Sahiwal City was evaluated during the PFS. The overall strategy adopted had the twin goals of delivering safe and healthy water 24 hours per day, 7 days per week, in accordance with the National Drinking Water Policy, 2009.

493. The current water supply system is locally-based, comprising a series of tube wells abstracting water from the available groundwater resource and feeding into a pressurized water distribution network, rather than relying on one large water treatment facility and major trunk main distribution.

494. The locally based system lends itself well to a more sustainable, resilient and affordable water supply that has the flexibility to expand or be rehabilitated without worry about a single main supply facility.

495. Notwithstanding that groundwater will remain the principal water source for the foreseeable future, alternative sources of potable water may need to be considered in the longer term given the reported lowering of the water table in the vicinity of Sahiwal City, the potential impact of climate change on recharge and the continued high cost of pumping.

496. The risk to water supplies from the reduced recharge of the aquifer can be addressed partially through demand-side management (for example, reduction in water abstraction from water loss reduction programs), in addition to consideration of alternative water sources, such as rainwater harvesting, artificial recharge and surface water development, as discussed below.

i. Rainwater Harvesting and Artificial Recharge

497. Rainwater harvesting can play a significant role in ground water recharge, as groundwater levels in Sahiwal are reported to be dropping potentially as a result of over exploitation and/or a reduction in natural groundwater recharge.

498. The rate of recharge can be increased through one or more of the following:

- Creation of storm water holding areas in areas of open space, which can recharge groundwater aquifers through percolation;
- Recharge tube wells or groundwater injection wells drilled specifically for the purpose of recharging deep aquifers;
- Recharge through abandoned dug wells and recharge trenches constructed where permeable strata is available at shallow depths.

499. There is limited open space available in many parts of Sahiwal and, thus, storm water holding ponds would appear to be potentially viable on a large scale only outside the city limits, where such use would compete with productive agricultural development. Standing bodies of water would also be associated with potential health risks from increased vector-borne disease (for example, malaria and dengue).

500. Recharging of the groundwater aquifer via wells and trenches requires a suitable source of water in the first instance, and this is not readily available other than via tapping a surface water source.

501. Notwithstanding the above, since the annual rainfall in Sahiwal is only about 200 mm per year and it experiences long dry periods every year, the option of rainwater harvesting for reducing dependence on ground water is unlikely to have a significant impact.

502. If a household level project is considered, it will require space to be available at the household for storage of rainwater. Moreover, roofs in most households are generally flat and not always in good condition so often there is not a suitable surface to harvest rainfall for potable use. It may be more feasible in areas such as Fareed Town and Tariq Bin Ziad Colony, but in these high income areas people have installed their domestic bores for emergency and surplus use of water, thus they will not need to go for rain water harvesting. If there is a limited demand for rainwater harvesting, public money cannot be invested in a project, which will be operated at the level of individual households. Thus for these reasons, rainwater harvesting options do not seem viable in Sahiwal. At best an incentive program might be considered whereby people would be provided with subsidies for installing a rainwater harvesting facility since it would result in water conservation.

ii. Surface Water Development

503. One alternative water source for Sahiwal city that might be considered is tapping surface water. There is the possibility of a surface water source for water supply through the Lower Bari Doab Canal. It is the perennial irrigation water distribution canal having a design discharge of 9,841 cusecs (1,003,782 m^3/hr), with 8,600 cusecs (877,200 m^3/hr) present carrying capacity in kharif season. The canal passes through the city, and it is reported to be closed once a year for a month, for de-silting purposes.

504. There is an option to convert the groundwater source to a surface water source by taking raw water from the Lower Bari Doab Canal, and construction of an 18 MGD Rapid Sand Gravity Filters Water Treatment Plant in the city, with provision for future to cater for projected demands in 2035. This 18 MGD Water Treatment Plant will meet the demands up to 2020, and the subsequent expansion by provision of additional filter beds and mechanical equipment will serve to meet the 2035 demand.

505. Alternatively, a smaller surface water system of up to 9 MGD could be installed such that water would be supplied partially by groundwater and partially by surface water. This would reduce the demand on the groundwater and redress the water table depletion and, at the same time, possibly make some saving on power costs (although there will be additional chemical costs for the surface water treatment plant). But by retaining the tube well operations, it will ensure the tube wells are in operating condition and can be pumped for additional hours during the one-month closure of the LBDC Canal.

506. Both of the above options might provide a long-term solution to reducing or even eliminating groundwater depletion. However, these options would compete with irrigation requirements given the relatively arid climate of the area. In addition, significant treatment of the raw water would be required to ensure potable water quality.

iii. Water Quality

507. Water quality issues have been cited as a major concern given indications of potential contamination of the water supply by sewerage from adjacent leaking sewer pipes, possibly laid in a common trench, as well as the poor condition of the existing pipe network. Whilst provision exists already for the application of chlorine treatment at tube wells, it is not known if such treatment is being applied routinely and/or at the correct dosage.

508. The disinfection of potable water provides a degree of protection from contact with pathogenic organisms including those causing cholera, polio, typhoid, hepatitis and a

number of other bacterial, viral and parasitic diseases. Disinfection is a process where a significant percentage of pathogenic organisms are killed or controlled.

509. Disinfection is usually the final stage in the water treatment process in order to limit the effects of organic material, suspended solids and other contaminants. The primary methods used for the disinfection of water in very small (25-500 people) and small (501-3,300 people) treatment systems are ozone, ultraviolet irradiation (UV) and chlorine. There are numerous alternative disinfection processes that have been less widely used in small and very small water treatment systems, including chlorine dioxide, potassium permanganate, chloramines and peroxone (ozone/hydrogen peroxide).

510. The simplest and most widely used disinfectant in Pakistan is liquid chlorine. It is usually employed at water supply facilities without considering any other alternative.

511. The application of liquid chlorine at each tube well, as well as in the OHRs, should maintain a potable water supply that adheres to national standards. In addition:

- the replacement of the older, corroded pipes in the network; and
- providing appropriate separation of the water supply and sewerage pipes; and
- providing a 24 hour supply; and
- ensuring the water mains is pressurized to prevent contaminated water from entering the water mains,

should reduce the water quality problems reported currently.

iv. No Project

512. As noted above, the design production capacity falls short of projected demand both currently and into the foreseeable future. The key issues identified currently, therefore, center on addressing the following short-term issues:

- re-instating the design water production capacity;
- the absence of continuous service provision 24/7 (intermittent supply only given the poor state of the pipe network and the absence of system storage);
- the overall availability of water due to significant losses in the pipe network as a result of inadequate maintenance and rehabilitation of the distribution system. This is reflected in the high levels of NRW which is indicative of low operational efficiency; and
- maintaining clean and safe water by mitigating the potential for contamination of water in the pipe network due to groundwater and sewage incursions.

513. The above issues are the focus of the sub-project proposals and need to be addressed irrespective of the development of alternative water supplies.

514. In the absence of the proposed sub-projects, the following scenario will apply:

- the tube well production capacity will continue to deteriorate, reducing available water supplies and the ability to continue to provide an adequate supply in response to temporary local system breakdowns and failures;
- the piped network will continue to degrade, resulting in increased water losses throughout the network, and the likely deterioration in water quality from the increasing ingress of contaminated water and sewage and the absence of effective disinfection facilities;

- water quality will continue to fail to meet National Standards for Drinking Water Quality (NSDWQ, Pakistan EPA, 2010); and
- in addition, as the pipe network degrades over time, the potential exists for increasing exposure of asbestos materials from the decay of ACP, posing a significant long-term health risk to the water supply and also during any excavation exposing such pipes.

B. Sewerage

515. At present there is little or no functioning sewage treatment with effluent being discharged directly into nullahs, with all the associated negative environmental and health impacts.

516. Industrial effluent is is currently either mixed with domestic waste or discharged directly into drains and water bodies. This is unacceptable and unsustainable.

517. The serious pollution of the nullahs resulting from disposal of untreated domestic and industrial wastewater is the most serious issue in the water and wastewater sector. The provision of wastewater treatment facilities is, therefore, a critical priority for the city.

518. The following project proposals have been advocated to address the wastewater issues:

- Rehabilitation of sewerage and drainage network and disposal stations;
- Construction of trunk sewers and sewerage system extensions; and
- Construction of sewage treatment plant.

i. Treatment System Design

519. In the PFS two options were considered for the overall design of the treatment system:

- Option 1 comprising four small decentralized sewage treatment plants, one at each of the four major disposal stations; or
- Option 2 comprising one centralized treatment plant.

520. Option 1 was regarded as a short term, primary treatment option only, since lack of available land would not permit secondary treatment facilities and process es to be installed. As such, whilst better than discharging untreated wastewater directly into the surface water courses, it would only provide a marginal improvement in the absence of being able to achieve significant reduction of the pollutant load.

521. Option 2 was considered as a long-term solution since it offered complete treatment with sufficient land availability. This was the option selected since the TMA undertook to acquire a suitable plot of land.

ii. Alternative Treatment Technologies

522. During the preliminary design of the STP undertaken in the FS, a range of different alternative treatment technologies has been evaluated.

523. The comparison of alternative technologies for STP design is presented on Table 6.1 and Table 6.2.

Table 6.1: Comparative Analysis of Alternate Treatment Processes

Treatment Process	Advantages	Disadvantages
Facultative Pond (FP)	- Simple construction, operation and maintenance - Low operating cost - No equipment - Practically no energy requirement - Satisfactory resistance to load variations - Sludge removal only necessary after periods of 20 years	- 85% BOD removal - High land requirement (650 acres) - Difficulty in satisfying restrictive discharge standards - Possible algal removal requirement from effluent - Variable performance with climatic conditions (temp and sunlight) - Possible insect & vegetation growth in ponds
Flow Through Complete Mix Aerated Lagoon (CMAL)	- Sufficient nutrient removal - Lowest land requirement among pond systems - Reliable process as long as it is properly supervised - Reduced possibility of odor, insects and worms	- 85% BOD removal - Land requirement still very high (130 acres excluding sedimentation tanks) - High energy consumption - Require complete sludge management - Noise and aerosol problem
Sequencing Batch Reactor (SBR)	- > 95% BOD removal - Satisfactory nutrient removal - Low land requirement (but higher than UASB) - Reliable process as long as it is properly supervised - Reduced possibility of odor, insects and worms - Operational flexibility	- High construction and operational cost - Requires equalization tank - High energy consumption, higher than other activated sludge systems - Highly sophisticated operation & controls - Higher level of maintenance associated with more sophisticated controls, automated switches, and automated valves - Require complete sludge management - Possible noise and aerosol problem
High Rate Trickling Filter (HRTF)	- > 90% BOD removal - Low land and energy requirement - Conceptually simpler than AS - Operation flexibility - Better resistance to load variations - Reduced possibility of bad odor - Better sludge thickening than AS	- High construction cost - Relative dependence on air temperature - Sensitive to shock loading - Complete sludge management is required - High head loss - Possibility of flies and mosquitoes

Treatment Process	Advantages	Disadvantages
Rotating Biological Contactors (RBC)	- 90% BOD removal - Frequent nitrification achieved - Very low land requirement - Conceptually simpler than AS - Reduced possibility of bad odor - Reduced head loss	- High construction and operation cost - Possibility of dead zones and solid accumulation - Usually the discs need to be covered - Relative dependence on air temperature - Complete sludge management is required - System is inconsistent and unreliable
Anaerobic Pond (AP)	- Simple construction, operation and maintenance - Low construction and operation costs - No equipment - Practically no energy consumption - Rapid startup after periods of no use - very low and stabilized sludge production - sludge only require dewatering	- 70% BOD removal - Difficulty in complying with quality standards & needs post treatment - Practically no N and P removal - Relatively sensitive to load variations and toxicity - Highly pH and temperature dependent - Possibility of generation of bad odor (H_2S) - Need for periodic removal of sludge - Need for a safe distance from surrounding dwellings - Possible insect growth
Upflow Anaerobic Sludge Blanket (UASB)	- Tolerance to influent high organic concentrations - Low land requirement - Low construction and operation costs - Practically no energy consumption - possibility of energy use of the biogas - very low and stabilized sludge production - sludge only require dewatering - Rapid startup after periods of no use	- 70% BOD removal - Difficulty in complying with quality standards - Usually need post treatment - Influent variation can upset balance between methanogenesis and acid formation - Highly pH and temperature dependent - Practically no N and P removal - Possibility of generation of odorous and corrosive gas (H_2S) - Initial startup is generally slow (6 months) - Relatively sensitive to load variations and toxicity - SRT cannot be maintained at low TSS concentrations

Table 6.2: Comparison of Various Treatment Technologies under STP Sahiwal Conditions

Facultative Ponds	High Rate Trickling Filter	Complete-mix Aerated Lagoon	Sequencing Batch Reactor	Rotating Biological Contactors	Anaerobic Ponds	Up-flow Anaerobic Sludge Blanket
Maximum BOD_5 Removal (%)[a]						
85	90	85	> 95	90	70	70
Area Requirement (acres)						
90 – 120	2.5 – 3.5	25 – 35	3.4 – 4.5	2.25 – 3.0	9.5 – 12.5	1.3 – 1.8
Resistance to Shock Loadings & Reliability of Results						
high	moderate to high	moderate to high	Moderate	less to moderate	less	Less
Equipment & Energy Requirement						
none	moderate	high	high	high	none	less to none
Operational & Maintenance Ease						
high	moderate	moderate	Less	less	high	moderate
Aesthetic (Nuisance)						
moderate odor & insect issues	moderate insect issues	severe noise & aerosols issues	severe noise & varying aerosol issues	moderate insect issues	severe odor, color & insect issues	severe odor and color issues
Compatibility to Current and Future Conditions						
less	high	high	High	moderate	less	less
Sludge Production and Management Requirement						
low	moderate	high	high	moderate	low	low

[a] BOD_5 removal is at temperature ≥ 30°C

524. The PFS recommended a combination of treatment technologies comprising an Upflow Anaerobic Sludge Blanket as primary treatment followed by Trickling Filters as a secondary treatment. This combines the ability to produce a relatively high removal of pollutant load, whilst being cost effective (capital and operating cost) and requiring a relatively low land take.

iii. No Project

525. There is no alternative to the provision of sewage treatment facilities or to the rehabilitation of the existing sewer lines and disposal stations, other than do nothing.

526. In the event of no project the following scenario will apply:

- Both wastewater and storm water drainage will continue to be collected by a combination of sewers and open drains which eventually discharge into nullahs;
- The nullahs will continue to receive a mix of domestic wastewater and polluting industrial wastewater;
- The capacity of the sewer system will gradually decrease over time, as more of the existing system becomes choked or is subject to collapse;
- There might be an increased potential for flooding in the City from contaminated wastewater as a consequence of the reduced carrying capacity. Increasing overflows from the sewers will occur during periods of peak stormwater drainage; and
- The risk of contamination to the potable water supply will increase as further leakage from the sewers occurs. The incidence of water-borne disease is likely to increase significantly.

C. Urban Public Spaces

527. Project proposals call for the rehabilitation and upgrading of existing infrastructure with regard to:

- Main transport routes;
- Main bus terminals; and
- Green spaces.

528. The design proposals set out in Section III are essentially pilot projects that are intended to be replicated at other locations throughout the City and to demonstrate the significant improvements that can be achieved with appropriate planning and management of urban public spaces. The primary aim of the proposals is to:

- Increase public amenity and recreational facilities;
- Reduce traffic congestion and pollution from vehicle emissions; and
- Enhance the liveability of the urban center.

529. The primary constraints on the proposed improvements arise from:

- The lack of alternative greenfield sites and spaces within the City limits, thereby dictating that improvements must be in the form of re-development of existing urban public space rather than the creation and development of new areas; and
- The desire of the parties affected by any redevelopment (such as commercial entities along main transport routes and shop owners in the bus terminals) to be limited to

cosmetic changes to existing structures as far as possible, so as not to impact their livelihood.

i. No Project

530. In light of the above, there are no project alternatives to the current design approaches.

531. In the event of no project the following scenarios will apply:

- The road network will continue to be poorly managed, resulting in severe congestion, with inefficient management and utilization of existing transport corridors. As the City continues to grow traffic congestion will become worse, with significant economic impacts;
- Air pollution from vehicle emissions along the main transport routes will increase, resulting in significant impacts on local communities. Enhanced rates of respiratory disease (RTI) are anticipated;
- Passengers and shop owners at the existing main bus terminals will continue to suffer poor and inadequate facilities; and
- Green spaces will not be used or improved, detracting from the aesthetics of the City and potentially impinging on public health and public amenity.

VII. ENVIRONMENTAL MANAGEMENT PLAN

532. The main purpose of the Environmental Management Plan (EMP) is to provide a strategy for environmental protection. According to this plan, all subproject implementation activities are controlled and monitored from the design phase, through construction, commissioning and operations. Problems that occur during the project's development are to be identified and rectified so as to prevent damage to the environment.

533. The EMP addresses specific potential impacts identified in this IEE. If some issues have been overlooked, or new issues arise during project implementation, then the EMP should be amended, in consultation with the regulatory authorities, so as to ensure effective mitigation is achieved at all stages in the project. The EMP aims to ensure that:

- Project activities are managed so as to avoid or reduce any negative environmental and social impacts and enhance positive impacts;
- Surrounding communities are better off after the project is implemented, on social and environmental indicators;
- Precautions are taken against damage, and claims arising from damage are handled in a timely manner;
- Information flow between the client, consultants, contractors and affected parties, if any, is optimized to ensure that all stakeholders are aware of their particular responsibilities;
- Any affected structures, infrastructure and natural features are protected during construction and then rehabilitated according to the guidelines in the EMP;
- Local labor and entrepreneurs from the affected communities are used throughout the project and for project related activities, wherever possible;
- Accurate records of the progress of the project (including objections) are maintained so that the concerned can be traced out in the event of claims against the client;
- Monitoring reports are produced for regulatory bodies. Their frequency and content are agreed upon prior to start of the construction phase; and
- Mechanisms are in place for reviewing the efficacy of the management plan and any improvements made in the course of the projects, so that other similar projects may benefit from the experience gained.

534. The EMP contains the following information to be used for its effective implementation:

- Responsibilities of individuals, groups, government agencies and Non-Government Organizations (NGOs) for carrying out mitigation actions identified in the IEE;
- Guidelines for communication between all stakeholders with responsibilities for implementing the management plan;
- Costs of implementing the proposed mitigation measures;
- Institutional and training requirements for implementing the mitigation measures;
- A monitoring program to track project related events and progress in implementing the mitigation measures;
- Community liaison procedures; and
- Mechanisms for improving the management plan.

A. Environmental Management Plan (EMP)

535. The EMP for those subproject activities which have environmental impacts of medium risk is provided in Table 7.1 for the construction phase and Table 7.2 for the operational phase (see below). The EMPs provide an overview of planned mitigation measures and identifies who is responsible for these. In addition, monitoring aspects have been included in the plan, comprising an overview of the frequency of monitoring, monitoring requirements and monitoring responsibilities.

536. One key issue identified during the preparation of the IEE pertains to the management of ACP.

537. Subprojects in both the water supply and sanitation sectors in PICIIP include replacement of water distribution mains (WDM) and sewer pipes. ACPs are known to have been used to construct significant portions of the existing WDM and may also have been used to construct some sections of the sewers.

538. Asbestos is recognized internationally as a hazardous material because it can present a risk to human health. In many jurisdictions asbestos is classified as hazardous and is a controlled chemical waste or a hazardous waste because, if it is mishandled, it can release airborne fibres that are known to cause asbestosis and may also be associated with other lung diseases and cancer. All forms of the asbestos mineral will release asbestos fibres if broken up and all types of asbestos containing materials (ACM) will release asbestos fibres, to some degree, if damaged, abraded, weathered or decomposed

539. It is standard practice for non-friable intact ACP to be left buried *in situ* when no longer required. This is an acceptable practice since it avoids exposure of the ACP and eliminates the potential for asbestos fibres to be released to the atmosphere.

540. For friable ACM (typically, materials that have begun to degrade and decompose) it is normal to remove such materials in accordance with specified procedures and protocols, as set out in an Asbestos Management Framework (AMF) and Asbestos Management Plan (AMP). Such a procedure is routinely adopted where:

    - specialist expertise exists within the contracting community experienced in handling asbestos materials; and
    - secure facilities are available for the safe disposal of asbestos wastes, normally to an engineered landfill.

541. Neither of these conditions is satisfied in Sahiwal or indeed elsewhere in Punjab.

542. Given that there may be significant risks involved in removing any friable ACP, and given the location of such pipes within high density residential areas, it is concluded that it would be unsafe and a risk to public health to extract friable ACP in the current project. The intention, therefore, will be to avoid disturbing existing ACP by laying the new PVC pipes alongside or above the old ACP. This also has the advantage of not having to interrupt the existing water supply while construction takes place.

543. It is proposed to manage any friable ACM, wherever possible, by leaving it *in situ* and ensuring that it remains buried to eliminate any potential exposure, until such time as the two conditions above are satisfied and it is deemed feasible to extract and dispose of it in a safe and secure manner.

544. In the longer-term there is still the risk that other construction activities, outside the project, may disturb the old ACP. In order to provide some warning to possible future works it is

proposed to lay hazard marking tape in the ground above the existing pipe. This will provide an in-ground warning to any future excavations. In addition, the co-ordinates of such materials should be recorded in order to ensure that any subsequent construction works in the area do not inadvertently expose the ACMs.

545. This approach will negate the need to remove the majority of the ACP but there are likely to be occasions when small amounts of pipe will need to be removed and disposed of correctly. Should it prove unavoidable to remove friable ACMs during the current project, then the contractor will be required to follow the procedures and protocols set out in Annexure 3 which provides guidance on how to manage the excavation, handling, transport, storage and disposal of ACM.

546. Long term temporary storage of ACM until suitable disposal options are developed is an alternative option to the above approach but presents its own set of risks, such as poor security and maintenance of the facility, joint use of storage space, damage to packaging, etc. In addition, as noted above, there are no contractors in Pakistan that specialize in asbestos removal, meaning that there is no available in-country technical experience currently.

B. Institutional Arrangements

i. Local Government and Community Development Department (LG&CDD)

547. The Local Government and Community Development Department (LG&CDD) of Punjab will be the executing agency (EA) of the project. Under the guidance of the Project Steering Committee, LG&CDD will be responsible for the overall execution of the project.

548. A Project Management Unit (PMU) has been established within LG&CDD to support LG&CDD.

ii. Sahiwal Municipal Corporation (SMC)

549. The city government of Sahiwal (municipal corporation) will be the implementing agency and will be responsible for day to day project implementation of the water supply, sewerage, transport routes and green spaces development projects in Sahiwal

550. The Mayor of Sahiwal is the executive head of the Municipal Corporation. The Deputy Mayor performs the functions of the Mayor if the Mayor is unable to perform functions on account of absence or for any other reason. The Mayor heads the Municipal Corporation. He is assisted by the Chief Officer (CO).

551. The CO co-ordinates and facilitates the performance of functions assigned to the Municipal Corporation under the supervision of the Mayor. The CO is the focal person in the Municipal Corporation. He acts as the coordinating and administrative officer in-charge of the offices and units of the Corporation.

552. There are five Municipal offices of the Corporation including:

i) Planning and Coordination;
ii) Municipal Regulations;
iii) Infrastructure;
iv) Services; and
v) Finance.

Table 7.1: Construction Phase Environmental Management and Monitoring Plan

Subproject Component	Mitigation Measure (By Contractor)	Monitoring:		
		Type	**Frequency**	**Responsible**
- Water supply pipe replacement and rehabilitation works - Sewer replacement works - New main sewers - STP - Urban public spaces (road improvements, Bus stand upgrade and green space redevelopment)	**Soil Pollution Control** - Placement of secondary containment under fuel/lubricant containers and generator fuel oil tank to collect spillage and leakage - Placement of fuel/lubricant container on paved floor at enclosed place - Properly collection and disposal of waste lube oil/oily rags after maintenance - Avoid spill and leaks of oil, lubricants on floor during maintenance activities - Immediate cleaning the spillage and leakage from the ground with approved spill kit, sawdust/cloth - Proper disposal of contaminated materials - Pump out contaminated water from pipe work prior to extraction or disconnection - Dispose of residual solids to approved site	Strict monitoring of best practices during fueling, oiling and maintenance activities to avoid soil contamination Visual check of pipe content prior to disconnection	Daily	Contractor
			Weekly and random inspections	Oversight by CIU/SMC
- Water supply pipe replacement - Sewer replacement	**Odor Control** - Pump out contaminated water from pipe work prior to extraction or disconnection - Adequate venting/pump out of pipe work prior to disconnection - Removal and disposal of residual solids to approved site - Use of odor suppressants	Visual check of pipe content prior to disconnection Monitoring of gasses such as H_2S, CO_2, CO and O2.	Daily	Contractor
			Weekly and random inspections	Oversight by CIU/SMC
- DNI zones - Water supply pipe replacement - New OHRs construction	**Dust Suppression** - Regular water sprinkling at dust producing areas during construction activities to suppress dust (Construction Phase Environmental Mitigation Plan, CPEMP, would	Visual inspection of water sprinkling practices at construction site	Daily	Contractor

Subproject Component	Mitigation Measure (By Contractor)	Monitoring:		
		Type	**Frequency**	**Responsible**
- Sewer Pipe replacement - New trunk main - STP - Railway Road upgrade - Bus stand redevelopment - Green space redevelopment	be appended with the contractor bidding document) - Covering of stockpiles of materials - Covering of spoil and construction materials in transit - Avoid excavation work and material movement and placement in periods of high wind	Visual inspection of stockpiles Visual inspection of trucks transporting construction materials and spoil materials	Weekly and random inspections	Oversight by CIU/SMC
- Water supply pipe replacement - New OHR construction - Sewerage pipe replacement and disposal station rehabilitation - Trunk main - STP construction - Railway Road upgrade - Bus stand redevelopment - Green space redevelopment	**Noise Control** - Operate well maintained vehicles and construction machines to avoid noise at the construction site - Regular preventative maintenance of vehicles and construction machinery (Proper lubrication, oiling and greasing of the moving parts of the machines) - Use of mufflers and silencers where noise levels exceed 85dBA - Use of noise barriers adjacent to high noise producing machines - Vehicle/machines movement permitted only during day time - No construction activity or movement of vehicles at night time	Review of maintenance record of vehicles and machines Noise monitoring of vehicles, machines and surrounding areas of the construction sites Noise monitoring at sensitive receivers	Daily noise monitoring at site of activity Monthly noise monitoring at sensitive receivers Submission of maintenance records monthly	Contractor
			Weekly and random inspections Review record for every new piece of equipment	Oversight by CIU/SMC

Subproject Component	Mitigation Measure (By Contractor)	Monitoring:		
		Type	Frequency	Responsible
- Water supply pipe replacement - New OHR construction - Sewerage pipe replacement and disposal station rehabilitation - Trunk main - STP construction - Railway Road upgrade - Bus stand redevelopment - Green space redevelopment	**Traffic Management** - Vehicles speed limit of 20 km per hour at the residential areas to avoid accident - Construction material carrying vehicles will be covered from the top to avoid dispersion of dust in the surrounding areas - Scheduling of vehicles arriving at the site to avoid congestion and nuisance for adjacent communities - Proper road marking and sign board posting at residential and commercial areas - Cordon off the construction work areas and diversion of traffic to other sides as per traffic plans - Prior communication of alternative routes to the public to avoid traffic congestion at construction site Maintain access of local community	Strict monitoring of speed limits and frequency of arrival at the site Monitoring of road marking and signboard placing at the road side Alternative route plans and communication to public for the affected roads Access maintenance	Daily Weekly and random inspections	Contractor Oversight by CIU/SMC
- Water supply pipe replacement - New OHR construction - Sewerage pipe replacement and disposal station rehabilitation - Trunk main - STP construction - Railway Road upgrade - Bus stand redevelopment - Green space redevelopment	**Construction Waste Disposal** - Controlled disposal of construction waste to approved facilities and locations - Prohibit dumping at residential areas - Prohibit dumping in the water bodies - Waste segregation - Maximize recovery of recyclable materials - Maximize re-use of spoil materials	Monitoring of construction waste dumping practices Records of disposal locations, quantities and types of waste Records of materials recovered and re-used	Daily inspections Weekly and monthly reports Weekly reviews and random inspections	Contractor Oversight by CIU/SMC

Subproject Component	Mitigation Measure (By Contractor)	Monitoring:		
		Type	**Frequency**	**Responsible**
- All subproject components	**Domestic Solid Waste Disposal** - Provision of facilities for collection of solid waste - Waste segregation at source - Maximize recovery of recyclable materials - Ensure disposal at designated disposal site	Visual inspection of facilities for waste collection, segregation and storage	Daily, weekly and monthly	Contractor and oversight by CIU/SMC
- All subproject components	**Sanitary Wastewater Disposal** - Provision of septic tanks and collection facilities - Disposal to sewer after primary settlement - Disposal of sludge to approved location	Visual inspection of facilities for waste collection Monitoring of wastewater parameters (pH, BOD5, COD, TSS, TDS) prior to discharge	Daily	Contractor
			Weekly monitoring of discharges	Oversight by CIU/SMC
- All subproject components	**Health and Safety of Workers** - Develop and implement Construction Safety Plan (CSP) - Provision of Personal Protective Equipment (PPE) - Undertake tool box talks - Provide training in site safety - Nominate site safety officer - Provide first aide medical facility at sites	Implementation of CSP Use of PPE Accident and down-time statistics	Daily visual inspections Weekly and monthly reports	Contractor
			Weekly reviews and random inspections	Oversight by CIU/SMC

Table 7.2: Operational Phase Environmental Management and Monitoring Plan

Subproject Component	Mitigation Measure (By Operator)	Monitoring:		
		Type	Frequency	Responsible
Chlorination facility at tube wells and OHRs	<u>Transportation:</u> Sealed containers of chlorine will be transported at site <u>Storage:</u> - Closed and locked storage of chlorine containers - Labelling, precautions/instructions at storage place in Urdu language - Secondary containment for chlorine container - Use of spill kit - Proper ventilation at storage place <u>Handling:</u> - Only authorized person for the dispensing of chlorine through pump under secondary containment - Use of face mask, gloves and apron during chlorine handling activities	Regular monitoring of safe handling and storage practices	Daily visual inspection Monthly reporting of all related activities	SUSC
Algal growth in OHRs	Cleaning and disinfection of OHRs	Visual inspection Records of work undertaken	Annually	SUSC
Sewage Treatment Plant (STP)	**Planting of Buffer Zone** Planting of trees at boundary of the plant Maintenance of trees and buffer zone, replanting as necessary	Progress review of status of tree planting as per vegetation and screening plan	At start of construction and then review biannually	SUSC
	Sanitary Wastewater Sanitary wastewater will be treated in the STP	Monitoring of flow records Monitoring of wastewater parameters (COD, TSS, TDS)	Daily review of records Quarterly analysis of parameters	Plant Manager Review by SUSC

Subproject Component	Mitigation Measure (By Operator)	Monitoring:		
		Type	**Frequency**	**Responsible**
Sewage Treatment Plant (STP) (continued)	**Generator Emissions** Regular maintenance and tuning of combustion chambers of generators Regular monitoring of air pollutants and adjust air fuel ratio accordingly for generators	Ensure that the maintenance of the generators is carried out as per preventive maintenance plan Regular monitoring of stack emissions of generators	Quarterly (CO, SOx, NOx)	Plant Manager Review by SUSC
	Vehicular Emissions and Noise - Use of maintained vehicles at project site to reduce noise and air pollution Regular monitoring of vehicular noise levels Taking appropriate maintenance measures in case noise level increases to 85dBA Vehicle movement is allowed only at day time	Review of maintenance record of each vehicle Noise monitoring of vehicles	Monthly Biannually	Plant Manager Review by SUSC
	Liquid Waste Proper collection, storage and handing over the liquid waste to licensed lube oil recyclers	Ensure that the waste lube oil is properly collected, stored and transferred to the recyclers	Monthly or as per requirement	Plant Manager Review by SUSC
	Plant Noise Control Exercising preventive maintenance of the plant machinery Proper lubrication, oiling and greasing of the moving parts of the machines Noise proof enclosure around noise producing machines such as pumps, generators, compressors etc. Exercising the use of ear plugs and ear muffs by the workers at plant Planting of trees at the boundary of the plant to help attenuate noise levels	Ensure that preventive maintenance plan is in place Ensure that maintenance plan is implemented Ensure use of noise enclosures at high noise areas Ensure use of PPE at high noise areas Ensure tree planting along boundary of the plant	Daily Weekly Monthly Quarterly	Plant Manager Review by SUSC

Subproject Component	Mitigation Measure (By Operator)	Monitoring:		
		Type	**Frequency**	**Responsible**
Sewage Treatment Plant (STP) (continued)	**Health and Safety** Strict enforcement of Operational Safety Plan of STP Strict enforcement of use of safety equipment during working at the plant Strict enforcement of adopting safety precautions during maintenance work In house first aide medical facility	Ensure that Operational Safety Plan is implemented at plant site	Daily	Plant Manager Review by SUSC
	Odor Control Tree planting at boundary of the plant to attenuate odor impacts to nearby community	Ensure that Tree Planting is maintained in the buffer zone	Biannually	Plant Manager Review by SUSC
	Mosquito /Insects Breeding Weekly spraying of anti- mosquito and insecticides spray at trash and sludge areas Use of mosquito repellent lotion by the workers	Ensure that there is weekly spraying of insecticides at sludge drying beds and trash removal areas	Weekly	Plant Manager Review by SUSC
	Plant Failure Preventive maintenance Inventory of spare parts Standby arrangement of crucial equipment such as pumps Arrangement of standby power source i.e. generator Training of workers on operation and maintenance of the plant Maintenance of daily log book Monitoring of crucial plant parameters Taking appropriate measures as per monitoring of parameters	Ensure that preventive maintenance plan is implemented Ensure that there is sufficient inventory of spare parts Regular monitoring of effluent characteristics (BOD_5, COD, TSS, TDS etc.) Regular monitoring of sludge quality (Cu, Cr, Ni, Hg) Regular monitoring of stack emissions of generators	- Daily - Daily - Daily Daily	Plant Manager Review by SUSC

Subproject Component	Mitigation Measure (By Operator)	Monitoring:		
		Type	**Frequency**	**Responsible**
Sewage Treatment Plant (STP) (continued)	**Air Emissions from Biological Tanks** Regular monitoring of NH_3 and H_2S gases near the aeration/biological tanks and take appropriate measures in case concentration of these gases is above threshold limit values	Regular monitoring of the gases	Daily	Plant Manager Review by SUSC
	Disposal of Sludge and Trash Dumping of trash and sludge at proposed solid waste treatment facility	Ensure that trash and sludge is properly transferred to the solid waste treatment facility	Daily or as per requirement	Plant Manager Review by SUSC
	Aerosol from Biological Tanks and Drying Beds Strict enforcement of face mask while working around aeration tanks and sludge drying beds	Ensure that trash and sludge is properly transferred to the solid waste treatment facility	Daily or as per requirement	Plant Manager Review by SUSC
	Diversion and Capture of Wastewater Strict monitoring/guarding of sewerage pipelines to avoid stealing of wastewater	Patrolling of sewerage network to ensure that untreated wastewater is not being taken by the local farmers for irrigation	Daily (day and night)	SUSC

553. A Municipal Officer (MO) heads each corporation office. These offices work under the CO. The MO Infrastructure and MO Services are responsible for water supply, sewage and sewage treatment and disposal, storm water drainage, sanitation and solid waste, roads and streets, traffic planning, street lighting, firefighting, parks and slaughter houses in the Municipal Corporation. In addition, this office provides all engineering related support to other offices of the corporation (and where requested to the Union Administration).

554. Overall, the SMC will be responsible for the implementation of all the projects proposed under Phase 1 of PICIIP. The water supply, sewerage and drainage and urban public spaces improvement projects will be executed directly by the SMC through contractors. Consultants will be engaged to assist with project implementation, audit monitoring, and institutional strengthening. A City Implementation Unit (CIU) has been established to support the SMC.

555. A new urban services company in Sahiwal will operate and maintain the urban services.

iii. The Urban Unit

556. The Urban Unit was established in 2006, as a Project Management Unit (PMU) of the Planning and Development Department under the Government of Punjab. In 2012, it underwent significant transformation and converted into an independent private limited company, registered with the Securities and Exchange Commission of Pakistan. The objective of The Urban Unit is to provide guidance and support to Government departments in developing urban sector reforms and to coordinate the implementation of the reform program.

557. Thematic areas of coverage include GIS, urban planning and design, solid waste management, water and sanitation, urban transport, municipal finance and urban economics, information and communication technology, management information system, capacity development and social and environment safeguards, and monitoring and evaluation (M&E). It is an important partner and interlocutor for PICIIP preparation activities in Sahiwal.

iii. CIU and Environmental Safeguard Specialist

558. The CIU will facilitate SMC in managing environmental concerns of the proposed projects and implementing environmental safeguard. Environmental safeguard specialist consultants will be hired for providing resources for environmental safeguard management as appropriate and required. The CIU, with the assistance of environmental safeguard specialist consultants, will be responsible for:

- Monitoring the implementation of environmental management and mitigation measures required for each subproject;
- Preparing environmental screening checklists and classifying subprojects that have not been yet classified;
- Based on the checklist and as per the requirements of ADB SPS (2009), PEPA1997and relevant provincial Environmental Protection Acts, preparing IEEs and EMPs;
- Submitting the checklists and IEE reports to ADB as part of the approval of subproject;
- Ensuring that EMPs are included in tender documents;

- Ensuring that all regulatory clearances are obtained before starting civil works for the subproject;
- Ensuring that the EMPs, including all proposed mitigation measures and monitoring programs, are properly implemented;
- Drafting and implementing an Asbestos Management Framework (AMF) and Asbestos Management Plan (AMP) should the need arise;
- Undertaking monitoring of subprojects and preparing environmental monitoring reports for submission to ADB.
- In the case of unpredicted environmental impacts occurring during project implementation, preparing and implementing a Corrective Action Plan (CAP);
- In the case that a Category B subproject needs to have its siting or alignment changed, or its environmental classification reconfirmed, reviewing it to determine whether a supplementary study is required. If so, carryout the study and implement any amendments to the original EMP;
- Preparing a project specific EMP for the operations that includes a Site Specific EMP for each of the work areas;
- Providing awareness training in environmental management for all employees working on the subproject;
- Ensuring that meaningful public consultations (including both men and women) are undertaken with affected groups and local NGOs. The list of people attending the consultation, time and locations, subjects discussed during consultation will be recorded in a systematic manner; and
- Sharing information and disclosure of environmental safeguard documents (including any CAP prepared in cases of change to original project design) as required.

iv. ADB

559. ADB will undertake the following responsibilities:

- Review project IEEs as a basis for the approval of subprojects;
- Publicly disclose the final IEE before project appraisal, and afterward updated IEE and any CAPs prepared during project implementation, as well as environmental monitoring reports on the ADB website;
- Monitor the implementation of the EMP and due diligence as part of overall project review mission; and
- Provide assistance to the TMA, if required, in carrying out its responsibilities and safeguard capacity building.

v. Civil Contractor

560. Civil contractors will be hired directly by SMC to undertake the bulk of the project work. The responsibilities of the civil contractor will comprise:

- Ensure compliance with the CPEMP, CAP, CSP and AMF and AMP, as applicable, throughout the construction activities;
- Ensure efficient site management for the storage of equipment and materials etc.;
- Ensure construction plan devised and agreed with the SMC;
- Ensure compliance with the agreed construction plan;

- Ensure quality of the work as per the construction contract specifications;
- Recruit labor from local communities first;
- For the construction camp on the site, ensure appropriate sanitary arrangements, accommodation and drinking water availability;
- Liaise with the local communities regarding services and goods supply at the site;
- Liaise with the local communities regarding construction activity, time span, likely nuisances such as noise, dust and disturbance;
- Ensure provision of appropriate night lights (if required) and standby power sources; and
- Plan working hours to provide minimum disturbance to the community.

vi. District Environment Officer (DEO)

561. The District's environment department is the sub department of Works and Services Department of District Government Sahiwal and is headed by the District Environment Officer (DEO). The major functions of the department include:

- To assist Provincial Environment Protection Agency (EPA) in the discharge of its functions under the Pakistan Environment Protection Act,1997;
- Regulate motor vehicles subject to the provision of the Pakistan Environment Protection Act,1997 and the rules and regulations made there under;
- To ensure, guide and assist the proponents of new projects in submission of IEE/EIA to the DG Punjab EPA for approval, as applicable; and
- Identify the needs for legislation in various sector of the environment.

562. The DEO of Sahiwal under the Environmental Protection Department (EPD), Punjab will have overall responsibility for the enforcement of PEQS through his inspectors. He will be responsible for the compliance with the following:

- Municipal and liquid industrial effluent parameters (32) for discharge to inland waters, sewage treatment facilities, and the sea;
- Industrial gaseous emissions (16) into the atmosphere;
- Motor and vehicle exhaust and noise (3);
- Ambient air quality (9);
- Drinking water quality (33); and
- Noise for residential, commercial, industrial and silence zones

vii. STP Plant Operational Staff

563. The following operational staff will work at the STP under the SUSC:

564. The Manager Wastewater or Plant Manager O&M will be responsible for the following tasks, during operation of the STP:

a. Manage plant efficiently at all times;
b. Maintain the cleanliness of the site and facilities;
c. Recruit highly motivated and well-trained staff to run the plant;

d. Ensure staff is aware of the contents of the operational manuals (on the wastewater treatment, in particular) comprising safety procedures, emergency, shut-down, or accidental injury on the site;
e. Ensure all equipment is regularly maintained and repaired;
f. Keep stocks of spare parts in case of equipment failure;
g. Ensure daily monitoring of effluent quality and that problems are remedied as soon as possible;
h. If there are problems with receiving un-authorized wastewater, then the Plant Manage, in coordination with the TMA, will identify the source of the problem and take remedial action;
i. Ensure the timely removal of sludge from the site to the disposal/treatment site;
j. Ensure the instant diagnoses and repair of leaks, spills and blockages, and alert the relevant communities of any imminent health hazards in the discharge area;
k. Liaise with community organizations regarding the nature and functions of the plant and their relationship with its operations;
l. Ensure the timely redress of complaints about the plant;
m. Maintain a record of complaints received and actions taken;
n. Ensure positive responses to requests for site visits, etc., with the view to enhancing relations with the locals and other institutions;
o. If monitoring shows that the effluent treatment is inadequate and does not meet what would be expected of the technology in place and the quality standards, then the Manager will take action to install the appropriate treatment;
p. If necessary, seek advice on how to improve the situation, especially if the equipment is not performing to the specifications;
q. Ensure sludge dewatering and removal takes place in an efficient and environment-friendly manner;
r. Devise an odor-control system if problems occur and persist; and
s. Ensure compliance with the Tree Plantation Plan, the Preventive Maintenance Schedule and the Safety Manuals

565. The Assistant Manager Operation will assist Manager Wastewater and will be responsible for the smooth operation of the STP.

566. The following responsibilities are identified for the Plant Operators O&M Team:

a. Read and digest the operational and safety manuals;
b. Ensure that safety and firefighting equipment are in place and accessible;
c. Ensure regular maintenance of the equipment;
d. Report to the Plant Manager any malfunctioning of the equipment and equipment failure; and
e. Ensure team members maintain responsible and conscientious attitudes toward the execution of their duties, at all times.

C. Local Regulations for Acquiring Environmental Approval

567. The water supply, sewerage and urban public spaces development projects do not require any No Objection Certificate (NOC) from the Environmental Protection Department of Punjab as per prevailing EIA/IEE regulations. The only exception relates to the STP.

568. As per Government of Punjab, the SMC may have to prepare and submit an environmental assessment report of the STP project to EPD Punjab in order to obtain a construction phase No Objection Certificate (NOC), prior to start of construction or implementation.

569. If required, this report will have to be prepared as per IEE or EIA guidelines. The public hearing and presentation of the project in front of nominated Expert Committee of EPD is also one of the requirements.

570. After receiving the NOC, the construction work can commence in accordance with the approved CPEMP, as given in the EIA or IEE report.

571. After the completion of construction, an environmental compliance report, as per EMP of the EIA or IEE, will have to be submitted along with the application for the grant of operational phase NOC.

D. Environmental Training Needs Assessment

572. SMC does currently have the capacity for ensuring environmental compliance of project proposals. For this purpose, SMC will need the support of the CIU, assisted by environmental consultants for monitoring the environmental performance of the projects and preparing performance reports for ADB. The consultants will be responsible for the preparation of monitoring and performance reports and submitting it to ADB, training of CIU and SMC staff on ADB's environmental safeguards during construction and operational phases, translation of EMP actions into on ground implementation etc.

573. Frequent training on environmental compliance will be required by those within the SMC (Infrastructure and Services officials, as well as CIU). Most of this training will be conducted on-the-job and in workshops.

E. Grievance Redress System

574. A Grievance Redress System (GRS) will be established by the SMC to facilitate resolution of community complaints and grievances about the subproject environmental performance, in line with the requirements of ADB's SPS 2009. Under this mechanism, a Grievance Redress Cell (GRC) will be established.

575. The civil contractors will maintain a Community Complaints Management Register (CCMR) at site for logging complaints and grievances. This register will be filled and maintained with the assistance of SMC. All written and oral grievances will be recorded in the Register. The information recorded will include the date of the complaint and particulars of the complainant; a description of the grievance; the follow-up action required; the person responsible for implementing the action; and a target date for its completion. Each contractor will primarily be responsible for redressing the grievances within its jurisdiction under overall supervision of SMC. Construction-based grievances will mainly be dealt with by the SMC. The CCMR will be checked frequently by the SMC and necessary actions will be taken in case the contractor is not following up.

576. A Grievance Committee will be established as soon as subproject implementation in each site commences. However, with careful observance of the provisions of the EMP by all stakeholders involved, grievances can be avoided.

577. If necessary, the aggrieved person will first address the CIU Safeguards Cell, whose officers will strive for an informal settlement within 10 days of lodging of the complaint.

If the complaint cannot be settled, the grievance will be referred to the Grievance Committee.

578. Within 30 days the committee will discuss the matter and refer grievances to the CIU Safeguards Cell, and obtain a resolution. If the complaint still remains unresolved, it can be re-lodged by the aggrieved person within one month of the Safeguards Cell decision with the Grievance Committee, which refers it to the PMU, LG&CDD.

579. The PMU will rule on the issue(s) within 21 days of its re-lodging with the Grievance Committee. The PMU decision must be in compliance with the provisions of the IEE. If the grievance redress mechanism fails to satisfy the aggrieved person, he/she can approach the Punjab Environmental Protection Agency.

580. Affected communities and their representatives will be identified during the project preparation stage. The SMC will work towards resolving the grievances recorded in the CCMR in conjunction with the contractors within seven calendar days.

F. Environmental and Social Complaint Register

581. SMC project management team will maintain an environment and social complaints register at site offices to document all complaints received from the local communities. The register will also record the measures taken to mitigate these concerns. The final report will be communicated to the ADB. The SMC monitoring team will monitor the implementation of social and environmental mitigation measures as per the ADB Safeguard Policy Statement.

G. Environmental Management Cost

582. The total cost of environmental management includes human resources, mitigation measures during the construction and operational phases, and laboratory testing charges. The estimated cost of EMP implementation is given in Table 7.3.

Table 7.3: Cost Estimate for Environmental Management

Particulars	Detail	Unit Rate (Rs)	No. of Units	Total Amount (Rs)
Environmental Safeguard Specialist	One person for 1 year responsible for compliance of ADB and GoPb requirements and training of SMC and private company staff	150,000/month	12	1,800,000
Construction phase compliance of CPEMP	Contractors will be responsible for implementing Construction Phase Environmental Mitigation Plan (as appended with the bidding and contract documents). These costs will be included in their bids and will be part of their overall construction cost	-	-	-

Particulars	Detail	Unit Rate (Rs)	No. of Units	Total Amount (Rs)
Tree plantation	Trees will be planted at STP, and at all those places where existing tree were cut during construction or rehabilitation activities as per Tree Plantation Plan	50	500	25,000
Monitoring equipment (1 set)	i) Noise meter ii) Light meter iii) NH_3 and H_2S gas detectors iv) Glass thermometer v) Infrared thermometer vi) COD apparatus vii) pH meter viii) TDS/conductivity meter	Lump Sum		500,000
Laboratory Testing Charges Construction Phase (2 to 4 months)	i) PM monitoring ii) Stack flue gas analysis for generators and vehicles iii) Wastewater analysis iv) Water quality analysis	i) 3,000 ii) 3,000 iii) 6,000 iv) 6,000	i) 30 ii) 150 iii) 35 iv) 35	960,000
Laboratory Testing Charges Operational Phase (2 year)	i) PM monitoring ii) Stack flue gas analysis for generators and vehicles iii) Wastewater & sludge analysis iv) Water quality analysis	i) 3,000 ii) 3,000 iii) 8,000 iv) 6,000	i) 30 ii) 250 iii) 100 iv) 100	2,240,000
Personal Protective Equipment (2 year)	i) Dust masks ii) Face masks iii) Ear plugs iv) Ear muffs v) Safety helmet vi) Safety shoes vii) Safety gloves viii) First aid boxes ix) Firefighting equipment	Lump sum		400,000
Environmental NOC Expenses for STP	i) Fee for EIA report submission to EPD ii) Public hearing expenses iii) Expenses for follow up	Lump Sump		200,000
Environmental training of the SMC and private company staff	i) General environmental awareness ii) ADB safeguard requirements iii) GoPP environmental legislation and compliance requirements iv) STP environmental issues	Lump Sum		500,000

Particulars	Detail	Unit Rate (Rs)	No. of Units	Total Amount (Rs)
	v) STP EMP vi) Monitoring requirement vii) Health and safety viii) Firefighting			
Total				**4,825,000**

VIII. PUBLIC CONSULTATION AND INFORMATION DISCLOSURE

583. Public consultations have been carried out at three stages:

- during the initial formulation of project proposals in the Pre-Feasibility Study;
- during the development of project proposals in the Feasibility Study, as part of the preparation of the IEE. Concerns expressed by stakeholders at this stage have been incorporated into final project design; and
- a public consultation workshop at the completion of the draft IEE.

584. Stakeholders consulted have included the local communities directly or indirectly affected either positively or negatively by the project components, NGOs, government departments, and private sector bodies.

585. At the feasibility study stage the consultations have been carried out during preparation of the Gender Analysis and Gender Action Plan, the Poverty Analysis and Social Development Plan, and the Land Acquisition and Resettlement Action Plans.

586. Upon completion of the draft IEE, a further one day workshop has been held in order to inform stakeholders of the project components, the anticipated environmental impacts, proposed measures to mitigate these impacts and the scope and content of the preliminary EMP.

587. At present, there are no public consultations for planning and development of projects in TMA Sahiwal. The consultations undertaken and reported in this IEE are a requirement of ADB.

588. The objective of the Public Consultation process was to involve stakeholders from the earliest stages. The viewpoints of the stakeholders have been taken into account and their concerns and suggestions for possible improvements have been included where appropriate.

589. Much of the consultation process to date has resulted in positive feedback from the stakeholders. Stakeholder have appreciated the project components which would improve their lives.

590. There is also a requirement for ongoing consultation for preparation of Land Acquisition and Resettlement Plan (LARP), as this relates to the proposed STP and to the upgrading of the Main Bus Terminals. These LARPs are documented separately.

591. It is expected that this process will continue throughout all stages of the subproject in order to accommodate stakeholders' aspirations and to orient the stakeholders positively towards the project implementation and where possible to harness cooperation over access issues in order to facilitate timely completion.

A. Pre-Feasibility Stage Public Consultation

592. Discussion points of the meetings focused on gathering information on the organization’s set up, to conceive their strengths and weaknesses; their priority related issues and concerns; willingness to support the project and its activities including possible assistance.

593. Listening to stakeholder concerns and feedback was a valuable source of information that improved project related aspects and outcomes, and helped to identify and control external risks. In this regard meetings were conducted with TMA authorities such as the Administrator, TMO, TO Finance, TO Infrastructure & Services and TO Planning, to brief them regarding the project objectives, and to obtain feedback regarding the available resources with TMA Sahiwal.

594. In addition, meetings were conducted with NGOs and civil society activists who are involved with different aspects of development in Sahiwal. The main NGOs in the area, such as Finca, Kashaf Foundation, U-Micro financing, Waseela, Tameer Bank and Akhoowat were consulted in order to understand the social and economic conditions of the area.

595. The meetings with stakeholders assessed the existing infrastructure practices, problem identification, root causes associated with them, needs, demands and priorities and explored the different options for future coordination.

596. In the social surveys undertaken under the PFS, water supply emerged as the main issue for people living in poor areas. Whilst detailed records of the individual consultations held are not available, the following key points are highlighted in the PFS report:

a) Poor urban infrastructure services with an old and outdated water supply system which does not perform efficiently;
b) Non-availability of the landfill site for proper dumping of the solid waste;
c) Blocked and choked sewage lines at various places;
d) Lack of a Social and Resettlement Expert to manage the LAR issues during the project execution;
e) Community ignorance regarding the city cleanliness;
f) Community willingness to participate in the project activities in terms of monetary and physical participation;
g) The TMA will replace the various sections of water supply line and restore the abandoned bores under the PCIIP;
h) The TMA will upgrade the damaged sections of the sewage pipelines under the PCIIP;
i) District Government (through the Revenue Department) will identify the landfill site;
j) NGOs will help the project proponent in identification of problematic areas in terms of poverty and gender issues;
k) The Resettlement Expert will build the capacity of the concerned department to address the safeguard issues in concurrence with the ADB's Safeguard Policy Statement (SPS) 2009;
l) Local people will be provided with employment on a priority basis under the project;
m) There will be provision in the contract that movement of the local population should not be hindered, especially the working class/students and women.

597. Through the field survey and FGDs it was revealed that drinking water is the highest-level priority and the sewerage system is the second priority of the Sahiwal residents.

598. Initial social assessment meetings were arranged with the residents/beneficiaries. They were interviewed to obtain the community's response to the proposed investment. People were asked about the potential benefits / problems related to the execution of the Project. They were also consulted to understand their views regarding the alternatives to determine any adverse impact of the project. Participants indicated that this project would be beneficial for the community in the future. Implementation of the water supply and sewerage component will result in a positive impact on their socio-economic status and quality of life.

599. During consultation, people shared their views regarding land acquisition for the sewage treatment plant:

i. People are reluctant to sell their land, as they intend to keep it for commercial purposes;
ii. They showed apprehension that the market land rate will not be provided to them, as the government always provides a lower amount.;
iii. The prevailing market rate is Rs.10,000,000/acre and the Government may not compensate them accordingly;
iv. The project is likely to have negative impacts on the surrounding areas as a result of bad odors, and eventually their life will become more miserable. The project should be launched away from the population centers;
v. The government should buy the land situated towards the north side that belongs to a single person; and
vi. Since the land is not transferred to the names of legal owners, they may go to court for a stay order.

B. Feasibility Stage Public Consultation

600. Focus Group Discussions (FGD) in Sahiwal were held in the period 31st October 2016 to 3rd November 2016. A list of participants is provided in Annexure 4.

601. A summary of the key points arising from these public consultations is as follows:

a) Women participants of the Focal Group Discussions (FGDs) reported that health related expenditures form a significant portion of their total monthly expenditures. There is anecdotal evidence that a large majority of the population relies on private sector health facilities;
b) Women and men in all FGDs have noted that there is a high prevalence of hepatitis which they attribute to contaminated water and inadequate solid waste disposal;
c) According to primary data from FGDs, there is no development activity, donor assisted projects or initiatives. The civil society representatives provided a different perspective but it can be stated that, with the exception of some philanthropic activity for installation of water filters, none of the sample areas are being targeted under any urban services improvement programs;
d) Women residents talked at length on the poor or non-existent services available to them in terms of the quality and quantity of water, sanitation, health or education;
e) Poor communities do not have gas and no proper arrangements for water supply, sewage or solid waste management;
f) At an institutional level, it is observed that there are no specific gender mainstreaming strategies or mechanisms at the level of the TMA in Sahiwal and it would not be an exaggeration to state that this public services institution is gender-

blind. The TMA does not employ any policies and resources to this effect and indeed the facilities and working environment is very unfriendly towards women, despite the fact that both employ women, at least in the workers' category;

g) Issues in water access and quality are common including poor water quality, erratic supply and mixing of water pipelines with sewage;

h) According to FGDs data, the government water supply follows fixed timings and is mostly available three times a day for an hour each time. The water quality has been reported to be poor to very poor and unsafe for drinking, in all cases. Some residents noted that water quality is so bad that it is even unfit for bathing. For drinking purposes, almost all households resort to either boiling water or collecting it from the various public and private water filtration plants installed in different areas. While a small number of people reported that they are making do with collecting water from filters, most of the women and men stated that filter plants are either far away or are dysfunctional;

i) Due to unavailability of municipal water supply, the majority, however, depend on motor operated pumps and pay heavy electricity bills (ranging between Rs 3,000-4,000 per month);

j) In the FGD in UC 44, men stated that less than 20 percent families have municipal water connections and that the overall reliance of households is on their own pumping-based water supply or collect water from the area filtration plants. They claim that the water quality is inferior, the timings for supply are unpredictable and few (3 times a day for one hour each) and that mixing of water and sewer lines is frequent. They claim that they have gotten water testing done in the past and have confirmed the water quality to be inferior in most cases. "The water quality is so poor that we do not want to pay the bills" they said claiming that more than 80 percent of those with official connections do not pay their bills;

k) The main points of conclusion from the consultations around the sewage system is as follows: the public system is a badly planned, haphazard, outdated, inefficient, faulty collection of old rusty pipes and open and semi-covered and covered drains. All primary data confirms a perpetual problem of clogged and overflowing drains, flooding of streets and lanes with filth and sewage with *ad hoc* arrangements being made in emergency situations that only provide temporary relief. The severity of the situation varies but is particularly alarming in middle- and low-income areas. Women respondents in all FGDs mentioned great difficulty faced by them due to this problem and the health, hygiene and mobility constraints they face because of this situation;

l) Rain water gathers and remains standing for days and many areas can reportedly remain inundated for days on end. The functioning of the TMA is highly unsatisfactory and people have mentioned that there are severe staff shortages or those who come do not do a satisfactory job. According to city residents, the cleaning and operation of the sewage system is a combination of luck, chance or circumstance where an active UC chairman or councillor will take action to mobilise resources. Moreover, it was learned (FGD UC 44, Sahiwal) that sewage is also sold to farmers for irrigation of vegetables and pumps operate more regularly during peak demand season. During peak demand of sewage for irrigation by farmers, pumps operate regularly and streets are clean. During slack periods of sewage demand for irrigation, pumps are not operated and sewage overflow occurs in different city areas;

m) In UC 44 FGD it was recorded that sanitary workers don't perform their jobs (and particularly the Muslim staff do not want to do cleaning/sweeping), the dustbins are not enough and a majority rely on private cleaners/sweepers who are paid

between Rs 50-100 per month. They also mentioned the dilemma of cattle owners within residential areas who violate blatantly the Corporation's rules, with animal waste creating health hazards, as well as choking up the sewage system.

n) The widespread involvement of marginalised gypsy families in Sahiwal in solid waste collection and disposal (and separation) was pointed out by an NGO (Lok Sujag) who also stated that these poor families have been operating informally for decades and their livelihoods would be at risk by induction of a new waste management company that has its own contractor arrangements. Some safeguards should be considered as to how these vulnerable families can be brought under any new system;

o) The FGD respondents mentioned that solid waste collection staff is limited; containers are not placed evenly across the city, neighborhood and lane level disposal is not thought out adequately, the dumpers are often faulty and timing schedules are not adhered to. Moreover, it was noted that the available SMC staff (sanitary workers) refused to work on the pretext that they are on strike. TMA has alleged that the separation of solid waste sanitary staff has created a worse situation whereby they sweep garbage directly into open lines and let the TMA staff attend to it;

p) The city faces an increasing problem of traffic congestion and road safety. Overcrowding and unregulated traffic flow and congestion are serious concerns. Commercial places are encroached upon by myriad vendor stalls and carts. There is no official public transit system. Walking, motorbikes, auto rickshaws and *qingchis* (motorcycle rickshaws) remain the dominant forms of transportation for men and women alike;

q) The only mode of transportation for a large majority of the population is the *qingchis* and auto rickshaws and these are also reportedly unaffordable. Most of the women noted that they travel on *qingchis* at a flat rate for Rs 20 within the city but more for travel to far off places and this places a financial burden, especially for those who have to go out every day for education or employment purposes;

r) Women students of various crafts (from rural and urban areas) met with in the district Sanatzaar (Industrial Home) Sahiwal claimed that one of their biggest issues was lack of transportation facilities in getting to the center. They asked for safe and reliable transport for women;

s) Overall, it is evident that the city residents (men and women) in Sahiwal feel that they are no adequate, safe, reliable, consistent or regular services vis-à-vis water supply, sewage, solid waste management or transportation. It is also evident that women, due to their multiple productive and reproductive roles, are inconvenienced and burdened due to limitations in service provision. Men and children are also involved in terms of both time and labour (water carrying/ collecting, garbage collection). The proposed projects, therefore, stands to benefit everyone and do not have any adverse impacts.

t) The field findings from the FGDs indicate community prioritisation of needs as follows:

   a. Better sewage and sanitation;
   b. Water supply;
   c. Solid waste management;
   d. Health facilities/improvements;
   e. Community spaces/centres; and
   f. Transportation.

u) Another equally important and oft mentioned concern by almost all women met with is their aspiration for a women friendly public space that is open to all and where they can come together for various purposes. “A women centre run for women and by women” is how many different women put it – a space where they can congregate for various purposes in a safe and unhindered manner;

v) The civil society organizations emphasized clean water, sewage system, health and education;

w) The willingness to pay for the amenities aspect was explored under all sectors and in all data collection instruments for primary data collection. By and large, all respondents reported that they are not able to pay any additional charges for water supply or solid waste because they are already barely able to make ends meet;

x) Households are already paying fees for privately acquired services, electricity bills for water or rickshaw fares which could be higher than municipal service charges for the same services which would suggest an ability to pay;

y) Participants of all FGDs indicated that hepatitis prevalence is highest in Sahiwal city because of contaminated water. In their opinion, about one quarter of the city population is suffering from hepatitis because of contaminated water, highly inadequate waste water disposal and inappropriate solid waste removal;

z) Another common utility is electricity-operated water pumps for water supply. Information provided in the FGD indicated that about 70% of the houses have their own water pumps and they are not dependent on municipal water supply;

aa) The FGDs with elected representatives of three union councils and women representatives indicated that quality of water is poor in most areas and tolerable in a few areas of the city. Sewerage and water supply pipelines are very old in some city areas and leakage from both is common. Sewage is mixing with water supply pipelines in many areas and water is not usable in many localities. People get drinking and cooking water from water filter plants installed in different localities. About 12 localities of the town receive the worst quality of water. The problem is more severe in areas where houses are very small and they have not installed water pumps;

bb) FGD conducted indicated that the sewerage system is almost dysfunctional in all areas of UC No. 50, and in some areas of UC 44. The elected councilor mentioned that streets are frequently flooded with sewage and access to houses is difficult. Complaints are made frequently but not addressed without follow up and payment of petty cash to sewer men. In their view, the main cause of flooding is irregular operation of disposal pumps.

cc) In city areas, a small proportion of households keep cattle and animal waste disposal is not done properly. In some localities, some people collect dung from other cattle owning households and dispose of it as farm yard manure. FGD participants considered this to be a health hazard and indicated that complaints in this regard have not produced any result.

dd) The TMA informed that only 20% of the consumers pay bills for water supply and 80% are defaulters;

ee) The FGD informed that water and sewerage rates are not paid by people on two pretexts: (i) very low quality of services, and (2) annual billing instead of quarterly bills. Many households cannot afford to pay annual bills because of the escalating cost of living and low incomes;

ff) FGDs conducted with public representatives indicated that the main reason for default is poor quality of services. Some of the members argued that payment of

water rates will increase after improvement of services. The main question is the tariff for water and sanitation services. They were asked about willingness to pay if the service charger were to be PKR 500 per month. A minority of the participants said that people will pay if they receive clean water and an efficient sewerage system. But the majority of the participants said that people cannot pay this amount because of low incomes. Women participants said that this amount is in addition to monthly bills paid by households for electricity and gas. Women said they have first-hand experience of economic conditions of the households where the vast majority face difficulties in paying utility charges and school fees for their children;

gg) The FGD participants informed that in large houses municipal water is used for irrigation of lawns, car wash, floor wash and sprinkling. Because of its contamination it cannot be used for other purposes. If water is metered, then the majority of the houses with their own water pumps may not apply for water supply connection. There will be little demand for water connection in households with their own water pumps;

hh) About 7% of the households own cars and about 40% own motorbikes. Traffic congestion is observed in the center of the city near government offices and markets. There are two traffic signals in the city but neither are operational;

ii) Unemployment among male educated youth and men was reported as a major problem by FGD participants. They cited general unemployment for daily wage earners and for skilled workers. Unemployment of women was not cited as problem by male and female FGD participants. They all agreed that there are few opportunities for women's employment in the city; and

jj) All people affected by proposed land acquisition for the STP were informed by Numberdar that a portion of the land will be acquired by the government for construction of the wastewater facility. All APs are willing to give land provided that the replacement value of land is paid. APs had expressed apprehension about compensation for land. In their view the land acquired by government is usually at a lower than the market price, because the average value of land is calculated based on recent transactions. It is common practice to report very low prices of land transactions to avoid payment of land mutation taxes. APs have expressed concern that land prices should be fixed according to the prevalent market rate.

C. Public Consultations on Upgrading of Main Bus Terminals

602. Information about PICIIP and subproject for upgrade of bus terminals was provided to shopkeepers by the SMC staff posted at bus terminals and field teams conducting census of assets and socioeconomic survey. This was necessary to seek their cooperation in data collection on both bus terminals.

603. There is no association of shopkeepers on the Multan Road bus terminal and all shopkeepers and managers of the transport companies were informed individually to send their representatives to the consultation meeting.

604. There is an association of shopkeepers on the Railway Road bus terminal. All shopkeepers and officers of the association of shopkeepers were informed about the consultation meeting for the upgrade of the bus terminal.

605. A consultation meeting at the Multan Road bus terminal was held at 11:00 am on 15th February 2017. The meeting was attended by 21 APs, which included 14 shopkeepers, 3 workshop technicians, 3 transport company managers and one game shop owner. The tax superintendent and rent collector of SMC also participated. The Deputy Team

Leader of the PPTA consultant and the LARP team conducted the consultations. The meeting lasted for one and half hour.

606. A further consultation meeting at the Railway Road bus terminal was held at 2:30 pm on 15th February 2017. The meeting was attended by 20 Aps, which included 10 shopkeepers, 3 LTCS shopkeepers, 3 transporters, 2 workshop owners, 2 transport company managers, tax superintendent and rent collector of SMC. The Deputy Team Leader of the PPTA consultant and LARP consultant team conducted the consultations. The Due Diligence Consultant of ADB also attended the consultation meeting. The meeting lasted for nearly two hours.

607. A list of participants of the two meetings with their signatures, together with a photographic record of the meetings, is reproduced in Annexure 4.

608. At the beginning of each meeting participants were informed about the PICIIP and its subprojects for improvement of water supply, sanitation, improvement of public parks and urban transport that included the upgrade of the bus terminals.

609. Both consultation meetings were held in the bus terminals in a free and fair atmosphere. All participants were given freedom to express their point of views, concerns and suggestions in a candid manner and without any restraint. None of the participant were interrupted during their talk and nor they were stopped on reiteration.

610. Participants of the consultation meetings raised three major concerns:

Disruption of Business

611. All the APs expressed concern that business activities will be disrupted because of infrastructure development as contractors start construction on all sides and make deliberate delays in completion of work.

612. They were informed that construction plan will be provided for sequential commencement and completion of different infrastructure components. Every effort will be made to avoid disruption to business activities.

Apprehension of Eviction

613. The APs expressed apprehension that after upgrade of bus terminal the SMC may reallocate tenancy contract to some new persons and some of them may be evicted.

614. They were informed that SMC will not evict any tenant. The long-standing tenancy will not be disrupted in any case. The APs welcomed this statement and said they will cooperate fully in upgrade of the bus terminal.

Apprehension of Rent Enhancement

615. The third major concern was about an increase in the rent of shops after upgrade. All these shops are given to tenants on almost nominal rent compared to the rent of private shops. The SMC has not increased rent of shops since long.

616. APs were assured that SMC will not increase the rent of shops after upgrade of the bus terminals. This was welcomed by the tenants. They were informed that their tenancy contracts including the terms and conditions with the SMC will remain unchanged after the upgrade of the bus terminals. Their business premises and businesses will remain intact throughout the improvement works.

617. Participants at the Multan Road consultation meeting made a number of suggestions for the upgrade of that bus terminal:

    i. Participants stated that washrooms and passengers' lounge built on the northern boundary of the bus terminal are a little away from the departure bays, to the extent that many passengers do not know about these services. The washroom is used by a small number of passengers, whilst the passengers' lounge is not used by passengers and it remains closed. They suggested the construction of passenger sheds with sitting areas close to the departure bays to facilitate passengers comfort;

    ii. There is no facility for drinking water at the bus terminals. The upgrade shall provide clean drinking water facilities at the bus terminal;

    iii. Adequate drainage shall be provided for waste water and storm water;

    iv. There is no adequate system for waste disposal in the bus terminal. Participants urged for making arrangements for waste collection. They were informed that arrangements for solid waste management under the PICIIP will include provisions for waste removal; and

    v. Pavement shall be provided for the entire area of the bus terminal.

618. For the consultation at Railway Road, participants also raised the issue that the upgrade may require acquisition of any shop which will deprive the AP from its source of livelihood.

619. They were informed that maximum effort will be made to avoid acquisition of shops. In case any acquisition of shop is required for the new infrastructure development, the SMC will provide replacement shop to the AP prior to the demolition of existing shop. APs expressed satisfaction at this kind of arrangement

620. Participants at the Railway Road consultation meeting made a number of suggestions for the upgrade of that bus terminal:

    i. Participants informed this bus terminal had a problem of storm water drainage which was overcome a few years ago with new drainage pipeline. There is no drainage on the southern outer boundary of the bus terminal which is dangerous for shops. They were informed that improvement of sewerage and storm water drainage is included in the PICIIP and this problem will be resolved;

    ii. Suggestions were given for building passengers waiting area, washrooms, and provision of clean drinking water. They were informed that passengers lounge with water and washroom facilities for men and women will be included in the design for upgrade of this bus terminal. Location of these facilities will be appropriate and they will be consulted again after completion of the design;

iii. The bus terminal is without proper light in the night. Lights shall be provided in all areas of the bus terminal;

iv. Suggestion was given to include improvement of bus entry road into the terminal. This road remains congested because of heavy traffic. Installation of traffic signals may help solve the problem. The design for upgrade will include improvement of the entry route to the bus terminal;

v. They suggested pavement of the ground in the bus terminal area. They were informed that this will be included in the upgrade subproject; and

vi. There is no adequate system for waste disposal in the bus terminal. Participants urged for making arrangements for waste collection. They were informed that arrangements for solid waste management under the PICIIP will include provisions for waste removal.

621. The preliminary consultations were held to document participants concerns and suggestions before the finalization of the engineering designs for bus terminal upgrade. Participants were informed that they will be consulted again after completion of the design so as to ensure that their suggestions and recommendations had been incorporated into the final design.

D. Public Consultations on STP Site

622. The sewage treatment plant, installation of conveyance system and trunk mains will have some impacts on the local population. Accordingly, a Land Acquisition and Resettlement Plan (LARP) has been prepared.

623. In the process of preparing this LARP, individual, group meetings and focus group discussions were held with Displaced Persons (DPs), neighboring community, general public and officials of concerned departments like TMA, revenue, forest and Agriculture.

624. These meetings were held during Feb 11 to March 06, 2017. A total of 13 groups meetings were held with the DPs. A total of 99 persons participated in these meetings. A summary of the consultations undertaken is shown in Table 8.1.

625. These consultations will be continued by the district staff and consultants during the LARP updating and implementation.

626. As a sewage treatment plant, installation of conveyance system and trunk mains, the sub-project will have impacts on the local population. Despite the impacts, the affected communities did not have a hostile attitude towards the sub-project although there were some concerns regarding the compensation rate as the government rates are normally in the lower side. The people are demanding the land compensation based on the productive value and future scenario of the land in terms of developing of housing schemes being located in the vicinity of Sahiwal city.

627. The principal concerns expressed during the meetings were as follows:

i. The government will not give the market rate of their lost land, as their land is much productive and in future may be needed for the housing colony being placed in the vicinity of Sahiwal city;

ii. The government can replace the sub-project site with the alternative private site owned by Mr. Mukhtar who is willing to sell out of his 8 acres. The site is located (same village 95/6R) in the neighborhood of this site;

iii. The remaining land is in small pieces and will be no more beneficial to them, so government should also acquire that piece of land;

Table 8.1: Detail of Consultation Meetings on STP

S #	Date	Place	No. of Participants	Remarks
1	11-02-2017	Faqeer's farm house	9	Meeting with the DPs of STP
2	11-02-2017	Ms. Kalsoom's place	11	Meeting with DPs including female DPs
3	12-02-2017	Manzoor Coloney	7	Meeting with the DPs of Sewerage Pipeline
4	15-02-2017	CIU office	5	Meeting with ADB (RETA Consultant), Social Development Expert of Firm and officials of CIU
5	15-02-2017	Ghulam Muhammad's farm	13	Meeting with DPs on STP and Sewage Conveyance System
6	16-02-2017	Bhatta Colony (89/6R)	12	Meeting with the Community of 89/6R disposal station
7	16-02-2017	Fareed Town	5	Meeting with the community of Fareed Town disposal station
8	23-02-2017	Chowk, 85/6R	7	Meeting with the community of Kachi Pacci Noor Shah disposal station
9	23-02-2017	85/6R	8	Meeting with the community of Kachi Pacci Noor Shah disposal station
10	23-02-2017	Old Harapa Road	5	Meeting with the community of Sewerage Pipeline
11	23-02-2017	Real Estate office	4	Meeting with the community of 3 Marlas schemes on sewerage pipeline
12	23-02-2017	Canal Bank	11	Meeting with the sewerage pipeline of Manzoor colony's disposal station
13	23-02-2017	Ch. Aslam's residence	2	Meeting with the representative of DPs on STP
Total			99	

iv. The government should shift the STP along with the disposal station of 89/6R where enough open land is available for the sub-project and also easy to dispose of the waste water into the river (Ravi);

v. The construction work is usually getting delayed; eventually their livelihood will be disturbed owing to the replacement of sewage conveyance system;

vi. The sewerage pipeline was installed recently (3 years ago), at the same route (Muhammad Pura road) of disposal 89/6R, eventually once again the local community including school, hospital etc. will be disturbed;

vii. Is there any provision of compensation for loss of business for encroachers and squatters during the construction stage?;

viii. The movements of population of 3 Marla housing scheme will be hindered due to having the narrow road, even already placed sewage system will also be disturbed;

ix. Is there any provision of compensation for the loss of crop owing to the installation of conveyance system?;

x. Provision of jobs for skilled and qualified local should be accepted as the right of inhabitants of area;

xi. The compensation for the loss of tree should be given;
xii. Chances of some environmental effects like noise/ vibration and dust emissions to the nearby community;
xiii. In forum for the complaint registration;
xiv. The movement towards the Mosque, Church, School and hospitals should not be disturbed;
xv. The STP will cause the continuous stinky smell; ultimately the surrounding population will be affected; and
xvi. The sub-project will cause the dismantling of field channels and access routes.

628. Satisfactory responses were provided to all of the above concerns.

629. In addition to the above consultations, a series of Focus Group Discussion were held with the local community surrounding the STP site. Separate sessions were held in each settlement. Residents of the settlements were informed in advance about the purpose of the meeting so that all the interested people could attend the session regardless of their gender, religion and age. Influential persons of the area were also invited in the meeting.

630. The community of the area was briefed about the proposed project (STP) in the area and overview of the nature of the construction and operational activities. The community was provided an opportunity to ask question regarding the proposed project. To ensure that project affected people had equal opportunity to receive project information and raise their concerns following approaches were used:

- Sufficient time was given to the participants so that they could voice their concerns;
- Participants were allowed to raise their concerns on one to one basis; and
- Illiterate (People who were not able to read and write) participants were asked to listen to the project description and give their comments to the consulting team.

631. The number of persons who attended the group discussions is summarized on Table 8.2. The list of persons is detailed in Annexure 4, together with their CNIC (Computerized National Identity Card) number and contact number.

Table 8.2: Number of Participants in Group Discussions

Settlement	Date	Union Council	Venue	Number of Participants
95/6R	Feb 10, 2017	11	Govt. School, village	30
94/6R	Feb 11, 2017	42	Village	41
135/9L	Feb 12, 2017	24	Private School, Village	39
Three Marla Housing Scheme	Feb 13, 2017	11	Settlement	27

632. During public consultation at Chak 95/6R, Chak 94/6R, Chak 135/A9L and Three Marla Housing Scheme, the overall response was positive. Most of the people of the project area were not aware of the proposed STP project. The overall project including proponent, components of the project, phases of the project, land acquisition, environmental and social impacts were introduced to the local people who were asked to raise their concerns related to the proposed project.

633. A summary of feedback received is presented in Table 8.3:

Table 8.3: Issues and Concerns Raised During FGDs on STP

Issue Discussed	Feedback
Land Acquisition	• Affected people apprehensions are related to the land to be acquired for the construction of the components of the project. They were of the view that they were poor people, authorities should pay them timely compensation on the basis of market rate; • One affected person of 95/6R was not willing to sell his agricultural land to the Government. He was of the view that Government should acquire an alternate land as cultivation is only source of bread earning for his family. • Judicious compensation should be paid to the affected people as per market rate; • Compensation procedure should be less time consuming.
Job Creation	• All the participants emphasized the need to ensure the selection of locals in non-technical jobs during the construction phase while during operational phase, employment to the locals should be provided on permanent basis according to their skills
Movement of Heavy Vehicles and Odor	• Authorities should consider a safe route rather than the route passing through the settlements for the movement of heavy vehicles and sludge carrying trucks during operational and construction phases. • Safety signs should be posted on the route selected for movement of vehicles • As the project site is near to 95/6R, construction activities should not be carried out at night times.
Air Quality	• Odor from STP may cause problem to nearby community as some people are more sensitive to the odors than others therefore management should implement practical measures to control the odor issue. • Management should purchase the surrounding land to serve as a buffer zone
Community Relations	• Authorities should maintain a cooperative attitude towards community and pay attention to all community concerns that may arise during the project implementation
Positive Achievement	• There is no proper sewerage system in the area. Sewage disposal system of the area should be connected to STP. • According to the residents of Three Marla Housing Scheme, the only benefit of the project is the proper drainage and sewerage system of their area • According to locals, sewerage system of the area has destroyed completely because of the low quality of sewerage pipe lines. Moreover, there was no proper wastewater disposal station of the area. One disposal station was available but it was not made operational from day first because only civil work was completed but no other machinery like electrical pump-motor sets were installed to functional this disposal station. Locals were hopeful that this non-operational disposal station will be made operational with the construction of ST
Wastewater	• Wastewater should comply the government requirements
Area Development	• Apart from STP related activities, natural gas, paved streets, vocational training center and medical facilities are the necessities for the development of the area.

E. Public Consultation Workshop

634. A Public Consultation workshop was held on July 17, 2017 at Municipal Corporation office Sahiwal. The purpose of the public consultation was to brief the participants and to seek their views, comments and concerns about the subprojects proposed Phase 1 of PICIIP and their anticipated environmental impacts.

635. The meeting was attended by the Mayor and other governmental officials, public organizations, industry representatives and consultants. Attendance sheet and participants pictures are reproduced in Annexure 4.

636. Mr. Shafqat Ullah, Environmental Safeguard Consultant, started the proceeding, thanked the Deputy Mayor and Municipal Corporation of Sahiwal for arranging the public consultation meeting and welcomed the participants for their participation. He briefly explained the participants about the PICIIP and the development projects proposed for Sahiwal city under Phase 1 of PICIIP.

637. After explaining the proposed projects, Mr. Ullah informed the participants that ADB required environmental assessment of the proposed projects before implementation so that the identified impacts could be managed during construction, as well as during the operational phases.

638. The environmental impacts would be managed by implementing an Environmental Management Plan (EMP). During environmental assessment, public consultation was required to obtain public's views from those directly or indirectly affected by these projects, both positively or negatively.

639. He then presented the environmental impacts of the proposed projects both at construction and operational phases. He emphasized that the identified impacts were mostly under LOW risk category and very few were under MEDIUM category which could be controlled by taking simple management actions during construction and operational phases. For LOW category there was no need for any action and MEDIUM risk impacts were manageable.

640. Overall, the participants appreciated all the proposed projects and hoped that these projects would be beneficial for them in future. However, participants, also raised their concerns. Few concerns were answered at the spot. Following were the major concerns raised by the participants:

- Participants emphasized that route of the 3 km road proposed for the improvement by the Municipal Corporation is Jhaal Road from Mazdoor Pulley to View Hotel;
- Participants were quite concerned about the schedule for when these projects would be started as already it had been delayed;
- The sewage treatment plant water would not be allowed to be thrown in the canal;
- There should be project implementation and management plan which should be shared with the Municipal Corporation to understand that it would not create problems during laying down pipelines and digging of roads. They had the experience that when pipelines were laid down, the existing water connections were disconnected and people were in real trouble at that time. The management plans should address these issues;
- It was not clear whether the disturbed roads and other structures would be rehabilitated after laying down the pipelines or left unaddressed;

- It was not clear whether budget would be allocated for the maintenance of these infrastructure or not and, if available, then for how long. The ADB should also give maintenance budget to the Municipal Corporation for the maintenance of the projects;
- What kind of taxes would be imposed on the public for the maintenance of the proposed projects;
- There should be two sewage treatment plants to avoid laying down trunk sewer and conveying wastewater through the whole city and then treated at a combined place. In case of two plants, there would no need for the trunk sewer and conveying wastewater from one point of the city to the other point;
- It was not clear whether the trunk sewer would be laid down as per available slope of the area or not because no information was available to them;
- There should be bypass sewer arrangement that if the trunk sewer at any point was blocked then there should be arrangement for the disposing of city wastewater; and
- There should be more than eight new tube wells in the city to improve water supply.

641. The above concerns were addressed and answered during the workshop.

IX. FINDINGS AND RECOMMENDATIONS

642. This IEE was carried out at the Feasibility Study stage of the PICIIP. Primary and secondary data were used to assess environmental impacts. The report has provided a picture of all potential environmental impacts associated with the project, and recommended suitable mitigation measures.

643. Most of the water supply, sewerage and urban public space development improvement projects have minor adverse transient environmental impacts during the construction phase only. These are manageable through implementation of the CPEMP with overall supervision by the SMC. However, the staff of the SMC will require training on EMP implementation during the construction phases.

644. The water supply, sewerage and urban public space projects (transport route, bus terminal and green spaces upgrading) do not require No Objection Certificates from the government, with the exception of the STP. The STP falls under Schedule II of EIA/IEE regulation requiring EIA study to be submitted to EPD prior to construction for acquiring NOC. The information provided in this report can form the basis of any further submission to ADB as required.

645. Construction phase environmental management plan (CPEMP) and construction safety plans are also required to be prepared before awarding the construction contract to the contractors. These plans will be part of the bidding documents.

646. These projects will not pose any negative social impact. However, where land acquisition is required, compensation to the APs and concerned parties will be provided. Gender Analysis and Gender Action Plan, Poverty Analysis and Social Development Plan, and, Land Acquisition and Resettlement Plan have been completed in tandem with this IEE. These studies have:

    a. Examined and assessed the overall social and poverty profile of the project area on the basis of the primary and secondary data sources and prepared socio-economic profiles of the project areas;

    b. Prepared a social and poverty analysis, taking into account socio-economic and poverty status of the project area of influence, including the nature, extent and determinants of poverty. In addition, estimation of the likely socioeconomic and poverty reduction impacts of the project were included;

    c. Held consultations with relevant officials from the government, including consultation with affected communities to assess responses to the project and ascertain the nature and scope of local participation in project planning and implementation; and

    d. Identified, analyzed and, where appropriate, quantified the potential resettlement Impacts (minimal) of the proposed project on the area and the population.

647. Baseline monitoring activities have not been carried out in the FS. The requirement for baseline monitoring, prior to the commencement of construction and operation activities, shall be integrated into contract documents in order to establish performance thresholds, pollution limits and contingency plans for the contractor's performance.

648. During the operational phase, the monitoring of environmental parameters should ensure that statutory requirements have been achieved. Monitoring activities will focus

on periodic recording of environmental performance and proposing remedial actions to address any unexpected impacts.

X. CONCLUSIONS

649. The water supply, sewerage and urban development projects under PICIIP are feasible and sustainable from engineering, environmental, and socio-economic points of view.

650. Implementation of the EMP is required to and the potential environmental impacts associated with subproject implementation need to be mitigated properly.

651. The positive environmental and social benefits of the projects far outweigh the temporary negative potential impacts arising from construction activities.

652. Existing institutional arrangements are available for the implementation of the EMP. Additional human and financial resources will be required by SMC to comply with environmental safeguard requirements. The proposed mitigation and management plans are practicable but require additional resources.

653. This IEE, including the EMP, should be used as a basis for an environmental compliance program and as guidelines for the preparation of construction related EMP document which should be included as an Appendix to the contract document.

654. The EMP shall be reviewed at different stages of the project and be updated as per requirement.

655. In addition, should any subsequent conditions be issued by EPA Punjab as part of the environmental clearance, these should also be included in the environmental compliance program. Therefore, continued monitoring of the implementation of mitigation measures and implementation of the environmental conditions for work should be properly carried out and reported at least twice a year as part of the project performance report.

ANNEXURE 1: REA CHECKLISTS

Rapid Environmental Assessment (REA) Checklist

SEWAGE TREATMENT

Instructions:

- ❑ This checklist is to be prepared to support the environmental classification of a project. It is to be attached to the environmental categorization form that is to be prepared and submitted to the Chief Compliance Officer of the Regional Sustainable Development Department.
- ❑ This checklist is to be completed with the assistance of an Environmental Specialist in a Regional Department.
- ❑ This checklist focuses on environmental issues and concerns. To ensure that social dimensions are adequately considered, refer also to ADB checklists and handbooks on i) involuntary resettlement, ii) indigenous peoples planning iii) poverty reduction, iv) participation, and v) gender and development.
- ❑ Answer the questions assuming the "without mitigation" case. The purpose is to identify potential impacts. Use the "remarks" section to discuss any anticipated mitigation measures.

Country/Project Title: PAKISTAN/Punjab Intermediate Cities Improvement Investment Project (PICIIP)

Sector Division: Water and other urban infrastructure and services

SCREENING QUESTIONS	Yes	No	REMARKS
A. Project Siting Is the project area			
➢ Densely populated?	☐	■	
➢ Heavy with development activities?	☐	■	
▪ Adjacent to or within any environmentally sensitive areas?			
➢ Cultural heritage site	☐	■	
➢ Protected area	☐	■	
➢ Wetlands	☐	■	
➢ Mangrove	☐	■	
➢ Estuarine	☐	■	
➢ Buffer zone of protected area	☐	■	
➢ Special area for protecting biodiversity	☐	■	
➢ Bay	☐	■	
B. Potential Environmental Impacts			

SCREENING QUESTIONS	Yes	No	REMARKS
Will the Project cause			
▪ Impairment of historical/cultural monuments/areas and loss/damage to these sites?	☐	■	
▪ Interference with other utilities and blocking of access to buildings; nuisance to neighboring areas due to noise, smell, and influx of insects, rodents, etc.??	■	☐	Transient impacts possible during replacement of sewer lines. Mitigation measures proposed as part of the EMP
▪ Dislocation or involuntary resettlement of people?	■	☐	LARP under preparation for the STP site
▪ Impairment of downstream water quality due to inadequate sewage treatment or release of untreated sewage?	■	☐	STP plant design to incorporate protection measures in the event of system failure. Mitigation measures proposed as part of the EMP
▪ Overflows and flooding of neighboring properties with raw sewage?	■	☐	STP plant design to incorporate protection measures in the event of system failure. Mitigation measures proposed as part of the EMP
▪ Environmental pollution due to inadequate sludge disposal or industrial waste discharge illegally disposed in sewer?	■	☐	STP plant design to incorporate protection measures in the event of system failure. Mitigation measures proposed as part of the EMP to cater for industrial waste water discharge to sewer. Sludge disposal to STD facility for use in composting operations.
▪ Noise and vibration due to blasting and other civil works?	■	☐	Transient impacts during construction. Mitigation measures proposed as part of the EMP.
▪ Discharge of hazardous materials into sewers, resulting in damage to sewer system and danger to workers?	■	☐	Compliance monitoring and inspection to be stipulated as part of the EMP.
▪ Inadequate buffer zone around pumping and treatment plants to alleviate noise and other possible nuisances, and protect facilities?	■	☐	Transient impacts during construction. Mitigation measures proposed as part of the EMP.
▪ Social conflicts between construction workers from other areas and community workers?	☐	■	
▪ Road blocking and temporary flooding due to land excavation during rainy season?	■	☐	Transient impacts during construction. Mitigation measures proposed as part of

SCREENING QUESTIONS	Yes	No	REMARKS
			the EMP. Scheduling of works to avoid the rainy season
▪ Noise and dust from construction activities?	■	□	Transient impacts during construction. Mitigation measures proposed as part of the EMP.
▪ Traffic disturbances due to construction material transport and wastes?	■	□	Transient impacts during construction. Traffic management measures proposed as part of the EMP.
▪ Temporary silt runoff due to construction?	■	□	Transient impacts during construction. Mitigation measures proposed as part of the EMP.
▪ Hazards to public health due to overflow flooding, and groundwater pollution due to failure of sewerage system?	□	■	
▪ Deterioration of water quality due to inadequate sludge disposal or direct discharge of untreated sewage water?	■	□	STP plant design to incorporate protection measures in the event of system failure. Mitigation measures proposed as part of the EMP. Sludge disposal to STD facility for use in composting operations.
▪ Contamination of surface and ground waters due to sludge disposal on land?	■	□	Sludge disposal to STD facility for use in composting operations.
▪ Health and safety hazards to workers from toxic gases and hazardous materials which may be contained in sewage flow and exposure to pathogens in sewage and sludge?	■	□	Health and safety measures for workers have been proposed during operational phase of the plant and incorporated into the EMP

Rapid Environmental Assessment (REA) Checklist

URBAN DEVELOPMENT

Instructions:

- ❑ This checklist is to be prepared to support the environmental classification of a project. It is to be attached to the environmental categorization form that is to be prepared and submitted to the Chief Compliance Officer of the Regional Sustainable Development Department.
- ❑ This checklist is to be completed with the assistance of an Environmental Specialist in a Regional Department.
- ❑ This checklist focuses on environmental issues and concerns. To ensure that social dimensions are adequately considered, refer also to ADB checklists and handbooks on i) involuntary resettlement, ii) indigenous peoples planning iii) poverty reduction, iv) participation, and v) gender and development.
- ❑ Answer the questions assuming the "without mitigation" case. The purpose is to identify potential impacts. Use the "remarks" section to discuss any anticipated mitigation measures.

Country/Project Title: PAKISTAN/Punjab Intermediate Cities Improvement Investment Project (PICIIP)

Sector Division: Water and other urban infrastructure and services

SCREENING QUESTIONS	Yes	No	REMARKS
C. Project Siting Is the project area			
➢ Densely populated?	☐	■	
➢ Heavy with development activities?	☐	■	
▪ Adjacent to or within any environmentally sensitive areas?			
➢ Cultural heritage site	☐	■	
➢ Protected area	☐	■	
➢ Wetlands	☐	■	
➢ Mangrove	☐	■	
➢ Estuarine	☐	■	
➢ Buffer zone of protected area	☐	■	
➢ Special area for protecting biodiversity	☐	■	
➢ Bay	☐	■	
D. Potential Environmental Impacts Will the Project cause			

SCREENING QUESTIONS	Yes	No	REMARKS
▪ Impacts on the sustainability of associated sanitation and solid waste disposal systems and their interactions with other urban services?	☐	■	
▪ Deterioration of surrounding environmental conditions due to rapid urban population growth, commercial and industrial activity, and increased waste generation to the point that both manmade and natural systems are overloaded and the capacities to manage these systems are overwhelmed?	☐	■	
▪ Degradation of land and ecosystems (e.g. loss of wetlands and wild lands, coastal zones, watersheds and forests?	☐	■	
▪ Dislocation or involuntary resettlement of people?	■	☐	Social safeguard report under preparation for parties affected by plans to redevelop the bus terminal
▪ Degradation of cultural property, and loss of cultural heritage and tourism revenues?	☐	■	
▪ Occupation of low lying lands, floodplains and steep hillsides by squatters and low income groups, and their exposure to increased health hazards and risks due to polluted industries?	☐	■	
▪ Water resource problems (e.g. depletion/degradation of available water supply, deterioration of surface and ground water quality, and pollution of receiving waters?	☐	■	
▪ Air pollution due to urban emissions?	☐	■	
▪ Social conflicts between construction workers from other areas and local workers?	☐	■	
▪ Road blocking and temporary flooding due to land excavation during rainy season?	■	☐	Traffic management measures required as part of the EMP. Scheduling of construction work to avoid rainy season
▪ Noise and dust from construction activities?	■	☐	Transient impacts from construction activities. Mitigation measures proposed as part of the EMP

SCREENING QUESTIONS	Yes	No	REMARKS
▪ Traffic disturbances due to construction material transport and wastes?	■	□	Traffic management measures required as part of the EMP. Transient impacts
▪ Temporary silt runoff due to construction?	■	□	Construction activities to be confined to dry season/dry weather. Scheduling to be stipulated in the EMP
▪ Hazards to public health due to ambient, household and occupation pollution, thermal inversion, and smog formation?	□	■	
▪ Water depletion and/or degradation?	□	■	
▪ Overpaying of groundwater, leading to land subsidence, lowered groundwater table, and salinity?	□	■	
▪ Contamination of surface and ground waters due to improper waste disposal	□	■	
▪ Pollution of receiving waters resulting in amenity losses, fisheries and marine resources depletion, and health problems?	□	■	

Rapid Environmental Assessment (REA) Checklist

WATER SUPPLY

Instructions:

- ❑ This checklist is to be prepared to support the environmental classification of a project. It is to be attached to the environmental categorization form that is to be prepared and submitted to the Chief Compliance Officer of the Regional Sustainable Development Department.
- ❑ This checklist is to be completed with the assistance of an Environmental Specialist in a Regional Department.
- ❑ This checklist focuses on environmental issues and concerns. To ensure that social dimensions are adequately considered, refer also to ADB checklists and handbooks on i) involuntary resettlement, ii) indigenous peoples planning iii) poverty reduction, iv) participation, and v) gender and development.
- ❑ Answer the questions assuming the "without mitigation" case. The purpose is to identify potential impacts. Use the "remarks" section to discuss any anticipated mitigation measures.

Country/Project Title: PAKISTAN/Punjab Intermediate Cities Improvement Investment Project (PICIIP)

Sector Division: Water and other urban infrastructure and services

SCREENING QUESTIONS	Yes	No	REMARKS
E. Project Siting Is the project area			
➢ Densely populated?	☐	■	
➢ Heavy with development activities?	☐	■	
▪ Adjacent to or within any environmentally sensitive areas?			
➢ Cultural heritage site	☐	■	
➢ Protected area	☐	■	
➢ Wetlands	☐	■	
➢ Mangrove	☐	■	
➢ Estuarine	☐	■	
➢ Buffer zone of protected area	☐	■	
➢ Special area for protecting biodiversity	☐	■	
➢ Bay	☐	■	
F. Potential Environmental Impacts Will the Project cause			

SCREENING QUESTIONS	Yes	No	REMARKS
▪ Pollution of raw water supply from upstream wastewater discharge from communities, industries, agriculture, and soil erosion runoff?	☐	■	
▪ Impairment of historical/cultural monuments/areas and loss/damage to these sites?	☐	■	
▪ Hazard of land subsidence caused by excessive groundwater pumping?	☐	■	
▪ Social conflicts arising from displacement of communities?	☐	■	
▪ Conflicts in abstraction of raw water for water supply with other beneficial water uses for surface and ground waters?	☐	■	
▪ Unsatisfactory raw water supply (e.g. excessive pathogens or mineral constituents)?	☐	■	
▪ Delivery of unsafe water to distribution system?	■	☐	Disinfection system proposed at production and storage facilities
▪ Inadequate protection of intake works or wells, leading to pollution of water supply?	☐	■	
▪ Over pumping of groundwater, leading to salinity and ground subsidence?	☐	■	
▪ Excessive algal growth in storage reservoir?	■	☐	Preventative maintenance required for all production and storage facilities
▪ Increase in production of sewage beyond capabilities of community facilities?	■	☐	Improvements to sewerage system proposed in parallel with this project
▪ Inadequate disposal of sludge from water treatment plants?	☐	■	
▪ Inadequate buffer zone around pumping and treatment plants to alleviate noise and other possible nuisances and protect facilities?	☐	■	
▪ Impairments associated with transmission lines and access roads?	☐	■	
▪ Health hazards arising from inadequate design of facilities for receiving, storing, and handling of chlorine and other hazardous chemicals?	■	☐	Handling and storage procedures built into the EMP

SCREENING QUESTIONS	Yes	No	REMARKS
▪ Health and safety hazards to workers from the management of chlorine used for disinfection and other containments?	■	□	Handling and storage procedures built into the EMP
▪ Dislocation or involuntary resettlement of people	□	■	
▪ Social conflicts between construction workers from other areas and community workers?	□	■	
▪ Noise and dust from construction activities?	■	□	Noise and dust control measures to be specified in the EMP. Impacts are transient.
▪ Increased road traffic due to interference of construction activities?	■	□	Traffic management plan to be specified in the EMP. Impacts are minor and transient.
▪ Continuing soil erosion/silt runoff from construction operations?	□	■	
▪ Delivery of unsafe water due to poor O&M treatment processes (especially mud accumulation in filters) and inadequate chlorination due to lack of adequate monitoring of chlorine residuals in distribution systems?	■	□	Preventative maintenance required for all production and storage facilities. Monitoring requirements to be specified in the Monitoring Plan
▪ Delivery of water to distribution system, which is corrosive due to inadequate attention to feeding of corrective chemicals?	■	□	Preventative maintenance required for all production and storage facilities. Monitoring requirements to be specified in the Monitoring Plan
▪ Accidental leakage of chlorine gas?	□	■	
▪ Excessive abstraction of water affecting downstream water users?	□	■	
▪ Competing uses of water?	□	■	
▪ Increased sewage flow to increased water supply	□	■	
▪ Increased volume of sullage (wastewater from cooking and washing) and sludge from wastewater treatment plant	■	□	Improvements to sewerage system proposed in parallel with this project

ANNEXURE 2: ENVIRONMENTAL SURVEY REPORTS

1) Ambient air quality monitoring (8 pages)
2) Water quality analyses (7 pages)
3) Noise monitoring (1 page)

ANNEXURE 3: ASBESTOS MANAGEMENT FRAMEWORK

1. This Asbestos Management Framework (AMF) was prepared for all subprojects funded under the Punjab Intermediate Cities Improvement Investment Project (PICIIP). The Asbestos Management Framework focuses specifically on environmental liabilities with respect to asbestos.

2. Nothing in this AMF shall be construed as modifying or releasing the Implementing Agency (IA) from any other obligations for environmental assessment of subprojects as required under the Project Administration Manual (PAM) with regards to the policy, procedures and institutional requirements for preparing subsequent sub-projects under the loan.

A. Development Activities Requiring Asbestos Management

3. Subprojects in both the water supply and sanitation sectors in PICIIP will include replacement of water distribution mains (WDM) and sewer pipes. Asbestos cement pipes (ACP) are known to have been used to construct significant portions of the existing WDM and may also have been used to construct some sections of the sewers.

4. The objective of this AMF is to reduce the risk of exposure of workers that have to handle asbestos, reduce the environmental liabilities associated with asbestos and also build capacity in the PMU of the IA, the CIU of Sahiwal City and the Sahiwal Urban Services Company, to manage asbestos related issues.

5. ADB's Safeguard Policy Statement (SPS) (2009) embraces environmentally responsible procurement (ERP) which is a fundamental principle for robust environmental management of subprojects. Asbestos is on the Prohibited List in ADB's guidelines for Environmentally Responsible Procurement (2007)[3].

6. Asbestos is recognized internationally as a hazardous material because it can present a risk to human health. In many jurisdictions asbestos is classified as hazardous and is a controlled chemical waste or a hazardous waste because, if it is mishandled, it can release airborne fibres that are known to cause asbestosis and may also be associated with other lung diseases and cancer.

7. All forms of the asbestos mineral will release asbestos fibres if broken up and all types of asbestos containing materials (ACM) will release asbestos fibres, to some degree, if damaged, abraded, weathered or decomposed.

8. Asbestos has been used widely in numerous types of materials – for example, in numerous types of cement materials, pipe insulation plaster and in refractory brick work Asbestos is often used because of its good qualities as a thermal insulation material and also because it is useful as a binder to form complicated cement shapes and durable pipes. The amounts of asbestos used varies from product to product but certain types of asbestos cement can contain more than 50% asbestos.

9. Asbestos containing materials are typically classified into two main groups based upon the physical characteristics of the material and the potential this offers for the airborne release of asbestos fibres, namely friable and non-friable materials.

[3] Environmentally Responsible Procurement – A guide to better practice. ADB, Manila (2007)

10. Friable materials are those which can be readily crushed or can disintegrate under pressure, either because of their inherent characteristics or due to longer-term deterioration or damage post installation. Non-friable materials are those which retain their physical integrity and in which the asbestos fibres are readily bound into the matrix of the material.

11. Asbestos cement pipes are regarded as non-friable materials, unless these have become damaged or weathered due to exposure.

12. When bound in the cement matrix of a pipe the asbestos is generally considered safe. However, over time, the cement surface of a pipe can become corroded or abraded and gradually become more friable leading to the release of asbestos fibres.

13. For buried or submerged AC pipe, the chemical conditions in the surrounding soil or water will also affect the rate of deterioration of the pipes as they gradually wear out or become more fragile.

14. The removal and replacement of AC pipes will give rise to some release of asbestos fibres as it is almost impossible to remove more fragile old ACPs without breaking them. Therefore, in addition to giving rise to a controlled waste, the removal of the ACP can also easily lead to the release of asbestos fibres if the removal is not conducted under controlled conditions.

15. This AMF has been prepared because ACPs will most likely be disturbed in the process of rehabilitating and/or replacing existing water supply pipework and sewers. Given the concerns expressed over the extensive leaking and dilapidated state of the WDM and sewers, it is likely that a significant part of the ACP are severely degraded, broken or cracked underground and will, inevitably, have to be physically removed and replaced.

16. The Asbestos Specialist in the PMU, CIU and/or Sahiwal Urban Services Company will be responsible ensuring that the AMF is implemented, that necessary asbestos assessments are prepared and that asbestos issues, as applicable, are considered early in the implementation at the detailed design stage.

17. The procedures to be adopted are outlined in this framework by reference to known asbestos in ACP but this AMF should be applied to all subprojects where any ACM is identified, anticipated or suspected. In these circumstances, a preliminary review of asbestos issues should be undertaken to identify any known uses of ACM or asbestos containing products that have been procured. In the case of subprojects involving WDM and sewer subprojects replacement or rehabilitation, either all cement pipes can be assumed to be ACP or sampling of the pipes can be undertaken by the Environmental Specialist early in the detailed design phase, The ACP samples shall be referred to a suitably qualified laboratory for analysis (refer to Appendix 3 to this AMF).

18. Asbestos investigations should be prepared for each subproject to check if there is any likelihood of ACM being encountered. If ACM is present Asbestos Management Plans (AMP) should be prepared and disclosed to ADB for review and approval prior to including the AMP in the contracts before commencement of work.

B. Requirement for Asbestos Management

19. Strict procedures are to be prescribed and adopted for handling, removing, transporting and disposal of ACM, where these are removed from their *in-situ* location. These procedures require the use of specially trained and equipped contractors working under

approved operational health and safety guidelines and approved waste management plans (refer to Appendix 2 to this AMF).

20. These procedures are mandatory for all materials classified as friable and are also to be applied where non-friable materials need to be cut, broken down or otherwise reduced in size (for example, cutting ACP into sections or removing pipe thrust blocks) as part of the protocol for their removal from the installed location.

21. For non-friable materials in ACP it is common practice, where such pipes are to be replaced, to leave the pipes *in-situ*, buried in their installed position, providing the ACPs are not disturbed and are assessed to be in good condition.

22. Best practice asbestos management usually entails several stages:

    I. Survey and investigation are the first steps in which the Asbestos Specialist will check all structural elements, fixtures and fittings for fibrous materials that are potentially asbestos;

    II. Samples are taken under controlled conditions and an accredited laboratory analyses the samples using polarized light microscopy;

    III. The Asbestos Specialist will then assess the type, location and condition of asbestos and make a hazard assessment;

    IV. If asbestos needs to be removed, an Asbestos Abatement Plan (AAP) is usually prepared to cover removal with detailed work specifications for specialist contractors; and

    V. In all cases the asbestos should be labelled and safety procedures instigated to prevent disturbance, until such time as it can be removed safely, if required.

23. There are as yet no statutory controls on hazardous waste in Pakistan. The Hazardous Substances Rules (HSR) were drafted in 2003 but were never brought into force. Asbestos wastes are listed in the draft HSR. If enacted the HSR would require an entity licensed under the Environmental Protection Act (1997, amended 2012) to have a waste management plan for any listed hazardous substance. This AMF is in line with the spirit of Pakistan's draft legislation.

24. The lack of a functioning Hazardous Waste Management (HWM) system is of grave concern, since many hazardous wastes are being co-mixed with municipal solid waste and disposed of to uncontrolled open dumps. This would presumably be the fate of any asbestos waste from the sub-projects under PICIIP if disposal of ACM is not controlled.

25. ADB standards are guided by World Bank Environment, Health and Safety (EHS) Guidelines that requires asbestos disposal should be carried out in line with host country regulations or following best international practice.

26. As there are, as yet, no local standards for asbestos control in Pakistan, any known asbestos waste requiring removal should be disposed of following best international practice.

27. In line with best international practice, the requirement for a dedicated Asbestos Management Plan (AMP) has been included in the EMP for relevant PICIIP subprojects.

C. Responsibilities / Authorities of Various Agencies

28. Potential environmental liabilities with respect to asbestos associated with subprojects will be minimized by implementing the requirements of the AMF and by prescribing the selection of alternative non-asbestos materials (Section D and Appendix 2).

29. All measures shall be in line with ADB's Safeguard Policy Statement (2009), any applicable National and Provincial Government regulations and guidelines, and ADB's guidance document on Environmentally Responsible Procurement (2007).

30. Subprojects shall only involve asbestos-related activities that follow the AMF.

31. The IA will be solely responsible for the implementation of all of the asbestos assessment and review procedures required in the AMF for all affected subprojects. This will include, but not be limited to, ensuring that the asbestos control procedures are strictly adhered to, that preparation of Asbestos Investigation Reports (AIR) and Asbestos Management Plans (AMP) are carried out in a timely and efficient manner and included in the construction contracts.

32. Sahiwal Urban Services Company (SUSC) will submit the asbestos checklist (Table 1), an AIR, an AMP and monitoring reports to ADB for review.

Table 1: Proposed preliminary checklist for AMF Implementation on PICIIP Subprojects

	Task/Progress	Yes/No (comment)	Date
1	Strengthen Safeguard Cell (SC) to manage asbestos		
2	Prepare asbestos screening checklist. A preliminary review of asbestos issues by SC. Are ACMs/ACPs known to have been used in the system ?		
3	Have potential locations for ACMs/ACPs been identified, surveyed, sampled and investigated by the Asbestos Specialist /qualified/registered asbestos consultant as per best practice ?		
4	Have the potential ACM/ACP bulk samples been analyzed by an accredited laboratory as per best practice (Appendix 4) ?		
5	Has the SC Specialist prepared an AIR, including the survey, sampling locations and confirmed or refuted the presence and types of asbestos as per best practice ?		
6	Has the SC Specialist prepared an AMP, including AAP, including results of the asbestos investigation, ACM locations and types of asbestos as per AMF procedures and best practice ?		
7	Are the requirements for AMP, including AAP, included in the contracts ?		
8	Have SUSC provided the necessary buffer storage space or landfill disposal location for the asbestos ?		
9	Do contractors have, or can obtain, the necessary skills, capability and equipment to carry out asbestos management as per the AMF ?		
10	If no to any of the above, provide remedial action and detail on separate sheets		

33. The Asbestos Specialist of the SUSC Safeguard Cell shall:

I. Assist SUSC to identify a suitable secure buffer store for waste asbestos;

II. Prepare an AIR and checklist to identify any asbestos issues in any subproject;

III. Ensure that adequate sampling and analysis of the existing facilities has been carried out to ensure all environmental liabilities with respect to asbestos have been identified, review the asbestos assessments AIR and AAP and submit the AIR and AAP to ADB; and

IV. Prepare the asbestos surveys and investigations, and prepare asbestos assessments, AIR and AAP reports, including an AMP, for inclusion in the construction contracts.

34. Prior to the commencement of civil works for subprojects the SUSC shall:

I. Set up the buffer store facility and ensure that all contractors have been briefed as to the presence of ACM in the subproject works and the nature of the hazards posed by the type of asbestos present;

II. Ensure that the contracts have specified the asbestos management procedures to be used in the construction of the subproject to control environmental liabilities to acceptable levels;

III. Ensure that the required mitigation measures during construction and the AMF are included in the bidding document of the subproject and that the all bidding contractors have access to the IEEs and EMP;

IV. Ensure that SUSC have identified a suitable secure buffer store for the waste ACM in lieu of landfill disposal being available and that the contractors know the location of the buffer store in the bidding documents; and

V. Ensure the selected contractor has made adequate provisions (including human resources, materials methods and training) to carry out works in line with the AMF as a payment milestone.

35. During the implementation of civil works for subprojects the Asbestos Specialist shall:

I. Ensure that the asbestos abatement procedures, including all proposed mitigation measures and monitoring in Appendix 2 are properly implemented;

II. Monitor the implementation of AMPs and present its monitoring report;

III. Ensure that ADB be given access to undertake environmental due diligence for all subprojects. It should be noted that SUSC shall have the main responsibility for undertaking environmental due diligence and monitoring of all the subprojects. The due diligence report, as well as monitoring reports on EMP implementation, shall be prepared systematically and include asbestos abatement issues.

36. ADB shall be responsible for regular review and timely approval of subproject AMF checklists (Table 1). Technical guidance shall be provided by ADB to the SUSC as needed. ADB shall also be responsible for reviewing regular monitoring reports and officially disclosing any aspects relating to the management of asbestos on the ADB website if required.

37. During the PICIIP ADB shall:

I. Review submitted AIRs and AMPs as a basis for subproject approvals;

II. Monitor the AMF and AMP implementation and due diligence as part of Project reviews; and

III. Provide assistance to SUSC, if required, in carrying out its responsibilities and for building capacity for compliance with the AMF.

D. Asbestos Control Procedures

1. Minimizing Asbestos Liabilities

38. Potential environmental liabilities with respect to asbestos associated with subprojects will be minimized by taking the following measures:

I. Implementing the requirements of the AMF and by prescribing the selection of alternative non-asbestos materials;

II. Where ACM must be disturbed in a subproject the ACM shall only be removed under controlled conditions for disposal in line with the provisions of the AMF or any rules subsequently promulgated by the Federal EPA or Punjab EPA;

III. Construction of the subprojects will not take place until the contractor has agreed to carry out the asbestos abatement procedures in line with the procedures included in the AMF;

IV. Conducting sampling of potential ACMs and compiling an AIR with adequate implementation;

V. For low risk ACP (non-friable materials) prepare an asbestos management plan based upon in-situ burial of undisturbed pipework;

VI. For high risk ACP and other high risk friable materials, if they are identified, prepare alternative asbestos abatement plans (AAP), with adequate implementation and monitoring budget, based on best international practice;

VII. All measures shall be in line with ADB's Safeguard Policy Statement (2009), any applicable National and Provincial Government regulations and guidelines, and ADB's guidance document on Environmentally Responsible Procurement (2007); and

VIII. The subprojects shall only involve asbestos activities that follow the AMF.

2. Preparation of Detailed Design

39. Detailed design work for each additional subproject will include and follow the recommendations of the AMF.

40. The SUSC will include the requirements of the EMP and IEE/EIAs (including the AMF) in subproject bid documents and ensure the detailed designs include such requirements.

41. Before contracts are finalized certification shall be provided by SUSC to ADB that the detailed designs comply with the EMPs recommendations in subproject IEE/EIAs (including any AMP). This certification shall be required before contracts can be signed and made effective.

42. The SUSC shall also allocate sufficient resources to recruit and support an Asbestos Specialist in the SUSC to monitor the progress of the asbestos management process for all subprojects under PICIIP.

3. Preparation of Construction Contracts

43. Early in the implementation period, model construction contracts shall be prepared incorporating general environmental safeguards and asbestos management practices based on Appendix 2 and Appendix 3 to this AMF.

44. Specific, individual contracts shall be based on the model contracts, but shall also be checked by the SUSC to ensure that all special or specific safeguard requirements and mitigation measures, recommended in the AMP, for that subproject are incorporated fully within the individual contract.

45. The SUSC shall also allocate sufficient resources to the Asbestos Specialist to monitor that the asbestos abatement mitigation measures specified in the AMP are included in all construction contracts under PICIIP.

4. Monitoring During the Construction Period

46. Monitoring during construction shall be the responsibility of the Asbestos Specialist. Monitoring will relate to compliance with the requirements for asbestos management and abatement included in the construction contracts.

47. The Asbestos Specialist shall inspect the ongoing works regularly and systematically, checking that the asbestos abatement mitigation measures specified in the AMP have been implemented effectively during the design and construction stages of the project and ensuring the implementation and effectiveness of mitigation measures. Reporting shall be to the SUSC on a regular basis (at least quarterly) and to ADB semi-annually.

48. The removal of any ACMs, if required, will occur only during the construction stage. No monitoring shall be required in the operational stage.

5. Institutional Arrangements

49. The IA at subproject level for the AMF shall be SUSC. An Environment Manager within the SUSC shall lead the implementation of the AMF throughout the duration of the loan and shall report directly to the head of the SUSC, who shall be accountable and responsible for implementation of the AMF at subproject level.

50. The dedicated Asbestos Specialist shall coordinate consistently the implementation of the AMF in all subprojects where asbestos has been identified as an issue.

51. The Asbestos Specialist shall also be responsible for coordinating and supervising monitoring of asbestos abatement, quality control, and writing the periodic progress reports on implementation of the AMF.

52. The implementation of the AMF shall commence immediately upon commencement of the detailed designs for the subprojects. The Asbestos Specialist shall, therefore, be designated at least one month before and released for duty before the loan becomes effective. SUSC will further ensure the release of resources for asbestos management and that monitoring budgets are made available for timely AMP implementation.

6. Monitoring and Evaluation

53. The AMF shall have both internal and external monitoring.

54. The Asbestos Specialist at the local level shall be responsible for internal monitoring of the AMF implementation, and shall forward quarterly progress reports to SUSC. The reports will contain progress made in AMF implementation with particular attention to

compliance with the principles set out in the AMF. The SUSC will submit a brief, semi-annual, monitoring report to ADB.

APPENDIX 1

DRAFT TERMS OF REFERENCE FOR SAFEGUARD CELL

ASBESTOS SPECIALIST

1. Qualifications

1. The Asbestos Specialist shall be a registered asbestos consultant or member of a recognized waste management association in an ADB member country and/or have extensive work experience and familiarity with all aspects of asbestos management and/or have attended a recognized full-time training course on all aspects of asbestos management. Candidates with broad experience in the field of asbestos management or hazardous waste management will be preferred.

2. The Asbestos Specialist shall at least be a graduate in environmental science, environmental engineering or a related discipline with significant experience in asbestos management or hazardous waste management. In addition, the candidate should have significant experience of the monitoring of projects and the implementation of mitigation measures and engineering controls to minimize risks associated with control of asbestos or hazardous wastes in the environment.

3. The general scope of work will be:

    a) Plan asbestos investigations and arrange for bulk sampling of potential asbestos containing materials (ACM);

    b) Compile and report results of bulk sampling and monitoring and verify results through random checking at the field level to assess whether AMF objectives have been met;

    c) Prepare asbestos investigation reports (AIR) for all subprojects to confirm the extent, or refute the presence, of ACM;

    d) Prior to controlled landfill disposal facilities being available, to assist Sahiwal Urban Services Company (SUSC) to identify a suitable buffer store to stockpile ACM collected from subprojects;

    e) If ACM is confirmed, to prepare asbestos management plans (AMP) including asbestos abatement plan (AAP) for SUSC for all subprojects;

    f) If ACM is confirmed, prepare an AMP for the buffer store and future landfill;

    g) Monitor the management of stockpiled ACM in the buffer store and subsequently monitor the management of waste ACM in the controlled landfill disposal facilities;

    h) When controlled landfill disposal facilities are available, to assist SUSC to monitor the implementation of necessary controls on asbestos disposal and to monitor the controlled handling, transfer and disposal of the stockpiled ACM from the buffer store;

    i) Review and verify the progress in AMP implementation for each subproject and assess whether robust asbestos management practices have been achieved and/or improved continually on all subprojects;

    j) Assess efficiency and effectiveness of asbestos management practices and engineering control measures that have been implemented, their impacts (positive as well negative) and sustainability, drawing both on policy and practice and to suggest any corrective measures, if necessary;

k) Review and verify the progress in AMF implementation of each subproject and every six months prepare reports for SUSC and ADB; and

l) Report directly to the Head of SUSC and the Project Management Unit (PMU) of the Implementing Agency if the progress with any aspect of the AMF is insufficient to support continued project financing from ADB.

4. The Asbestos Specialist shall be involved in ongoing monitoring of the AMF implementation for the SUSC.

5. This TOR to be modified depending on the management details.

6. The position may be combined with other consultant support arrangements through a firm.

APPENDIX 2

ASBESTOS ABATEMENT PROCEDURES

1. Removal of Asbestos Cement Pipes (ACP)

1. The principle will be that asbestos cement pipes (ACP) shall be excavated carefully, lifted on to plastic sheets for wrapping, wrapped in polythene and sealed with duct tape and then lifted and lowered on to the transport lorry for transport to the designated storage area or landfill.

2. The procedure shall follow the measures indicated below:

A. Preparation

3. The CONTRACTOR shall make available the materials in Appendix 3.

4. The CONTRACTOR shall be prepared and agree to remove and transport, on lorries covered with tarpaulins, all the wrapped ACP and fractured ACP that is in drums, from the site to the secure temporary buffer store designated by SUSC to await disposal.

5. The CONTRACTOR shall provide approved protective clothing to all workers. The CONTRACTOR shall also provide approved protective clothing to the SUSC Asbestos Specialist/Inspector as and when requested. Protective clothing shall consist of an approved disposable full body coverall, with head cover. Hard hats and boots shall also be made available to all workers by the CONTRACTOR.

6. Workers handling the ACP shall wear approved half face dust masks, protective coverall and goggles. The CONTRACTOR shall ensure all workers wear the protective clothing provided.

7. The SUSC Asbestos Specialist/inspector shall carry out a visual inspection to check that the preparation has been carried out satisfactorily and issue a written certification to the Contractor to proceed.

B. Abatement Method

8. The ground / pipe trench shall be excavated carefully to avoid the risk of contact with and damage to the ACP.

9. The last 5 cm of excavation to the pipe surface shall be undertaken using hand tools to expose the old ACP.

10. Any accidentally excavated loose pieces of asbestos cement shall be picked up and stored in plastic bags, sealed and then placed in drums or barrels.

11. The drums / barrels to contain the fractured pieces of ACP shall be made of plastic or metal. If made of some other material, the drums / barrels shall be lined with two layers of 0.15mm polythene sheeting. When the drums are full the plastic lining shall be folded over the pipe segments and secured in place with duct tape and the lid placed on the drum and secured in place with duct tape

12. The ACP shall be removed in sections carefully using manual labour and hand tools to expose the old ACP so that it can be lifted carefully to avoid cracking as far as possible. Any accidentally fractured loose pieces of asbestos picked up and stored in plastic bags or barrels and sealed.

13. The surface of the asbestos shall be wet before commencing the process to remove ACP. Any dry areas of exposed existing asbestos cement pipes shall be sprayed with water containing a wetting agent to reduce fibre release. The wetting agent shall be of a correct mix and concentration in accordance with the manufacturer's instructions as specified under materials (refer to Appendix 3).

14. The wetting solution (amended water) shall be sprayed using equipment capable of providing a 'mist' application to reduce the release of fibres. The existing asbestos material shall be sufficiently saturated to wet it thoroughly. The existing asbestos material shall be sprayed repeatedly during the removal processes to maintain a wet condition and to minimize asbestos fibre dispersion.

15. Fixed ACP shall be separated carefully and prized off any supporting brackets and separated from any attached ACP or cement screed base and taken up in manageable sections taking care not to drop, crack, break or damage the ACP.

16. POWERED MECHANICAL EQUIPMENT (such as backhoe) SHALL NOT BE USED TO REMOVE THE ASBESTOS CEMENT PIPES because this will increase the risk of cracking and fibre release.

17. Once removed the ACP shall be wrapped immediately in two layers of polythene. Smaller pieces/sections can be double bagged and goose neck tied with duct tape and the polythene shall be wet wiped clean.

18. The bottom 10cm of soil below the old ACP shall be assumed to be contaminated with asbestos fragments or fibres and shall be loosened and shoveled or picked up and stored in plastic bags or barrels and sealed as ACM.

19. A further 5cm of soil below the old ACP, and any loose debris and rubble, will be removed to create a level floor to the trench and to designate the completion of the removal work.

20. The exposed surfaces of the partially wrapped pipes and the surface of the trench shall be sprayed with adhesives to be used as "lock down" on surfaces during the final clean-up of the area. This is to bind any traces of asbestos fibre which may remain on exposed surfaces.

21. The SUSC Asbestos Specialist/inspector shall carry out a visual inspection to certify that all visible ACP and fragments have been removed to a satisfactory standard prior to the installation of any new replacement pipework.

22. If the visual inspection indicates a satisfactory standard all the wrapped asbestos cement packs shall be counted and picked up and transferred to the lorries for transportation to the temporary buffer store to await disposal. All wrapped asbestos cement packs shall remain at the temporary buffer store and not be removed. An inventory of material taken to, and received at, the temporary buffer store shall be prepared and maintained.

23. The workers shall wet wipe down their overalls and mask and wash hands and face and any accidentally exposed areas of skin to decontaminate. Dust masks, overalls, gloves, wet wipes and any other litter shall be double bagged and goose neck tied for disposal as asbestos waste.

24. The SUSC Asbestos Specialist/inspector shall then carry out a further visual inspection to certify that all remaining polythene packs and equipment and visible asbestos has

been removed to a satisfactory standard and proper decontamination of tools and equipment has taken place. (xv)

25. The SUSC Asbestos Specialist/inspector shall check and record the number of packs of waste transferred to the lorries are the same as those that arrive at the temporary buffer or landfill using a trip ticket system. (xvi)

26. The SUSC Asbestos Specialist/inspector shall monitor and periodically audit the buffer store and landfill security to ensure no pilfering or theft of the stockpiled waste.

27. The Asbestos Specialist inspector shall report on the progress of all the asbestos abatement works under PICIIP twice per year to ADB.

APPENDIX 3

MATERIALS AND EQUIPMENT and ASBESTOS LABORATORIES

A. Containment Materials

1. At least two layers of transparent plastic (0.15mm thickness low density polythene (B.S.4932:1973) shall be used for wrapping the ACP in sizes which minimize the need for jointing.

2. Polythene transparent bags and containers used for packing of asbestos waste should be able to resist puncturing by the sharp edges of the asbestos cement.

3. The wrappings shall be joined carefully and sealed with wide duct tape or spray adhesive capable of sealing adjacent sheets of polythene and facilitating attachment of polythene to the asbestos cement. The adhesive agents should be capable of adhering and maintaining the wrapping in place under both wet and dry conditions.

4. Pipe sections and fragments of 2m or less shall be completely wrapped in polythene or collected in polythene bags.

5. Pipe sections and fragments of greater than 2m shall have each end (up to 1m) and any cracked or broken areas completely wrapped in polythene.

6. Intact pipe sections greater than 2m shall have the ends end up to 1m and any cracked or broken areas completely wrapped in polythene. (iv)

7. Access to the asbestos waste shall be guarded at all times by security personnel.

B. Wetting Agent and Lock Down

8. It is strongly recommended to apply amended water containing a wetting agent on the asbestos materials prior to removal so as to minimize the release of asbestos fibres during the removal process.

9. Electrical equipment is not likely to be present in the excavated trenches but if electrical cables are present these should be de-energized and isolated prior to the application of wetting agents.

10. The recommended wetting agent for the amended water to enhance penetration should be 50% polyoxyethylene ester and 50% polyoxyethylene ether or equivalent. The wetting agent shall be diluted in accordance with the manufacturers' instructions.

11. As a fall back option household, washing up detergent mixed at 10% can be substituted to prepare the wetting water.

12. Water based polyvinyl acetate adhesives (PVA) shall be used as "lock down" for spraying on to surfaces during the final clean-up of the area and shall be able to bind traces of asbestos fibre which may remain on exposed surfaces. The adhesive shall be dyed to indicate where it has been sprayed and to facilitate a check as to whether they have been applied or not and to facilitate crosschecking at a later stage.

C. Lifting Gear & Ladders

13. All lifting appliances, i.e. wire slings, ropes and chain blocks, must comply with the local construction sites safety regulations.

14. Valid test certificates must be kept on site for checking at all times.

15. Ladders shall be used in line with general safety procedures.

16. Joints and ends of ladders, scaffolds and parts of lifting gear where appropriate shall be sealed with tape to prevent the incursion of asbestos fibres and finished to create a smooth surface to facilitate cleaning.

*D. **Respirators*** (dust mask)

17. Respirators to be provided by the CONTRACTOR shall be of an approved type deemed appropriate for protection against the level of asbestos fibres reasonably expected in the particular stage and environment of work. In this case half face dust mask shall be required.

18. The CONTRACTOR shall provide disposable paper respirators to all workers with a protection factor of 4 (e.g. recommended 3M8812 or equivalent).

19. The CONTRACTOR shall also provide approved respirator(s) to the SUSC Asbestos Specialist /inspector as and when requested. (iii)

20. The respirators shall be removed when wet and be treated as contaminated waste. A new half face dust mask shall be provided to each worker prior to each shift, and the CONTRACTOR shall hold sufficient spare masks on site at all times for replacement purposes.

E. Protective Clothing

21. The CONTRACTOR shall provide approved protective clothing to all workers.

22. He shall also provide approved protective clothing to the SUSC Asbestos Specialist inspector as and when requested.

23. Protective clothing shall consist of an approved disposable full body coverall, with head cover. Hard hats and boots shall also be made available by the CONTRACTOR.

24. Coveralls will be of a disposable type:

    a) made from material which does not readily retain asbestos dust;

    b) prevents, so far as is reasonably practicable, dust penetration;

    c) is close fitting at the neck, wrists and ankles; and

    d) without external pockets or unnecessary pleating or accessories.

F. Preliminary List of Laboratories in Pakistan with the Capability to Identify Asbestos

25. There are a number of laboratories in Pakistan that are equipped to provide analyses and determination of the presence and content of asbestos in materials.

26. Details of four laboratories are provided below. Note that this list does not purport to be comprehensive or exhaustive; there may be other laboratories in Pakistan that have the facilities to identify and confirm the presence of asbestos.

    a) Pakistan Council of Scientific & Industrial Research PCSIR Labs Complex Off University Road Karachi. Tel#: +92-21-8141841, Fax#: +92-21-8141847;

    b) National Physical and Standards Laboratory (NPSL), Islamabad Plot No.16, Sector H-9 Islamabad. Tel#: +92-51-9257459, +92-51-9257462-7, Fax#: +92-51-9258162;

    c) Pakistan Council of Scientific & Industrial Research PCSIR Labs Complex Ferozepur Road Lahore. Tel#: +92-42-9230688-95, +92-42-9230704, Fax#: +92-42-9230705; and

    d) SGS Pakistan (Private) Limited, H-3/3, Sector 5, Korangi Industrial Area, Karachi, 74900. Tel#: +92-21-35121388-95, +92-21-11122274

ANNEXURE 4: RECORDS OF PUBLIC CONSULTATIONS

Name	Title/Designation and Organization	Date, Place
Sahiwal		
Mian Mohammad Asghar	Tehsil Municipal Officer, Sahiwal	31st Oct
Malik Nisar Ahmed Hayat	Tehsil Officer, Infrastructure & Services, TMA	31st Oct
Sheikh Waheed Qaiser	SDO	31st Oct
Dr Shirazi	Sanitation Enforcement Inspector, TMA Sahiwal	31st Oct
Tariq Mehmood	Katchi Abadi Incharge, TMA	1st Nov
Syed Alamdar Husain	District Officer Social Welfare/EDO Community Development	1st Nov
Mohammad Abbas	Deputy District Officer, Social Welfare	1st Nov
Ms Sidra	Superintendent, Dar-ul-Aman	1st Nov
Mian Nadeem Zia	Assistant Director/Manager, Sanatzaar	1st Nov
Shafique Butt	Executive Director, Punjab Lok Sujag	2nd Nov
Dr Mujtaba Jamal	President, Social Development Organisation	2nd Nov
Anjum Raza Mattoo	Insaan Dost Asociation	2nd Nov
Syed Mohd Haider	District Officer Labour, Sahiwal	3rd Nov
Chaudhry Tariq	Numberdar, Shahabad, 95 -6/R	3rd Nov

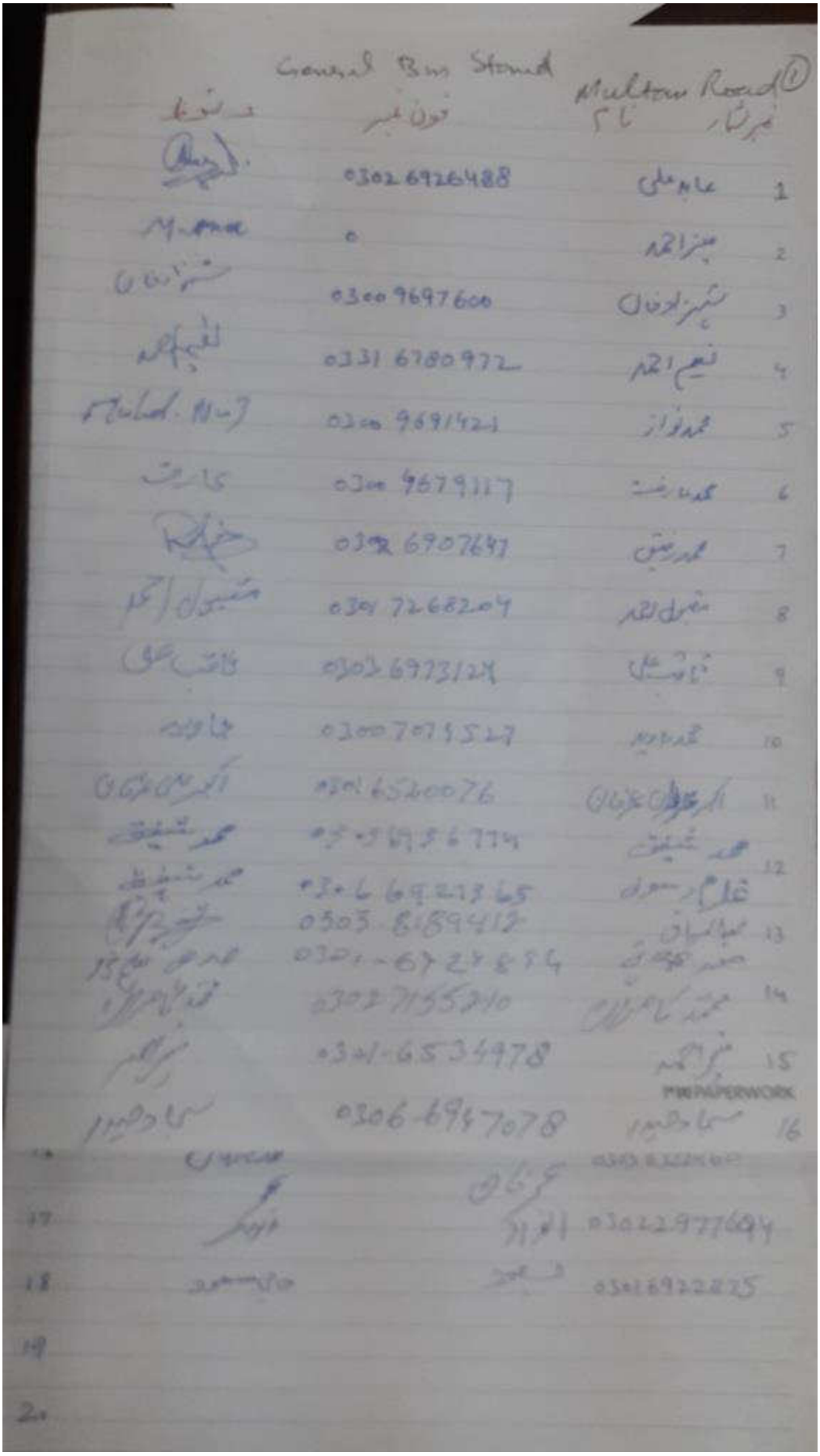
Sahiwal
FGD 1: Katchi Abadi, Fateh Sher Colony, Union Council 45 **Participants:** 1. Surraya bib 2. begum Parveen 3. Kausar bibi 4. Zakiya bibi 5. Aasiya bibi, 6. Shamim bibi
FGD 2: UC 44 **Participants:** 1. Mohd Zafar Ashraf 2. Rana Mohd. Latif 3. Mohd Amir Nomi 4. Rana Mohd Ali 5. Mohd Anwar 6. Mohd Aslam 7. Imtiaz Ahmed
FGD 3: Khokha Baazar, Madina Colony, Union Council 49 **Participants:** 1. Firdous Zafar 2. Najma Bashiran 3. Bashiran bibi 4. Attiya Noreen 5. Parveen Shahbaz 6. Bilquis Akhtar 7. Jamila Nafees
GD 4: Shah Abad, 95 – 6/R **Participants:** 1. Kishwar 2. Rashidaan 3. Kulsum Akhtar 4. Bilquis Akhtar 5. M Amjad 6. Nazir Husain *(Note: Technically this was not an FGD but a group discussion held over different locations) and also in a rural UC marked for land acquisition)*

List of Participants in the Consultation Meeting at Multan Road Bus Terminal, Sahiwal Held on 15th February, 2017 at 11.00 am

No.	Name of Affected Person	Business of Affected Person
1	Abid Ali	Shopkeeper
2	Muneer Ahmed	Shopkeeper
3	Shehzad Khan	Shopkeeper
4	Naeem Ahmed	Shopkeeper
5	Muhammad Nawaz	Bus service manager
6	Muhammad Arif	Shopkeeper
7	Muhammad Rafeeq	Shopkeeper
8	Maqbool Ahmed	Bus service manager
9	Saqib Ali	Shopkeeper
10	Muhammad Javed	Workshop
11	Akbar Irfan	Shopkeeper
12	Muhammad Shafeeq	Shopkeeper
13	Ghulam Rasool	Shopkeeper
14	Abdul Razzaq	Snooker game shop
15	Muhammad Siddique	Shopkeeper
16	Muhammad Kamran	Bus service manager
17	Sajjad Haider	Shopkeeper
18	Munir Ahmed	Workshop
19	Malik Irfan	Shopkeeper
20	Anwaar	Workshop
21	Haji Masood	Shopkeeper
Consultant and Participants from SMC		
1	Dr Saifur Rahman Sherani	LARP Consultant
2	Azher Uddin Khan	Deputy Team Leader of PPTA
3	Muhammad Asher	LARP Assistant
5	Muhammad Ali	Tax Superintendent SMC
6	Imtiaz Ahmad	Rent collector SMC

Consultation Meeting at Multan Road Bus Terminal

Consultation Meeting at Multan Road Bus Terminal



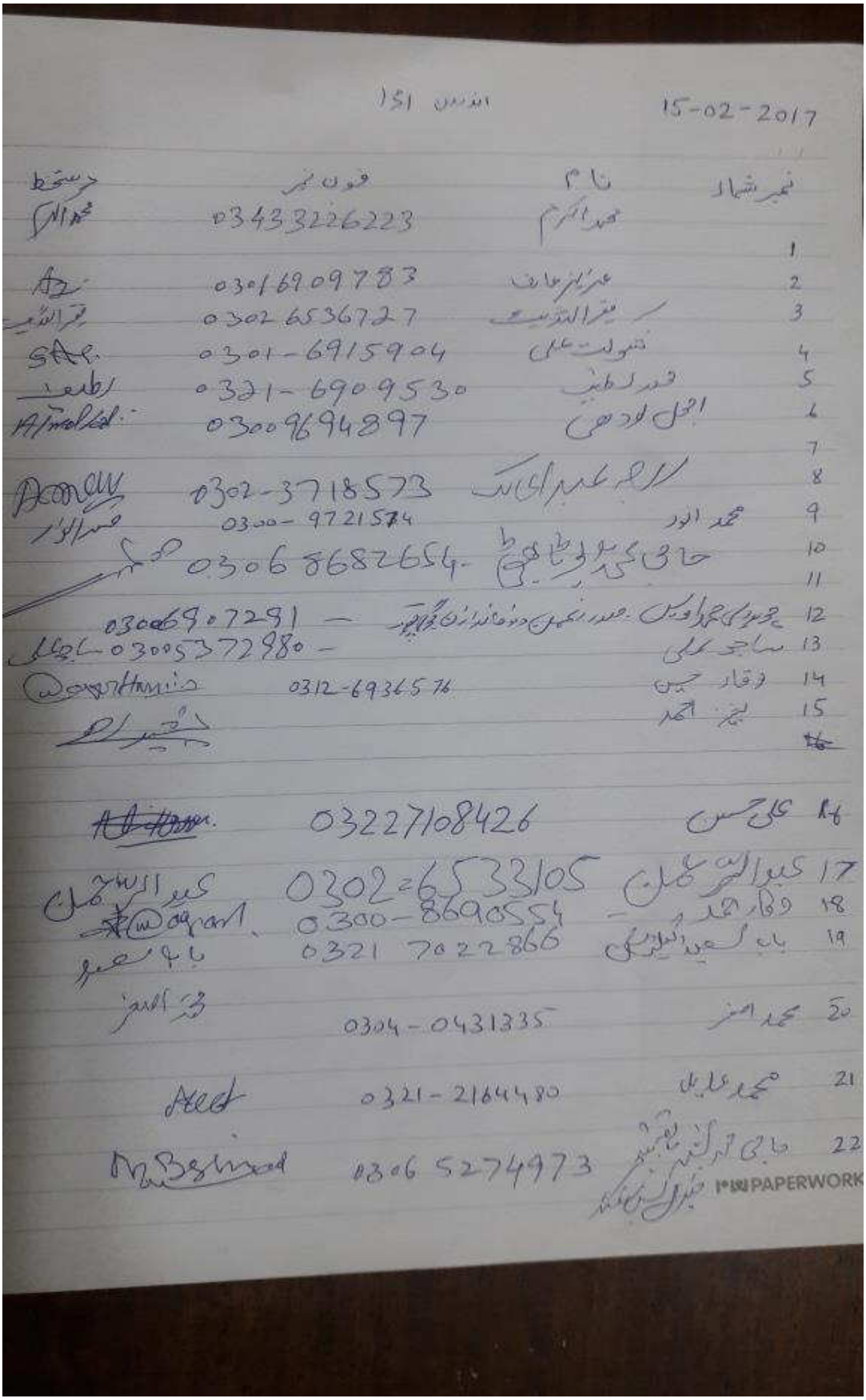
Signed List of Participants, Consultation Meeting at Multan Road Bus Terminal

List of Participants in the Consultation Meeting at Railway Road Bus Terminal, Sahiwal
Held on 15th February, 2017 at 14.30 pm

No.	Name of Affected Person	Business of Affected Person
1	Muhammad Akram	Shopkeeper
2	Aziz Arif	Shopkeeper
3	Faqeer Ullah Butt	Shopkeeper
4	Shaukat Ali	Shopkeeper LTCS
5	Muhammad Lateef	Transporter
6	Ajmal Lodhi	Shopkeeper
7	Raja Abdullah	Shopkeeper
8	Muhammad Anwar	Battery shop LTCS
9	Haji Muhammad Boota Bhatti	Shopkeeper LTCS
10	Chaudhary Muhammad Awais	Workshop
11	Sajid Ali	Workshop
12	Waqar Hussain	Transporter
13	Basheer Ahmed	Transporter
14	Ali Hassan	Shopkeeper
15	Abdul Rehman	Transport manager
16	Waqar Ahmed	Shopkeeper
17	Baba Saeed	Shopkeeper
18	Muhammad Asghar	Shopkeeper
19	Muhammad Adeel	Transport manager
20	Haji Muhammad Basheer	Shopkeeper
Consultant and Participants from SMC		
1	Dr Saifur Rahman Sherani	LARP Consultant PPTA
2	Azher Uddin Khan	Deputy Team Leader of PPTA
3	Ayaz Asif	Due Diligence Consultant ADB
4	Hafeez Buzdar	LARP Coordinator
5	Muhammad Asher	LARP Assistant
6	Muhammad Ali	Tax Superintendent SMC
7	Fazal Qadir	Tax Collector Bus terminal SMC

Consultation Meeting at Railway Road Bus Terminal

Consultation Meeting at Railway Road Bus Terminal



151 [illegible] 15-02-2017

دستخط	فون نمبر	نام	نمبر شمار
[illegible]	03433226223	محمد اکرم	1
[illegible]	03016909783	عزیز عارف	2
[illegible]	0302 6536727	[illegible]	3
SAE.	0301-6915904	شوکت علی	4
[illegible]	0321-6909530	فہد لطیف	5
[illegible]	03009694897	افضل لودھی	6
			7
[illegible]	0302-3718573	[illegible]	8
[illegible]	0300-9721574	محمد انور	9
[illegible]	0306 8682654	[illegible]	10
			11
	03006907291	[illegible]	12
[illegible]	03005372980	ساجد علی	13
[illegible]	0312-6936576	وقار حسین	14
[illegible]		بشیر احمد	15
~~[illegible]~~	03227108426	علی حسن	16
[illegible]	0302-6533105	عبدالرحمٰن	17
[illegible]	0300-8690554	وقار احمد	18
[illegible]	0321 7022860	[illegible]	19
[illegible]	0304-0431335	[illegible]	20
[illegible]	0321-2164480	[illegible]	21
[illegible]	0306 5274973	[illegible]	22

Signed List of Participants, Consultation Meeting at Railway Road Bus Terminal

Dated: 11-02-17 Village: 95 - 6R Place of Meeting: House of Kalsoom Akhtar

Attendance Sheet of Participants of Consultation Session: Sewage Treatment Plant (STP)-Sahiwal: Punjab Intermediate Cities Improvement Investment Programme (PICIIP)

S.NO	Name	Signature
1	Akhtar Kalsoom bibi D/o Shah Muhammad	کلثوم اختر
2	Balqees bibi W/O M. Akram	بلقیس بی بی
3	Rubina W/O Najiv Ahmad	
4	Hina W/O Mudassar	Hina Mudassar
5	Nahid bibi W/O Intiq	Nahid
6	Intiq S/O Faqeer Muhammad	محمد امتیاز
7	Iftikhar S/O Faqeer Muhammad	
8	M. Akram S/O Ali Muhammad	M Akram
9	Farjand Ali	
10	Gulam Murtaja	Murtaja
11	JAWAD RASOOL S/O IFTIKHAR AHMAD	
12		

Dated: 11-2-2017 Village: 95/6R Place of Meeting: Faqir Muhammad Farm.

Attendance Sheet of Participants of Consultation Session: Sewage Treatment Plant (STP)-Sahiwal: Punjab Intermediate Cities Improvement Investment Programme (PICIIP)

S.NO	Name	Signature
		0343-6815528
1	Iftikhar s/o Faqeer M	
2	Abdul Latif s/o Farzand Din Farzand Ali s/o Nizam	
3	M. Sultan s/o Din M	
4	Ghulam Hussain s/o Ch. Ali Muhd	Ghulam Hussain
5	Chorasha s/o Ghulam	
6	Ghulam Murtaza s/o Zaffar Ali	
7	Jawad Rasool s/o Iftikhar Ahmad	Jawad Rasool
8	Ahmed s/o Rasheed ~~sto~~ Ahmad	
9	Mubashar Ali s/o Bashir Ahmad	
10		
11		
12		

Dated: 16-02-2017 Village: 89/6R Place of Meeting: Bhatta chowk

Attendance Sheet of Participants of Consultation Session: Sewage Treatment Plant (STP)-Sahiwal: Punjab Intermediate Cities Improvement Investment Programme (PICIIP)

S.NO	Name	Signature
1	M. Anjad s/o Noor M	
2	M. Waseem s/o Shabir Ahmad	
3	M. Shakeel s/o M. Rafiq	
4	Haji Rasheed Ahmed s/o Lalu Bhatti	
5	M. Arshad s/o Mushtaq Ahmad	
6	Shafiq-ur-Rehman s/o Manzoor Ahmed	
7	Rasheed Ahmed s/o M. Bhatti	
8	Aleem Bari s/o Ghulam Rasool	
9	M. Imran s/o Khadim	
10	Ihsan ul-Haq Jafri s/o Muhammad Ibrahim	
11	M. Anwar s/o Abdul Haleem	Anwar
12	M. Usman	

Dated: 23-02-17 **Village:** Manzoor Colony **Place of Meeting:** Canal Bank

Attendance Sheet of Participants of Consultation Session: Sewage Treatment Plant (STP)-Sahiwal: Punjab Intermediate Cities Improvement Investment Programme (PICIIP)

S.NO	Name	Signature
1	Sajid S/o Taj Mukd	Sajid
2	Naeem S/o Bashir Ahmad	
3	Muhammad Arshid S/o Umer Din	
4	Farasat Ali S/o Mukd Umair	
5	Jamil Ahmad S/o M. Yaqoob	
6	M. Tahir S/o Nasir Ahmad	
7	M. Anwar S/o Habib Ali	
8	Ghulam Rasul S/o Inyat	
9	Habib Ullah S/o M. Shafi	
10	M. Bocta S/o Muhammad	
11	Niamet S/o Hadayat Ali	
12		

Dated: 23/02/18 Village: 95/6R Place of Meeting: CA. Aslam's Advocate

Attendance Sheet of Participants of Consultation Session: Sewage Treatment Plant (STP)-Sahiwal: Punjab Intermediate Cities Improvement Investment Programme (PICIIP)

S.NO	Name	Signature
1	Ch. Muhammad Aslam s/o Mian Ghulam Mohd	0303-6954915
2	M. Abul Barkat s/o Mian Mohd Akram	
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		

Dated: 23-2-2017 Village: 85/6R Place of Meeting: Farm House Kachi Pucca New Sohawa Road

Attendance Sheet of Participants of Consultation Session: Sewage Treatment Plant (STP)-Sahiwal: Punjab Intermediate Cities Improvement Investment Programme (PICIIP)

S.NO	Name	Signature
1	Muhammad Arshid s/o M. Boota	
2	Faqir M s/o Eidha	
3	M. Yasin s/o Rehmet Ali	
4	Ghulam Farid s/o Muhd. Din	
5	Sultan Ali s/o Muhammad Azim	سلطان علی
6	Haroon s/o Naseem	محمد ہارون
7	Sabina Bibi w/o Noor Muhd	
8	Amanat Ali s/o Allah Ditta	AA
9		
10		
11		
12		

Dated: 23-2-17 **Village:** 85/6R **Place of Meeting:** village chowk

Attendance Sheet of Participants of Consultation Session: Sewage Treatment Plant (STP)-Sahiwal: Punjab Intermediate Cities Improvement Investment Programme (PICIIP)

S.NO	Name	Signature
1	Muhd. Khalid s/o Sardar M	
2	M. Usman s/o M Shafi	
3	Rahim Abbas s/o Rana M. Safdar	
4	M. Arslan s/o Haji M. Akram	
5	M. Boota s/o Ali Asghar	
6	M. Nasir s/o M. Waryam	
7	M. Aslam s/o Mian Nabi	
8	M. Nadeem s/o Ghulam M	Nadeem
9	Dildar Ahmad s/o Siraj Din	
10	Bashir Ahmad s/o G M	Bashir
11	Asif Ali s/o M. Aslam	
12	~~Ghulam Haider~~ F.04/93 s/o Bashir Ahmad	

Dated:

Village: 95/6R Place of Meeting: Ghulam Hussain Farm

Attendance Sheet of Participants of Consultation Session: Sewage Treatment Plant (STP)-Sahiwal: Punjab Intermediate Cities Improvement Investment Programme (PICIIP)

S.NO	Name	Signature
1	Ghulam Hussain S/o Ch. Ali Muhd	Ghulam Hussain
2	M. Sharif S/o Mureed Ahmad	ظفر حسین
3	Nazar Hussain S/o Ch. Ali Muhd	ظفر حسین
4	M. Anwar S/o Faqir Hussain	M. Anwar
5	Muhd. Akram S/o Ali Muhd	M Akram
6	Shoukat Ali S/o Ghulam Mohiddin	Shaukat Ali.
7	Muhd Amjad S/o Faqir Muhd.	محمد امجد
8	Rizwan S/o M. Javed	رضوان
9	Waqas S/o Nazar Hussain	Waqas
10	Shoaib S/o M. Bashir	Shoaib
11	Ali Raza S/o G. Hussain	Ali Raza
12	Ch. Naveed S/o Haji Arshad	
13.	Wasim S/o Faqir Muhd	

Consultation Meetings for STP and Conveyance System

FGD: SOCIO-ECONOMIC SURVEY - STP SAHIWAL

CHAK NO: 135 A/ 9L
UNION COUNCIL NO: 24
CHAIRMAN NAME: AZEEM AZAM KHAN

SR#	NAME	ID CARD NO.	CONTACT NO.
1	AMMAN ULLAH	36502-3414047-9	0321 - 6910726
2	SAJJID ALI	36502-8459776-7	0321 - 6907913
3	MUHAMMAD NAYYAZ	36502-1288490-1	0305 -2184835
4	MUHAMMAD AWAIS	36502-1288492-5	0321 - 6981205
5	MUHAMMAD ASLAM	36502-7786659-7	NIL
6	AHMED SHUJA	36502-1288165-5	0320 - 4721030
7	MUHAMMAD ALMAS KASHIF	36502-5587084-9	0300- 45745275
8	MUHAMMAD NAVEED	36502-1030187-9	0302 -2153128
9	MUHAMMAD ARSALAN	36502-7489381-7	0313-7489381-7
10	ABDUL GHAFFOR	36502-0264186-3	NIL
11	MUHAMMAD NAEEM ANWER	36502-6229318-9	0300 - 6930628
12	ASIF NAYYAZ	36502-6978491-3	0321 - 4949420
13	ARMGHAN SHOIAB	36502-0940891-7	0320 -3073990
14	MUHAMMAD BILAL YONUS	36502-5369892-9	0321 -4392804
15	MUHAMMAD ANWER	36502-1288509-7	0313 - 6315135
16	JAVID HASSAN	36502-1062921-7	0306 - 9397739
17	MUHAMMAD SARWER	36502-1288482-7	0341- 6363073
18	MUHAMMAD TUAFAL ANJUM	36502-1384511-7	0322 - 7096533
19	MUHAMMAD MUBASHER HABIB	36502-4433654-3	NIL
20	ARSHAD HUSSAIN	36502-1288115-1	0303 - 7978579
21	ABDUL KARIM	36502-1288114-5	0312 - 6053135
22	FAYYAZ HUSSAIN	36502-1288116-7	0300 - 4170595
23	CH. AKHTARSALEEM IRFAN	36502-13986114-1	0311 - 6907913
24	MUHAMMAD AFZAL YONUS	36502-1283495-1	0321 – 6931038
25	MUHAMMAD MOHSIN	36502-5534450-1	0314 - 4560073
26	JHAGEER ALI	36502-8286509-5	0300 - 6936235
27	MUHAMMAD FAYYAZ	36502-4100155-1	0300 - 6907263
28	ABID ALI	36502-7456919-3	0321 - 6936835
29	MEHRAN AZEEM	36502-9537251-5	0321 - 6923225
30	NOUMAN ALI	36502-5949505-9	0300 -6917466
31	ABDUL GHAFFAR	36502-2293693-5	NIL
32	MANZOOR ALI	36502-7166307-1	0321 -6907913
33	NAVEED HASSAN	36502-9733751-3	0306 - 9397739
34	WAHEED HASSAN	36502-6618313-9	0320 - 7750071
35	MUHAMMAD ARSAD	36502-1622655-3	0301 - 7133638
36	BUHADAR ALI	36502-6981326-3	NIL
37	JUSTON JHAN PARWANA	36502-1348607-3	NIL
38	MUHAMMAD ASIF	36502-7100740-9	0300 - 6919722
39	MUHAMMAD ADNAN ALI	36502-9645884-7	0321 - 6931797

CHAK NO:3 MARLA HOUSING SCHEME
UNION COUNCIL NO: 11
CHAIRMAN NAME:MALIK FAROOQ

SR#	NAME	ID CARD NO.	CONTACT NO.
1	MUHAMMAD AKRAM	36502-1224346-5	0302 - 6921171
2	MUHAMMAD SHAFIQUE	36502-1341513-5	0315 - 6238321
3	LIAQUAT ALI	36502-5843169-9	0341 - 7209177
4	MUHAMMAD USMAN	36502-1172919-9	0303 - 9002969
5	MUHAMMAD HABIB	36502-6379851-1	0344 - 6106128
6	AMIR SALEEM	36502-5786557-5	0304 - 0542894
7	MUHAMMAD RIAZ	36502-7746252-1	0321 - 6903355
8	MUHAMMAD SHAFI	-------	0313 - 3317916
9	MIRZA MUHAMMAD AZAM	36502-7210225-7	0313 - 6901474
10	GHULAM HUSSAIN	36502-0986827-9	0345 - 7458094
11	MUHAMMAD SALEEM	36502-1335144-1	0301 - 6912387
12	TALIB HUSSIAN	-------	0321 - 6907376
13	MUHAMMAD ASLAM	36502-2369857-3	0304 - 0762205
14	ILYAS UR REHMAN	36502-5434081-3	0300 - 3710500
15	MUHAMMAD AFZAL JAVID	36502-8647762-1	0321 - 5250188
16	MUHAMMAD FAIZAN ALI	36502-5167146-0	0302 - 6928092
17	ZAHID RASHID	36502-1091634-3	0301 - 6530136
18	NAEEM NASIM	36502-4791874-3	0302 - 6925938
19	NADEEM	36502-7224020-5	0302 - 6910738
20	MUHAMMAD ASIF IQBAL	36502-1262003-3	0300 - 8674297
21	IFTIKHAR HUSSAIN	36501-9300564-3	0300 - 4849187
22	RANA SHABIR HUSSAIN	36502-1403892-7	0308 - 6934140
23	KHALID MEHMOOD	36502-1307112-5	0321 - 6935198
24	HAFIZ MUJAHID	----------	0334 - 7133693
25	KHALID ZIA	36502-3904455-7	0300 - 6906850
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UNION COUNCIL NO: 42

SR#	NAME	ID CARD NO.	CONTACT NO.
1	CH. BASHIR AHMED	36502-0185138-1	0301 - 3713694
2	BASHIR AHMED	36502-1098950-5	0301 - 6538543
3	SAJID MEHMOOD	36502-5145597-3	0300 - 6513809
4	M. ASHFAQ	36502-2406088-1	0306 - 7919493
5	BAO ALLAH DATA	36502-9694417-7	NIL
6	ABDULL KHALIQ	36502-4053618-7	0345 - 4700025
7	ZESHAN SAJID	36502-4961606-7	0302-6538761
8	M. SEWAR NAJMI	36502-3731704-7	0307 - 6931432
9	RASHID AHMED	36502-3710694-1	0302 - 7107212
10	M. KASHIF RAFIQ	36502-4753186-1	0305 - 77727553
11	MANZOOR	36502-4529103-3	NIL
12	SAJID ALI	36502-8782765-3	0302- 7552612
13	JAFAR HUSSAIN	36502-1278113-5	0306 - 7532750
14	M. AMIN	36502-6385162-7	0300- 6900930
15	M. AKBAR	36502-5443714-5	0347-3284215
16	M. NAZIR	36502-3335484-9	NIL
17	M. ANWER NAVID	36502-5607053-5	0300- 9691252
18	M. WAQAS	36502-7531177-5	0308- 8556172
19	NAVID MASIH	36502-0534235-1	0302-4855598
20	IRFAN	36502-7420952-7	0300 - 4040087
21	MUKHTAR AHMED	36502-4290720-9	NIL
22	ABDULL JABBAR	36502-0997396-5	NIL
23	AMJID RAFIQ	36502-6231667-5	0300 - 4040087
24	TAJ DIN	36502-7532583-1	0305-7101395
25	M. RIZWAN	36502-4447579-3	0348 - 4216003
26	M. SAJID	36502-1352288-7	0300 - 6936455
27	M. ASHIQ	36502-4946373-7	NIL
28	M. ISMAEEL	36502-2585455-1	0305 - 7530036
29	M. AKRAM	36502-7994345-1	0304 - 6484693
30	M. RAMAZAN	36502-1277855-9	0303 - 7805294
31	M. RIZWAN	36502-4447579-3	0348 - 4216003
32	SHAHBAZ ALI	36502-5313272-5	0305 - 6744755
33	PEER BUKSH ANJUM	36502-1409738-7	0322 -7057194
34	M. SADIQ	36501-6883206-9	NIL
35	M. ASHRAF	36502-1328225-7	NIL
36	M. SALEEM TAHIR	36502-5682518-3	0308-5094355
37	M. FASAIL	36502-56604811	0303 -7970893
38	ALI SHUKRAN	36502-2995282-1	0344 - 4445177
39	QASIM ALI	36502-2077026-7	0302 - 5844856
40	BASHIR AHMED	36502-1854876-7	NIL
41	M.RIAZ	36502-3319461-5	0305-6722840

CHAK NO:95/6R
UNION COUNCIL NO:11
CHAIRMAN NAME: MALIK FAROOQ

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5	BASHIR AHMED	36502-8939137-1	0302-6530940
6	M.REHMAN	36502-3614398-3	0305-8438395
7	ARSHAAD	36502-4680159-9	NIL
8	M. RIZWAN	36502-0308707-5	0322-8775740
9	M. AFZIL	36502-2841576-1	0345-7442208
10	M. IRFAN	36502-1091502-5	0305-3952237
11	SABBAR HUSSIAN	36502-6778276-5	0346-7460490
12	M. SHAKEEL	33105-6642242-9	0342-0220600
13	ASLAM MASIH	36502-2707868-3	NIL
14	AKRAM MASIH	36502-9339725-7	NIL
15	NADEEM MASIH	36502-4051413-3	NIL
16	M. HANIF	36502-1086956-9	NIL
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19	MAQSOOD MASIH	36502-0950212-3	0301-6136994
20	MAQBOOL	------	0307-2734762
21	TALIB HUSSAIN	------	0301-6917281
22	M. SADIQUE	------	0345-7444894
23	AKRAM UL HAQ	------	0304-1468986
24	HAKAM ALI	------	0305-8911475
25	M. SHARIF	------	0302-6534314
26	M. AKRAM	------	0321-6938733
27	MALIK KHAN	36502-64161126-1	NIL

Insert Photographs of Public Consultation workshop followed by 2 pages of signed attendance sheets

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18. Draft Land Acquisition and Resettlement Plan. Sahiwal Bus Terminals Upgrade. Local Community and Development Department, Government of Punjab. February 2017