Initial Environmental Examination

Project Number: 51036-002
August 2021

Pakistan: Khyber Pakhtunkhwa Cities Improvement Project

Mingora Greater Water Supply Scheme and Surface Water Treatment Plant

Prepared by Project Management Unit, Local Government, Elections and Rural Development Department, Government of Khyber Pakhtunkhwa for the Asian Development Bank.

GOVERNMENT OF KHYBER PAKHTUNKHWA
PROJECT MANAGEMENT UNIT
KHYBER PAKHTUNKHWA CITIES IMPROVEMENT PROJECT
LOCAL GOVERNMENT, ELECTIONS & RURAL DEVELOPMENT DEPARTMENT, PESHAWAR

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No: LGE&RD/KPCIP/2021/712-713 **Dated: 24 August 2021**

To:

Mr. Kiyoshi O. Nakamitsu
Principal Urban Development Specialist
CWRD, ADB, 6 ADB Avenue, Mandaluyong City
1550 Metro Manila, Philippines
Tel: +63-2-632-4444
Manila, Philippines.

Subject: **51036-002-PAK: KHYBER PAKHTUNKHWA CITIES IMPROVEMENT PROJECT**
- ***ENDORSEMENT OF ENVIRONMENT AND SOCIAL SAFEGUARDS DOCUMENTS***

Dear Mr. Kiyoshi,

This is to confirm our endorsement of the following documents and their disclosure:

- Environmental Impact Assessment: Abbottabad Solid Waste Management Facility Development
- Environmental Impact Assessment: Mardan Solid Waste Management Facility Development
- Environmental Impact Assessment: Mingora Solid Waste Management Facility Development
- Environmental Impact Assessment: Peshawar Solid Waste Management Facility Development
- Initial Environmental Examination: Extension of JICA Water Treatment Plant and Gravity Water Supply Scheme (Abbottabad)
- Initial Environmental Examination: Construction and Improvement of Sewage Treatment System at Kohat Development Authority Township, Kohat
- Initial Environmental Examination: Construction of Rorya Sewage Treatment Plant and Revamping of Sewerage System in Mardan
- Initial Environmental Examination: Kohat Solid Waste Management Facility
- Initial Environmental Examination: Improvement of Water Supply System Kohat
- Initial Environmental Examination: Salhad Park Abbottabad
- Initial Environmental Examination: Water Supply Scheme, Mingora
- Initial Environmental Examination: Improvement of Water Supply System Peshawar
- Social Due Diligence Report
- Land Acquisition and Resettlement Framework
- Land Acquisition and Resettlement Plan: Landfill Site in Abbottabad
- Land Acquisition and Resettlement Plan: Landfill Site in Kohat
- Land Acquisition and Resettlement Plan: Access Route to Landfill Site in Mingora
- Land Acquisition and Resettlement Plan: Greater Water Supply Scheme Mingora
- Land Acquisition and Resettlement Plan and Environmental Safeguard Documents: Pedestrianization of Abbottabad Old City
- Corrective Action Plan: Chuna Water Supply, Abbottabad
- Corrective Action Plan: Integrated Solid Waste Management System & Landfill Site Mingora
- Corrective Action Plan: Integrated Solid Waste Management System & Landfill Site Peshawar
- Environmental Management Plan
- Resettlement Plan
- Due Diligence Report for Use of ADB Funds for Land Acquisition and Resettlement

We are committed to their full implementation in compliance with the requirements of ADB SPS (2009) Policy, please

(VASIF SHINWARI)
PROJECT DIRECTOR
PMU, KPCIP, LGE&RDD, Peshawar

Copy to:
- PS to Secretary LGE&RDD – for information

CURRENCY EQUIVALENTS

As of 20 August 2021	Currency Unit – Pak Rupees (Pak Rs.)
Pak Rs 1.00 = $ 0.0061	US$1.00 = Pak Rs. 164

CONVERSIONS

1 meter = 3.28 feet
1 hectare = 2.47 acre

ACRONYMS

ADB	Asian Development Bank
AIP	Access to Information Policy
AMSL	Above Mean Sea Level
BC	Before Construction
BOQ	Bill of Quantities
CORDEX	Coordinated Regional Downscaling Experiment
COVID-19	Corona Virus Infectious Disease-2019
CSC	Construction Supervision Consultant
DC	During Construction
DO	During Operation
EA	Executing Agency
EDCM	Engineering Design Construction Management
EGL	Existing Ground Level
EHS	Environmental, Health, and Safety
EIA	Environment Impact Assessment
EMP	Environmental Management Plan
EPA	Environmental Protection Agency
GER	Gross Enrollment Rate
GoP	Government of Pakistan
GRM	Grievance Redress Mechanism
GWSS	Gravity Water Supply Scheme
HDPE	High Density Polyethylene
IA	Implementing Agency
IEE	Initial Environmental Examination
IFC	International Finance Corporation
IPCC	Intergovernmental Panel on Climate Change
KP	Khyber Pakhtunkhwa
KPCIP	Khyber Pakhtunkhwa Cities Improvement Project
KP-EPA	Khyber Pakhtunkhwa Environmental Protection Agency
KPI	Key Performance Indicator
LAA	Land Acquisition Act (of 1984)
LARP	Land Acquisition and Resettlement Plan
Lea	Equivalent sound pressure level
LGERDD	Local Government, Elections and Rural Development Department
LHW	Lady Health Worker
LULC	Land use/Land cover
MGD	Million Gallons per Day
MSDS	Material Safety Data Sheet
NCS	National Conservation Strategy
NEP	National Environmental Policy
NEQS	National Environmental Quality Standards

NRW	Non-Revenue Water
NER	Net Enrollment Rate
OHS	Occupational Health and Safety
O&M	Operation & Maintenance
PAP	Project Affected Persons
PC	Public consultation
PCC	Plain Cement Concrete
PCOs	Public Call Offices
PDD	Planning & Development Department
PEP Act	Pakistan Environment Protection Act 1997
PEPC	Pakistan Environmental Protection Council
PGA	Peak Ground Acceleration
PMU	Project Management Unit
PPE	Personal Protective Equipment
RCC	Reinforced Cement Concrete
REA	Rapid Environmental Assessment
RFP	Request for Proposal
RP	Resettlement Plan
SCADA	Supervisory control and data acquisition
SOPs	Standard Operating Procedures
SS	Suspended Solids
SPS	Safeguard Policy Statement
SSEMP	Site Specific Environmental Management Plan
TMA	Tehsil Municipal Administration
TMP	Traffic Management Plan
USEPA	United States Environmental Protection Agency
WHO	World Health Organization
WTP	Water Treatment Plant
WSSC	Water and Sanitation Services Company
WSSCS	Water and Sanitation Services Company Swat

NOTE

In this report, “$” refers to US dollars

DEFINITION OF TERMS

"Chlorination" Water chlorination is the process of adding chlorine or chlorine compounds such as sodium hypochlorite to water. This method is used to kill bacteria, viruses and other microbes in water. In particular, chlorination is used to prevent the spread of waterborne diseases.

"Clarifier"Clarifiers are settling tanks built with mechanical means for continuous removal of solids being deposited by sedimentation. A clarifier is generally used to remove solid particulates or suspended solids from liquid for clarification and/or thickening

"Coagulation&Flocculation"The coagulation process involves adding iron or aluminum salts, such as aluminum sulphate, ferric sulphate, ferric chloride or polymers, to the water. These chemicals are called coagulants, and have a positive charge. The positive charge of the coagulant neutralizes the negative charge of dissolved and suspended particles in the water. When these reactions occurs, the particles bind together, or coagulate (this process is sometimes also called flocculation). The larger particles, or floc, are heavy and quickly settle to the bottom of the water supply.

"Ground Water": The supply of fresh water found beneath the Earth's surface, usually in aquifers, which supply wells and springs.

"Laws": means state and local laws and all regulations, rules, orders, decrees, decisions, instructions, requirements, policies and guidance which are issued or made by any Relevant Authority and which are legally binding, as any of them may be amended from time to time.

"Nodal Demand"It's a demand for each node in a water distribution network calculated by multiplying as representative length and demand per meter length. Demand per meter length is calculated by q = Q/total network length, where Q is total demand of concerned area

"Peaking Factor"Peak wateruse is typically expressed as a ratio, orpeaking factor, dividing thepeak wateruse by the average daily water use. Water supply networks design on peaking factor

"Per Capita Demand"It is the annual average amount of daily water required by one person and includes the domestic use, industrial and commercial use, public use, wastes, thefts, etc.

"Personal Protective Equipment" (also PPE): Clothing and equipment worn by pesticide mixers, loaders and applicators and re-entry workers, hazmat emergency responders, which is worn to reduce their exposure to potentially hazardous chemicals and other pollutants.

"Peak Ground Acceleration" (PGA) is a measure of earthquake acceleration on the ground and an important input parameter for earthquake engineering.

"PRVs"A relief valve or pressure relief valve (PRV) is a type of safety valve used to control or limit the pressure in a system

"Rapid Sand Filtration" Rapid sand filtration is a purely physical drinking water purification method. Rapid sand filters (RSF) provide rapid and efficient removal of relatively large suspended particles.

"Risk Assessment": Qualitative and quantitative evaluation of the risk posed to human health and/or the environment by the actual or potential presence and/or use of specific pollutants.

“SCADA” Supervisory control and data acquisition (SCADA) is a system of software and hardware elements that allows industrial organizations to Control industrial processes locally or at remote locations

“Sedimentation” Sedimentation is the process of allowing particles in suspension in water to settle out of the suspension under the effect of gravity

“Sheet Flow”An overland flow or downslope movement of water taking the form of a thin, continuous film over relatively smooth soil or rock surfaces and not concentrated into channels larger than rills

“Sludge”sludge is the solid, semisolid, or slurry residual material that is produced as a by-product of water treatment processes

“Transmission Main”Transmission main are larger pipes (12” & 24” in diameter and larger) which are designed to move large quantities of water from the source to treatment plant

“Treated Water Supply Main” Treated water supply main are larger pipes (12” in diameter and larger) which are designed to move large quantities of water from water treatment plant to the smaller distribution mains.

CONTENT DETAILS

S/No.	Version	Date	Summary of Revisions made
1	1	20-08-2021	Final Draft of IEE report

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Executive Summary

Project Overview

1. The Khyber Pakhtunkhwa Cities Improvement Projects (KPCIP) will improve the quality of life of the residents of five KP cities, including Abbottabad, Kohat, Mardan, Mingora, and Peshawar, directly benefitting about 6 million of urban population. KPCIP will help selected cities improve their access to quality urban services through three interlinked outputs: (i) Climate resilient and gender friendly urban infrastructure improve, (ii) Institutional capacities of urban service providers and governments strengthened, and (iii) Increased women's participation in urban governance and access to economic opportunities.

2. KPCIP will support the Government of Pakistan's development priorities, established in (i) the National Water Policy (2018), (ii) the Local Government Act (2019), and (iii) Pakistan Vision 2025. The project is also aligned with ADB's operational priorities of (i) addressing remaining poverty and reducing inequalities; (ii) accelerating progress in gender equality; (iii) tracking climate change, building climate and disaster readiness; (iv) making cities more livable; and (v) strengthening governance and institutional capacity, outlined in ADB's Strategy 2030, and is included in ADB's country operations business plan for Pakistan, 2021–2023.

3. The project readiness financing (approved in March 2019) has financed the preparation and engineering design of the KPCIP. The Department of Local Government, Elections and Rural Development Department (LGE&RDD), the Government of Khyber Pakhtunkhwa, will be the executing agency for the project and the city governments of the five target cities, including the respective Water and Sanitation Services Companies, will be the implementing agencies.

4. This report has been prepared based on detailed engineering designs, due diligence assessments, and studies conducted by the government and project readiness financing consultants. The Government of Pakistan, Asian Development Bank (ADB), and Asia Infrastructure Investment Bank (AIIB) are expected to approve KPCIP in Q3 2021

5. The Khyber Pakhtunkhaw Cities Improvement Project (KPCIP) is being processed through the Project Readiness Finance (PRF) modality by Asian Development Bank (ADB) under Loan 6016-PAK, being executed by KP Local Government Election and Rural Development Department (LGE&RDD). The Project is focused on investments of subprojects related to water supply, sanitation and drainage, solid waste management, and urban/green spaces. The Project has the following four major components:

- Improvement of water supply systems in five (5) cities.
- Improvement of sewerage and drainage systems in five (5) cities, including provision of sewage treatment plants (STPs)
- Provision of Integrated Solid Waste management (ISWM) system in five (5) cities
- Development of Urban/Green Spaces in five cities.

6. The proposed Mingora Greater Water Supply Scheme and Surface water treatment plant has the following two main components:

Component 1: Construction of surface water treatment plant on left bank of Swat River and to increase total available water reservoirs, currently there are 67 no. of existing and proposed water storage reservoirs in the city.

Component 2: To fulfill water supply requirements of Mingora city for the projected planning horizon population, from surface water source, i.e. River Swat, via a gravity-based transmission system of 20 Km length and distribution network.

7. The proposed project aims to fulfill water supply requirements of Mingora city for the projected planning horizon population, from a surface water source, via a gravity-based transmission and distribution system. The proposed project will include drawing water from intake at River Swat. The water from intakes shall be transported to the proposed water treatment plant.

8. The identified location of intake site is located in a wide river reach/floodplain about 600 m. The natural river bed slope prevailing in the study reach is between of 1 in 200 to 1 in 250. The project proposed intake site is located about 62 km upstream of Amandara Barrage and 710m downstream of Matta Bridge across River Swat on main Nowshehra-Chakdara-Chitral (NCC) road.

9. The water treatment plant has been proposed to be constructed at the left bank of River Swat at about 20 km Upstream of Mingora City, District Swat, Khyber Pakhtunkhwa (KP).The proposed water treatment plant has been designed based on the ultimate water flow of 46 cusec (30 MGD).In addition to design flow 10 % of flow has been additionally added for friction and other losses. Two parallel treatment streams/trains (each having flow of 15 MGD) have been proposed to provide flexibility in operation. Each train will consist of one plain sedimentation tank, two flash mixers & flocculation chambers, two clarifiers, one rapid gravity filter unit, one chlorine contact tank and treated water tank.

10. Raw water from River Swat is first conveyed from the Raw Water Intake structure to the proposed water treatment plant, and then the treated water will be supplied via transmission main pipeline from the proposed water treatment plant to multiple water storage reservoirs in Mingora city. The proposed transmission main is having a length of approximately 20kms which is designed to be operated under gravity up to the receiving water storage reservoirs in Mingora city. The proposed ROW of water supply line is 3 meters and will be established in the government and private land.

11. The transmission main originates from clear water reservoirs of the treatment plant and ends near Hayatabad area i.e. the first receiving storage reservoir in Mingora City. From that point onward, the proposed1200 mm transmission main branches out into various smaller diameter supply mains in the city.

12. There are 67 no. of existing and proposed water storage reservoirs in the city. Catchment area for each water storage reservoir was marked and number of plots was counted for each catchment. Accordingly, the population for each water storage reservoir or catchment was calculated keeping in view the criteria of 7 persons per house. Allowance for future projected population was also considered as per the population projection estimates.

13. In Mingora city, Water and Sanitation Services Company (WSSC) is operational in nine (9) Union Councils (UCs). The names of the UCs under the jurisdiction of WSSC Swat are(i)UC-1 - Nawakalay/ Shadara, (ii)UC-2 - Banr/ Usmanabad, (iii)UC-3 - Malook Abad, (iv)UC-4 – Rang Mohallah / Gumbat Maira(v)UC-5 - Malakanan Landy Kass(vi)UC-6 – Rahimabad(vii)UC-7 - Amankot/ Faizabad(viii)UC-8 - Panr / Gulkada(ix)UC-9 - Saidu Sharif/ Shagai

14. Location map of the project is provided as **Figure ES-1.**Project schematic layout showing all the major components (excluding distribution network) of Mingora Greater Water Supply Scheme is presented in **Figure ES-2.**

Project Need

15. The current mode of operation for water supply in Mingora city is intermittent through ground water sources with approximately 64 number of tube wells. Rapid depletion of ground water table has been observed during recent years, with approximately 40 feet of draw down observed in some parts of Mingora city during last year. The depleting ground water levels has been a cause of concern for the city threatening the reliability of supply to the residents of the city. Therefore, a reliable surface water source is deemed necessary for Mingora city.

16. High energy costs related to pumping is another main reason that the city cannot operate on a 24/7 mode of water supply. The distribution network is spread on a large area with elevation difference of 920 to 1100 meters. Accordingly, the water network is divided into several pressure zones. Each pressure zone has its own set of tube wells installed. Water is pumped from these tube wells to water storage reservoirs and then distributed under gravity fed pipelines. In few cases, direct pumping from source to distribution network is also being practiced. On average, a normal consumer gets 1 hour of water supply on daily basis in Mingora city. Major part of the water supply is wasted by illegal connections, non-revenue water (NRW), and leakages. NRW percentage for Mingora city is reported to be around 60 percent.

17. Based on the population estimates, the average daily demand for Mingora city was calculated assuming 35 gallons per capita per day as the daily consumption rate. The projected water demand indicates that the current water demand of Mingora city is approximately 12 million gallons per day (MGPD) while the projected demand for 30 years design period (2050) is estimated as 30 MGPD. To fulfill the existing demand and projected demand of water for Mingora and to close existing system constraints like intermittent supply, illegal connections/leakages and NRW in Mingora, development of dedicated water supply is pressing need of the city.

Project Benefits

18. The main benefits of this project include the following:

- Mingora Greater Water Supply will eliminate the need to rely on tube wells in mostly all the areas currently served by WSSC Swat;
- Project has lower operational costs by reducing or eliminating pumping costs in the system;
- Mingora greater water supply will be a surface water source-based supply which is more sustainable and reliable than the current pumping-based tube well source of supply;

19. The project will provide an end-to-end solution from source to end customers including intake structure, water treatment plant, transmission main, storage reservoirs, distribution network inside the city, and water metering system.

Environment Category of the Project

20. According to ADB's Safeguard Policy Statement (SPS) 2009, a Rapid Environmental Assessment (REA) Checklist was prepared for the proposed Mingora surface water treatment plant and greater water supply scheme. Based on the initial findings, it was ascertained that certain adverse environmental impacts are site specific due to development of the proposed "Mingora Greater Water Supply Scheme", impacts and short term and can be mitigated with the proposed mitigation measures and thus the subject project is considered environmentally "B" category as per ADB SPS, 2009. Therefore, an IEE has been conducted. The project before its commencement will comply with the IEE/EIA regulations, 2000 and necessary approval will be obtained from KP EPA.

Study Methodology

21. According to ADB's Safeguard Policy Statement (SPS) 2009, a Rapid Environmental Assessment (REA) Checklist was prepared for the proposed Mingora Water Supply Sheme.This involves collecting information from the ADB, PMU KPCIP and Engineering Design and Construction Management (EDCM) technical team on the proposed project activities and understanding the activities to identify potential impacts of implementing these.

22. Both secondary and primary data on ambient noise levels and air quality, water resources, flora, fauna and information from the detailed design conducted for this and other projects of similar nature was collected, reviewed, and analyzed. Extensive field visits to the project area were undertaken and key receptors and stakeholders within the project area have been identified and consulted.

23. Surface water quality was monitored to assess raw water quality of Intake structures. The twenty-four hours composite sampling through KP EPA certified lab was performed for two (2) consecutive days during the month of June 2020 and then one day sampling was carried out in September 2020.The test results of raw water at Khawazakhela intake indicates the presence of turbidity, Suspended solids and coliforms.

24. Detailed ambient air quality and noise monitoring at different key receptor points in the project area were conducted. Apart from exceedence in PM_{10} at various locations, all other pollutants are within the applicable 'most stringent' standards/guidelines. The ambient noise levels were also assessed to be generally within the applicable standards/guidelines during the day time while exceedances at various locations were observed during the night time. Furthermore, the ground water quality samples were also assessed to be within the applicable NEQS limits.

25. The significance of impacts from the proposed project were then assessed and for those impacts requiring mitigation, suitable measures were proposed to reduce impacts to within acceptable limits as per local and international applicable regulations. A detailed environmental management and monitoring plan was developed to ensure compliance to the proposed measures during the project development.

Baseline Conditions

Physical Environment

26. The project is located in Mingora city, district headquarter of Swat. The town is situated in the lower areas of Hindu Kush about 170 Km northeast of Peshawar. Mingora city acts as a tourist center for Swat Valley. It is also a market town for the fertile Swat Valley and supplies much of its products to Peshawar and other parts of the province. The climate of the area is characterized as moderate. During summer, it is somewhat warm in the lower areas of the valley but cool and refreshing further north of Mingora. The winter months extend from November to February. Rain and snow occur during this season.

27. Topography of Mingora is comprised of mountains ranges (offshoots of Hindukush) and associated valleys with plains. Proposed Mingora Greater Water Supply Scheme Intake structure is run of the river project to be constructed on Swat River.

28. The intake is located on the left end of the river and is inclined at an angle of about 53 deg to the axis of approach channel. In a normal year, the low flows in Swat River are around 1200 / 1300 cfs in the month of December and January. In the summer, the normal high flows are around 11, 000 to 16, 000 cfs in July and August. Normal yearly floods can raise the flows to 20,000 to 25,000 cfs.

29. The project area (Swat) falls in Seismic Zone 3 with peak ground acceleration of 0.24 to 0.32g, according to the Seismic Zoning Map of Pakistan. It is therefore, recommended that the project structures should be designed to cater for the requirements of Zone 3 of Building Code of Pakistan (2007).

30. In general, the ambient air of project area seems to be of good quality. Ambient air quality monitoring at four different locations within area of influence has been conducted as part of collecting baseline data. Results shows that the ambient air quality is within the acceptable NEQS standards with Particulate matter PM_{10} being the only pollutant that is exceeding stringent WHO guidelines at all the monitored locations. Increased PM_{10} in air is due to unpaved roads within the vicinity, fields, or increased residential fires for cooking purpose due to unavailability of gas supply within nearby villages.

31. Raw water characterization study was carried to assess raw water quality of Intake structures. The twenty-four hours composite sampling through KP EPA certified lab was performed for two (2) consecutive days during the month of June 2020 and then one day sampling was carried out in September 2020. The test result of raw water at intake indicates the presence of turbidity, Suspended solids and coliforms. The turbidity values are within the permissible limit of NEQS for drinking water i.e., >5NTU. Typical values of turbidity from collected grab samples at both streams are in the range 20-40 NTU.

32. The presence of total coliform, fecal coliform, and E-Coli has also been reported within the permissible limits. During EDCM details survey no upstream drains were located Project design has incorporated the treatment of microbial contamination and it is recommended that repeat sampling and analysis exercise should be carried out to validate the results and to trace the microbial contamination at intake structures.

Biological Environment:

33. Site is falling outside environmental sensitive areas (Wildlife Park, Wildlife sanctuary, Game Reserve or Protected/Reserved Forests) and critical habitats. Site of WTP is located in agriculture land along the bank of Swat River. Proposed ROW of water supply mains would be of 3 meter which will be completely restored once laying of pipeline is completed hence no significant impact of ecological environment of the area is projected.

34. Major land use of the WTP is cropped land (66%) followed by barren land (13.4%), Settlements (8.5%) and tree cover (7%). The present flora of the cultivated areas around Mingora is exotic. The common trees are Phulai, Honey Mesquite, Ber, Jand, Mulberry, Indian rosewood, Tamarisk and blue gum. The most common shrubs Turmeric, Small red poppy and spear grass.

35. Indian Grey Mongoose, Golden Jackal, Wild Goat, Pheasant, Black-necked Spitting Cobra and Mule are the common fauna of the area. As per IBAT report of other KPCIP project (landfill site at Khetwaro Maira), there are 27 numbers of threatened species that are potentially found within 50 Km from area of interest which include 17 avian species, 06 mammalian, 03 Actinopterygii, and 01 Magnoliopsida. As WTP is located in agriculture land and water supply network is located in urban sprawl of Mingora city and habitats has been converted into human settlements at large scale therefore no impact on such species is expected from project activities.

Social Environment:

36. The project area falls in Mingora city, district Swat Khyber Pakhtunkhwa province. The city having 9 union councils. Mingora is not only the administrative capital of Swat Valley; it is also the main center of social, cultural and economic activities in the Malakand region.

37. The project proposed intake site is located about 62 km upstream of Amandara Barrage and 710 m downstream of Matta Bridge across River Swat on main Nowshehra-Chakdara-Chitral (NCC) road. The water treatment plant has been proposed to be constructed at the left bank of River Swat at about 20 km Upstream of Mingora City, District Swat, Khyber Pakhtunkhwa (KP).

38. Proposed project involve construction of water supply scheme on 15 acres of land, crops and trees. Length of water supply main would be 20 km. The proposed ROW of water supply line is 3 meters and will be established in the government and private land. The components also include the intake structures, treatment plant, and water reservoir, 10 no of surface tank and 8 nos. of OHRs. The proposed ROW of water supply line is 3 meters and will be established in the government and private land.

39. No building/housing structure fall within proposed WTP area. There are scattered concentrations of residential properties of varying sizes, almost all of them at respectable distances away from the site perimeter. Major settlement of the project area include Hyatabad, Bandai, Ghareeb abad Bandai, Alam Ganj, Qayyum Market Dakorak, Kamel pura, Sangota, Ahingaro Dherai and naway kalay.

40. Mingora is a beautiful city with moderate weather and tourist attractions. Since the time of the Swat State (1915-1969) tourists from inside and outside the country stayed in Mingora before moving to the upper valleys of Swat. The city is also home to rare Buddhist ruins and stupas.

41. Apart from the local Yousafzai tribe of the Pashtuns (predominantly Muslim), Hindu and Sikh families also live in the city-giving diversity to its cultural life.

Public Consultation Process

42. Public consultations were organized through Focus Group Discussions (FGDs) within local community in the month of May, 2020. Total 3 FGDs were conducted on Mingora Greater Water Supply Scheme& Surface Water Treatment Plant, Mingora. Information on positive and negative impacts associated with construction and operational stage and proper mitigation of adverse impacts were shared at these consultations. Consultations were also carried out with primary, secondary and institutional stakeholders in Mingora city and findings are documented in this IEE report.

43. Round of consultations at Khawzkhela and Charbagh has been carried out by EDCM and PMU to brief local community about the project and to seek feedback about the project. Information on positive and negative impacts associated with construction and operation phase of the project were discussed. Findings of consultation shows that ROW alignment for transmission main is passing from fields which is the only source of livelihood of land owners. Project design team should review the alignment and consider it passing along the river or along the road. Project design should be revised to avoid such issues.

44. Consultation plan for construction and operation phase of Mingora water supply scheme will be prepared in order to take response of project stakeholders and general public about the project. Periodic consultations and community feedback surveys will be carried out to develop positive perception about the project. Intended stakeholders for such consultations will be all stakeholders that are consulted at the time of IEE preparation and KPCIP PRF processing. Record of such consultations will be maintained at PMU/WSSC Swat offices and necessary changes in operational modalities will be introduced in the system in light of the response provided by the consultees.

Analysis of Alternatives

45. If 'no project' option is triggered, it will result in loss of all positive impacts caused that project will pose on Mingora city; such as improved and sustainable potable water availability to citizens of Mingora for next thirty years, the project will reduce abstraction of ground water from tube wells and water bores omitting chances of ground water depletion. At the most clean potable water will reduce water borne disease and ultimately reduced pressure on health care system.

46. Furthermore, project implementation will also create job opportunities during construction, thereby improving the socioeconomic condition of the local people and help in improving their quality of life. Thus, the 'no project' option is not a viable option.

Site Alternatives

47. The route of the proposed transmission main is mainly going through the open agriculture fields. The option of pipe route along the main Madyan road/N-95 was not feasible due to the residential and commercial properties along the route at multiple locations. A 3 meter corridor width is proposed for the proposed transmission main for the future operation and maintenance purposes. The route of the proposed transmission main has been adjusted based on the existing features identified in

topographic survey. Some structures along the route of the pipe were avoided including cellular tower, houses or commercial properties. The proposed route was selected such that to the extent possible, maximum bends in the pipe line and road crossings are avoided or minimized. Inside the city area, the proposed transmission main will run along the main Madyan road.

Water Treatment Plant Technology Alternatives

48. The applicable treatment processes for treatment of surface water with turbidity and suspended solids' loads are:

- Conventional Water Treatment
- Membrane Filtration (through Ultra-Filtration)

49. Conventional water treatment comprises coagulation, flocculation and clarification followed by filtration and disinfection while Membrane filtration, microfiltration and ultra-filtration are also used for the removal of turbidity / particulates, bacteria and virus. The filtration through membrane takes place by separation of particulate from water while raw water passes through membranes under pressure.

50. Conventional Water Treatment Plant (CWTP) is simpler and environmental friendly as compared to complex Membrane Water Filtration Systems (MWFS). Energy requirements for CWTP are lower as compared to (MWFS) which can reach 0.3 KWh/m^3 of treated water. Conventional System involve Civil Works that last up to 50 years while Membrane System needs to be replaced every 5 years. Moreover, Conventional System is less complex and requires less technical expertise in compare to Membrane Systems which need careful supervision.

51. Proposed WTP at Mingora is designed on CWTP because it is cost effective for high volumes treatment with limited operational constraints as compare to Ultra filteration.

Potential Major Impacts

52. The Impact screening matrices for the pre-construction, construction and operation phases of the Mingora greater water supply scheme are provided below as **Tables ES.1, ES.2** and **ES.3**.

53. **Pre-construction/design phase**: The key potential impacts that have been assessed and for which necessary mitigation measures have also been proposed, as required, are as follows:

- Improper selection of intake source and reduce ecological flows
- Improper location of water storage tanks
- Improper designing of distribution networks including transmission main

54. **Construction phase**: The key potential impacts that have been assessed and for which necessary mitigation measures have also been proposed, as required, are as follows:

- Construction of water treatment plant and other structures not in accordance with finalized design
- Impacts associated with construction of water distribution network including

transmission and supply mains

- Traffic congestion and community health and safety issues
- Occupational health and safety issues
- Communicable diseases including COVID-19
- Improper handling and/or disposal of hazardous and non-hazardous waste

55. **Operation phase:** The key potential impacts that have been assessed and for which necessary mitigation measures have also been proposed, as required are as follows:

- Generation of Sludge and wash water
- Water system leaks and water discharges
- Handling of Hazardous Chemicals and Chlorine release
- Occupational Health and Safety including COVID-19
- Generation of Solid waste

Mitigation Measures

56. Mitigation measures associated with design, construction and operation phases are detailed in the IEE report. Necessary design considerations have been included for intake water source and location of intake structure, water treatment plant and technology for water treatment. The intake points have been selected that the raw water shall be conveyed under gravity and without exploiting downstream water use of Swat River. Detailed hydrological analysis has been conducted for both intake source and is designed to sufficiently fulfill water requirement for next 30 years.The route of the proposed transmission main has been adjusted based on the existing features identified in topographic survey. Some structures along the route of the pipe were avoided including cellular tower, houses or commercial properties. Conventional water treatment plant is suggested to limit usage of chemicals and high cost equipment's like membranes. Mitigations associated with construction phase are detailed in the IEE report to avoid construction related impacts.

57. Major impacts associated with construction activity are clearance of vegetation, traffic hindrance and social grievances during laying of pipeline networks within city. Proposed WTP is located in agriculture land involving limited vegetation clearing. Necessary plantation will be carried out to improve aesthetic appeal of the area. Transmission main shall be laid to avoid tree cutting with minimum vegetation clearance. RoW for Transmission main shall be restored. Contractor camp shall be located on a vacant land to avoid unnecessary clearance. Traffic management plan shall be developed to avoid hindrance to locals while laying of distribution networks.

58. Mitigations associated with operations phase are handling of solid waste and sludge generated during operation phase. Solid waste management plan is developed to manage solid waste generated during operation. For settled sludge two circular sludge holding tanks (one for each train) are proposed with a diameter of 10 m. The sludge from plain sedimentation tanks and clarifiers shall be discharge to the sludge holding tanks through pumping. The sludge from the holding tanks will transported into nearby

landfill site. The wash water received from filter beds, contains a little number of solids. The wash water will be discharged into nearest drain.

Environmental Management Plan

59. For the effective implementation and management of mitigation measures, an Environmental Management Plan (EMP) has been prepared and given in section 7of the IEE report. The EMP provides a delivery mechanism to address potential impacts of project activities, to enhance project benefits and to introduce standards of good practice in all project activities. The EMP has been prepared with the objective of:

- Defining legislative requirements, guidelines and best industry practices that apply to the project.
- Defining mitigation measures required for avoiding or minimizing potential impacts assessed by the IEE.
- Defining roles and responsibilities of the project proponent and the contractor/s; and
- Defining requirements for environmental monitoring and reporting.

60. The Environmental Management Plan (EMP) for Mingora Water Supply Scheme has been prepared keeping in view the anticipated environmental impacts during design, construction and operational stages of the project on the existing environmental conditions including air, soil, water, land, biodiversity and socio economic condition of the project area, and suggests appropriate measures to mitigate the potential adverse impacts and enhance the positive impacts. The compliance monitoring of mitigation measure implementation would be ensured through the implementation of the Environmental Monitoring Plan included in the EMP. The EMP will be included in the contract under specific conditions making it obligatory for the contractor to carry out the works assigned in the EMP.

EMP Cost, Monitoring and Reporting

61. Total estimated indicative cost for EMP implementation is about PKR 6.7 million. Environmental monitoring cost for pre-construction phase (once) and construction and operation phase (annually) will be about PKR 2.4 million.

62. During the construction phase, the overall responsibility for the implementation and monitoring of the EMP rests with the Project Director (PD), Project Management Unit (PMU), KPCIP. The PD at the PMU, using the Construction Supervision Consultant (CSC), will supervise the implementation of the proposed mitigation measures and monitor the implementation progress in the field.

63. During the operation phase, the overall responsibility for the implementation and monitoring of the EMP rests with CEO WSSC Swat. Project will be administered and monitored through City Implementation Unit (CIU) that will be developed within WSSC Swat which will deliver services based on indicators sets out in Services and Assets Management Agreement (SAMA).

64. EMP implementation would be responsibility of all project stakeholders including PMU, WSSC Swat, Project Construction contractors, O&M contractor and other suppliers involved in the project. Requirement of environmental staffing will be part of bidding documents and necessary cost will be allocated as BOQ item by the bidder. PMU will maintain environmental safeguard staffing (Environmentalist/Environment Associate) for construction and operation phase of the project to monitor and supervise EMP implementation and performance. Environemnt expert will also be part of CSC technical team and will produce bi-weekly and monthly environmental compliance

reports during construction phase. Environment expert of CSC will be responsible to monitor the implementation of EMP during construction phase by project contractors. Project contractors will also hire sufficient environmental officers to implement the EMP requirements and prepare necessary EMP documentation. Project contractor EMP staff will prepare daily environmental reports and submit to CSC for approval and record. Within city implementation unit (CIU), WSSS will hire qualified environmental specialist during operation phase of the project who will be responsible for EMP implementation and reporting by WSSC Swat and its O&M contractors during operation. Monthly environmental compliance report will be prepared by WSSC Swat and circulated to concerned authorities.

Climate Change Exposure of Water Treatment Plant and distribution Networks

65. Climate change can impact different aspects of the project activities due to projected increased temperatures and intense floods from heavy rainfalls at the intake locations and water treatment plant location. These climatic changes in the nearby areas can also have serious consequences on the intake sources and intake structures due to flash flooding in the catchment of Khawazakhela intake and distribution networks due to intensive rains which may cause subsequently washout sections of water supply networks located in hilly areas.

66. Concrete ducts has been recommended to provide around transmission mains and distribution mains in areas which are prone to land sliding or areas adjacent to water channels

Climate Change Adaptation Measures for Water Treatment Plant and Distribution Networks

67. Detailed Catchment studies are conducted as part of designing intake flow from sources. The average daily rainfall data for 49 years (from 1961 to 2009) and 54 year (from 1961-2014) was collected and analyzed to get the rainfall values of 2, 5, 10, 50- & 100-year return period. Rainfall Runoff model for watershed, basin model for computation of runoff volumes analyzed. Time of concentration at intake points calculated after computing CN number that consider catchment characteristics including the soils; cover type, treatment, and hydrologic conditions/land use etc.

68. In a normal year, the low flows in Swat River are around 1200 / 1300 cfs in the month of December and January. In the summer, the normal high flows are around 11, 000 to 16, 000 cfs in July and August. Normal yearly floods can raise the flows to 20,000 to 25,000 cfs. Project is designed on ultimate flow of 46 cfs only, therefore, downstream water availability will not be compromised and enough water would be flowing downstream in Swat River to maintain ecological flows.

69. Intake structures are designed to withstand flash flooding in event of intensive rain.

70. Concrete ducts has been recommended to provide around transmission mains and distribution mains in areas which are prone to land sliding or areas adjacent to water channels.

Cumulative Impacts

71. No other infrastructure works are planned to be conducted in the project area while these project works shall be conducted. Thus, no cumulative impacts are expected.

Indirect and Induced Impacts

72. Potential impacts arising from each phase of the proposed Mingora Greater water supply scheme has been identified and assessed on the basis of field data, secondary data, expert opinion and examining previous similar projects in Pakistan. These include effects on physical, biological and socio-economic environment. Impacts on the environment from air emissions, traffic and community noise have also been assessed and have found to be acceptable and within the carrying capacities of the environmental media.

73. Thus, negative indirect and induced impacts from the proposed works are not expected.

Ecological Flows of Mingora Water Supply Scheme

74. The Mingora Greater Water Supply Scheme project is run of the river project to be constructed on Swat River located in District Swat. The intake site is located about 62 km upstream of Amandara Barrage and 710m downstream of Matta bridge across River Swat on main Nowshehra-Chakdara-Chitral (NCC) road. The total water demand at intake is 46cusec for the proposed project. Hydrologic information relevant for the hydropower project area and available in the Swat valley includes Kalam and Chakdara on the Swat River. Both stations are operated by Surface Water Hydrology Project (SWHP). The most relevant information about the hydrological station at Chakdara. For the determination of the mean monthly ecological flow, a formula [1]representing a function of the available mean monthly discharges and the mean annual discharges was used, maximum flow is available 150676 cusecs in the month of July while minimum flow 1230 cusecs in the month of January are available in river Swat.

75. Based on the available data, it can be safely concluded that sufficient environmental flows are available for downstream ecological life. Therefore, downstream water availability will not compromised and enough water water would be flowing downstream in Swat River to maintain ecological flows.

76. Intake structures are designed to withstand flash flooding in event of intensive rain.

77. Concrete ducts has been recommended to provide around transmission mains and distribution mains in areas which are prone to land sliding or areas adjacent to water channels.

Institutional Arrangements

78. During the construction phase, the overall responsibility for the implementation and monitoring of the EMP rests with the Project Director (PD), Project Management Unit (PMU) KPCIP, KP Local Government Election and Rural Development Department (LGERDD). The PD through assistance from the Supervision Consultant's Environmental staff and the Environment team of PMU, will supervise the

1 The above formula was developed by CEMAGREF, agricultural and Environmental Engineering Research, of France and was also used for the feasibility study of the Gabral-Kalam Hydropower Project and. It is also recommended by the International Association of Small Hydropower /Water Inteake structures.

implementation of the proposed mitigation measures and monitor the implementation progress in the field. During operation phase responsibility of EMP implementation lies with WSSC Swat with limited support from PMU. Monthly environmental monitoring data/reports will be incorporated in the progress reports to be shared with ADB and such monthly reports will be consolidated into bi-annual monitoring reports and submitted to ADB for review and clearance. Upon clearance, all such reports will be uploaded on the PMU and ADB websites.

Conclusion & Recommendations

79. Mingora Greater water supply scheme is high significance considering the urgent need for improving sustainable water supply system of Mingora city.

80. Mitigation measures will be assured by a program of environmental monitoring conducted during construction and operation phase to ensure that all measures in the EMP are implemented and to determine whether the environment is protected as intended. This will include observations on and off-site, document checks, and interviews with workers and beneficiaries, and any requirements for remedial action will be reported.

81. The EMP contained within this IEE document is considered sufficient for issuance as part of the Contracts to the successful bidder(s) and for subsequent use during the project works. It should be mentioned that prior to the commencement of works, this EMP must be further updated by the Contractor into site specific EMPs (SSEMPs) for review and approval of ADB. In these SSEMPs, aspects such as a detailed traffic management plan, identification of locations for disposal of debris and spoil and any other details which shall become available later must be included for efficient implementation of all proposed mitigation measures and the subsequent monitoring of these measures.

82. Based on the findings of the IEE, the subproject is unlikely to cause any significant, irreversible or unprecedented environmental impacts. The potential impacts are localized, temporary in nature and can be addressed through proven mitigation measures. Hence, the classification of the subproject as Category B per ADB SPS, 2009 is confirmed. No further study or assessment is required at this stage.

Recommendations:

- Obtain statutory clearances prior to award of contract and ensure conditions/requirements are incorporated in the subproject design and documents;
- Upon mobilization of the contractors, PMU KPCIP to provide a safeguards orientation per IEE and project administration manual;
- Contractor to appoint environmental safeguards nodal person responsible for environmental safeguards compliance, occupational health and safety and core labor standards;

83. The IEE will be updated and the final IEE report will incorporate results of detailed engineering design and of any additional baseline monitoring as required (e.g., air, noise, surface water quality) and will be submitted to ADB for approval and disclosure at ADB website.

Information Disclosure

84. After completion/revision and approval from the ADB and the KP-EPA, the IEE will be disclosed to all the stakeholders as part of public consultation process. The summary of the IEE report will be made available to the stakeholders at ADB website and official website of PMU KPCIP LGERDD.

Table ES-1: Screening of possible Impacts during Design/Pre-Construction Phase

S/No.	Potential Issue	Likelihood (Certain, Likely, Unlikely, Rare)	Consequence (Catastrophic, Major, Moderate, Minor)	Risk Level (Significant, Medium, Low)	Residual Impact (Short term, Long term)
1	Improper selection of intake source and reduce ecological flows	Likely	Moderate	Medium	Long Term
2	Improper design of water treatment plant and distribution network including supply mains	Likely	Moderate	Medium	Long Term
3	Improper location of water treatment plant and storage tanks	Likely	Moderate	Medium	Long Term
4	Improper designing of water treatment plant and distribution networks including transmission main	Likely	Moderate	Medium	Long Term
5	Lack of integration of IEE/EMP requirements into Construction bid documents	Likely	Moderate	Medium	Short Term
6	Contractor's Environmental Safeguards Capacity	Likely	Moderate	Medium	Short Term
7	Improper location of worker camps leading to improper disposal of solid waste and sewage and privacy issues for residents in project area.	Likely	Moderate	Medium	Short Term
8	Cultural Heritage & Religious Sites, Social Infrastructure	Unlikely	Moderate	Low	No residual Impact
9	Land acquisition and resettlement impacts	Unlikely	Moderate	Low	Long Term
10	Impacts due to natural hazards	Unlikely	Moderate	Low	No residual Impact
11	Impacts due to existing utilities	Likely	Moderate	Low	No residual Impact

Critical Risk Level
Significant Risk Level
Medium Risk Level
Low Risk Level

Table ES-2: Screening of Possible Impacts during Construction Phase

S/No.	Potential Issue	Likelihood (Certain, Likely, Unlikely, Rare)	Consequence (Catastrophic, Major, Moderate, Minor)	Risk Level (Significant, Medium, Low)	Residual Impact (Short term, Long term)
1	Construction of water treatment plant and other structures not in accordance with finalized design	Unlikely	Major	Medium	Long term
2	Construction of water distribution networks and Transmission Mains	Likely	Moderate	Medium	Short term
3	Degradation of air quality due to construction works	Likely	Moderate	Medium	Short term
4	Potential accidents and injuries to communities in project area during construction works and Road closure/Increased traffic congestion in populated areas	Likely	Moderate	Medium	Short term
5	Injuries to workers from lack of necessary training and/or not using PPEs etc.	Likely	Moderate	Medium	Short term
6	High noise levels from construction activities	Likely	Moderate	Medium	Short term
7	Improper handling and/or disposal of hazardous and non-hazardous waste	Likely	Moderate	Medium	Short term
8	Untreated disposal of effluent from worker camps and batching plant(s)	Likely	Moderate	Medium	Short term
9	Soil Contamination	Likely	Moderate	Medium	Short term
10	Employment Conflicts	Likely	Moderate	Medium	Short term
11	Communicable diseases incl. COVID-19	Likely	Moderate	Medium	Short term
12	Vegetation and Wildlife Loss	Unlikely	Moderate	Low	No residual Impact
13	Historical/Archaeological Sites	Unlikely	Moderate	Low	No residual Impact
14	Construction of Admin building and other infrastructure	Likely	Moderate	Medium	Short term

Critical Risk Level

Significant Risk Level

Medium Risk Level

Low Risk Level

Table ES-3: Screening of Possible Impacts during Operation Phase

S/No.	Potential Issues	Likelihood (Certain, Likely, Unlikely, Rare)	Consequence (Catastrophic, Major, Moderate, Minor)	Risk Level (Significant, Medium, Low)	Residual Impact (Short term, Long term)
1	Reduce downstream water availability	Likely	Major	Medium	Long term
2	Generation of Sludge and wash water	Likely	Major	Medium	Long term
3	Water system leaks and water discharges during flushing	Unlikely	Major	Medium	Long term
4	Handling of Hazardous Chemicals and Chlorine release	Likely	Major	Medium	Long term
5	Occupational Health and Safety	Likely	Major	Medium	Long term
6	Generation of solid waste	Likely	Major	Medium	Long Term
7	Improved drinking water availability	Positive impacts expected			Long term positive residual impact
8	Improvements in Public Health	Positive impacts expected			Long term positive residual impact

Critical Risk Level

Significant Risk Level

Medium Risk Level

Low Risk Level

Positive Impacts

Figure ES-1: Location Map of Mingora Water Treatment Plant

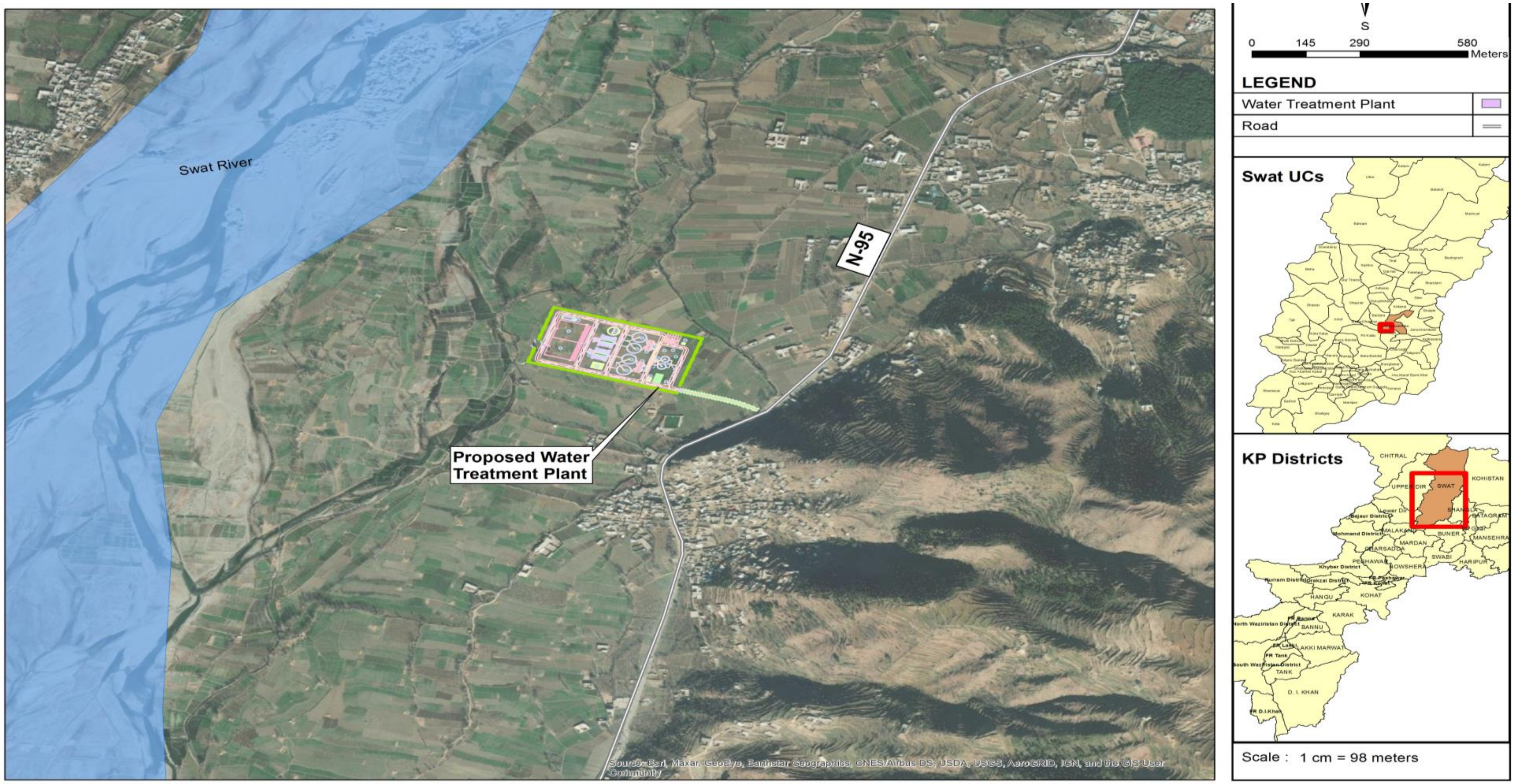
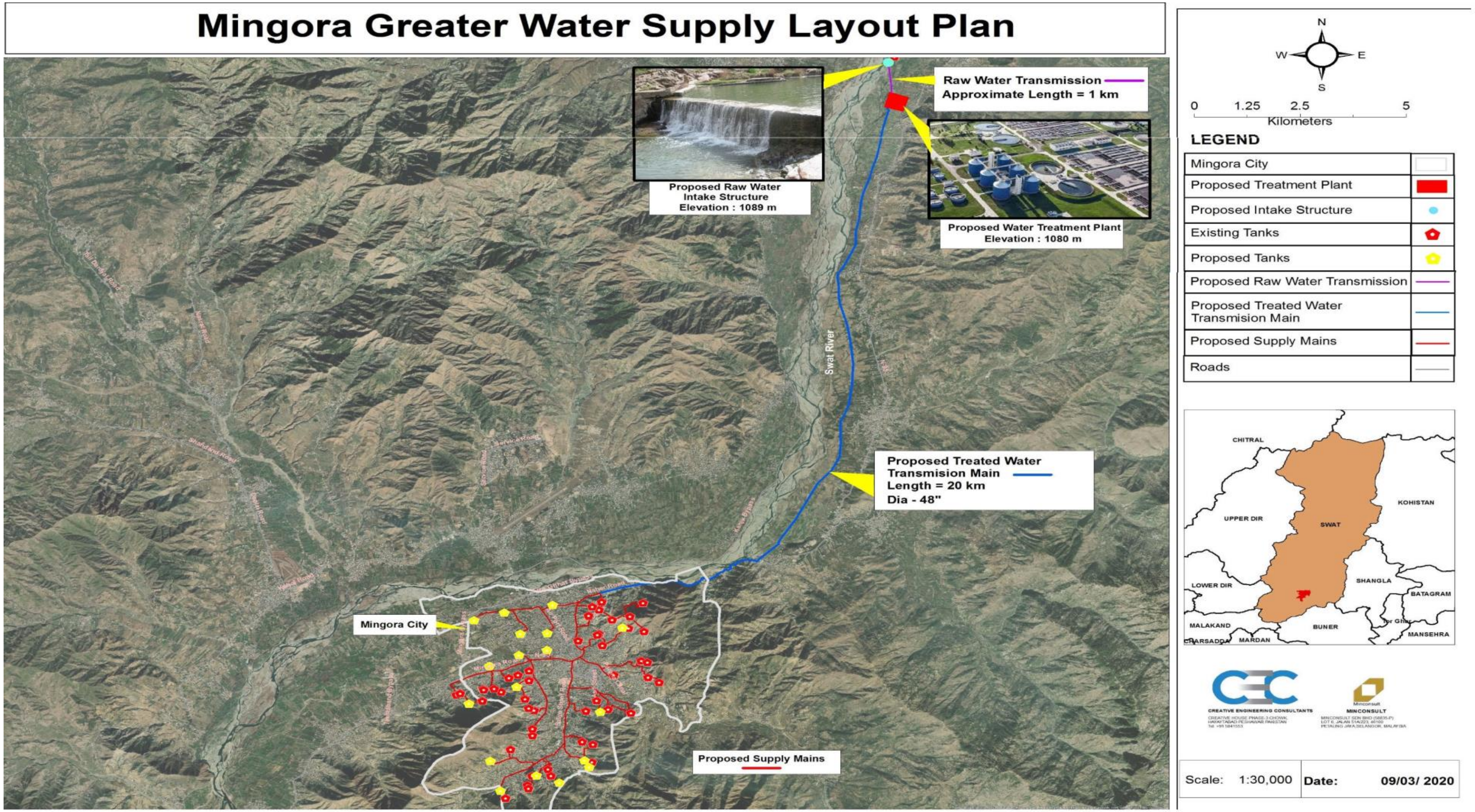


Figure ES-2: Layout Plan of Mingora WTP and GWSS



1 Introduction

1.1 Overview

1. The Khyber Pakhtunkhwa Cities Improvement Projects (KPCIP) will improve the quality of life of the residents of five KP cities, including Abbottabad, Kohat, Mardan, Mingora, and Peshawar, directly benefitting about 6 million of urban population. KPCIP will help selected cities improve their access to quality urban services through three interlinked outputs: (i) Climate resilient and gender friendly urban infrastructure improve, (ii) Institutional capacities of urban service providers and governments strengthened, and (iii) Increased women's participation in urban governance and access to economic opportunities.

2. KPCIP will support the Government of Pakistan's development priorities, established in (i) the National Water Policy (2018), (ii) the Local Government Act (2019), and (iii) Pakistan Vision 2025. The project is also aligned with ADB's operational priorities of (i) addressing remaining poverty and reducing inequalities; (ii) accelerating progress in gender equality; (iii) tracking climate change, building climate and disaster readiness; (iv) making cities more livable; and (v) strengthening governance and institutional capacity, outlined in ADB's Strategy 2030, and is included in ADB's country operations business plan for Pakistan, 2021–2023.

3. The project readiness financing (approved in March 2019) has financed the preparation and engineering design of the KPCIP. The Department of Local Government, Elections and Rural Development Department (LGE&RDD), the Government of Khyber Pakhtunkhwa, will be the executing agency for the project and the city governments of the five target cities, including the respective Water and Sanitation Services Companies, will be the implementing agencies.

4. This report has been prepared based on detailed engineering designs, due diligence assessments, and studies conducted by the government and project readiness financing consultants. The Government of Pakistan, Asian Development Bank (ADB), and Asia Infrastructure Investment Bank (AIIB) are expected to approve KPCIP in Q3 2021

5. The Khyber Pakhtunkhaw Cities Improvement Project (KPCIP) is being processed through the Project Readiness Finance (PRF) modality by Asian Development Bank (ADB) under Loan 6016-PAK, being executed by KP Local Government Election and Rural Development Department (LGE&RDD). The Project is focused on investments of subprojects related to water supply, sanitation and drainage, solid waste management, and urban/green spaces. The Project has the following four major components:

   - Improvement of water supply systems in five (5) cities.
   - Improvement of sewerage and drainage systems in five (5) cities, including provision of sewage treatment plants (STPs)
   - Provision of Integrated Solid Waste management (ISWM) system in five (5) cities
   - Development of Urban/Green Spaces in five cities.

6. The proposed Mingora Greater Water Supply Scheme has the following two main components

- **Component 1:** Construction of surface water treatment plant on left bank of Swat River and to increase total available water resorviors, currently there are 67 no. of existing and proposed water storage reservoirs in the city.

7. **Component 2:** To fulfill water supply requirements of Mingora city for the projected planning horizon population, from surface water source, i.e. River Swat, via a gravity-based transmission system of 20 Km length and distribution network system.

8. The proposed project aims to fulfill water supply requirements of Mingora city for the projected planning horizon population, from a surface water source, via a gravity-based transmission and distribution system. The proposed project will include drawing water from intake at River Swat. The water from intakes shall be transported to the proposed water treatment plant.

9. The identified location of intake site is located in a wide river reach/floodplain about 600 m. The natural river bed slope prevailing in the study reach is between of 1 in 200 to 1 in 250. The project proposed intake site is located about 62 km upstream of Amandara Barrage and 710m downstream of Matta Bridge across River Swat on main Nowshehra-Chakdara-Chitral (NCC) road.

10. The water treatment plant has been proposed to be constructed at the left bank of River Swat at about 20 km Upstream of Mingora City, District Swat, Khyber Pakhtunkhwa (KP). The proposed water treatment plant has been designed based on the ultimate water flow of 46 cusec (30 MGD).In addition to design flow 10 % of flow has been additionally added for friction and other losses. Two parallel treatment streams/trains (each having flow of 15 MGD) have been proposed to provide flexibility in operation. Each train will consist of one plain sedimentation tank, two flash mixers & flocculation chambers, two clarifiers, one rapid gravity filter unit, one chlorine contact tank and treated water tank.

11. To treat the surface water and bringing the water quality parameters within prevailing provincial environmental standards i.e. National Environmental Quality Standards (NEQS), a conventional water treatment plant has been proposed for Mingora City. Supply mains shall transmit treated water to water storage reservoirs and connected to water distribution network inside the city to distribute water from storage reservoirs to end users with a water metering system.

12. Raw water from River Swat is first conveyed from the Raw Water Intake structure tothe proposed water treatment plant, and then the treated water will be supplied via transmission main pipeline from the proposed water treatment plant to multiple water storage reservoirs in Mingora city. The proposed transmission main is having a length of approximately 20kms which is designed to be operated under gravity up to the receiving water storage reservoirs in Mingora city. The transmission main originates from clear water reservoirs of the treatment plant and ends near Hayatabad area i.e. the first receiving storage reservoir in Mingora City. From that point onward, the proposed1200 mm transmission main branches out into various smaller diameter supply mains in the city.

13. There are 67 no. of existing and proposed water storage reservoirs in the city. Catchment area for each water storage reservoir was marked and number of plots was counted for each catchment. Accordingly, the population for each water storage reservoir or catchment was calculated keeping in view the criteria of 7 persons per house. Allowance for future projected population was also considered as per the population projection estimates.

14. In Mingora city, Water and Sanitation Services Company (WSSC) is operational in nine (9) union councils (UCs). The names of the UCs under the jurisdiction of WSSC Swat are (i) UC-1 - Nawakalay/ Shadara, (ii) UC-2 - Banr/ Usmanabad, (iii) UC-3 - Malook Abad, (iv) UC-4 – Rang Mohallah / Gumbat Maira (v) UC-5 - Malakanan Landy Kass

(vi) UC-6 – Rahimabad (vii) UC-7 - Amankot/ Faizabad (viii) UC-8 - Panr / Gulkada (ix) UC-9 - Saidu Sharif/ Shagai.

15. The main benefits of this project include the following:

- Mingora Greater Water Supply will eliminate the need to rely on tube wells in mostly all the areas currently served by WSSC Swat;
- Project has lower operational costs by reducing or eliminating pumping costs in the system;
- Mingora greater water supply will be a surface water source-based supply which is more sustainable and reliable than the current pumping-based tube well source of supply;
- The project will provide an end-to-end solution from source to end customers including intake structure, water treatment plant, transmission main, storage reservoirs, distribution network inside the city, and water metering system.

16. This Initial Environmental Examination (IEE) document focuses solely on the scope of works of Mingora Greater Water Supply Scheme and assesses any potentially significant impacts and proposes required mitigation measures, which shall be implemented by the Contractor and monitored by the Project Management Unit (PMU) KPCIP, and ADB using the Environmental Management Plan (EMP).

1.2 Project Location

17. The project is located in Mingora city, district headquarter of Swat. The town is situated in the lower areas of Hindu Kush about 170 Km northeast of Peshawar. Mingora city acts as a tourist center for Swat Valley. It is also a market town for the fertile Swat Valley and supplies much of its products to Peshawar and other parts of the province.

18. In Mingora city, water and sanitation services company (WSSC) is operational in nine (9) union councils (UCs). The names of the UCs under the jurisdiction of WSSC Swat are as follow:

- UC-1 - Nawakalay/ Shadara
- UC-2 - Banr/ Usmanabad
- UC-3 - Malook Abad
- UC-4 – Rang Mohallah / Gumbat Maira
- UC-5 - Malakanan Landy Kass
- UC-6 - Rahimabad
- UC-7 - Amankot/ Faizabad
- UC-8 - Panr / Gulkada
- UC-8 - Panr / Gulkadabada

19. The water treatment plant has been proposed to be constructed at the left bank of River Swat at about 20 km Upstream of Mingora City, District Swat, Khyber Pakhtunkhwa (KP). A map showing the location of Mingora intake structure and WTP Swat are shown in **Figure 1-1**. Schematic layout of Mingora water supply scheme is marked in **Figure 1-2.**

1.3 Environmental Category of Project

20. Based on the initial findings, it was ascertained that certain adverse environmental impacts are site specific due to development of the proposed "Mingora Greater Water Supply Scheme", and short term and can be mitigated with the proposed mitigation measures and thus the subject project is considered environmentally "B" category as per ADB SPS, 2009. Therefore, an IEE has been conducted. The project before its commencement will comply with the IEE/EIA regulation, 2000 and necessary approval will be obtained from KP EPA.

1.4 Objectives of the IEE

21. Following are the objectives of this IEE study:

- Assess the existing environmental conditions of project area, including the identification of environmental sensitive receptors and develop a baseline of its prevalent environmental and socioeconomic conditions;
- Identify and investigate all impacts of the Mingora Greater Water Supply Scheme pre-construction/design, construction, operation, on the physical, biological and socioeconomic environment of the project area;
- To propose mitigation measures that will help KP LGERDD and WSSC Swat in conducting the proposed project activities in an environmentally sustainable manner;
- To uncover the planning and operational phase impacts up to microenvironment levels in which project is proposed to be sited; and
- To develop an Environmental Management Plan (EMP) that will assist KP LGERDD and WSSC Swat in the effective implementation of the recommendations of the IEE

1.5 IEE Team

22. The IEE study team comprised of following experts.

Environment Specialists by ADB, PMU KP LGE&RDD and EDCM

Environmental associate

Water Treatment Plant Design Team

Integrated Environmental Laboratory

Climate change expert

Social Safeguard Expert

Social safeguard team of EDCM

Gender Expert

ADB and PMU technical team

1.6 Methodology OF IEE Study

23. The following methodology was employed for this IEE:

1.6.1 Understanding of the Proposed Operation

24. This involved collecting information from the ADB, PMU KP LGREDD and Engineering Design and Construction Management technical team on the proposed project

activities and understanding the activities to identify potential impacts of implementing them.

1.6.2 Review of Legislation and Guidelines

25. National legislation, international agreements, environmental guidelines both of KP EPA, and ADB, and best industry practices have been reviewed to set environmental standards that KP LGREDD as the executing Agency will adhere to during implementation of the project.

1.6.3 Secondary Data Collection

26. Available published and unpublished information pertaining to the background environment has been obtained and reviewed. All data sources have been carefully reviewed to collect the following information:

- **Physical environment** – topography, geology, seismology, geomorphology, soils, surface and groundwater resources and climate;
- **Biological environment** – habitat types, flora and fauna (particularly rare or endangered species), critical habitats, vegetation and communities within the area;
- **Physical cultural resources** – sites, structures, groups of structures, and natural features and landscapes that have archaeological, paleontological, historical, architectural, religious, aesthetic, or other cultural significance; and,
- **Socio-economic environment-**settlements, socio-economic conditions, infrastructure and land use.

1.6.4 Field Data Collection (Baseline Survey)

27. Field visits were undertaken consisting of preliminary scoping through survey and assessment activities to establish the potential impacts and categorization of activities and the Rapid Environmental Assessment (REA) Checklist was completed. The key receptors and stakeholders within the project area were identified.

28. Baseline surveys required to identify and establish physical and biological conditions and ecosystems in the project area has been carried out by IEE team and results has been incorporated in this report. The socio-economic environment in the project areas has been obtained through the socio-economic profiles. Climate risk and vulnerability assessment findings have also been presented and discussed.

29. Primary data collection in a two kilometre area of influence, such as ambient noise levels, ambient air quality and ground water quality at the key receptor locations in the project area and particularly in close proximity to the project site was conducted.

30. Review of secondary information on the physical, biological and ecological aspects, physical cultural resources and infrastructure utilities in the project area was conducted.

1.6.5 Public Consultations

31. Public consultations (PC) were carried out with all key stakeholders, particularly local communities residing in the project area, local businesses and government and local government bodies in line with ADB's "Safeguard Policy Statement (SPS) – June

2009"/ Environmental Assessment Guidelines. Under ADB requirements, the environmental assessment process must also include meaningful public consultations during the completion of the study. In this IEE study, the public consultation process was carried out including verbal disclosure regarding the project development with stakeholders to brief them about project and to seek their response/recommendation.

1.6.6 Impacts Identification and Assessment

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

1.6.7 Recommendations for Mitigation Measures

33. Mitigation measures to minimize, eliminate or compensate the potential environmental impacts has been recommended. The mitigation measures have been recommended on the basis of past experiences, best industry practices, legislative requirements and professional judgment.

1.6.8 Development of Environmental Management Plan (EMP)

34. An Environmental Management Plan (EMP) has been developed for effective implementation of the recommended mitigation measures. The EMP includes controls to minimize the identified impacts and monitoring program to monitor effect of mitigation measures implemented and residual impacts, if any, during implementation. The EMP has identified roles and responsibilities of all concerned parties during the implementation of the project.

1.7 Proponent of Project

35. The LGE&RDD, GoKP is the Executing Agency (EA) for this Mingora Greater Water Supply Scheme development while the project will be implemented through Water and Sanitation Services Company (WSSC), Swat with support from PMU.

36. Contact details of the EA are provided as **Table 1.1** below.

Table 1—1 Executing Agency Contact Details

Executing Agency Details	Information
Name of EA	Project Management Unit KPCIP, Local Government, Elections and Rural Development Department (LGE&RDD), GoKP
Address	Ground Floor, Afzal Apartments, Jamrud Road, Phase-3 Chowk, Hyatabad Peshawar
Telephone	0092-91-5854555
E-mail	pdkpcip@gmail.com, info@kpcip.gov.pk
Web	Kpcip.gov.pk

1.8 Structure of the Report

37. The IEE report contains eleven chapters as follows:

- Introduction
- Policy and Legal Framework
- Description of the Project
- Description of Environment
- Analysis of Alternatives
- Assessment of Environmental Impacts and Mitigation Measures
- Institutional Requirements Environmental Management Plan
- Public Consultation
- Grievance Redressal Mechanism
- Findings, Recommendations and Conclusions
- References

1.9 IEE Team

38. IEE team comprising of following members

- Environment Specialists by ADB, PMU KP LGREDD and Engineering Design Construction Management (EDCM)
- Environmental associate
- WTP design experts
- Integrated Environmental Laboratory
- Climate change expert
- Social Safeguard Expert
- Social safeguard team of EDCM
- Gender Expert
- ADB and PMU technical team

1.10 Further Additions & Updating Of IEE Study

39. This version of the report will be further updated once the detailed design is completed and any other details of the proposed water supply and WTP project become available over the coming weeks and months. These revisions shall be incorporated into any subsequent updated versions of this IEE report. Updated IEE will be submitted for ADB review and approval and posted at ADB and PMU / Project website. IEE/EMP will be disclosed locally at PMU KPCIP website at least two weeks prior to the next

consultation to allow the public time to read, look for information or consult experts, and form opinions.

Figure 1-1: Project Location Map

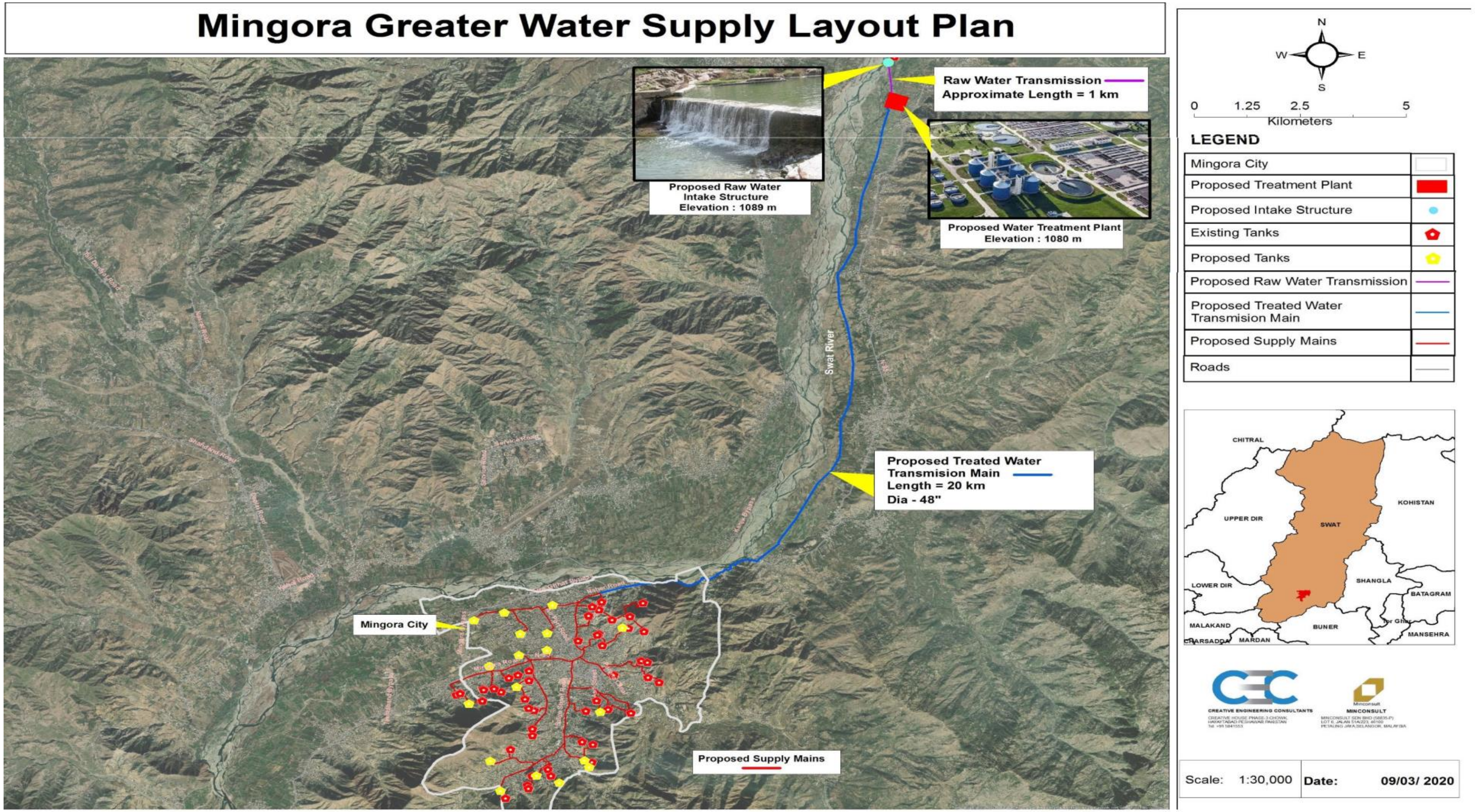
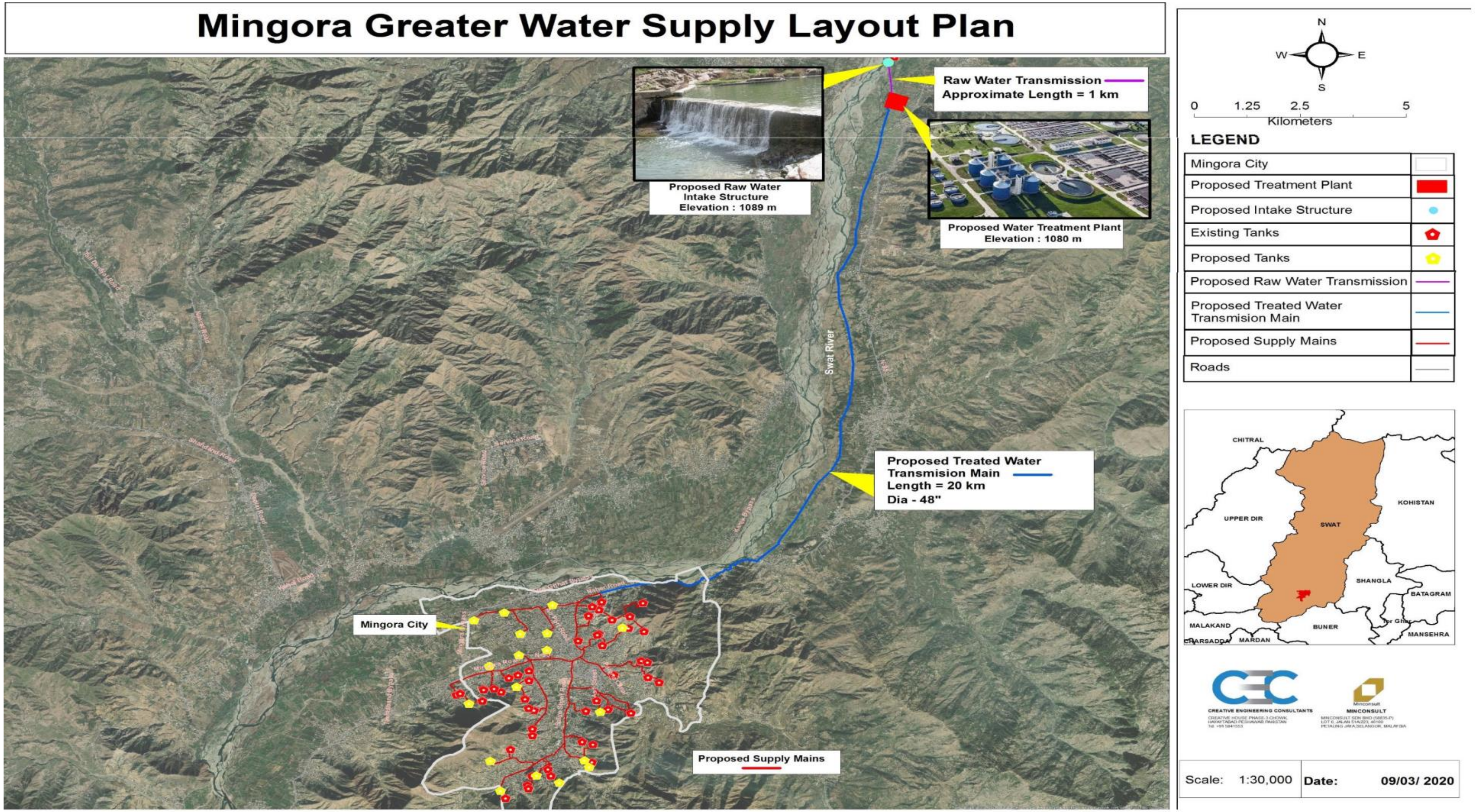


Figure 1-2: Project Area Layout Map



2 Policy and Legal Framework

2.1 General

40. This section provides an overview of the policy framework and national legislation that applies to the proposed Mingora Great Water Supply Scheme development at Mingora City. The project will comply with all national legislation relating to the environment in Pakistan and will obtain all the regulatory clearances required from the financing agency, ADB. Project will be consistent with the environmental safeguards requirements as specified in the ADB SPS 2009.

2.2 National Policy and Legal Framework

41. The Pakistan National Conservation Strategy (NCS) that was approved by the federal cabinet in March 1992 is the principal policy document on environmental issues in the country (EUAD/IUCN, 1992). The NCS outlines the country's primary approach towards encouraging sustainable development, conserving natural resources, and improving efficiency in the use and management of resources. The NCS has 68 specific programs in 14 core areas in which policy intervention is considered crucial for the preservation of Pakistan's natural and physical environment. The core areas that are relevant in the context of the proposed water supply scheme are sustainable consumption and production patterns, urban water management by increasing system efficiency and reducing non revenue water through adequate investments to address drinking water demand while restoring and maintaining the health of the environment and water related eco systems.

42. The National Water Policy lays down a broad policy framework and set of principles for water security on the basis of which the Provincial Governments can formulate their respective Master Plans and projects for water conservation, water development and water management.

43. Prior to the adoption of the 18^{th} Constitutional Amendment, the Pakistan Environmental Protection Act (PEPA) 1997 was the governing law for environmental conservation in the country. Under PEPA 1997, the Pakistan Environmental Protection Council (PEPC) and Pak EPA were primarily responsible for administering PEPA 1997. Post the adoption of the 18^{th} Constitutional Amendment in 2011, the subject of environment was devolved and the provinces have been empowered for environmental protection and conservation.

2.3 Regulations for Environmental Assessment, Pakistan EPA

44. Under Section 12 (and subsequent amendment) of the PEPA (1997), a project falling under any category specified in Schedule I of the IEE/EIA Regulations (SRO 339 (I0/2000), requires the proponent of the project to file an IEE with the concerned provincial EPA. Projects falling under any category specified in Schedule II require the proponent to file an EIA with the provincial agency, which is responsible for its review and accordance of approval or request any additional information deemed necessary.

2.4 Regulatory Clearances, KP EPA

45. In accordance with provincial regulatory requirements, an EIA satisfying the requirements of the KP Environmental Protection Act (2014) is to be submitted to KP environmental protection agency (KP-EPA) for review and approval, and subsequent issuance of NOC before the commencement of construction. The project will comply with the IEE/EIA Regulation 2000 before the commencement of the work.

2.5 Guidelines for Environmental Assessment, Pakistan EPA

46. The Pak-EPA has published a set of environmental guidelines for conducting environmental assessments and the environmental management of different types of development projects. The guidelines that are relevant to the proposed sub-project are listed below:

- Guidelines for the Preparation and Review of Environmental Reports, Pakistan, EPA1997;
- Guidelines for Public Consultations; Pakistan EPA May 1997;

2.6 National Environmental Quality Standards (NEQS) 2000 & 2010

47. The National Environmental Quality Standards (NEQS), 2000& 2010, specify the following standards:

- Maximum allowable concentration of pollutants (32 parameters) in municipal and liquid industrial effluents discharged to inland waters, sewage treatment facilities, and the sea (three separate sets of numbers);
- Maximum allowable concentration of pollutants (16 parameters) in gaseous emissions from industrial sources;
- Maximum allowable concentration of pollutants (two parameters) in gaseous emissions from vehicle exhaust and noise emission from vehicles;
- Maximum allowable noise levels from vehicles;
- Maximum allowable concentration of parameters in drinking water

48. NEQS are attached as **Annexure J.**

2.7 Other Environment Related Legislations

49. The national laws and regulations are provided in Table 2.1 below.

Table 2—1: Environmental Guidelines and Regulations

Legislation/Guideline	Description
National Environmental Policy (2005) (NEP)	NEP is the primary policy of Government of Pakistan addressing environmental issues. The broad Goal of NEP is, "to protect, conserve and restore Pakistan's environment in order to improve the quality of life of the citizens through sustainable development". The NEP identifies a set of sectoral and cross-sectoral guidelines to achieve its goal of sustainable development. It also suggests various policy instruments to overcome the environmental problems throughout the country.
The Forest Act (1927)	The Act empowers the provincial forest departments to declare any forest area as reserved or protected. It empowers the provincial forest departments to prohibit the clearing of forest for cultivation, grazing, hunting, removing forest produce, quarrying and felling, lopping and topping of trees, branches in reserved and protected forests. No protected forest is situated in the project area for the development of the water treatment plant and distribution network.
Khyber Pakhtunkhwa Wildlife and Biodiversity Act, 2015	It empowers the government to declare certain areas reserved for the protection of wildlife and control activities within in these areas. It also provides protection to endangered species of wildlife. As no activities are planned in these areas, no provision of this law is applicable to the proposed project.
The KP Antiquities Act (2016)	It ensures the protection, preservation, development and maintenance of antiquities in the province of KP. The Act defines "antiquities" as ancient products of human activity, historical sites, or sites of anthropological or cultural interest, national monuments, etc. The Act is designed to protect these antiquities from destruction, theft, negligence, unlawful excavation, trade, and export. The law prohibits new construction in the proximity of a protected antiquity and empowers the GoKP to prohibit excavation in any area that may contain articles of archaeological significance. Under the Act, the subproject proponents are obligated to ensure that no activity is undertaken in the proximity of a protected antiquity, report to the Department of Archaeology, GoKP, any archaeological discovery made during the course of the project. However, if any archaeological antiquity discovered Archeological Chance Find procedure shall be adopted. Archeological Chance Find procedure has been attached as **Annexure F**.
Pakistan Penal Code (1860)	It authorizes fines, imprisonment or both for voluntary corruption or fouling of public springs or reservoirs so as to make them less fit for ordinary use.
NATIONAL ENVIRONMENTAL AND CONSERVATION STRATEGIES	
National Conservation Strategy	Before the approval of NEP, the National Conservation Strategy (NCS) was considered as the Government's primary policy document on national environmental issues. At the moment, this strategy just exists as a national conservation program. The NCS identifies 14 core areas including conservation of biodiversity, pollution prevention and abatement, soil and water conservation and preservation of cultural heritage and recommends immediate attention to these core areas.
Biodiversity Action Plan	The plan recognizes IEE/EIA as an effective tool for identifying and assessing the effects of a proposed operation on biodiversity.
INTERNATIONAL CONVENTIONS	

Legislation/Guideline	Description
The Convention on Conservation of Migratory Species of Wild Animals (1981.21)	The Convention requires countries to take action to avoid endangering migratory species. The term "migratory species" refers to the species of wild animals, a significant proportion of whose members cyclically and predictably cross one or more national jurisdictional boundaries. The parties are also required to promote or cooperate with other countries in matters of research on migratory species. There are no endangered species of plant life or animal life in the vicinity of the proposed project areas for the water supply project works.
Convention on International Trade in Endangered Species of Wild Fauna and Flora (1973)	The convention requires Pakistan to impose strict regulation (including penalization, confiscation of the specimen) regarding trade of all species threatened with extinction or that may become so, in order not to endanger their survival further.
International Union for Conservation of Nature and Natural Resources Red List (2000)	Lists wildlife species experiencing various levels of threats internationally. Some of the species indicated in the IUCN red list are also present in the wetlands of Pakistan.
Convention on Wetlands of International Importance Especially as Waterfowl Habitat (Ramsar Convention) (1971)	The Ramsar Convention deals with the protection of water bodies of international importance and their associated biodiversity, as well as promoting wise use of allied resources. The Convention was adopted in 1971 at Ramsar, Iran and entered into force in 1975. Pakistan signed the Ramsar Convention in 1971, and ratified it in July 1976. There are 19 Ramsar sites in Pakistan.
Basel Convention on the Control of Trans-boundary Movements of Hazardous Wastes and their Disposal (1992)	The Basel Convention deals with the controlled trans-boundary movement of hazardous wastes and their disposal. The Convention was adopted on March 22, 1989, and entered into force on May 5, 1992; Pakistan signed the Convention in May 1992 and ratified it in October 1994.
United Nations Framework Convention on Climate Change (UNFCCC) (1994)	This convention highlights broad guidelines for protecting the climate of the planet. It was adopted in 1992 and came into force in 1994. Pakistan signed the UNFCCC in 1992 and ratified it in June 1994.
Kyoto Protocol to UNFCCC (2005)	The Kyoto Protocol seeks to mitigate climate change and to reverse the pace of climate change through the use of carbon sequestration and carbon credits known as Certified Emission Reduction trading. The Protocol was adopted in 1997 and came into force in 2005; Pakistan signed the Protocol in December 1997 and ratified it in January 2005.

2.8 Implications of National Policies and Regulations on Proposed Project

50. The Pak-EPA formulated regulations in 2000 for 'Review of IEE and EIA' which categorize development projects under three schedules-Schedules I, II and III. Projects are classified on the basis of expected degree and magnitude of environmental impacts and the level of environmental assessment required is determined from the schedule under which the project is categorized.

51. The projects listed in Schedule-I include those where the range of environmental issues is comparatively narrow and the issues can be understood and managed through less extensive analysis. Schedule-I projects require an IEE to be conducted, rather than a full-fledged EIA, provided that the project is not located in an environmentally sensitive area.

52. The projects listed in Schedule-II are generally major projects and have the potential to affect a large number of people in addition to significant adverse environmental impacts. The impacts of projects included in Schedule-II may be irreversible and could lead to significant changes in land use and the social, physical and biological environments. The proposed Water Supply Scheme Development project has been categorized as Schedule II (F) and requires an EIA.

53. The LGE&RDD, GoKP, being the Executing Agency for the Project is responsible for management of project impacts, and have to undertake the commitments and mitigation measures proposed in this environmental report and in the subsequent review and approval conditions.

54. According to the regulations, no construction, preliminary or otherwise, relating to the project shall be undertaken until and unless approval of the EIA/IEE report has been issued by the KP EPA.

55. The LGE&RDD will submit the EIA Report on a prescribed application along with the processing fee to KP EPA.

2.9 ADB'S Safeguard Policy Statement (SPS), 2009

56. The ADB's SPS 2009 requires that environmental considerations be incorporated into ADB funded projects to ensure that the project will have minimal environmental impacts and be environmentally sound. Occupational health & safety of the local population should also be addressed as well as the project workers as stated in SPS. A Grievance Redress Mechanism (GRM) to receive application and facilitate resolution of affected peoples' concerns, complaints, and grievances about the project's environmental performance is also established.

57. All loans and investments are subject to categorization to determine environmental assessment requirements. Categorization is to be undertaken using Rapid Environmental Assessment (REA) checklists, consisting of questions relating to (i) the sensitivity and vulnerability of environmental resources in project area, and (ii) the potential for the project to cause significant adverse environmental impacts. Projects are classified into one of the following environmental categories:

58. **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 environmental impact assessment (EIA) is required.

59. **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 initial environmental examination (IEE) is required.

60. **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.

61. **Category FI:** A proposed project is classified as category FI if it involves investment of ADB funds to or through a financial intermediary (FI).

2.10 ADB'S Access to Information Policy (AIP) 2018

62. ADB's new Access to Information Policy (AIP), reflects the ADB's ongoing commitment to transparency, accountability, and participation by stakeholders. The policy contains principles and exceptions to information sharing with external stakeholders, led by a new overarching principle of "clear, timely, and appropriate disclosure."

2.11 ADB'S Accountability Mechanism Policy 2012

63. The objectives of the Accountability Mechanism is providing an independent and effective forum for people adversely affected by ADB-assisted projects to voice their concerns and seek solutions to their problems, and to request compliance review of the alleged noncompliance by ADB with its operational policies and procedures that may have caused, or is likely to cause, them direct and material harm. The Accountability Mechanism is a "last resort" mechanism.

2.12 Implications of ADB's Safeguard Policies on Proposed Project

64. The objectives of ADB's safeguards are to:

- Avoid adverse impacts of projects on the environment and affected people, where possible;
- Minimize, mitigate, and/or compensate for adverse project impacts on the environment and affected people when avoidance is not possible; and
- Help borrowers/clients to strengthen their safeguard systems.

65. ADB's SPS sets out the policy objectives, scope and triggers, and principles for three key safeguard areas:

- Environmental Safeguards,
- Involuntary Resettlement Safeguards, and
- Indigenous Peoples Safeguards.

66. The objective of the environmental safeguards is to ensure the environmental soundness and sustainability of projects and to support the integration of environmental considerations into the project decision-making process. ADB's policy principles are summarized in Table 2.2 below.

Table 2—2: ADB Policy Principles

No.	Policy principle	Summary
1	Screening and categorization	Screening process initiated early to determine the appropriate extent and type of environmental assessment.
2	Environmental assessment	Conduct an environmental assessment to identify potential impacts and risks in the context of the project's area of influence.
3	Alternatives	Examine alternatives to the project's location, design, technology, and components and their potential environmental and social impacts, including no project alternative.
4	Impact mitigation	Avoid, and where avoidance is not possible, minimize, mitigate, and/or offset adverse impacts and enhance positive impacts. Prepare an environmental management plan (EMP).
5	Public consultations	Carry out meaningful consultation with affected people and facilitate their informed participation. Involve stakeholders 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. Establish a grievance redress mechanism.
6	Disclosure of environmental assessment	Disclose a draft environmental assessment in a timely manner, in an accessible place and in a form and language(s) understandable to stakeholders. Disclose the final environmental assessment to stakeholders.
7	Environmental management plan	Implement the EMP and monitor its effectiveness. Document monitoring results and disclose monitoring reports.
8	Biodiversity	Do not implement project activities in areas of critical habitats.
9	Pollution prevention	Apply pollution prevention and control technologies and practices consistent with international good practices. 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. Avoid the use of hazardous materials subject to international bans or phase-out.
10	Occupational health and safety/Community safety.	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
11	Physical cultural resources	Conserve physical cultural resources and avoid destroying or damaging them. Provide for the use of "chance find" procedures.

67. The basic environmental assessment requirements for Category 'A' projects are provided in Table 2.3 below.

Table 2—3: ADB Environmental Assessment Requirements for Category 'B' projects

Aspect	Environmental Assessment & Management Requirements
Project processing	
Reporting	▪ Prepare full-scale environmental assessment (IEE)
Public consultations	▪ Conduct consultations at the early stage of IEE field work and when the draft IEE report is available during project preparation, and before project appraisal by ADB.
Disclosure of environmental assessment report	▪ Disclose Final IEE on its completion or project Board Approval whichever is earlier
Project implementation	
Reporting	▪ Submit semiannual reports during project construction, and annual reports during project operation to ADB for disclosure.

2.13 IFC Sector Specific Guidelines on Water and Sanitation[2]

68. The IFC EHS Guidelines for Water and Sanitation include information relevant to the operation and maintenance of (i) potable water treatment and distribution systems, and (ii) collection of sewage in centralized systems (such as piped sewer collection networks) or decentralized systems (such as septic tanks subsequently serviced by pump trucks) and treatment of collected sewage at centralized facilities.

69. Environmental issues associated with water and sanitation projects may principally occur during the construction and operational phases, depending on project-specific characteristics and components.

70. Guidelines are related to following impacts associated with Drinking water supply and treatment are as follows:

- Water Withdrawal
- Water Treatment
    - Solid waste
    - Wastewater
    - Hazardous chemicals
    - Air emissions
    - Ecological impacts
- Water Distribution
    - Water system leaks and loss of pressure

[2] https://www.ifc.org/wps/wcm/connect/8e307e4e-7668-4049-b163-f8d00f0cdef7/1-4%2BWater%2BConservation.pdf?MOD=AJPERES&CVID=ls4XhtY

- Water discharges

2.14 Comparison of International and Local Environmental Legislations

71. The ADB SPS, 2009 requires application of pollution prevention and control technologies and practices consistent with international good practice, as reflected in internationally recognized standards. The SPS states that when host country regulations differ from these standards, the EA will achieve whichever is more stringent.

72. In order to select the most stringent standards applicable, a mix of local (NEQS) and international (IFC) regulations have been selected. The IFC Environmental, Health, and Safety (EHS) Guidelines, General EHS Guidelines and Environmental standards are also applicable. It shall be ensured that all necessary noise mitigation measures are implemented to minimize the noise levels in the project area.

73. The Table 2.4 presents IFC workplace noise standards that are applicable to the construction workers. It should also be noted that IFC EHS guidelines advise that where existing ambient noise levels already exceed thresholds, the project should not result in an increase of more than 3 dB over existing ambient noise levels at the nearest receptor location off-site.

74. A comparison of applicable local and international guidelines for ambient air quality has been provided in Table 2.5 below. In the case of most pollutants, the Pak NEQS standards for ambient air quality are more stringent in comparison to USEPA and WHO/IFC standards. The applicable and most stringent parameters for each respective pollutant are highlighted in green.

75. Similar to the standards for air quality, the comparison of noise standards provided in Table 2.6 clearly shows that the Pakistan NEQS standards for noise are more stringent in comparison to the IFC standards. The only exception is the daytime noise level standard for Industrial areas where the IFC standard is more stringent (70 dB (A)) in comparison to NEQS (75 dB (A)) and so for this particular parameter, the IFC standard will be used. Apart from this one exception, the NEQS standards have been used for the proposed Water supply scheme development project.

76. Comparison of international and local water quality standards is provided as Table 2.7.

77. As far as regulations regarding other environmental parameters are concerned such as acceptable effluent disposal parameters, the local regulations i.e. NEQS take precedence over any other international regulations such as IFC.

Table 2—4: IFC Work Environment Noise limits

Type of Work, workplace	IFC General EHS Guidelines
Heavy Industry (no demand for oral communication)	85 Equivalent level L_{eq},8h
Light industry (decreasing demand for oral communication)	50-65 Equivalent level L_{eq},8h

Table 2—5: Comparison of International and local Air Quality Standards*

Pollutants	USEPA		WHO/IFC		Pak. NEQS	
	Avg. Time	Standard	Avg. Time	Standard	Avg. Time	Standard
SO_2	3 hrs. 1 hr.	0.5 ppm 75 ppb	24 hr 10 min	20 ug/m³ 500 ug/m³	Annual Mean 24 hrs	80 ug/m³ 120 ug/m³
CO	8 hrs 1 hr	9 ppm (11 mg/m³) 35 ppm (43 mg/m³)	-	-	8 hrs 1 hr	5 mg/m³ 10 mg/m³
NO_2	Annual Mean 1 hr	100 ug/m³ (53 ppb) 100 ppb	1 yr 1 hr	40 ug/m³ 200 ug/m³	Annual Mean 24 hrs	40 ug/m³ 80 ug/m³
O_3	8 hrs	0.07ppm (148 ug/m³)	8 hrs	100 ug/m³	1 hr	130 ug/m³
TSP	-	-	-	-	Annual Mean 24 hrs	360 ug/m³ 500 ug/m³
PM_{10}	24 hrs	150 ug/m³	1 yr 24 hr	20 ug/m³ 50 ug/m³	Annual Mean 24 hrs	120 ug/m³ 150 ug/m³
$PM_{2.5}$	Annual Mean 24 hrs	15 ug/m³ 35 ug/m³	1 yr 24 hr	10 ug/m³ 25 ug/m³	Annual Average 24 hrs 1 hr	15 ug/m³ 35 ug/m³ 15 ug/m³

*: The standards highlighted in green for each respective pollutant are the most stringent based on a comparison between local and international regulations and thus shall be applicable for the proposed project.
* In instances where the airshed is significantly degraded and the pollutant levels are already exceeding the ambient pollutant concentrations provided in the table above, it shall be ensured that the project activities cause as small an increase in pollution levels as feasible, and amounts to a fraction of the applicable short term and annual average air quality guidelines or standards as established in the project specific environmental assessment.

Table 2—6: Comparison of International and Local Noise Standards

Category of Area/Zone	Limit in dB(A) Leq			
	NEQS		WHO/IFC	
	Day Time 06:00 – 22:00	Night Time 22:00-06:00	Day Time 07:00 – 22:00	Night Time 22:00-07:00
Residential Area (A)	55	45	55	45
Commercial Area (B)	65	55	70	70
Industrial Area (C)	75	65	70	70
Silence Zone (D)	50	45	55	45

*: The standards highlighted in green for each respective Area/Zone are the most stringent based on a comparison between local and international regulations and thus shall be applicable for the proposed project.
* In instances where baseline noise levels are already exceeding the standards above, it will need to be ensured that the project activities do not cause an increment of more than 3 dB (A) from the baseline noise levels.

Table 2—7: Comparison of International and Local Water Quality Standards

Parameter	Unit	NEQS	WHO/IFC
Bacterial			
E-Coli	Numbers/Ml	Must Not Be Detectable In Any 100 ml Sample	Must Not Be Detectable In Any 100 ml Sample
Total Coliform	Numbers/Ml	Must Not Be Detectable In Any 100 ml Sample	Must Not Be Detectable In Any 100 ml Sample
Physical			
Color	Tcu	≤ 15 TCU	-
Taste	No Objectionable/Acceptable	-	-
Odor	No Objectionable/Acceptable	-	-
Turbidity	Ntu	< 5 NTU	
Total Hardness	Mg/L	< 500 mg/L	
Tds	Mg/L	< 1000	
Ph		6.5-8.5	
Chemical			
Aluminum	Mg/L	≤0.005 (P)	0.2
Antimony	Mg/L	≤0.005 (P)	<0.005 (P)
Arsenic	Mg/L	≤0.005 (P)	0.01
Barium	Mg/L	0.7	0.3
Boron	Mg/L	0.3	0.3
Cadmium	Mg/L	0.01	0.0003
Chloride	Mg/L	<250	250
Chromium	Mg/L	≤0.05	0.05
Copper	Mg/L	2	2
Cyanide	Mg/L	≤0.05	0.07
Fluoride	Mg/L	<1.5	1.5
Lead	Mg/L	≤0.05	0.01
Manganese	Mg/L	≤0.5	0.5
Mercury	Mg/L	≤0.0001	0.0001
Nickel	Mg/L	≤0.02	0.02

Parameter	Unit	NEQS	WHO/IFC
Nitrate	Mg/L	≤50	50
Nitrite	Mg/L	≤3	-
Selenium	Mg/L	0.01	0.01
Residual Chlorine	Mg/L	0.2-0.5 At Consumer End	-
Zinc	Mg/L	5	3

*: The standards highlighted in green for each respective Area/Zone are the most stringent based on a comparison between local and international regulations and thus shall be applicable for the proposed project.

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3 Project Description

3.1 Project Introduction

78. The proposed Mingora Greater Water Supply Scheme and Surface Water Treatment Plant has the following two main components

Component 1: Construction of surface water treatment plant on left bank of Swat River and to increase total available water resorviors, currently there are 67 no. of existing and proposed water storage reservoirs in the city.

Component 2: To fulfill water supply requirements of Mingora city for the projected planning horizon population, from surface water source, i.e. River Swat, via a gravity-based transmission system of 20 Km length and distribution network.

79. The proposed project aims to fulfill water supply requirements of Mingora city for the projected planning horizon population, from a surface water source, via a gravity-based transmission and distribution system. The proposed project will include drawing water from intake at Swat River. The water from intakes shall be transported to the proposed water treatment plant.

80. The identified location of intake site is located in a wide river reach/floodplain about 600 m. The natural river bed slope prevailing in the study reach is between of 1 in 200 to 1 in 250. The project proposed intake site is located about 62 km upstream of Amandara Barrage and 710m downstream of Matta Bridge across River Swat on main Nowshehra-Chakdara-Chitral (NCC) road.

81. The water treatment plant has been proposed to be constructed at the left bank of River Swat at about 20 km Upstream of Mingora City, District Swat, Khyber Pakhtunkhwa (KP). The proposed water treatment plant has been designed based on the ultimate water flow of 46 cusec (30 MGD).In addition to design flow 10 % of flow has been additionally added for friction and other losses. Two parallel treatment streams/trains (each having flow of 15 MGD) have been proposed to provide flexibility in operation. Each train will consist of one plain sedimentation tank, two flash mixers & flocculation chambers, two clarifiers, one rapid gravity filter unit, one chlorine contact tank and treated water tank.

82. To treat the surface water and bringing the water quality parameters within prevailing provincial environmental standards i.e. National Environmental Quality Standards (NEQS), a conventional water treatment plant is proposed for Mingora City. Location of proposed supply mains shall transmit treated water to water storage reservoirs and connected to water distribution network inside the city to distribute water from storage reservoirs to end users with a water metering system.

83. The UCs under the jurisdiction of WSSC Mingora for the proposed water supply network are as follow:

- UC-1 - Nawakalay/ Shadara
- UC-2 - Banr/ Usmanabad
- UC-3 - Malook Abad
- UC-4 – Rang Mohallah / Gumbat Maira
- UC-5 - Malakanan Landy Kass
- UC-6 - Rahimabad
- UC-7 - Amankot/ Faizabad
- UC-8 - Panr / Gulkada

- UC-9 - Saidu Sharif/ Shagai

84. A map showing the location of intake sources, Transmission main and location of WTP and UCs are shown in **Figure 3-1**

3.1.1 Project Need

85. The current mode of operation for water supply in Mingora city is intermittent through ground water sources with approximately 64 number of tube wells. High energy costs related to pumping is a main reason that the city cannot operate on a 24/7 mode of water supply. The distribution network is spread on a large area with elevation difference of 920 to 1100 meters. Accordingly, the water network is divided into several pressure zones. Each pressure zone has its own set of tube wells installed. Water is pumped from these tube wells to water storage reservoirs and then distributed under gravity fed pipelines. In few cases, direct pumping from source to distribution network is also a practice. On average, a normal consumer gets 1 hour of water supply on daily basis in Mingora city. Major part of the water supply is wasted by illegal connections, non-revenue water (NRW), and leakages. NRW percentage for Mingora city is reported to be around 60 percent.

86. There are 67 no. of existing and proposed water storage reservoirs in the city. Catchment area for each water storage reservoir was marked and number of plots was counted for each catchment. Accordingly, the population for each water storage reservoir or catchment was calculated keeping in view the criteria of 7 persons per house. Allowance for future projected population was also considered as per the population projection estimates. The details of water storage reservoirs, catchment marking, and future growth projection are presented below.

87. Apart from the supply received from the existing Mingora greater water supply scheme, Mingora city is being served through a ground water-based system i.e. tube wells. The declining water table at existing 64 tube wells that necessitated identification of new sources of surface water to be tapped to satisfy the water demands of current and projected population of the Mingora city.

88. Based on the population estimates, the average daily demand for Mingora city was calculated assuming 35 gallons per capita per day as the daily consumption rate. The projected water demands indicates that the current water demand of Mingora city is approximately 12 million gallons per day (MGPD) while the projected demand for 30 years design period (2050) is estimated as 30 MGPD.

3.1.2 Project Benefits

89. The main benefits of this project include the following

- Mingora Greater Water Supply Scheme thereby eliminating the need to rely on tube wells in mostly all the areas currently served by WSSC Mingora;

- Mingora Greater Water Supply Scheme will result in a water supply system that has lower operational costs by reducing or eliminating pumping costs in the system;

- Mingora Greater Water Supply Scheme will be a surface water source-based supply which is more sustainable and reliable than the current pumping-based tube well source of supply;

90. The project will provide an end-to-end solution from source to end customers including intake structure, water treatment plant, transmission main, storage reservoirs, distribution network inside the city, and water metering system

3.2 Detailed Engineering Design Water Supply Network

91. The various tasks carried out during the detailed engineering design for water supply network including design criteria are presented in the section below.

3.2.1 Design Criteria

92. The design criteria are mainly based on the standards and specifications of WASA Lahore. Where required, international best practices were also considered in establishing the design criteria for the proposed water supply system.

3.2.2 Design life

93. For Mingora Greater water supply scheme, a design life of 30 years is considered keeping in view the significant improvements proposed and expected return on investment benefits.

3.2.3 Planning Horizon

94. Mingora Greater water supply scheme is mainly dependent on the capacity of the available surface water sources to cater for the projected demands. Two different scenarios were evaluated depending on the total water production from different water sources and the projected demands

95. Design criteria established for the proposed water supply distribution system and transmission main is summarized below in Table 3—1

Table 3—1: Design criteria of proposed water supply system

Sr No	Parameter	Criteria
Water Distribution network		
1	Per capita water consumption including unaccounted for water	35 Gallons per capita per day
2	Peak demand for design of distribution network	Peak factor of 1.5 for maximum day demand and peak factor of 2 for maximum hourly demand
3	Permissible velocity in distribution lines	0.3 m/s min to 2.25 m/s max
4	Minimum Pipe Size for Distribution Network	75 mm
5	Pipe size and material for Domestic connection	18.75 mm
6	Pipe size for Commercial Connection	25.4 mm
7	Pipe material	HDPE PE-100, PN-12/PN-16 for underground pipe and GI for at grade
8	Minimum terminal pressure for the farthest point in system	1 bar

Sr No	Parameter	Criteria
9	Desirable maximum pressure	6.5 bars
10	Maximum test pressure	1.5 times the designed pressure
11	Minimum cover to pipe from the finished level / ground level	1.2 m
12	Hydraulic modelling software	Bentley's Water CAD
13	Laying of distribution network	Loop/grid system
14	Isolation valves	Every zone defining junction
15	Pipe crossing existing roads	Concrete encasement
16	Pipe roughness coefficient	130 (Hazen William's Co-efficient)
17	Pipe bedding	Sand bedding for plain/hilly areas
Transmission and Delivery/ Supply mains		
1	Permissible velocity	0.3 m/s min to 2.5 m/s max
2	Pipe material	Mild Steel
3	Maximum allowable pressure	16 bars
4	Maximum test pressure	1.5 times the designed pressure
5	Minimum cover to pipe from the finished level / ground level	1.2 m
6	Hydraulic modelling software	Bentley's WaterCAD
7	Isolation valve/ drain valve	Every 4 kms
8	Air valve/washout valve	As per requirement/high low point
9	Pipe crossing existing roads	Concrete encasement
10	Minimum vertical alignment/ slope	1:1000
11	Provision of thrust block	Every bend>11.25^{o} at high pressure
12	Pipe roughness coefficient	110 (Hazen William's Co-efficient)
13	Pipe bedding	100mm sand bedding for plain/hilly areas

3.2.4 Existing Water Distribution System

96. The current mode of operation for water supply in Mingora city is intermittent through ground water sources with approximately 64 number of tube wells. High energy costs related to pumping is a main reason that the city cannot operate on a 24/7 mode of water supply. The distribution network is spread on a large area with elevation difference of 920 to 1100 meters. Accordingly, the water network is divided into several pressure zones. Each pressure zone has its own set of tube wells installed. Water is pumped from these tube wells to water storage reservoirs and then distributed under gravity fed pipelines. In few cases, direct pumping from source to distribution network is also a practice. On average, a normal consumer gets 1 hour of water supply on daily basis in Mingora city. Major part of the water supply is wasted by illegal connections, non-revenue water (NRW), and leakages. NRW percentage for Mingora city is reported to be around 60 percent.

3.2.5 Population Estimate and Water Demand computations

97. In order to comply with the design life of the project, projected population for next 30 years for Mingora city was estimated in the concept design stage, by assuming a 3% growth rate, as shown in below table. The current population estimate was sourced from Census data 2017. Table 3-2 indicates that the current population of Mingora city is 0.35 million while the projected 30 years population will be approximately 0.85 million.

Table 3—2 Population Projection for Mingora City

Current Estimated Population (2017 Census)	Projected Population @3% growth ($Pt = P_0(1+r)^t$)		
	10 Years	**20 Years**	**30 Years**
350,000	470,371	632,139	849,542

98. There are 67 no. of existing and proposed water storage reservoirs in the city. Catchment area for each water storage reservoir was marked and number of plots was counted for each catchment. Accordingly, the population for each water storage reservoir or catchment was calculated keeping in view the criteria of 7 persons per house. Allowance for future projected population was also considered as per the population projection estimates. The details of water storage reservoirs, catchment marking, and future growth projection are presented below.

99. Based on the population estimates provided above in Table 3-2, the average daily demand for Mingora city was calculated assuming 35 gallons per capita per day as the daily consumption rate. The projected water demands given in Table 3-3 below indicates that the current water demand of Mingora city is approximately 12 million gallons per day (MGPD) while the projected demand for 30 years design period (2050) is estimated as 30 MGPD.

Table 3—3 Current and Projected Demand for Mingora City

	Population	Current Water Demand (based on 35gpcd) GPD	
		GPD	**MGPD**
Current	350,000	12,250,000	12
Projected (30 Years)	850,000	29,750,000	30

100. During detailed engineering design stage, the calculations of population and water demand were finalized for each proposed and existing water storage reservoir as shown in Table 3-4.

Table 3—4 Current and Projected Demand for Individual Tanks based On Planning Data

Sr. No	Tank Names	Served Houses	Served Population	Avg. daily demand (US gpd)	Max daily demand (US gpd)	Max. Peak Hour demand (US gpd)
1.	Shagai 50,000	322	2,257	79,009	118,514	237,028
2.	Abdul Manan Mohallah	266	1,862	65,170	97,755	195,510
3.	Afsar Abad Colony 100,000	540	3,780	132,300	198,450	396,900
4.	XYZ Tank (near baramaQawnj)	852	5,964	208,745	313,118	626,236
5.	Afsar Abad Saidu 50K	2,026	14,182	496,369	744,554	1,489,107
6.	Akram mohallah shahdara 10K	494	3,458	121,026	181,539	363,077
7.	Aziz Abad tank Raja Abad	1,815	12,704	444,645	666,968	1,333,935
8.	Bacha Mohallah 50K	2,098	14,686	514,011	771,017	1,542,034
9.	Baitullah Mohallah (Lower) 30K	1,170	8,190	286,640	429,960	859,920
10.	Baitullah Mohallah (Upper) 50K	1,558	10,905	381,690	572,536	1,145,071
11.	BakhtMand Mohallah 50K	451	3,157	110,499	165,748	331,496
12.	Bakroo Gat Shine Krapa 30K	1,206	8,442	295,470	443,205	886,410
13.	Bali Garam Bar Kaly 50K	1,372	9,604	336,156	504,234	1,008,468
14.	Bali Garam Bar Kaly 50K(2)	1,740	12,180	426,308	639,462	1,278,923
15.	Barama Qawnj 30K	2,019	14,134	494,692	742,038	1,484,076
16.	Chil Shagai Shaheen Abad 30K	978	6,846	239,609	359,414	718,828
17.	College Colony 100K	1,801	12,610	441,352	662,028	1,324,055
18.	Gheer Abad SoorGhar 100K	2,169	15,183	531,418	797,127	1,594,254

Sr. No	Tank Names	Served Houses	Served Population	Avg. daily demand (US gpd)	Max daily demand (US gpd)	Max. Peak Hour demand (US gpd)
19.	Gujar Abad Mohallah 10K	588	4,116	144,060	216,090	432,180
20.	Gulkada (1) Near EPI Office 50K	3,358	23,506	822,702	1,234,053	2,468,106
21.	Gulkada (2) 50K	1,966	13,762	481,682	722,523	1,445,045
22.	Janasay GraveYard 100K	280	1,960	68,604	102,906	205,812
23.	Kaan mohallah shahdara 65K	713	4,991	174,687	262,030	524,060
24.	Kargal Tank 10K	970	6,790	237,663	356,494	712,988
25.	Khuja Abad 30K	2,846	19,922	697,257	1,045,885	2,091,770
26.	Khuna Cham Morra 50K	370	2,590	90,650	135,975	271,950
27.	Lala Gano tank 50K	354	2,478	86,730	130,095	260,190
28.	Maizaroo Dehrea Lower 30K	726	5,082	177,883	266,824	533,648
29.	Maizaroo Dehrea Upper 10K	336	2,352	82,320	123,480	246,959
30.	Malook Abad (Volta) Zamarood	284	1,988	69,575	104,363	208,726
31.	MianGano Cham (Upper) 100K	1,270	8,890	311,151	466,727	933,453
32.	Mohammad Gul Shaheed 15K	1,280	8,959	313,573	470,360	940,720
33.	Near Malook Abad Tank 100K	3,006	21,044	736,541	1,104,812	2,209,623
34.	Qambar 30K	1,632	11,424	399,829	599,743	1,199,486
35.	Qayum Abad Shah Dara 50K	1,626	11,379	398,281	597,421	1,194,842
36.	Qayum Abad Shah Dara 100K	480	3,360	117,602	176,403	352,805
37.	Rehmanabad 10K	2,065	14,455	505,909	758,863	1,517,726

Sr. No	Tank Names	Served Houses	Served Population	Avg. daily demand (US gpd)	Max daily demand (US gpd)	Max. Peak Hour demand (US gpd)
38.	Rehmanabad 100K	674	4,718	165,131	247,696	495,392
39.	Rang Mohallah 100K	174	1,218	42,635	63,952	127,904
40.	Sakka Cheena Aman 50K	916	6,409	224,321	336,481	672,962
41.	SDO Mohalllah ShahDara 50K	630	4,410	154,351	231,527	463,053
42.	Shagai 10k	376	2,632	92,113	138,170	276,340
43.	Shagai 50K	322	2,257	79,009	118,514	237,028
44.	Shagai Morra 10K	570	3,990	139,653	209,479	418,958
45.	Sharif Abad Dehrai ABC	2,447	17,129	599,526	899,290	1,798,579
46.	Sherari Yari Paray 30K	782	5,474	191,587	287,381	574,761
47.	Usma Khil AmanKot 30K	1,843	12,903	451,615	677,423	1,354,846
48.	Usman Abad 50K	1,052	7,364	257,734	386,601	773,201
49.	Proposed OHR 1	1,532	10,723	375,303	562,955	1,125,909
50.	Proposed OHR 2	3,214	22,500	787,498	1,181,247	2,362,493
51.	Proposed OHR 3	4,992	34,944	1,223,040	1,834,560	3,669,120
52.	Proposed OHR 4	1,465	10,254	358,892	538,338	1,076,675
53.	Proposed OHR 5	3,069	21,483	751,903	1,127,854	2,255,708
54.	Proposed OHR 6	2,060	14,419	504,668	757,002	1,514,003
55.	Proposed OHR 7	3,941	27,587	965,545	1,448,318	2,896,636
56.	Proposed OHR 8	1,246	8,722	305,270	457,905	915,809
57.	Proposed Tank 1	3,396	23,772	832,020	1,248,030	2,496,060
58.	Proposed Tank 2	1,308	9,153	320,340	480,510	961,020
59.	Proposed Tank 3	566	3,962	138,676	208,014	416,028
60.	Proposed Tank 3A	320	2,240	78,400	117,600	235,200

Sr. No	Tank Names	Served Houses	Served Population	Avg. daily demand (US gpd)	Max daily demand (US gpd)	Max. Peak Hour demand (US gpd)
61.	Proposed Tank 3B	512	3,584	125,446	188,170	376,339
62.	Proposed Tank 4	762	5,334	186,700	280,050	560,100
63.	Proposed Tank 5	775	5,428	189,989	284,983	569,966
64.	Proposed Tank 6	1,482	10,374	363,086	544,629	1,089,258
65.	Proposed Tank 7	1,608	11,256	393,960	590,941	1,181,881
66.	Proposed Tank 8	843	5,900	206,496	309,744	619,487
67.	Proposed Tank 9	1,239	8,670	303,457	455,185	910,370

3.2.6 Design of Proposed Water Supply System Components

101. Mingora Greater Water Supply Scheme is comprised of the following system components:

- Raw Water Intake Structure;
- Raw Water Transmission main from intake to the water treatment plant;
- Proposed Water Treatment Plant (WTP);
- Treated water supply mains/Supply mains from WTP to Mingora City;
- Receiving Water Storage reservoirs;
- Water Distribution Network and water meters

102. Project schematic layout showing all the major components (excluding distribution network) of Mingora Greater Water Supply Scheme is presented in **Figure 3-1** while the details of these components are provided below.

3.2.7 Treated Water Transmission Main

103. Raw water from River Swat is first conveyed from the Raw Water Intake structure to the proposed water treatment plant, and then the treated water will be supplied via a transmission main pipeline from the proposed water treatment plant to multiple water storage reservoirs in Mingora city. The proposed transmission main is having a length of approximately 20kms which is designed to be operated under gravity up to the receiving water storage reservoirs in Mingora city. The transmission main originates from clear water reservoirs of the treatment plant and ends near Hayatabad area i.e. the first receiving storage reservoir in Mingora City. From that point onward, the proposed 1200 mm transmission main branches out into various smaller diameter supply mains in the city.

104. **Hydraulic characteristics:** Hydraulic model based on Water Cad software was run for the proposed transmission main using the elevations obtained from the topographic survey. Characteristics of the proposed transmission main are provided below:

- Nominal Diameter = 1200 mm (48 inches)
- Length of transmission main = Approximately 20 kms.
- Pipe material = Mild Steel (To be laid underground)
- Pipe Roughness = 110 (Hazen William Coefficient)
- Flow = MGD (For 30-Years projected population/ water demands)
- Velocity = 1.2 m/s
- Head loss Gradient = 1.213 m/km
- External Coating = Bitumen
- Internal Coating = cement mortar lining / liquid-applied epoxy
- Proposed valves: Different types of valves are proposed at the transmission main including isolation valves, air valves, washout valves, etc.

105. **Proposed Route:** The route of the proposed transmission main, as shown in Figure 3-1 is mainly going through the open fields. The option of pipe route along the main Madyan road/N-95 was not feasible due to the residential and commercial properties along the route at multiple locations. A 5 meter corridor width is proposed for the proposed transmission main for the future operation and maintenance purposes. The route of the proposed transmission main has been adjusted based on the existing features identified in topographic survey. Some structures along the route of the pipe were avoided including cellular tower, houses or commercial properties. The proposed route was selected such that to the extent possible, maximum bends in the pipe line and road crossings are avoided or minimized. Inside the city area, the proposed transmission main will run along the main Madyan road.

3.2.8 Treated Water Supply Mains

106. Within the city limits, the transmission main branches out into a network of smaller diameter pipelines to connect to each of the water storage reservoir (existing and proposed). These pipelines are referred to as the Supply Mains. These supply mains are laid within the city and they feed all the existing and proposed storage reservoirs. The hydraulic model, using WaterCad software, was simulated for flows and pressures in both the proposed transmission main as well as the proposed supply mains. The purpose of the hydraulic model simulations was to establish and finalize the pipe sizes of the supply mains keeping in view the requirements of flows and pressures to be achieved in these pipelines as per the design philosophy. The end pressure of supply mains at each of the water storage reservoir has been kept at minimum 1 bar.

107. Based on the results of the hydraulic model, the diameters of the proposed supply mains vary from 1100mm to 100mm range. Each supply main will be equipped with flow Control Valve prior to connection with water storage reservoir. This will help in flow monitoring/regulation of the overall system. The general layout of proposed supply mains is shown below in Figure 3-2.

3.2.9 Receiving Water Storage Tanks

108. The raw water transmission main from the proposed water treatment plant branches out into multiple supply mains to ultimately supply water to the exiting and newly proposed water storage reservoirs. These reservoirs will further supply water to the end users/customers through newly proposed water distribution system pipelines and house connections. As per the data collected from WSSC Swat, there are 48 number of existing water storage reservoirs in Mingora city under the jurisdiction of WSSC Swat. All of these existing water storage reservoirs are surface water tanks. The details of the existing water storage reservoirs including the capacity and location are provided below in the Table 3-5.

Table 3—5 : Details of Existing Surface Reservoirs

Sr. No	Existing Receiving Tanks	Capacity (US Gallons)	Northing	Easting
1.	Abdul Manan Mohallah	10,000	72.3415	34.7638
2.	Akram Mohallah Shahdara	10,000	72.3684	34.7875
3.	Gujar Abad Mohallah	10,000	72.346	34.7683
4.	Kargal Tank	10,000	72.3484	34.7592
5.	Maizaroo Dehrea Upper	10,000	72.337	34.7645
6.	Rahman abad	10,000	72.3309	34.7637
7.	Shagai	10,000	72.3472	34.7384
8.	Shagai Morra	10,000	72.3415	34.735
9.	Mohammad Gul Shaheed	15,000	72.3619	34.7771
10.	Baitullah Mohallah (Lower)	30,000	72.3492	34.7536
11.	Bakroo Gat ShnaKrapa	30,000	72.3491	34.7518
12.	Barama Qawnj	30,000	72.3779	34.7712
13.	Chil Shagai Shaheen Abad	30,000	72.3432	34.7481
14.	Khuja Abad	30,000	72.3794	34.7667
15.	Maizaroo Dehrea Lower	30,000	72.3368	34.7647
16.	Qmabar	30,000	72.3299	34.7633
17.	Sherari Yari Patay	30,000	72.3747	34.7572
18.	Usmakhil Amankot	30,000	72.3489	34.7693
19.	Afsar Abad Saidu	50,000	72.3618	34.7497
20.	Aziz Abad Tank Raja Abad Ishaq Mohallah	50,000	72.3669	34.7786
21.	Bacha Mohallah	50,000	72.3488	34.7667
22.	Baitullah Mohallah (Upper)	50,000	72.3498	34.7585
23.	Bakht Mand Mohallah	50,000	72.3397	34.7647
24.	Baligaram Bar Kaly	50,000	72.3527	34.7426

Sr. No	Existing Receiving Tanks	Capacity (US Gallons)	Northing	Easting
25.	Baligaram Bar Kaly	50,000	72.3527	34.7426
26.	Gulkada (1) Near Epi Office	50,000	72.3659	34.7607
27.	Gulkada (2)	50,000	72.3688	34.7583
28.	Khuna Cham Morra	50,000	72.3485	34.7408
29.	Lalagano Tank	50,000	72.3436	34.7675
30.	Qayum Abad Shah Dara	50,000	72.365	34.7836
31.	Rang mohallah Chawak	50,000	72.368	34.7757
32.	Sakha Cheena Aman	50,000	72.3476	34.7617
33.	Sdo Mohallah Shahdara	50,000	72.3659	34.7862
34.	Sharia	50,000	72.3474	34.7375
35.	Sharif Abad Dehraiabc	50,000	72.3707	34.7676
36.	Usman Abad	50,000	72.375	34.7801
37.	Kaan Mohallah Shahdara	65,000	72.3675	34.7853
38.	Afsar Abad Colony	100,000	72.3646	34.7489
39.	College Colony	100,000	72.3631	34.758
40.	Ghareeb Abad SoorShar	100,000	72.3789	34.7792
41.	JanasayGarve Yard	100,000	72.3641	34.7441
42.	Malook Abad (Volta) ZamaroodKaan	100,000	72.3709	34.7825
43.	MianGano Cham (Upper)	100,000	72.3823	34.7653
44.	Near Malook Abad Tank	100,000	72.3673	34.7788
45.	Qayum Abad Shah Dara	100,000	72.3648	34.7838
46.	Rahmanabad Tank	100,000	72.3365	34.7615
47.	Rangmohallah Tank	100,000	72.3755	34.7833
48.	Xyz Tank Near BraramaQawnj	50,000	72.3795	34.7708

109. Each of the existing water storage reservoir will be supplied treated water via a dedicated supply main. Based on the hydraulic model of the proposed transmission main and supply mains, the water storage reservoirs with elevation levels in the range of 1030 MSL will get uninterrupted water supply via a gravity system. While the remaining reservoirs, located at slightly higher elevation than 1030 MSL, will be fed through a pumping system. In order to minimize the operational cost of pumping system, solarization of those pumping houses is proposed. The solar pumps will have capacity to run 12 hours on solar energy as well as conventional electric supply as a back-up and alternate energy source. The details of existing water storage reservoirs which will be served via pumping arrangements are given in Table 3-6

Table 3—6 Details of Existing Surface tanks served via Solar Pumps

Sr. No	Water storage reservoir	Sr. No	Water storage reservoir
1	Rang mohallah 100K	2	Kargal tank 10K
3	Ghareebabad soorghar 100K	4	Khunachammorra 50K
5	Proposed Tank 3-B	6	Mianganocham (Upper) 100k
7	Proposed Tank 2	8	Baligaram bar kaly 50k
9	Malookabad (volta) zamarood kaan	10	Shagai 10k
11	Afsarabad colony 100k	12	Usman abad 50k
13	Proposed Tank 3-A	14	Sakha cheenaaman 50k
15	Shagaimorra 10K	16	Bakroo gat shnakrapa 30k
17	Shagai 50K	18	Rahmanabad 100k
19	Proposed Tank 6		

110. Beside the 48 number of existing water reservoirs, new surface and overhead water storage reservoirs/tanks were proposed to provide a minimum storage equivalent to demand of one-day covering the entire population of Mingora City. The location for the proposed water reservoirs were selected in close coordination with WSSC Swat. 10 new surface water reservoirs and 8 overhead water tanks are being proposed to supply treated water to customers and increase daily storage capacity of the distribution system in the city. Moreover, these reservoirs will also help to serve the areas that are facing shortfall in water supply or currently not served at all. All the proposed water storage reservoirs are Reinforced Cement Concrete (R.C.C) type. The location of the proposed surface water reservoirs and OHRs along with their capacities is given below in Table 3-7 while these water reservoirs are also shown below in Figure 3-2.

111. The locations of the newly proposed water reservoirs and OHRs have already been shared with WSSC Swat in the earlier submitted concept design report. Subsequent meetings were also held with WSSC Swat to get their consent and feedback on the proposed locations of these water storage reservoirs. WSSC Swat recommended some modifications to the locations of some of the proposed water storage reservoirs,

and these changes have now being incorporated in the detailed engineering design stage.

Table 3—7 Details of Proposed Surface tanks & OHRs

Proposed Tanks	Proposed Capacity (US Gallons)	Northing	Easting
Surface Tank 1	150,000	72.373497	34.7803001
Surface Tank 2	200,000	72.3667984	34.7575989
Surface Tank 3	300,000	72.3621979	34.7445984
Surface Tank 4	300,000	72.3496017	34.7408981
Surface Tank 5	100,000	72.3403015	34.7369995
Surface Tank 6	200,000	72.3454971	34.7650986
Surface Tank 7	150,000	72.3330002	34.7607994
Surface Tank 8	150,000	72.3378983	34.7450981
Surface Tank 3-A	100,000	72.3632965	34.7428017
Surface Tank 3-B	100,000	72.3554993	34.738800
OHR 1	200,000	72.3536987	34.7747002
OHR 2	200,000	72.3539963	34.7793999
OHR 3	200,000	72.3555984	34.7868996
OHR 4	200,000	72.3470001	34.7793999
OHR 5	200,000	72.3431015	34.7853012
OHR 6	200,000	72.3464966	34.7736015
OHR 7	200,000	72.3352966	34.7834015
OHR 8	200,000	72.3386993	34.7709007

112. Currently, the total storage capacity of the existing water supply system is approx. 2,380,000 GPD. With the addition of the proposed water storage reservoirs and upsizing of some of the existing reservoirs, the overall storage capacity of the proposed water supply system will be 7,270,000 GPD. At the upstream of each water storage reservoir, a complete assembly of flow control valve was proposed. Each assembly contains, flow control valve, flow meter, pressure transmitter and dedicated valve chamber. This arrangement will help to create water balance sheet for each tank and limit terminal pressure of inlet supply main.

Figure 3-1 Overall Schematic Layout Plan for Mingora Greater Water Supply Scheme=

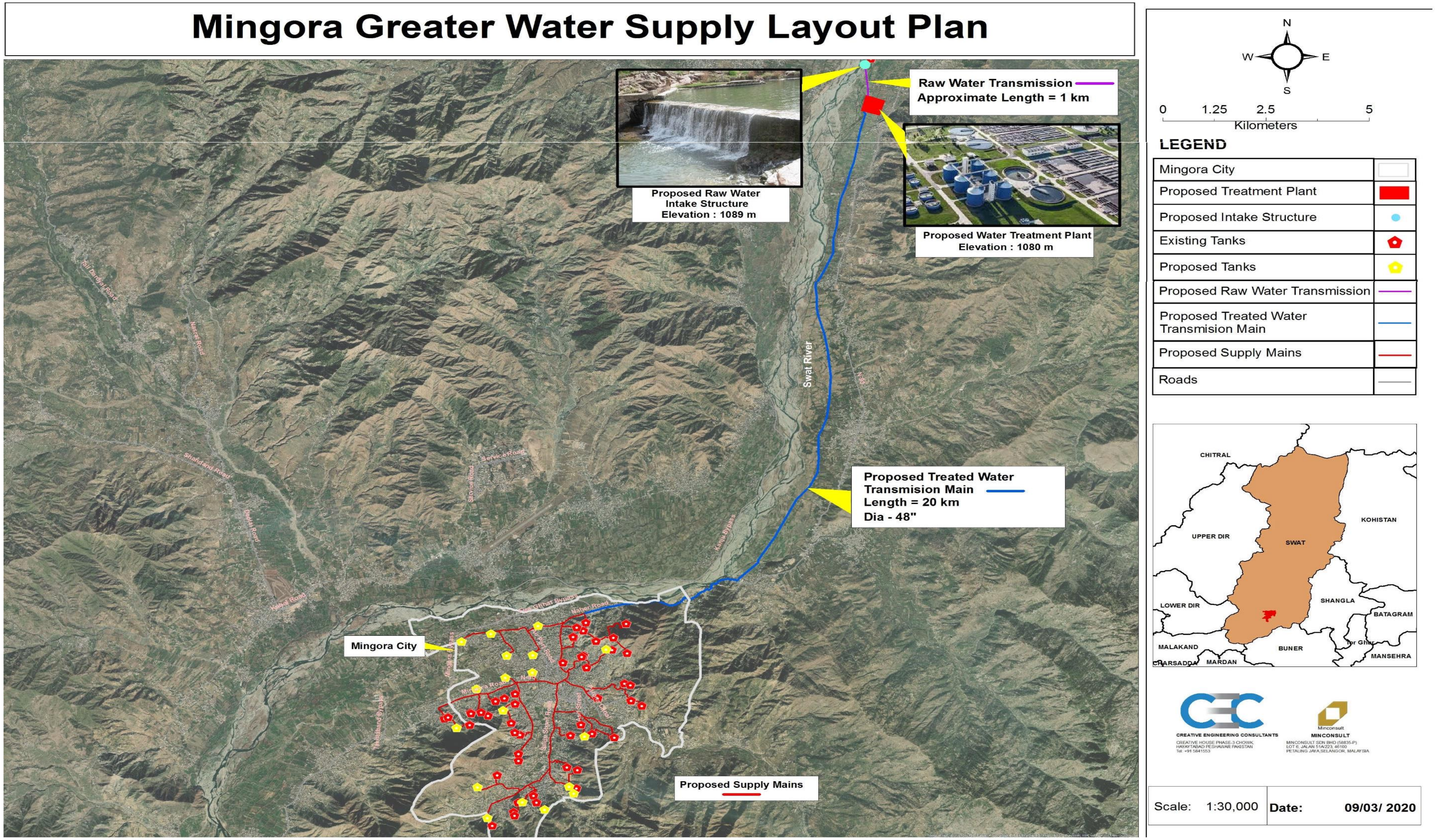
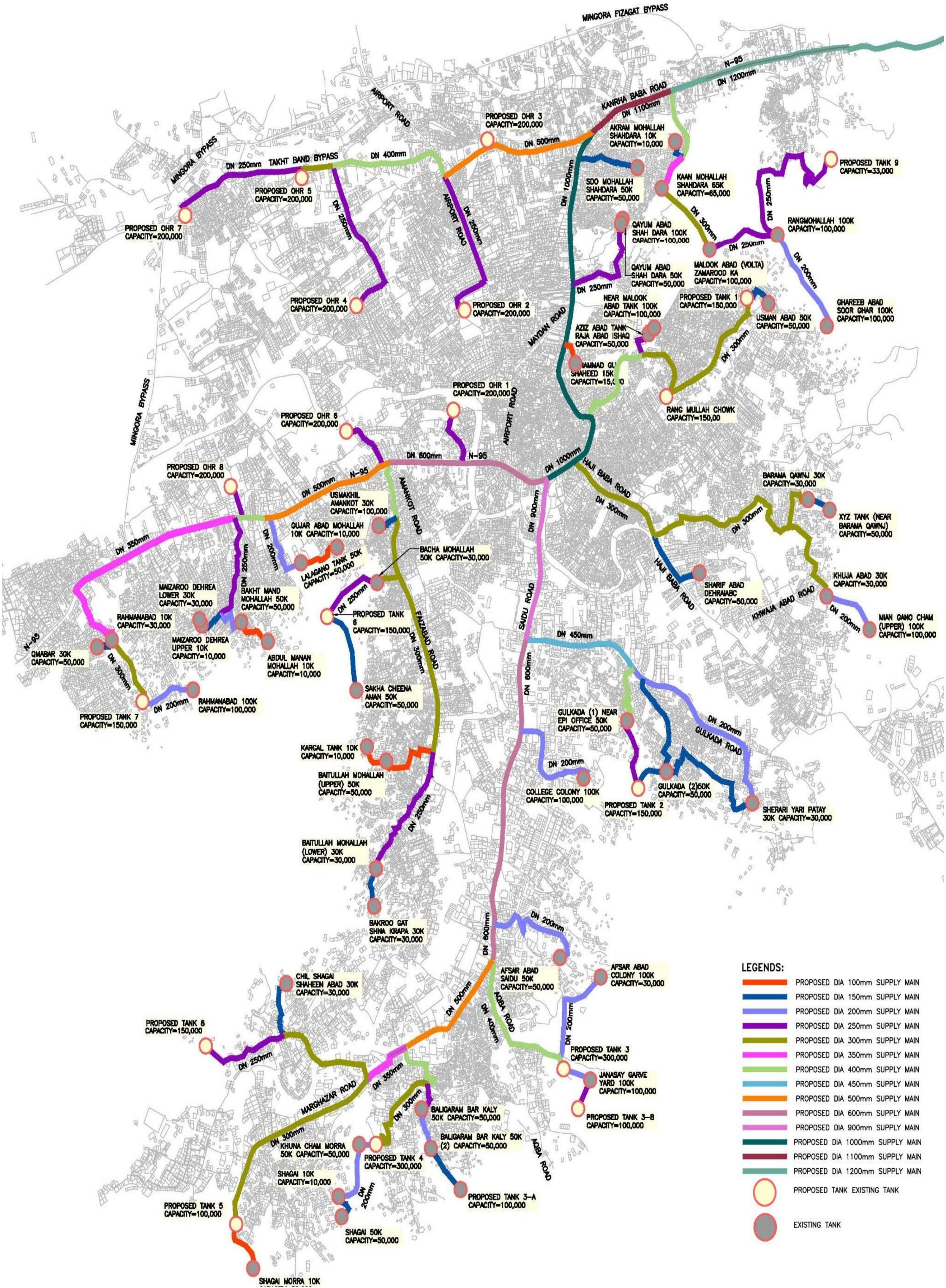


Figure 3-2 Schematic layout plan for proposed supply mains in Mingora city



3.3 Raw Water intake Design & Hydrology

113. This section outlines the detailed design related to the source water and raw water intake proposed to draw water from identified new sources i.e. natural streams. The water from intake shall be transported to the proposed water treatment plant (WTP) which will supply treated water to the residents of Mingora City.

3.3.1 Intake Location

114. The identified location of intake site is located in a wide river reach/floodplain about 600 m. The natural river bed slope prevailing in the study reach is between of 1 in 200 to 1 in 250. The project proposed intake site is located about 62 km upstream of Amandara Barrage and 710m downstream of Matta Bridge across River Swat on main Nowshehra-Chakdara-Chitral (NCC) road. Coordinates of proposed intake is given below in Table 3.8.

Table 3—8 : Proposed Intake Location

Location	Northing DMS	Easting DMS
Intake	34°56'9.35"	72°27'4.14"

115. The intake structure will draw water from the Swat River through approach channel. The intake is located on the left end of the river and is inclined at an angle of about 53 deg to the axis of approach channel. The intake is 16 m long and 3 m wide. The crest level of the intake will be 1 meter higher than crest level of the under sluice part. Intake is designed for diversion capability of1.3cumecs (46 cusecs). The left abutment of the intake extends 71 m upstream of the vertical face of the intake to an existing retaining wall. The crest block has a 1:3 sloping glacis which has 7.5 m long cistern of 0.8meterthickness and a downstream sloping end sill. The cistern delivers water to a sump of size 6x6 m, where 3 m delivery pipe carries water downstream to water treatment plant.

3.3.2 Flow measurement

116. In a normal year, the low flows in Swat River are around 1200 / 1300 cfs in the month of December and January. In the summer, the normal high flows are around 11, 000 to 16, 000 cfs in July and August. Normal yearly floods can raise the flows to 20,000 to 25,000 cfs.

117. Average monthly discharge of Swat River at Chakdara are presented in following Table 3.9

Table 3—9 Average Monthly Swat River flow at Chakdara

Month	River Swat Flow at Chakdara (cusecs)
January	1276
February	1525
March	2817
April	6663
May	9798
June	15122
July	14917
August	9830

Month	River Swat Flow at Chakdara (cusecs)
September	5157
October	2355
November	1643
December	1365

*Source: Soil Survey Swat Catchments (Average in Cusecs)

3.3.3 Catchment Area

118. River Swat originates in the form of Ushu and Gabral streams in the Kohistan range of northern mountains of Khyber Pakhtunkhwa and takes the name of River Swat at Kalam at the confluence of the two. Fed by snow melting and glaciers it receives drainage of the entire Swat Valley. The River flow southward, then westward, until joined by Panjkora River. Pankora River is major tributary of Swat River and it merges into Swat River at Kulangi Post. The River then flows south-westward into Peshawar plain and joins the Kabul River. Total catchment area upto its confluence with Kabul River near Charsada is 13645 sq.km. Catchment area of Swat River at Kalam and Chakdara is 2020 and 5770 sq.km respectively.

119. The catchments area is drained by Swat River and its tributaries. The Panjkora River joins River Swat downstream of Hisar / Totakan at Sharbatai. The river discharge increases in summer because of more snow melting due to rise in temperature.

3.3.4 Hydrological Data

120. There are two (02) gauge stations available near the project site maintain by SWHP, WAPDA, as given in Table 3.10 Stream flows of Swat River are being observed on daily basis.

Table 3—10 Stream Flow Gauging Stations

Sr. No.	Station	River	Location		Catchment Area (Km^2)	Period of record
			Longitude	Latitude		
1	Kalam	Swat	35°28’10”	72°35’40”	2020	1961-2009
2	Chakdara		34°38'40.23"	72°1'42.83"	5776	1961-2014

121. Kalam gauge station is located on Swat River 2.4 km (approx.) downstream of the junction of Ushu and Gabral rivers and have the longest records of river flow for around forty-nine (49) years.

122. Chakdara gauge station is located on Swat River 6 km (approx.) upstream of Batkhela. This station is maintained by SWHP, WAPDA and has the records of river flows for around fifty-four (54) years (1961 to 2014).

3.4 Proposed Water Treatment Plant

123. This section covers the details pertaining to the detailed process design of the proposed Water Treatment Plant‟s components in light of the raw water quality (discussed in section 4.1.1 of IEE report) and the quality of water to be achieved through treatment.

3.4.1 Detailed Design Basis

124. The design of the Water Treatment Plant has been carried out considering the design criteria / parameters and raw water quality parameters discussed in previous sections.

3.4.2 Location of Water Treatment Plant

125. The water treatment plant has been proposed to be constructed at the left bank of River Swat at about 20 km Upstream of Mingora City, District Swat, Khyber Pakhtunkhwa (KP).Layout of Mingora Water Treatment Plant has been shown in Figure 3-1.

3.4.3 Capacity of Water Treatment Plant

126. As mentioned in preceding section the units of water treatment plant are designed for a daily flow of 112,526 m3/day (30 MGD) and10% additional flow for losses to account for losses during the treatment process such as sludge discharges from sedimentation tanks and sand filters backwashing, use of make-up water for chemical preparation, plant cleansing water etc.

3.4.4 Water Treatment Processes

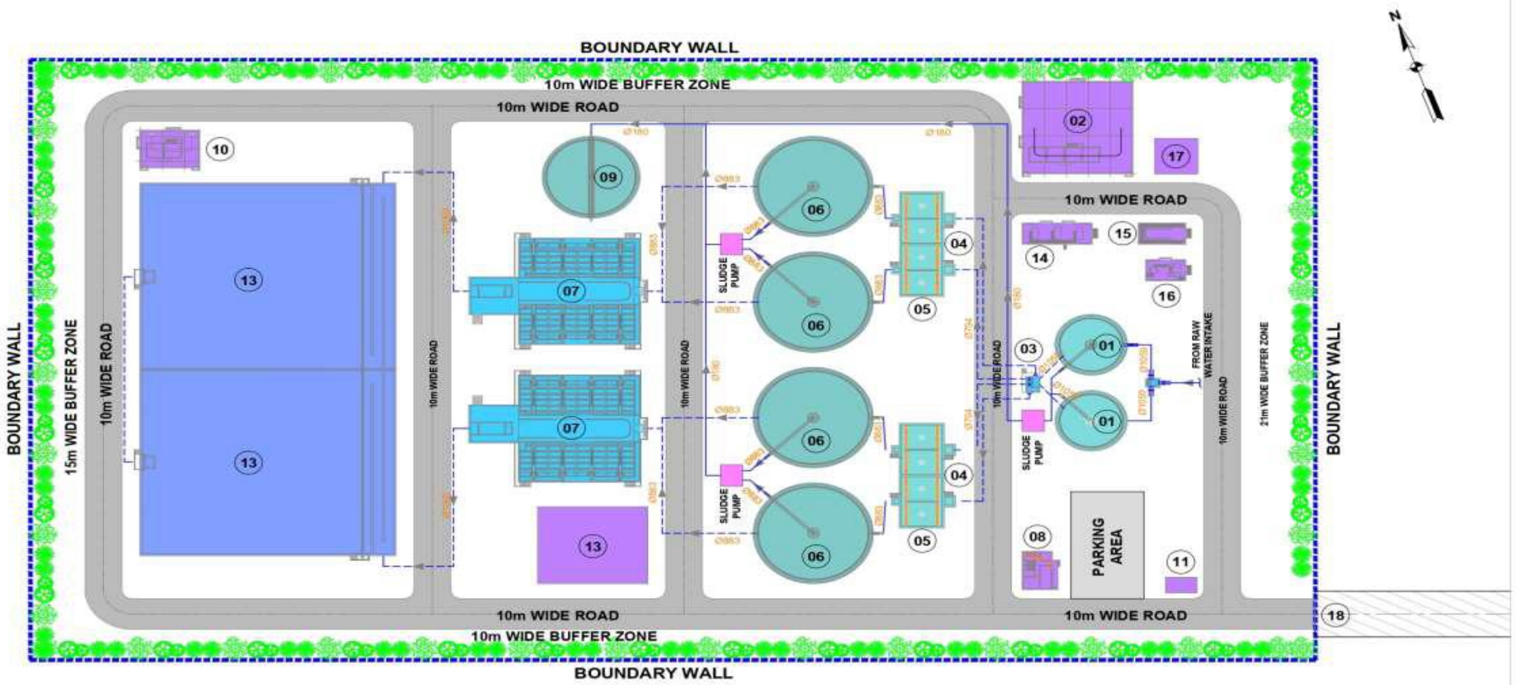
127. The treatment process will be so employed that biological contaminants and suspended solids are brought in the limits set forth in Pakistan Standards and WHO Guideline values for Drinking Water.

128. As discussed in preceding sections-, conventional surface water treatment plant (rapid gravity filtration) is proposed for the treatment of source water. With the conventional treatment, the turbidity can be reduced to the limit of < 5 NTU, as per Pakistan Standard for Drinking Water Quality.

3.4.5 Process Train

129. Two process trains have been proposed each having treated water capacity of 56,263 m3/day (15 MGD), each train will consist of separate plain sedimentation tank, two flash mixers, two flocculation basin, two clarifiers and a filtration unit. The water in the two trains will be fed from a structure known as distribution chamber. The process flow diagram is shown in **Figure 3-3.** Process flow of proposed water treatment plan is shown in **Figure 3-4.**

Figure 3-3: Layout Plan of Proposed Water Treatment Plant



1. Plain Sedimentation Tank
2. Chemical Building
3. Distribution Chamber
4. Flash Mixer
5. Flocculation Chamber
6. Clarifier
7. Rapid Sand Filters
8. Admin Building
9. Sludge Holding Tank
10. Chemical Building
11. Guard Room
12. Workshop and Store
13. Chlorine Contact Tank
14. Generator Room
15. Electrical Control Room
16. Sub Station Building
17. Operator Quarter
18. Main Gate

3.4.6 Water Treatment Plant Components

130. The components of the proposed treatment plant shall be as below:

- Distribution Chamber;
- Plain Sedimentation Tank;
- Flash Mixer;
- Flocculation Chamber;
- Clarifier;
- Rapid Sand Filters;
- Chlorine Contact Tank
- Treated Water Tank (Clear well);
- Sludge Holding Tank.
- Chemical Building;
- Chlorination Building;

131. The layout plan of proposed WTP is presented in Figure 3.4. The description of each aforesaid component with its design and basis of design is presented in forthcoming paragraphs.

3.4.7 Distribution Chamber No. 1

132. The raw water from source will be conveyed into a distribution chamber, from where the flow will be divided in two parts to feed the two trains. The chamber will be equipped with pH, temperature sensors and turbidity meter for the measurement of pH, temperature and turbidity respectively. The flow from the chamber will be controlled through penstock gates.

3.4.8 Plain Sedimentation Tanks (PST)

133. Surface water generally contains suspended solids of various sizes ranging from 0.001 mm to 2 mm; the former size is of clay particles while the later one is of coarse sand particles and silt particles size lies in between them. The silt particles of the size of 0.1 mm diameter have settling velocity of 0.023 ft/sec (6.9 mm/sec). This implies that the silt will settle quickly in case of low flow velocity like that of in flocculation tanks.

134. Plain sedimentation facilities are used to remove easily settle-able sand and silt, often present in surface water supplies, to avoid silting in treatment plant inlet piping. In PST, suspended solids are allowed to settle via gravity under quiescent condition. Settled sludge is collected and removed through an opening provided in the sludge hopper at bottom whereas clarified water is collected through overflow weirs. Considering overflow rate of 200 m/d, two plain sedimentation tanks each of 20 m diameter have been proposed (one for each train). Each tank shall be equipped with automatic sludge scraper with scum hopper. The settled sludge from plain sedimentation tanks shall be conveyed into Sludge Holding Tank through pumping. The water from each plain sedimentation tank will flow into distribution chamber #2. The design criteria and the unit dimensions are provided in the Table 3.11.

Table 3—11 Plain Sedimentation tank Design

Description	Unit	Value
Adopted Design Criteria		
Overflow Rate	m/d	200
Water Depth(D)	m	3
Design		
Q(design)	m^3/d	123,778.6
Number of Tanks	Nos.	2
Flow in eachTank	m^3/d	61,889.3
Geometry of Tank		Circular
Volume of eachTank	m^3	928
Surface Area of eachTank(As)	m^2	309
Internal tank Diameter	m	20
Water Depth	m	3
Bottom Slope		1:12
Detention Time	min	22

3.4.9 Distribution Chamber No. 2

135. The water from plain sedimentation tank will be conveyed into a distribution chamber no. 2, from where the flow will be divided in four equal parts to feed the four flash mixers. The chamber will be equipped with pH and temperature sensors and turbidity meter for the measurement of pH, temperature and turbidity respectively. The flow from the chamber will be controlled through penstock gates.

3.4.10 Flash Mixers

136. The turbidity is caused by small size suspended particles called Colloidal particles (generally clay particles) which are negatively charged; with a very little settling velocity. Clay has generally particle diameter of 0.01 mm to less than 0.001 mm (1 μm). It is impractical to remove them from water by plain sedimentation or even by filtration without addition of particular chemicals known as coagulant. Therefore, in order to enhance the settling velocity (by forming insoluble flocs) and to destabilize those, chemicals generally Alum ($Al_2SO_4.14H_2O$) or ferric chloride is added in the raw water. The market investigations indicate that Alum is much cheaper than ferric chloride and also it is being used at existing water treatment plants, such as in Karachi, Islamabad, Rawalpindi and Faisalabad. Considering detention time of 60 seconds, four flash mixers (two for each train) has been proposed. Each flash mixer will have 2.5 m width and 2.5 m length. For thorough mixing the raw water requires agitation, which will be imparted through turbine or propeller mixer. The design criteria and the unit dimensions are provided in the Table 3.12.

Table 3—12 Design criteria and the unit dimensions of Flash Mixer

Description	Unit	Value
Adopted Design Criteria		
Detention Time	sec	60
Design		
Type of Coagulant	-	Alum
Type of Mixing Device	-	Turbine Propeller Mixer
Q(design)	m^3/min	86.0
Number of Tanks	Nos.	4
Flow in eachTank	m^3/min	21.5
Volume of eachTank	m^3	21.49
Dimension of Tank	-	Square
Length x Width (As)	m^2	2.50 x2.50
Water Depth	m	3.5

3.4.11 Flocculation Chamber

137. The flocculation process provides conditions for contact between particles to promote their gathering together into flocs (generally of 1 to 1.5 mm diameter) for ease of removal, mainly by clarification and finally by filtration. These contacts between particles result from gentle stirring created by a mechanical mixing, at a rate much slower than the mixing rate in coagulation. The flocs so formed will have higher settling velocity than that of discrete particles. The coagulated raw water will be transferred in flocculation tank, wherein agitation will be provided again to form flocs. Like flash mixer, these tanks will be four in number (two for each train), and the size of each tank will be 17 m x 8.5 m. Each flocculation tank will be further divided into two compartments having dimension of 8.5 m x 8.5 m. The agitation will be imparted through mechanical flocculator (paddle mixers). The velocity gradient will be 30/s. The design criteria and the unit dimensions are provided in theTable-3.13

Table 3—13 Flocculation Chamber Design

Description	Unit	Value
Adopted Design Criteria		
Detention Time	min	20.6
Design		
Type of Flocculant aid		Polyelectrolyte

3.4.12 Clarifiers

138. The flocculated water will enter from the center of clarifier via pipe. The clarifier allows flocs in flocculated water to get separated under the action of gravity. The clarifiers are equipped with circular scrappers, because of their easy operation and less maintenance cost over the other types of clarifiers, have been proposed.

139. Four clarifiers are proposed (two for each train). The internal surface area of each clarifier with surface loading of 38 m/d will be 814 m^2 having an internal diameter of 32 m. The water from clarifier will be collected in the launder provided along the circumference of tank from where it will be transferred to the filter complex unit through clarifier effluent pipe.

140. The clarifiers will have de-sludging system through slow moving scrapers, which scrap the settled sludge in the central part of the clarifier, from where the sludge will be drained off through pipe of 180mm diameter by pumping and is transferred to Sludge holding Tank. The design criteria of clarifier and the unit dimensions are provided in the Table 3.14.

Table 3—14: Design of Clarifier

Description	Unit	Value
Adopted Design Criteria		
Surface Loading Rate	m/d	38
Water Depth(D)	m	4.5
Design of Clarifier		
Q(design)	m^3/d	123,779
Number of Tanks	Nos.	4
Geometry of Tank		Circular
Flow in eachTank	m^3/d	30,945
Volume of eachTank	m^3	3,664
Surface Area of eachTank(As)	m^2	814
Internal Tank Diameter	m	32.2
Bottom Slope		1:12
DetentionTime	hr	2.8

3.4.13 Rapid Gravity Filters

141. The clarified water from each train (two clarifiers) will transfer to a Rapid Gravity Filtration Unit through combined influent channel. Rapid Gravity Filtration will involve the removal of suspended solids by accumulating them in the pores of filter media and clear water will be obtained.

142. The total filtration area required, at filtration rate of 130 m^3/m^2/day and flow of 61,889m3/d, is 476m2. There will be 8 filter beds each having dimension of 9.4m x 6.25m in each filtration plant. The filter media will be silica sand of effective size of 0.6

mm with uniformity coefficient of 1.4 and gravels having uniformity coefficient of 1.8. The depth of silica sand and gravel media will be 450 & 750mm respectively.

143. The design criteria and the unit dimensions are provided in the table 3.15

Table 3—15: Rapid Sand Filter Design

Description	Unit	Value
Adopted design criteria		
Filtration Rate	$m^3/m^2/d$	130
Backwash Rate	m/hr	50
Air Scour Rate	m/hr	50
Design		
Q(design)	m^3/d	123,779
Number of Filter Units	Nos.	2.0
Total Filtration Area	m^2	476
a) Filter beds		
Number of beds in each train	No.	8
Area of one FilterUnit(LxW)	m^2	9.4 x6.25
Maximum filtration rate during one filter Backwash	$m^3/m^2/d$	151
b) Filter Media		
SilicaSand		
Uniformity Coefficient	-	1.4
Shape factor	-	1
Porosity	-	0.4
Effective size	mm	0.6
Bed Depth	mm	750
Gravel		
Uniformity Coefficient	-	1.8
Shapefactor	-	0.73
Porosity	-	0.5
Bed Depth	mm	450
c)Backwashing		
Backwash flow	m^3/h	2960
Number of backwash Pump	No.	2 + 1(standby)
Discharge of each pump	m^3/h	1480
Head of each pump	m	12

Description	Unit	Value
Type of Pump	-	VerticalTurbine
Number of Air Blower	No.	1 + 1(standby)
Air flow of Each Blower	m^3/h	3225
Pressure of blower	bar	1

3.4.14 Chlorine Contact Tank

144. The purpose of disinfection is to kill the pathogenic microorganisms. Disinfection through Chlorine is one of the most commonly used methods of disinfection. For high flow rates, use of Sodium Hypochlorite is the most suitable option. In the tank, baffle walls will be provided to avoid short circuiting. The walls will also provide plug flow in the tanks, for better mixing of disinfectants i.e. sodium hypochlorite which will be injected in the tank by dosing pumps at the inlet of chlorine contact tank.

145. Two chlorine contact tanks with 30 minute of retention time are proposed. Effluent pipe of filtrate will divide into two and will connect to their respective chlorine contact tanks for disinfection. Each tank will have 2 parallel channels / baffle walls with length 25m.

146. The disinfected water will then overflow to treated water storage tank (Clear well) through weir wall. The design criteria and the unit dimensions are provided in the Table 3.16

Table 3—16: Design of Chlorine Contact Tank

Description	Unit	Value
Adopted Design Criteria		
ContactTime	min	30.0
Design		
Q(design)	m^3/min	78.1
Number of Tank	Nos.	2
Flow in eachTank	m^3/min	39.1
Volume of eachTank	m^3	1172.1
Depth of each Tank	m	4.3
Width of each Tank	m	2.5
Number of Parallel Channel	Nos.	2.0
Required Length of eachChannel	m	54.5

3.4.15 Treated Water Tank (Clearwell)

147. The treated water will be stored in treated water tank (Clear well) having 7.5 hours storage. Two treated water tanks will be provided (each for one train). Each tank will have dimensions of 60m x 60m x 5m.

148. All water requirements with in premises of treatment plant (i.e. to prepare solutions and other potable use) will be covered by clear well.

149. The design criteria and the unit dimensions are provided in the Table 3.17

Table 3—17: Treated Water Tank Design

Description	Unit	Value
Q(design)	m^3/hr	4688.6
StorageTime	hrs.	7.5
Number of Tank	Nos.	2
Geometry of Tank		Square
Flow in eachTank	m^3/hr	2344.3
Volume of eachTank	m^3	17,582.2
Depth of eachTank	m	5
Area of eachTank(Lx W)	m^2	60 x 60
Total Volume of each Tanks	m^3	35,164.4
Total Area of each Tanks	m^2	200

3.4.16 Sludge Holding Tank

150. The sludge from Plain Sedimentation tank and clarifiers of both trains will be transferred and collected into sludge holding tank. Transfer of sludge will be carried out by sludge pumps. Circular tank having internal diameter of 26m will allow 4 days sludge holding time. The sludge from the holding tanks shall be transported into nearby landfill site. The unit dimensions are provided in the Table 3.18

Table 3—18: Sludge Holding Tank Design

Description	Unit	Value
Q(design)	m^3/d	623
Number of Tanks	Nos.	1
Geometryof Tank		Circular
Volumeof Tank	m^3	2492
Depth	m	5
Surface Area of eachTank (As)	m^2	498
Internal DiameterofTank	m	26

3.4.17 Chlorination Building

151. As per WHO guidelines, at least marginal chlorination will be required to disinfect water for public supply. The building will have a hall where two mixing tanks and sodium hypochlorite storage space will be provided. Sodium Hypochlorite (NaOCl) will be mixed with water, and the solution of sodium hypochlorite and water will be fed in the

chlorine contact tank through dosing pumps. In the chlorination building, monorail (capacity of 2 Ton) will be installed for the handling of sodium hypochlorite drums.

3.4.18 Chemical Building

152. Chemical building has been proposed to house the facilities like storage of Alum, Lime and polymer, dose preparation facilities and dosing pumps.

153. Monorail and overhead crane with capacity of 2 ton & 5 ton respectively has been proposed in the Chemical Building.

3.4.19 Mechanical Equipment

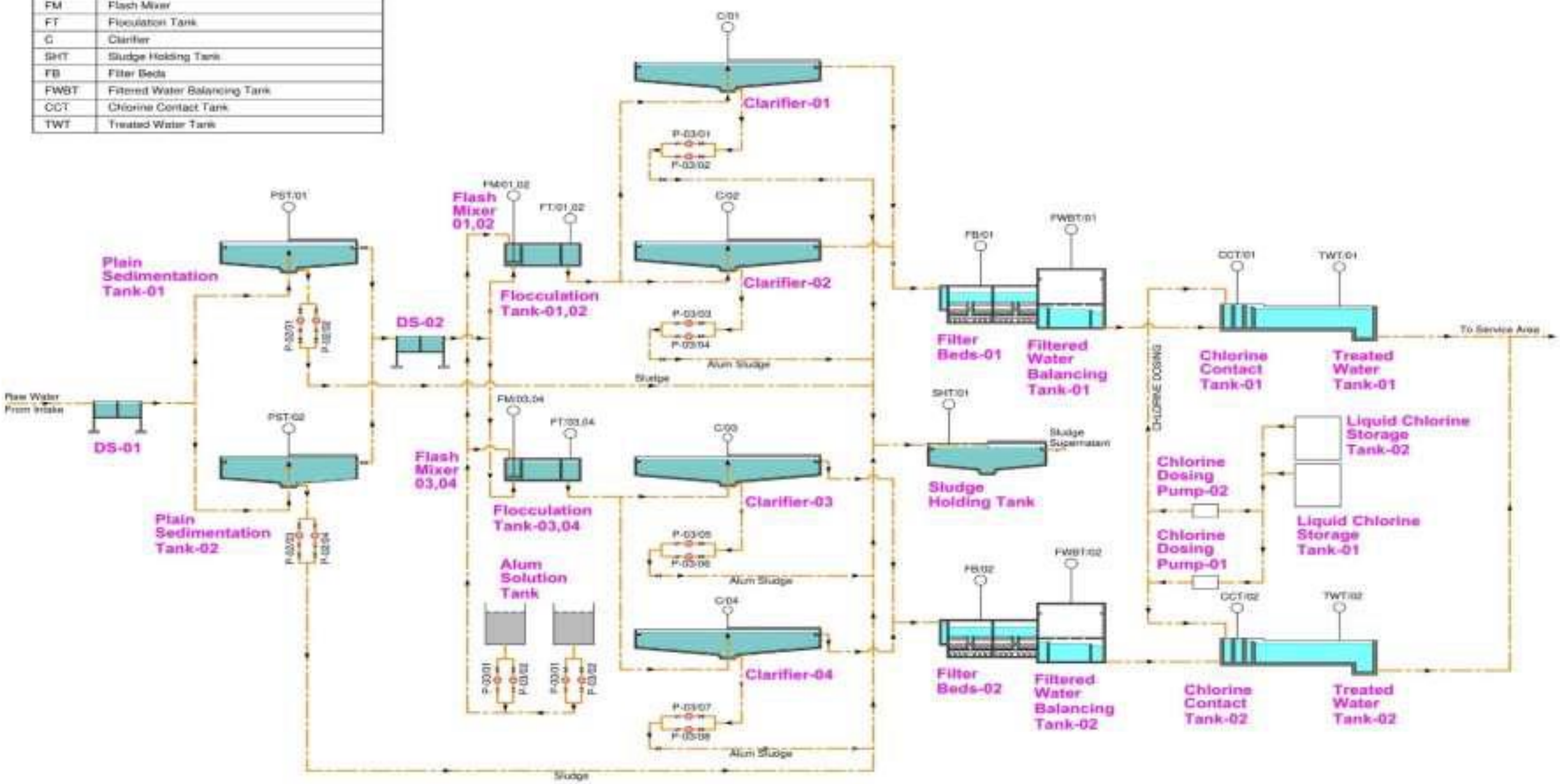
154. Most important mechanical equipment used in various components of the treatment plant is given below.

- Penstock gates
- Sludge pumps
- Sludge Scrapers for Plain Sedimentation Tank and Clarifiers
- Backwash Pumps
- Air Blowers
- Sludge Scraper for sludge thickener
- Cranes
- Flow Meters and valves

155. Type of mechanical equipment is discussed in the design sections of the relevant components where equipment will be installed.

Figure 3-4 Process flow of Proposed Water Treatment Plant

List of Abbrevation	
DC	Distribution Chamber
P-02	Sludge Pumps
P-03	Alum Sludge Pumps
PST	Plain Sedimentation Tank
FM	Flash Mixer
FT	Flocculation Tank
C	Clarifier
SHT	Sludge Holding Tank
FB	Filter Beds
FWBT	Filtered Water Balancing Tank
CCT	Chlorine Contact Tank
TWT	Treated Water Tank



3.4.20 Administration Building

156. A common administration building for the staff has been proposed which will have following facilities.

- Offices
- SCADA Control Room
- Laboratory
- Meeting Room
- Kitchen
- Toilets

Laboratory

157. A testing laboratory has been provided to monitor the operational parameters and to facilitate the operation of plant. Laboratory will be located inside the Administration building with an independent access.

158. The following instrument/equipment are proposed to be provided at Plant Site Laboratory:

159. Drying oven & sterilizers, (ii) Ultrasonic washers, (iii) Colony counter, (iv) Double beam spectrophotometer, (v) Turbidity meter, (vii) pH meters, (viii) Conductivity meter, (ix) Refrigerator and medical freezer, (x) Centrifuges, (xi) Nitrogen digester and distillation apparatus, (xii) Jar testers, (xiii) Furniture and glassware, (xiv) Microscopes, and any equipment/instrument for testing of parameters specified hereunder.

160. (i) Temperature, (ii) Color, (iii) Residual Chlorine, (iv) Turbidity, (v) pH, (vi) Nitrate (vii) Total Hardness, (viii) Calcium Hardness, (ix) Magnesium Hardness, (x) Total Dissolved Solids, (xi) Total Coliform Count, (xii) Fecal Coliform Count, (xiii) Jar testing to check coagulant dose, (xiv) Iron, and (xv) Manganese.

Workshop Building

161. A work shop/store has been proposed to facilitate the maintenance activities inside the plant. An overhead crane has been provided in the workshop for handling of equipment requiring maintenance. In the workshop following equipment will be provided: (i) Lathe machine, (ii) Drilling and grinding machine, (iii) Welding machine, (iv) Air compressor, (v) Vibration meter and (vi) Insulation resistance tester.

Staff Building

162. A staff building with two rooms has been provided for the accommodation of fulltime residence staff at the site.

Internal Roads

163. Internal roads have been proposed to provide access to all buildings and facilities having mechanical equipment. Walkways have been proposed around the structures & buildings.

Plant Potable Water

164. Potable water pumps will draw water from treated water tanks. Potable water tank and associated plumbing & piping have been provided for the administration building, guard room, staff building, chlorine and chemical building.

Plant Sewerage System

165. Sanitary drainage system and external sewers have been provided to collect the sewage from toilets located in the admiration building, guard room and staff building.

Plant Piping

166. Plant piping has been provided for the conveyance of raw water, sludge, electric cables, fiber optic cables etc. within the plot boundaries.

3.4.21 Residual Management

167. In the conventional water treatment, the plant residuals are:

a) Sludge drained off from the plain sedimentation tanks and clarifiers; and
b) Wash water produced from backwashing of rapid gravity filters.

The characteristics of these residuals are:

168. About 90% suspended particles and turbidity is removed in the clarifiers. The sludge is formed due to (i) suspended solid particles which coalesce together on the mixing of coagulants and (ii) the coagulant themselves add to the sludge concentration in terms of solids. The solid concentration of clarified sludge ranges from 1 to 2% of the sludge volume while the total sludge volume is in the range of 2 to 3 % of the product water; and

169. The solid concentration in the wash water of filter beds generally ranges from 0.05 to 0.5% and these solids are only 10% of the total solids generated due to turbidity and coagulants.

Settled Sludge

170. Two circular sludge holding tanks (one for each train) have been proposed with a diameter of 10 m. The sludge of plain sedimentation tanks and clarifiers shall be discharged to sludge holding tanks through pumping. The sludge from the holding tanks shall be transported into nearby landfill site.

Wash Water

171. The wash water received from filter beds, contains a little number of solids. The wash water shall be discharged into drain. The same practice is also being followed at Rawal Lake Filtration Plant, Rawalpindi and Sang Jani Water Treatment Plant, Islamabad.

3.4.22 Residual Disposal

172. The residual disposal is carried out through:

- Discharge through natural water ways;
- Transportation to Landfill,
- Beneficial reuse such as fertilizers.

3.4.23 Instrumentation and SCADA System

173. Instrumentation and control through SCADA system will be provided to allow continuous monitoring of process variables, rapid transfer of data to the operator or manager for immediate execution of corrective measures when needed. The use of instrumentation and control through SCADA provides multitude benefits in terms of process improvement, equipment performance and convenience to personnel.

3.5 Construction Phase Details for WTP

Construction Schedule

174. The project construction phase is expected to last for a total of 2 years with the activity expected to commence in the last quarter of 2021 and completed by end of 2023.

Construction phase activities

175. The activities to be conducted during construction phase of the project are provided below:

- **Development of Construction and Labor Camps**

176. One of the first activities to be completed by the Contractor shall be the establishment of the construction and labor camp. The Contractor will also establish construction yards and sites (including storage and batching plant), offices and a workshop.

177. The construction of the proposed WTP and Greater water supply system will be divided into construction work packages and these packages will be awarded to the selected project Contractors or single contractor whichever is feasible.

178. The construction activity has to span over approximately twenty-four months. There shall be a number of contracts for a variety of works. The selected Contractors shall have the option to select suitable site(s) located near the project sites to establish his labor camps. If private land is selected, the contractor shall enter into contract with the private owner. During construction phase, an estimated 150-200 persons consisting of both semi-skilled and skilled human resource will be required.

179. Essential for the work bases is easy approach, availability of a suitable place for temporary storage of material and availability of water for construction in the vicinity. Presence of shade from trees close to the work bases can add to the comfort of the labor while taking rest during the hot season.

180. The location of storage materials and camps will be critical. Since the project contractor(s) will be responsible for identifying the suitable locations for storage and labor camps from the private sector, thus there will need to be clear guidelines for this process, which will need to be closely monitored by the implementing agency. As far as possible, the project design team shall be assigned the task to identify the suitable location(s) for storage of materials since inappropriate storage of materials may result disruption of the traffic movement.

181. The proposed site or already constructed buildings within project area can be used as the Contractor's camp and it shall include the following facilities:

Labor camp site

- Accommodation
- Kitchen
- Dining area
- Sanitation facilities
- Septic tank
- Liquid and solid waste disposal facilities
- Generator(s), for operation when the power supply from the grid station was not available

- **Construction camp site**

  - Uncovered material storage
  - Covered material storage
  - Parking for vehicles and plant
  - Batching plant (if required)
  - Generator(s)
  - Site offices

- **Workshop site**

  - Workshop
  - Storage area
  - Generator(s)

- **Site preparation**

182. There may be a need to carry out cutting and filling of the land in order to attain the designed ground elevation. During the process, areas above the design elevation shall be cut and spoils shall be used to fill areas below the designed elevation. The area is to be clean of any obstructions in areas where the general design elevation is already attained. Cut and fill activities will be carried out using mostly heavy mechanical equipment. Manual labor will be negligible.

183. The ground will be compacted until the desired ground bearing capacity is attained. This is to ensure that all structures, particularly the foundations to be erected are stable and will not be subject to subsidence, settlements and other earth pressures.

- **Associated construction works of WTP and Supply Network**

184. Major construction works are construction of intake structures, laying of transmission/supply/delivery mains of varying diameter from 100-1200mm on sand bedding, scarification of existing road pavement structure, disposal of unsuited material for road pavement, excavation for the water supply line in well Graded Gravels with Silty Clay material, backfilling of excavated material, laying of pipes and providing and laying of common fill material.

185. Two process trains each having treated water capacity of 12,965m^3/day (150L/sec) will be constructed for WTP. Each train will consist of separate plain sedimentation tank, flash mixer, flocculation basin, and clarifier. Both trains will have a combine filtration unit.

- **Construction of WTP Components and building infrastructure**

186. Following WTP components and building infrastructure will be constructed and installed at proposed site at Mingora Water Treatment Plant.

- Bar Screens;
- Distribution Chamber;
- Plain Sedimentation Tank;
- Flash Mixer;
- Flocculation Basin;
- Clarifiers;
- Filters;
- Treated Water Tank (Clear well)
- Chlorination Building;
- Sludge Holding Tank
- Chemical House;
- Administration Building including offices, laboratory and control room;
- Workshop;
- Security Gate and Boundary Wall;
- Internal Roads;
- External Electrification
- Internal pipe work; and
- Control and monitoring system.

Construction Machinery Requirement

187. For storing materials, stocking equipment and parking machinery and vehicles, the Contractor(s) shall require open and accessible sites close to the labor camps. The Contractor(s), at his own expense, but keeping in view his contractual obligations to honor the applicable national and international guidelines regarding level of pollution, shall make the arrangements.

188. The **Table 3.19** below outlines the approximate number of major machinery and vehicles that are envisaged to be required for the project construction works.

Table 3—19: Estimated Contractor's Equipment and Machinery

Sr. No.	Machinery / Equipment	Quantity required*
1	Excavators	2
2	Batching Plants	2-4
4	Loaders	1
5	Power Generators	2
6	Tractor Trolley	2
7	Compactor / Roller	1
8	Crane	1
10	Concrete Pump	1
11	Vibro Hammer	1
13	Watering Tanks (moveable)	1
14	Cars/Pickups	4

* Number of machinery is indicative and can be changed subject to working schedule.

Construction Materials Requirement

189. During the construction phase, construction materials in considerable volumes will be required. Typical material required for WTP and associated supply network is available locally and same will be utilized. The common source of the material require for civil work are described in **Table 3.20** below.

Table 3—20: Source of Raw Material

Sr.#	Raw Material	Source
1	Earth Material	Available locally, borrowed from the lands acquired for the project.
2	Aggregate	Available at many sources within the vicinity of the site.
3	Rip-rap material	Available locally from nullah bed deposits and rock excavations.
4	Sand	Sand is available in near vicinity and river bed.
5	Water	Ground water is available at depth of up to 80-200 feet and it will be used for construction purpose.
6	Cement	Ordinary Portland Cement is suitable, which is available at various factories in Pakistan mainly from Haripur
7	Reinforcement steel	Steel re-rolling mills in Peshawar meeting the standards from the billet produced either by Pakistan steel or imported. These will serve the purpose of steel availability.
8	Energy	Electricity supplies are available at the site through WAPDA grid.

3.6 Operation Phase Details for WTP

Scope of Activities

190. The activities to be conducted during the operational phase of proposed project are provided below.

- 24/7 Operation and uninterrupted water supply
- Replacement/clearing of Screens
- Coagulation and Flocculation dosing
- Sedimentation arrangement
- Disinfection activities
- Preventive/Corrective Maintenance
- Condition monitoring of Intake structure and WTP
- Provision of spare parts and consumables
- Repair/refurbishment arrangements
- Execution of scheduled outages
- Revenue collection for water supply from residents of UCs falling under

jurisdiction of WSSC Swat.

Operation Equipment and Machinery

191. As proposed WTP will be based on SCADA system therefore limited machinery/equipment will be required for operation of WTP.Machinery required for operation of WTP would be fork lifter for handling of chemical bags, vacuum truck and loader for handling of sludge and monorail crane in chemical house for lifting of chemicals. Equipment used during WTP operation will be pumps, turbines and mixers.

Manpower Requirement

192. It is expected that existing organizational capacity of WSSC Swat may not be able to successfully run the future mode. An institutional review and capacity building firm has been engaged under the project to successfully operationalize the project and improve the capacity of WSSC Swat.

193. Estimated manpower requirements during construction phase of the project would be about 150 persons while during operation phase would be 50 persons.

3.7 Climate Risks from Project

3.7.1 Climate Change Trends and Extremes in Mingora[3]

194. Water stress, glacial retreat and permafrost conditions at higher altitude are considered as the key potential climate change impacts for Mingora city which can negatively affect urban infrastructure including Mingora Greater Water Supply Scheme .Climate Change is expected to adversely affect the Swat region by increasing the frequency and severity of natural disasters including avalanches, storms, droughts, riverine floods and cloudburst flashfloods (CBFF).

195. The average annual temperature in Mingora is 19.3°C | 66.7°F. With an average of 29.2°C | 84.6 °F, June is the warmest month. January has the lowest average temperature of the year. It is 7.5°C | 45.5°F. The average temperatures vary 21.7°C. The mean temperature reveals an increase of 0.9°C, maximum temperature 0.4°C and mean minimum temperature 0.5°Celsius (Kalam station, district Swat).

196. The precipitation regimes in project area are mainly controlled by monsoon rains from July to September; they have become more intense in recent years. Significant increasing trends in precipitation over time have been detected during the monsoon season.

197. During winter monsoon March receives 125 mm rainfall while during summer August receives maximum rainfall of 134 mm. Average total annual rainfall in the Mingora is about 897 mm.

198. Long term annual climatic patterns using standardized seasonal and precipitation time series data over a 51-year period (1961-2011) shows a decreasing trend during winters in the first decade, however the values seem to be increasing through 2010. The LOWESS curve for summer precipitation seems to be gradually increasing through the years. For the annual precipitation series, significant positive trends were detected at Saidu Sharif station (7.48mm/yr) from 1961 to 2011.

[3] Climate data and findingd are adopted from Climate Risk and Vulnerability Assessment (CRVA) report for Mingora City.

199. Monthly precipitation trends at Saidu Shareef station using the Mann-Kendall and Spearman's rho test showed a statistically significant increased precipitation trend from January to June and from October to December but a significant decline in July and August. Different studies have found a statistically significant increasing trend in winter precipitation for the northwest area of Pakistan however significant variations have been seen in summer precipitations during the 1961-2011 period.

200. These climate change patterns and socio-economic changes including rapid urbanization can cause urban flooding events. Intense precipitation as well as infrastructure developments that have reduced urban surface interception, flash floods are increasing, which are likely to continue to become more severe in the future. Urban flooding is largely due to intense precipitation and changes in land use (especially increased concrete surfaces due to residential and commercial area growth) and due to inadequate sewerage and drainage systems while the main nullahs, rivers, streams are flooded due to intense rainfall.

3.7.2 Climate Change Considerations for Mingora water treatment Plant and water supply scheme

201. Summary of the main climate change trends and projections observed in Mingora water Treatment Plant and water supply scheme is shown in following table 3.21.

Table 3—21: Summary of the main Climate Change Trends and Projections observed in Mingora

Climate Trend	Description	Current and/or future impacts
Precipitation increase	Based on CSIRO-CCAM RCM precipitation is expected to rise 7.48mm/yr. during 2011	Flash floods may increase, which will adversely affect the ground water. Groundwater will continue to decline. Runoff enhancement in the near and far future again adversely effecting ground water. Together with temperature rise, decrease in precipitation may result in more soil erosion and slope instability.
Temperature Increase	The average annual temperature in Mingora is 19.3°C | 66.7°F. With an average of 29.2°C | 84.6 °F, June is the warmest month. January has the lowest average temperature of the year.	Increased demand for water and electricity, putting an additional pressure on the stretched supply of both. Temperature rise will enhance evaporation and losses. It will also adversely impact structural design and urbanization. Adverse changes to the ecosystem, local flora and fauna.

4 Description of Environment

4.1 General

202. Mingora is surrounded by Chitral, Upper Dir and Lower Dir in the West, Gilgit-Baltistan in North Kohistan, Buner and Shangla in the East and South East. It is located at an altitude of 950 meters and about 2 kilometers away from Saidu Sharif, the present administrative capital of Swat. The city of Mingora serves as a gateway to the popular tourist destinations like Kalam valley, Kumrat valley, Maydan, Bahrain, Marghazar, Mian dam, Malam Jabba and Saidu Sharif.

203. The proposed Mingora Greater Water Supply Scheme project is run of the river project to be constructed on Swat River located in District Swat of Khyber Pakhtunkhwa province. The project proposed intake site is located about 62 km upstream of Amandara Barrage and 710m downstream of Matta Bridge across River Swat on main Nowshehra-Chakdara-Chitral (NCC) road. The water treatment plant has been proposed to be constructed at the left bank of River Swat at about 20 km Upstream of Mingora City, District Swat, Khyber Pakhtunkhwa (KP).

204. The description of various features of the project area environment including the physical, ecological, cultural and socio-economic environmental aspects are presented in the following sub-sections.

4.2 Physical Resources

4.2.1 Topography

205. Topography of Mingora is comprised of mountains ranges (offshoots of Hindukush) and associated valleys with plains. This range runs in the general direction of North and South and has a varied elevation within the Swat area, beginning from 600 meters above sea level in the South and rising rapidly up towards the North, to around 6,000 meters above sea level. Proposed Mingora Greater Water Supply Scheme project is run of the river project to be constructed on Swat River.

206. A detailed topographic survey was carried out for the proposed intake structure, intake delivery pipe, water treatment plant, and transmission main. A 20-Km transmission main is proposed from the water treatment plant to Mingora city.

Figure 4-1 Topographic Survey at the Site

4.2.2 Soils

207. The Mingora is covered with un-consolidated deposits of silt, sands and gravels. The surface soil materials are less deposits, residual mantle on sandstones and shale bedrocks, or narrow strips of silty/loam alleviation along major streams. The soil characteristics vary within the area depending upon the parent material and the soil age. Inseptisols, Entisols and Ardisols are the dominant soil types.

208. The project proposed intake site is located about 62 km upstream of Amandara Barrage and 710m downstream of Matta Bridge across River Swat on main Nowshehra-Chakdara-Chitral (NCC) road. The rocky nature of the terrain and impervious subsoil exist at the project site.

River Geo-Morphology

209. The River Swat originates from western Karakoram and Himalayan ranges at altitude of 4850m. Ushu and Gabral (Utrore) streams join at Kalam to form Swat River which flows southwards. The river has steep slopes flowing in narrow valley upto the Baghderi. Thereafter, the river widens extending even up to two kilometers and flows at elevation varying from 1220 m to 600 m till downstream of Batkhela. Downstream of it, the river again becomes narrower and enter mountainous gorge downstream Kalangai Bridge where after it shortly joined by the Panjkora River.

Figure 4-2: Geology of Project Area

4.2.3 Climate

210. The Mingora lies on 950 m above sea level. In Mingora, the climate is warm and temperate. Mingora has a significant amount of rainfall during the year. This is true even for the driest month. Climate is characterized by hot-summer Mediterranean. According to Köppen and Geiger, this climate is classified as Cfa. Climate profile of Mingora is provided in Table 4.1.

Table 4—1: Climate Data of Mingora City

Climate data for Mingora [hide]													
Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Average high °C (°F)	13.0 (55.4)	15.8 (60.4)	20.2 (68.4)	25.6 (78.1)	31.7 (89.1)	36.8 (98.2)	35.4 (95.7)	33.7 (92.7)	32.3 (90.1)	28.0 (82.4)	21.8 (71.2)	15.3 (59.5)	25.8 (78.4)
Daily mean °C (°F)	7.6 (45.7)	10.3 (50.5)	14.2 (57.6)	19.2 (66.6)	24.5 (76.1)	29.2 (84.6)	29.0 (84.2)	27.8 (82.0)	25.6 (78.1)	20.5 (68.9)	14.6 (58.3)	9.4 (48.9)	19.3 (66.8)
Average low °C (°F)	2.1 (35.8)	4.8 (40.6)	8.2 (46.8)	12.7 (54.9)	17.3 (63.1)	21.6 (70.9)	22.6 (72.7)	21.9 (71.4)	18.9 (66.0)	12.9 (55.2)	7.4 (45.3)	3.5 (38.3)	12.8 (55.1)
Average rainfall mm (inches)	81 (3.2)	98 (3.9)	125 (4.9)	90 (3.5)	46 (1.8)	31 (1.2)	130 (5.1)	134 (5.3)	64 (2.5)	28 (1.1)	22 (0.9)	48 (1.9)	897 (35.3)

211. The summer season is short & moderate in upper valleys of the project area and warm in the lower valleys. The winter is extremely cool. The hottest month is June with mean maximum temperature of 33°C and 16°C, while the coldest month is January and means maximum and minimum temperature is 11°C and -2°C respectively. The winter season is long and extends from November to March. The amount of rainfall received during the winter season is more than that of summer. The highest rainfall recorded during the month of March is about 242 mm.

a) Precipitation

212. Project area weather is characterized by extreme winter and moderate summer. The monsoon penetrates into the project area but main mechanism of producing rainfall is due to western disturbance. Climate of the project area can be classified as cold and sub humid. As per available record of climate stations located in and around project area, indicate higher precipitation at higher altitude than at lower as given in

213. Daily rainfall data of Kalam have been collected from SWHP, WAPDA for a period of 1963-2011, while from Pakistan Meteorological Department (PMD) daily rainfall record for period of 2004 to 2019 have been collected. Available records indicate that precipitation in the project area and its vicinity occurs throughout the year with two peaks one is in spring and other in summer. Isoheytal map of the Pakistan (1981-2010) collected from PMD is provided as Figure 4.3 which reveals that in project area annual rainfall range is in between 1000 mm to 1200 mm.

Table 4—2 Mean Monthly Rainfall (mm) at Kalam (Pakistan Met. Department)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
2004	287	141	100	181	64.4	22	44	41.3	54	304.5	45	103.5	1388
2005	77	344.5	270	227	143.6	26.4	30.2	48	16	96.8	103	11	1394
2006	262	131.5	84	130.5	33	24.5	42	50.6	35	12.5	150.2	205	1161
2007	18	112.8	244.4	55	219.4	49.7	62.4	48.4	28.6	9	4.2	60.4	912
2008	284	62.8	124	165	47.5	6	39.9	22	31	20	28	159.5	990
2009	149	322	90	--	--	--	--	17	18	13	81	64	--
2010	63	474.6	53.5	107	123.7	42.1	182	85.9	79.9	1.9	0	2	1216
2011	40	306	167	137	50	12	17	34	32	103	64.5	1	964
2012	109	124	152	68	112	24.1	14	41	97	48	39	89	917
2013	39	234	177	137	45	46	12	96	17	28	31	17	879
2014	24	148	260	119	93	7.1	31	36	6.1	80.3	66	7	878
2015	55	224	179.5	184	71.8	26.1	47.4	60.4	74.6	102.5	90	50	1165
2016	76	23	234	268.3	89.5	47.5	35	55.8	20	11	14.8	25	900
2017	193	171	118	118.2	48	26.8	62	29.8	3.9	21	5	37	834
2018	35	79.5	153.5	201.5	107.4	14.8	37.4	14	22	60	109.6	21.2	856
2019	160	120	69.5	171.6	81	56.2	39.1	61.5	759				
Average	**117**	**189**	**155**	**151**	**89**	**29**	**46**	**46**	**36**	**61**	**55**	**57**	**1014**

Figure 4-3: Isohyetal Map of Pakistan (1981-2010)

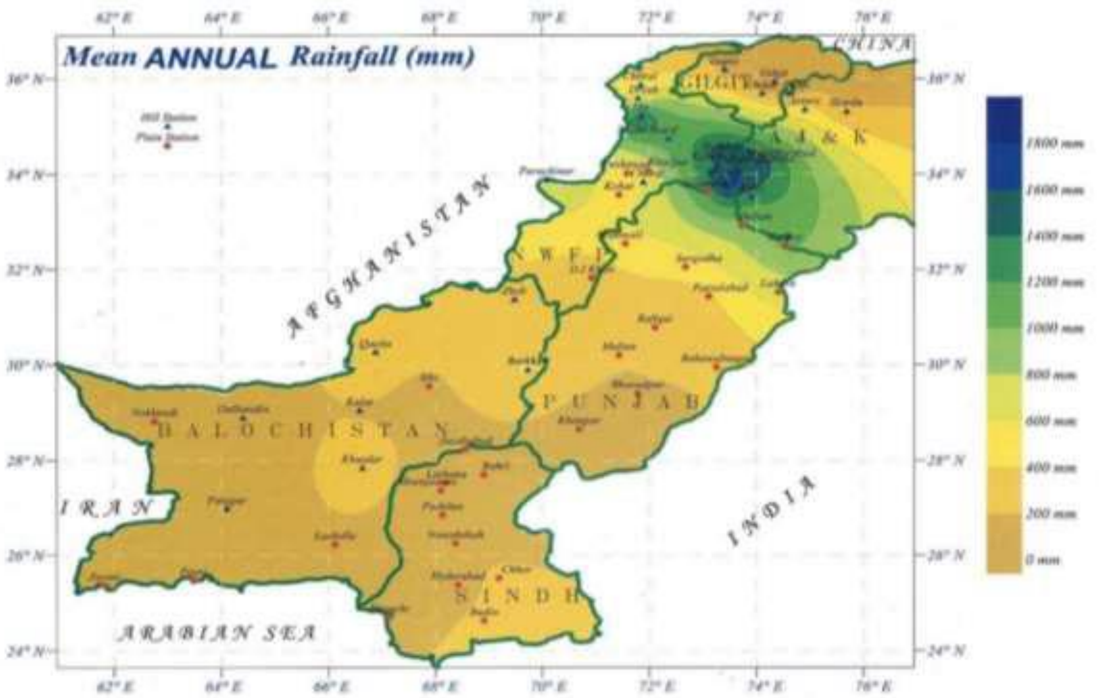


Figure 4-4: Mean monthly rainfall (1963-2011) at Kalam (Source: SWHP, WAPDA)

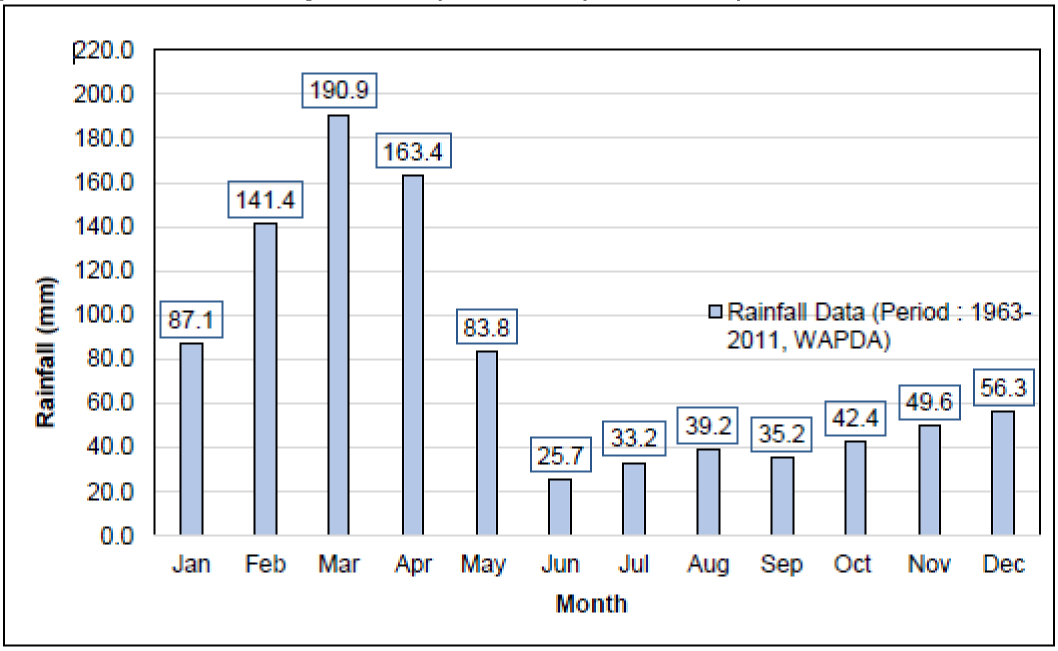
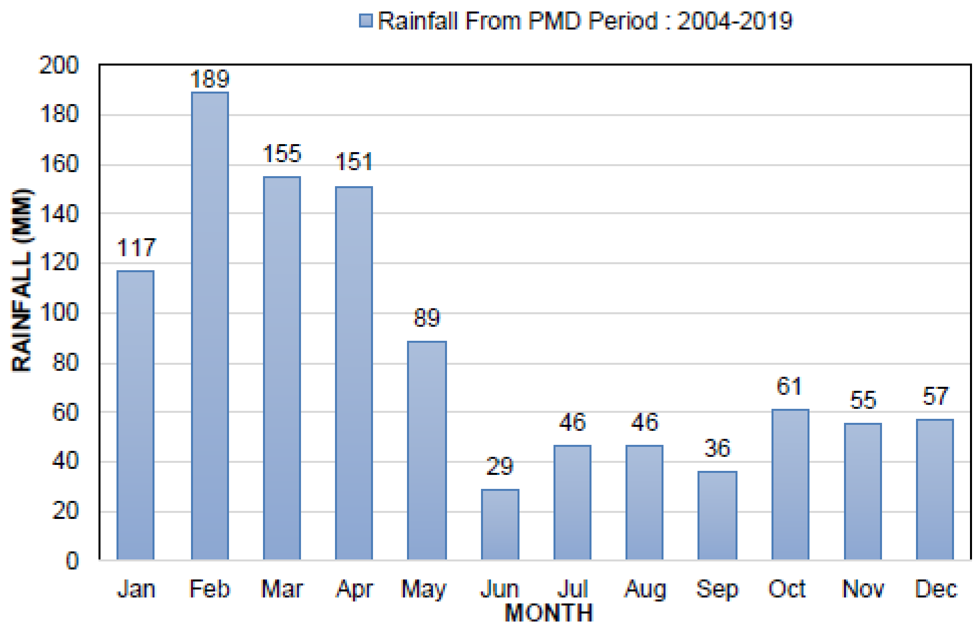


Figure 4-5: Mean monthly rainfall at Kalam (2004-2019) (Source: PMD))



b) *Temperature*

214. Temperature is an important parameter that helps to define the climate of the project area. As Mingora Great Water Supply Project is proposed on Swat River in which flows are mostly generated due to snow and glacier melt. Therefore, monthly mean maximum and minimum temperatures at Kalam for the period of 1966 to 2015 are shown in Figure 4-6. The results depict that mean monthly maximum temperature

ranges from 26.2°C in the month of June to 7.6°C in the month of January, whereas monthly mean minimum temperature varies between 14.9°C in July and -6.4°C in January.

Figure 4-6 Monthly Mean Maximum and Minimum Temperature (°C) at Kalam Station

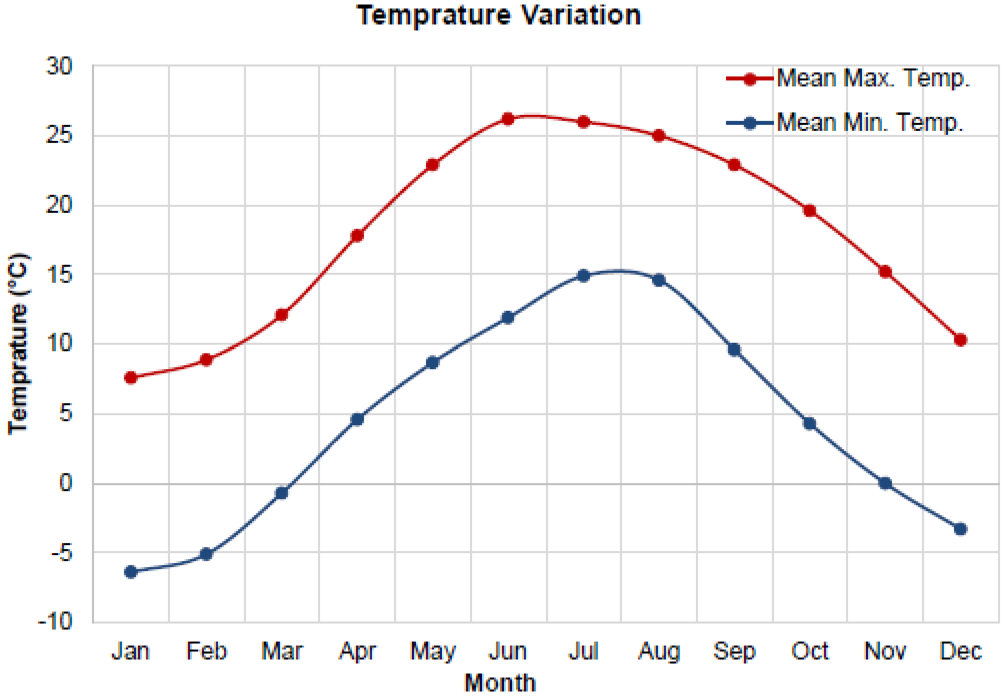


Table 4—3 Mean Monthly Max. Temperature (°C) at Kalam from 2016 to 2019

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2016	9.3	12.6	12.9	16.8	25.2	27	27.2	25.9	25	22	16.8	13.8
2017	6.1	10.2	11.5	19.2	24.7	27	27	27.2	26.1	22.5	17.1	11.5
2018	12	11.4	17.6	20.3	22.1	27.8	27	27.8	25	18.7	13	11.1
2019	4.5	5.5	13	18.8	22.1	24.7	27.2	25.9				
Average	**8**	**10**	**14**	**19**	**24**	**27**	**27**	**27**	**25**	**21**	**16**	**12**

(Source: PMD)

Table 4—4: Mean Monthly Min. Temperature (°C) at Kalam from 2016 to 2019

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2016	-4.2	-3.8	0.5	3.8	9	11.7	14.3	12.1	9.4	4.4	0.8	-2.1
2017	-6.2	-8.1	-1.2	4.1	8.5	12.4	15	12.9	8.7	4.1	-0.6	-4
2018	-5	-3.4	-0.1	3.2	5.6	11.5	14.4	14.3	7.2	2.3	-0.6	-5.2
2019	-9.2	-8.2	-4.8	3.9	5.9	8.1	13.8	12.6				
Average	**-6**	**-6**	**-1**	**4**	**7**	**11**	**14**	**13**	**8**	**4**	**0**	**-4**

(Source: PMD)

215. Mean monthly rainfall and temperature data of climate station at Dir are given in Table 4-5.

Table 4—5: Mean Monthly Rainfall and Temperature

Month	Min Temperature	Max Temp	Precipitation (1981-2010)(Mm)
January	-2.5	12	112.5
February	-0.8	12.6	176
March	3.1	16.8	256.5
April	7.4	23	166
May	11.5	28.5	90.5
June	15.1	32.3	56.4
July	18.6	31.7	154.5
August	18.2	30.6	147.5
September	13.7	29.3	76
October	7.1	25.4	72.3
November	2.3	20.3	59.1
December	-1.1	14.6	79.9
Average	7.7	23.1	Total 1447.2

(Source: PMD)

Figure 4-7 Mean Monthly Precipitation (mm) at Climate Station Dir

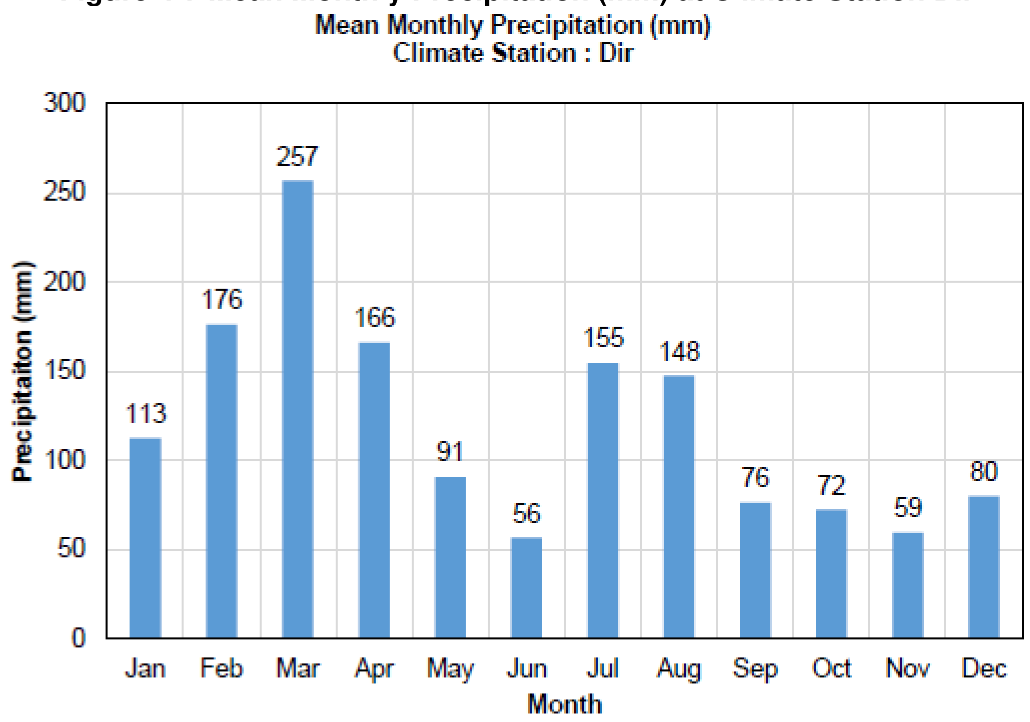
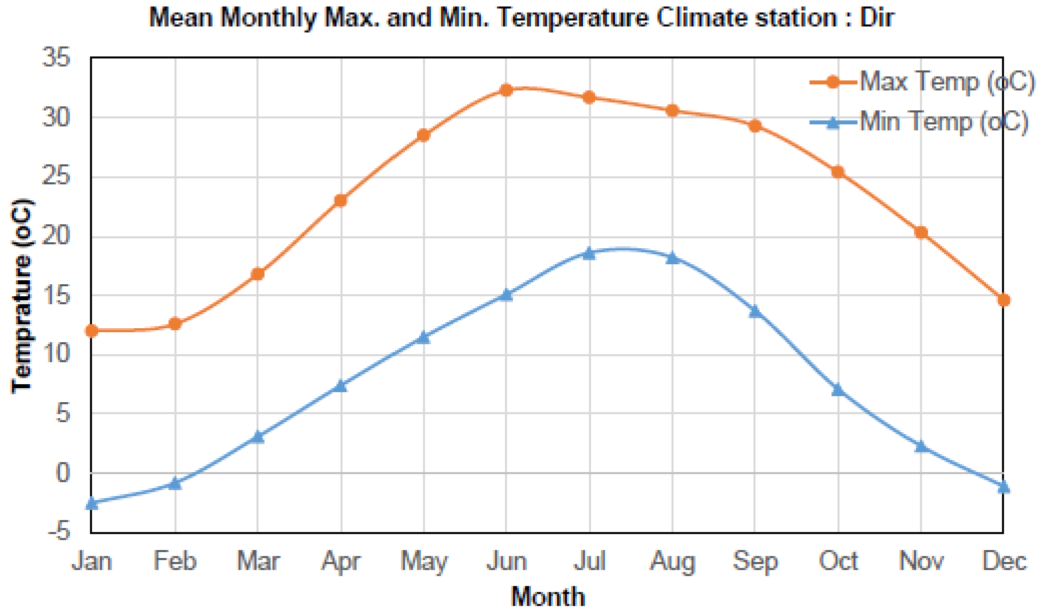


Figure 4-8: Mean Monthly Max & Min. Temperature at Climate Station Dir



216. The average annual temperature in Mingora is 19.3°C | 66.7°F. With an average of 29.2°C | 84.6 °F, June is the warmest month. January has the lowest average temperature of the year. It is 7.5°C | 45.5°F. The average temperatures vary 21.7°C. The mean temperature reveals an increase of 0.9°C, maximum temperature 0.4°C and mean minimum temperature 0.5°Celsius (Kalam station, district Swat).

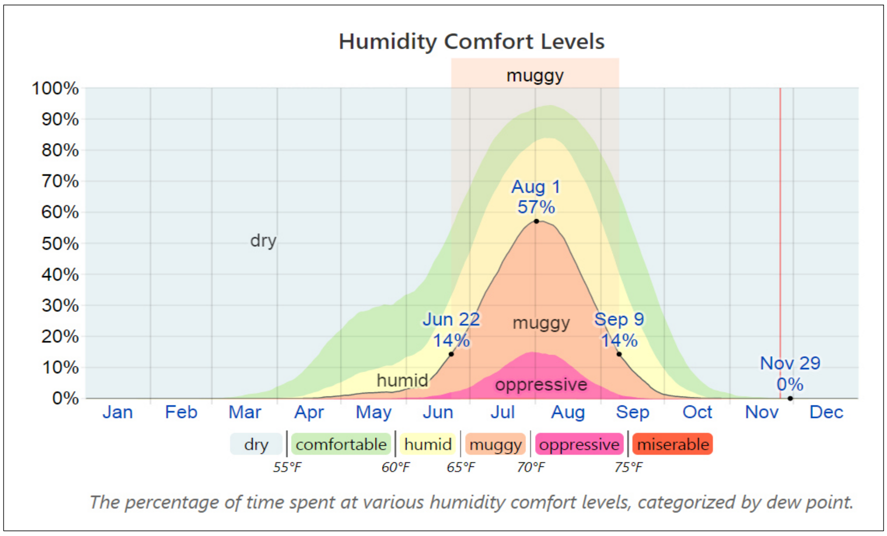
217. The warm season lasts from the May to August with an average daily maximum temperature of above 36°C. The cold season lasts from the October to April with an average daily minimum temperature below 20°C.

4.2.4 Relative Humidity

218. Mingora experiences extreme seasonal variation in the perceived humidity. The muggier period of the year lasts for 2.6 months, from June 22 to September 9, during which time the comfort level is muggy, oppressive, or miserable at least 14% of the time. The muggiest day of the year is August 1, with muggy conditions 57% of the time as can be seen in **Figure 4.9** below.

219. The air is driest around Jan-Mid March and in Nov-Dec at which time the relative humidity drops to 0%.

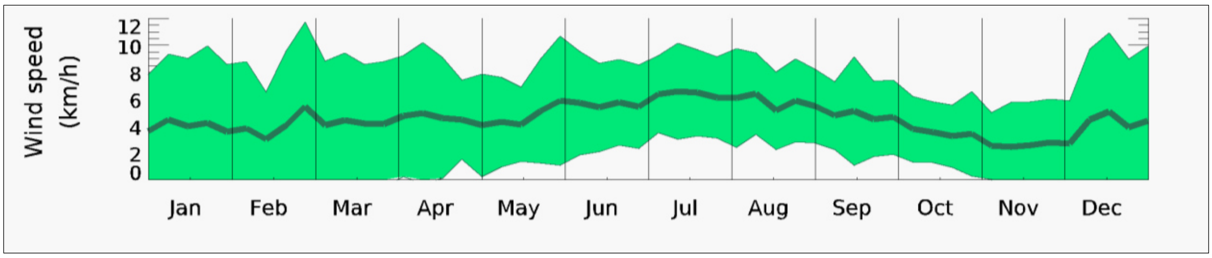
Figure 4-9: Humidity Profile of Mingora City[4]



4.2.5 Wind Speed

220. Over the course of the year, the typical wind speed vary between 0 km/h and 8km/h (moderate to high breeze), rarely exceeding 12m/s (strong breeze) as can be seen in **Figure 4.10** below.

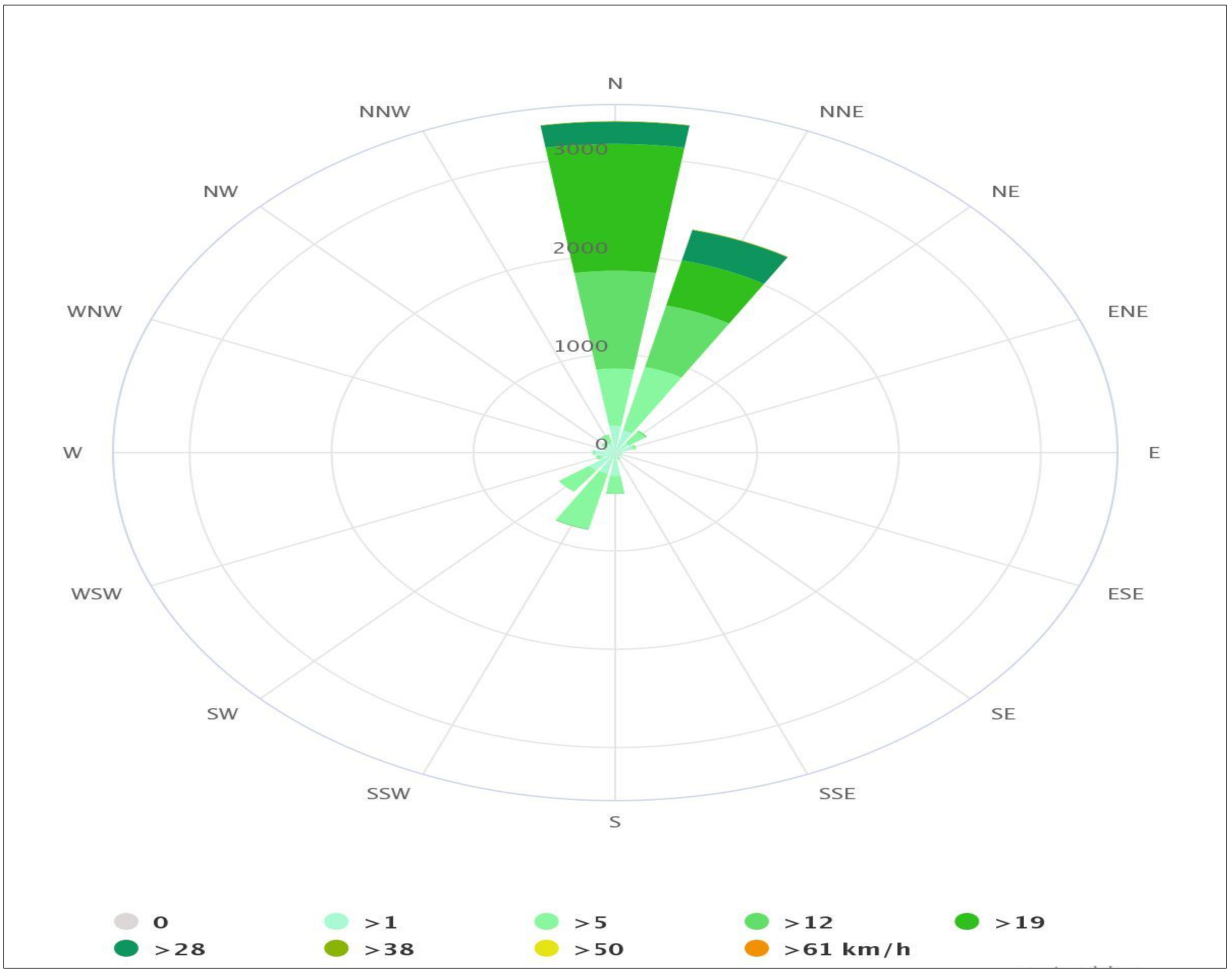
Figure 4-10: Wind Speed Profile of Mingora City



[4]https://weatherspark.com/y/107422/Average-Weather-in-Mingora-Pakistan-Year-Round#Sections-Humidity.

221. Dominant direction of wind in Mingora is south and south south west side and north to north east side. The Windrow profile for Mingora is provided as Figure 4.11 below.

Figure 4-11: Wind Rose for Mingora[5]

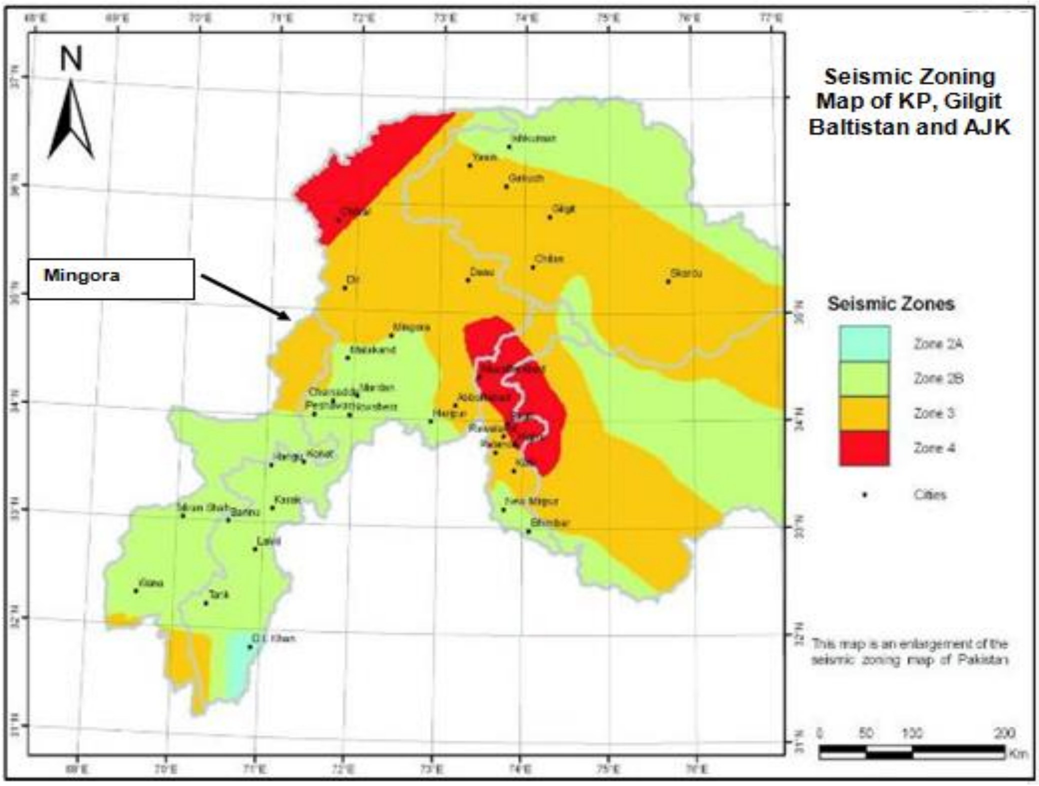


4.2.6 Seismology

222. The seismic zone map of Pakistan is shown in Figure 4.12 below. Mingora is placed in Zone 3. It is therefore, recommended that the project structures should be designed to cater for the requirements of Zone 3 of Building Code of Pakistan (2007).

[5] https://www.meteoblue.com/en/weather/historyclimate/climatemodelled/mingora_pakistan_1170395, The meteoblue climate diagrams are based on 30 years of hourly weather model simulations and available for every place on Earth at 30 Km spatial resolution.

Figure 4-12: Seismic Zones of Pakistan



4.2.7 Hydrology

223. The aspect of Hydrology which is of principal interest in the present study is the study of floods in river Swat and the determination of design flood for which the diversion structure has to be designed. In a normal year, the low flows in Swat River are around 1200 / 1300 cfs in the month of December and January. In the summer, the normal high flows are around 11, 000 to 16, 000 cfs in July and August. Normal yearly floods can raise the flows to 20,000 to 25,000 cfs. The barrages of Indo-Pakistan subcontinent have mostly been designed for 1 in 100 return period. The 100-year flood event was experienced by barrages on Indus River in 2010.

Catchment Area

224. River Swat originates in the form of Ushu and Gabral streams in the Kohistan range of northern mountains of Khyber Pakhtunkhwa and takes the name of River Swat at Kalam at the confluence of the two. Fed by snow melting and glaciers it receives drainage of the entire Swat Valley. The River flow southward, then westward, until joined by Panjkora River. Panjkora River is major tributary of Swat River and it merges into Swat River at Kulangi Post. The River then flows south-westward into Peshawar plain and joins the Kabul River. Total catchment area up to its confluence with Kabul River near Charsada is 13645 sq.km. Catchment area of Swat River at Kalam and Chakdara is 2020 and 5770 sq.km respectively. Climate of the area is pleasant. In the upper region of watershed, the weather is very cold in winter with snow fall in December to February, while in summer the weather is very pleasant. In lower reaches (plain area) summer is relatively hot. Western disturbances and monsoon can be visualized in rainfall pattern in watershed. Most of rainfall occurs in monsoon and low intensity rainfall occurs in December to April. In upper reaches of watershed annual rainfall is more than 50 inches while in lower region it is between 20 to 30 inches. The

rain water drain-out rapidly due to steep slopes, dissected and rocky nature of the terrain and impervious subsoil. The snow on the other hand remains on the ground surface for a considerably long period and drain out slowly as summer set in. It provides a permanent source of water to the area and feeds the streams regularly. A part of the precipitation moisture is conserved by the soil and helps to grow plants. Some water is also diverted from streams for irrigation at suitable locations. Springs, streams and wells are the main source of drinking water. At places, energy of the water running down slope is utilized for operating small flour mills (Jaranda). The catchments area is drained by Swat River and its tributaries. The Panjkora River joins River Swat downstream of Hisar / Totakan at Sharbatai. The river discharge increases in summer because of more snow melting due to rise in temperature. Average monthly discharge of Swat River at Chakdara are presented in following Table 4:6.

Table 4—6 Average Monthly Swat River flow at Chakdara

Month	River Swat Flow At Chakdara (Cusecs)
January	1276
February	1525
March	2817
April	6663
May	9798
June	15122
July	14917
August	9830
September	5157
October	2355
November	1643
December	1365

Source: Soil Survey Swat Catchments (Average in Cusecs)

Figure 4-13 Catchment Area

Hydrological Data

225. There are two (02) gauge stations available near the project site maintain by SWHP, WAPDA, as given in **Table 4.7.** Stream flows of Swat River are being observed on daily basis.

Table 4—7 Stream Flow Gauging Stations

Sr No.	Station	River	Location		Catchment Area (km²)	Period of Record
			Latitude	Longitude		
1	Kalam	Swat	35°28"10”	72°35"40”	2020	1961-2009
2	Chakdara	Swat	34°38'40.23"	72°1'42.83"	5776	1961-2014

Kalam gauge station is located on Swat River 2.4 km (approx.) downstream of the junction of Ushu and Gabral rivers and have the longest records of river flow for around forty-nine (49) years.
Chakdara gauge station is located on Swat River 6 km (approx.) upstream of Batkhela. This station is maintained by SWHP, WAPDA and has the records of river flows for around fifty-four (54) years (1961 to 2014).

4.2.8 Design Flood

226. Flood studies are carried out for planning and design as well as for checking the safety of hydraulic structures. To estimate the design flood at least thirty years of instantaneous flow data or precipitation data is normally required at the project location. In case of Mingora GWSS, both does not exist. Therefore, recourse has to be made to the instantaneous flow records of the swat river at Kalam and Chakdara gauging stations, which is available for 49 and 54 years maintained by the Surface water Hydrology (SWHP), WAPDA. For design flood estimation, Regional Based Envelope Curve method is adopted. Peak flood of other similar hydro-meteorological stations in the Regional enlisted below have been collected and compiled in excel. Flood frequency analysis of each gauging stations listed below are carried out and summary of results are tabulated below. Detail peak flood data is provided as below:

Table 4—8 Instantaneous & Peak Mean Daily Flows at Kalam

Sr No	Year	Peak mean Daily Flows (m^3/s)	Peak instantaneous flows (m3/s)	Sr no	Year	Peak	Peak instantaneous flows (m^3/s)
1	1961	297.3	314.3	26	1986	430.4	518.2
2	1962	373.8	404.9	27	1987	342.6	379.4
3	1963	376.6	470.1	28	1988	376.6	390.8
4	1964	424.8	521	29	1989	328.6	333.8
5	1965	419.1	464.4	30	1990	421.9	534
6	1966	404.9	424.7	31	1991	485.5	549.8
7	1967	390.8	421.9	32	1992	430.1	468.8
8	1968	419.1	438.9	33	1993	341.2	403.1
9	1969	427.6	455.9	34	1994	445.4	489.3
10	1970	328.5	370.9	35	1995	433.8	487.8
11	1971	328.5	351.1	36	1996	452.6	533.7
12	1972	424.8	472.9	37	1997	310.3	344.7
13	1973	368.1	387.9	38	1998	416.3	494.7
14	1974	280.6	337	39	1999	321.7	373.6
15	1975	455.9	464.4	40	2000	221.1	236.9
16	1976	376.6	393.6	41	2001	183.8	196.5
17	1977	320	342.6	42	2002	317.5	347.5
18	1978	461.6	597.5	43	2003	381.8	393.1
19	1979	396.4	470.1	44	2004	313.4	327.7
20	1980	351.1	393.6	45	2005	485.9	505.6
21	1981	376.6	407.8	46	2006	253.5	270.5
22	1982	211.8	233	47	2007	304.1	319.1
23	1983	351.1	368.1	48	2008	289.6	298.2
24	1984	342.6	413.4	49	2009	353.3	364.7
25	1985	264.8	308.7				

Figure 4-14 Instantaneous Flow Data at Kalam

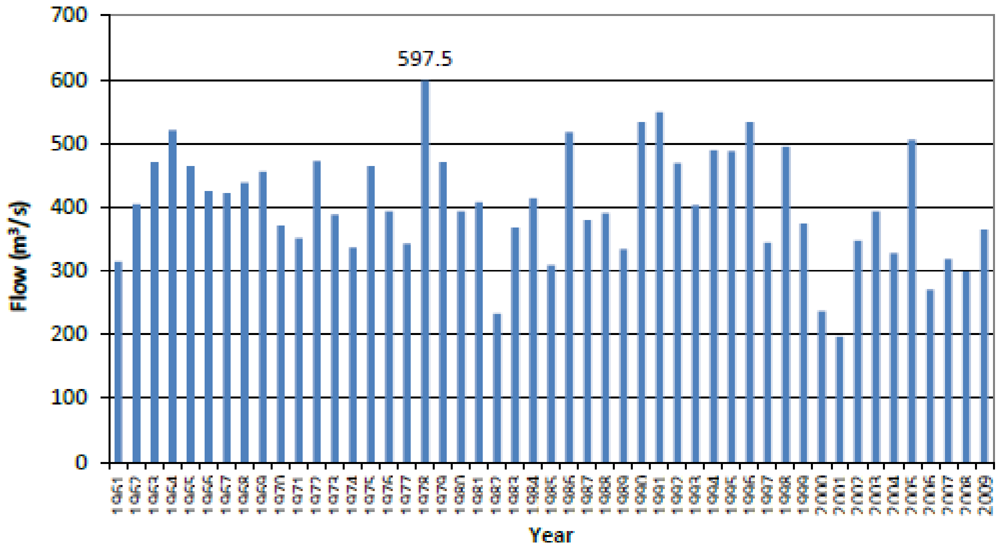


Table 4—9 Instantaneous Mean Daily Flows at Chakdara

Sr No	Year	Peak Instantaneous Flows (m^3/s)	Sr No	Year	Peak Instantaneous Flows (m^3/s)
1	1961	677	28	1988	2430
2	1962	917	29	1989	891
3	1963	602	30	1990	1192
4	1964	946	31	1991	1237.5
5	1965	810	32	1992	1575
6	1966	1002	33	1993	801
7	1967	901	34	1994	1951
8	1968	750	35	1995	2773
9	1969	773	36	1996	883
10	1970	674	37	1997	1009
11	1971	490	38	1998	760
12	1972	818	39	1999	843
13	1973	574	40	2000	451
14	1974	504	41	2001	1438
15	1975	864	42	2002	809
16	1976	906	43	2003	682
17	1977	1209	44	2004	806
18	1978	790	45	2005	921
19	1979	566	46	2006	1004
20	1980	617	47	2007	875
21	1981	898	48	2008	732
22	1982	433	49	2009	697
23	1983	952	50	2010	6297
24	1984	611	51	2011	487
25	1985	1331	52	2012	532

Sr No	Year	Peak Instantaneous Flows (m^3/s)	Sr No	Year	Peak Instantaneous Flows (m^3/s)
26	1986	659	53	2013	957
27	1987	1008	54	2014	506

Figure 4-15 Instantaneous Flow Data at Chakdara

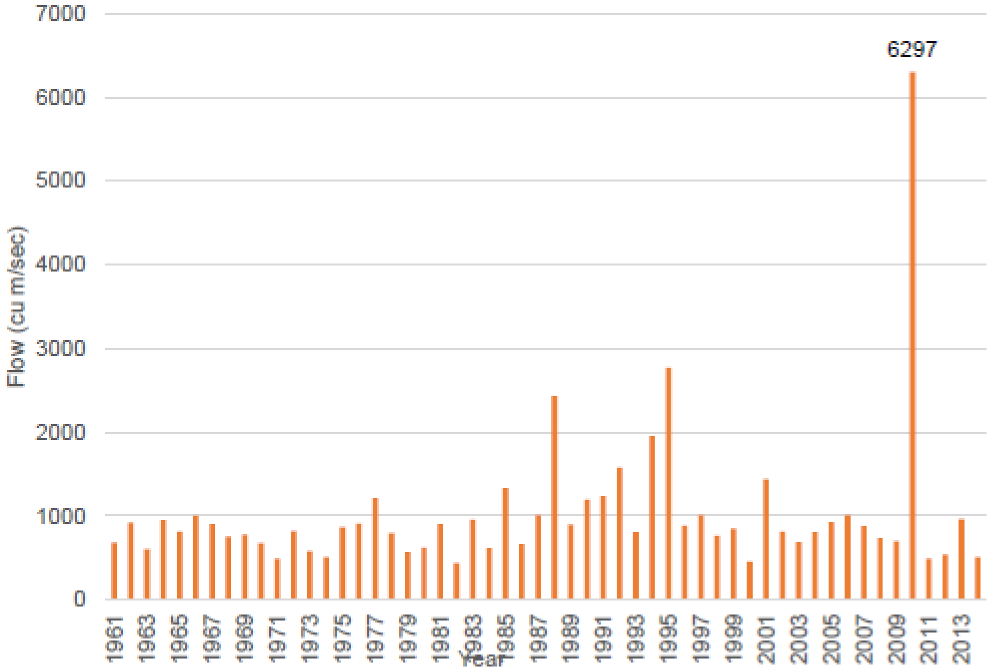


Table 4—10 Summary of Daily Maximum Flood Frequency Analysis Results

Return Period	Design Flood (Cusec)	
	Climate Station: Chakdara	Climate Station: Kalam
2	561	710
10	1,440	970
25	1,882	1,101
50	2,210	1,198
100	2,536	1,294
200	2,860	1,390
500	3,288	1,517
1000	3,612	1,613
2400	4,020	1,733

4.2.9 Surface water

227. The project is located in the catchment area of the Swat River. There are many hill torrents and streams which collect the rain water run–off or seepage water in the form of springs that ultimately drain into the Swat River.

228. The Swat River rises from the Shandur or Mashabar Range bordering Swat district with Chitral in the north and flows south and south–west approximately dividing the district into two halves. The other prominent rivers are Harnoi Khwar, Deolai Khwar and Daral Khwar. In addition to this, some small channels also originate from hills and joins Swat River. Village communities have designed irrigation channels and the river water is diverted to these channels for irrigation purposes.

229. Raw water characterization study was carried to assess raw water quality of Intake structures. The twenty-four hours composite sampling through KP EPA certified lab was performed for two (2) consecutive days during the month of June 2020 and then one day sampling was carried out in September 2020. The test result of raw water at intake indicates the presence of turbidity, Suspended solids and coliforms. The turbidity values are within the permissible limit of NEQS for drinking water i.e., >5NTU. Typical values of turbidity from collected grab samples at both streams are in the range 20-40 NTU.TSS values are higher during monsoon due to rainwater intrusion which carries suspended solids of catchment area.

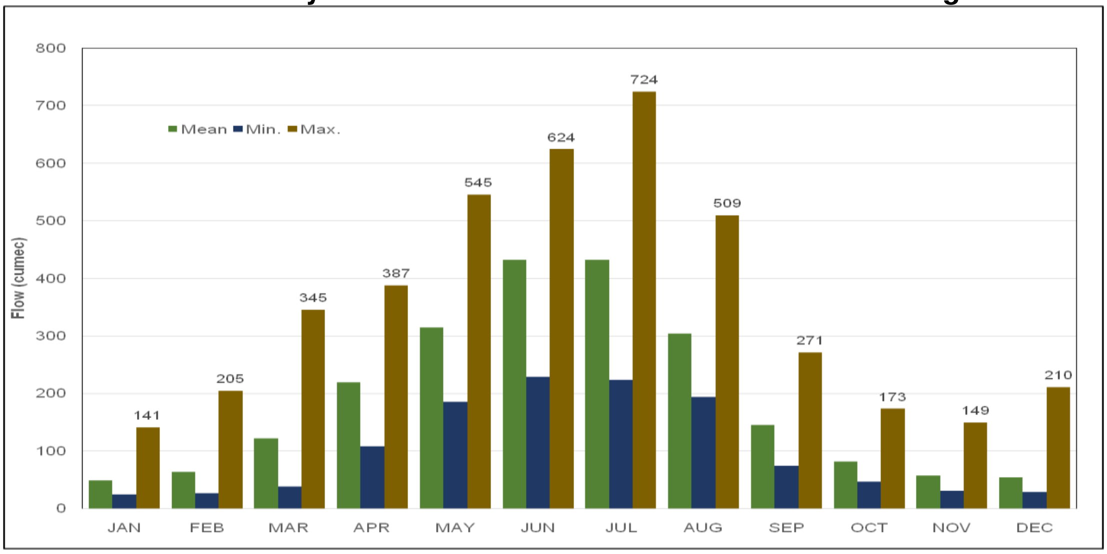
230. The presence of total coliform, fecal coliform, and E-Coli has also been reported within the permissible limits. During EDCM details survey no upstream drains were located Project design has incorporated the treatment of microbial contamination and it is recommended that repeat sampling and analysis exercise should be carried out to validate the results and to trace the microbial contamination at intake structures.

Figure 4-16: Location Plan of proposed Water Treatment Plant Site of Mingora

4.2.10 Ecological Flow (E-Flow)

231. E Flows are defined as the quantity, frequency, timing, and quality of water and sediment flows necessary to sustain freshwater and estuarine ecosystems and the human livelihoods and well-being that depend on these ecosystems. Since the water intake is from River Swat which may pose a potential impact on downstream aquatic biology, therefore, sufficient water should be available to sustain the aquatic life.

Mean Monthly Flow Pattern of Swat River at Chakdara Bridge



232. For the determination of the mean monthly ecological flow, a formula [6]representing a function of the available mean monthly discharges and the mean annual discharges was used and as presented below:

MQ eco = {(0.0651 * MQ mo + 2)/100} * MQ an

Were MQ eco = mean monthly ecological flow in m^3/s

MQ mo = mean monthly flow in m^3/s

MQ an = mean annual flow in m^3/s

[6] The above formula was developed by CEMAGREF, agricultural and Environmental Engineering Research, of France and was also used for the feasibility study of the Gabral-Kalam Hydropower Project and. It is also recommended by the International Association of Small Hydropower

Table 4—11Summary of Water Availability at Intake Structure

Month	River Swat Flow at Chakdara (cusecs)	Total Water Demand at Intake (cusecs)	Percentage of Water withdrawn from River Swat
January	1276	46	3.61%
February	1525	46	3.02%
March	2817	46	1.63%
April	6663	46	0.69%
May	9798	46	0.47%
June	15122	46	0.30%
July	14917	46	0.31%
August	9830	46	0.47%
September	5157	46	0.89%
October	2355	46	1.95%
November	1643	46	2.80%
December	1365	46	3.37%

233. As given in the table above maximum flow is available 150676 cusecs in the month of July while minimum flow 1230 cusecs in the month of January are available in river Swat. Based on the available data, it can be safely concluded that sufficient environmental flows are available for downstream ecological life.

234. The test result of raw water (Swat River) indicates the presence of turbidity, suspended solids and coliforms. The turbidity values lie in the range of 28 to 30 NTU which is beyond the permissible limit of NEQS for drinking water i.e. <5 NTU. The suspended solids concentration is in the range of 67 to 71 mg/L. The presence of total coliform, fecal coliform, and E-Coli has also been reported above the permissible limits.

4.2.11 Groundwater

235. The boring of tube wells to obtain ground water is a standard practice being implemented by the residents of Mingora to ensure a continuous supply of water which has led to a reduction in the water table of 40 feet over the last 02 years.

236. Presently, water need of Mingora is mainly met by groundwater resources however due to increase urbanization; the residents of different areas of Mingora usually face water shortage particularly during summer season.

237. As part of IEE baseline, three drinking water samples were collected and analyzed from EPA certified lab. The results of the tests are presented as **Annexure C,** which indicates that all parameters of the water samples taken are within the applicable NEQS/WHO guidelines with no exceedances observed.

4.2.12 Noise

238. The map showing the selected ambient noise monitoring locations are shown in **Figure 4.18** below. While the results indicate the ambient noise levels being within the most stringent guidelines during the daytime, however, exceedances were observed at the night time at two locations in the project area. There are nearest sensitive receptors (with respect to noise) from the proposed project cells which are located at a distance of 200 meters. During construction phase noise impacts are of short duration and necessary mitigation measures will be adhered to therefore no noise significant noise sensitivities are involved in the project area. Noise monitoring results are attached as **Annexure C.**

4.2.13 Air Quality

239. The map showing the selected air quality monitoring locations are shown in **Figure 4.18** below. Ambient air quality has been carried out in all the directions of the project site and locations have been selected keeping in view of the wind direction during the monitoring activity. Results of 24 hourly Ambient Air Monitoring from EPA Approved laboratory has been attached as **Annexure C**.

240. As can be observed, in general the air shed seems to be of good quality with the ambient air quality within the acceptable NEQS standards with PM_{10} being the only pollutant that is exceeding the guidelines at all monitored locations.

4.2.14 Land Use

241. The water treatment plant has been proposed to be constructed at the left bank of River Swat at about 20 km Upstream of Mingora City, District Swat, Khyber Pakhtunkhwa (KP). And the proposed greater water supply scheme is for Mingora City which covers nine (9) urban union councils under the jurisdiction of WSSC Swat. These nine (9) UCs cover almost every major population cluster located within and at the outskirts of the Mingora City.

242. Land use distribution map of 2 km radius around project location has been shown in **Figure 4-17**. The analysis of land use indicates that majority of the 66% of land is crop land. 13.4% of land is barren land, 8.5% is settlement and only 7 % land is tree cover.

243. Proposed project involve construction of water supply on 15 acres of land, crops and trees. Length of water supply main would be 20 km. The components also include the intake structures, treatment plant, and water reservoir, 10 no of surface tank and 8 nos. of OHRs. The proposed ROW of water supply line is 3 meters and will be established in the government and private land.

244. No building/housing structure fall within proposed WTP area. There are scattered concentrations of residential properties of varying sizes, almost all of them at respectable distances away from the site perimeter. Major settlement of the project area include Hyatabad, Bandai, Ghareeb abad Bandai, Alam Ganj, Qayyum Market Dakorak, Kamel pura, Sangota, Ahingaro Dherai and naway kalay.

Figure 4-17 Land use distribution of map of 2 km radius around project location

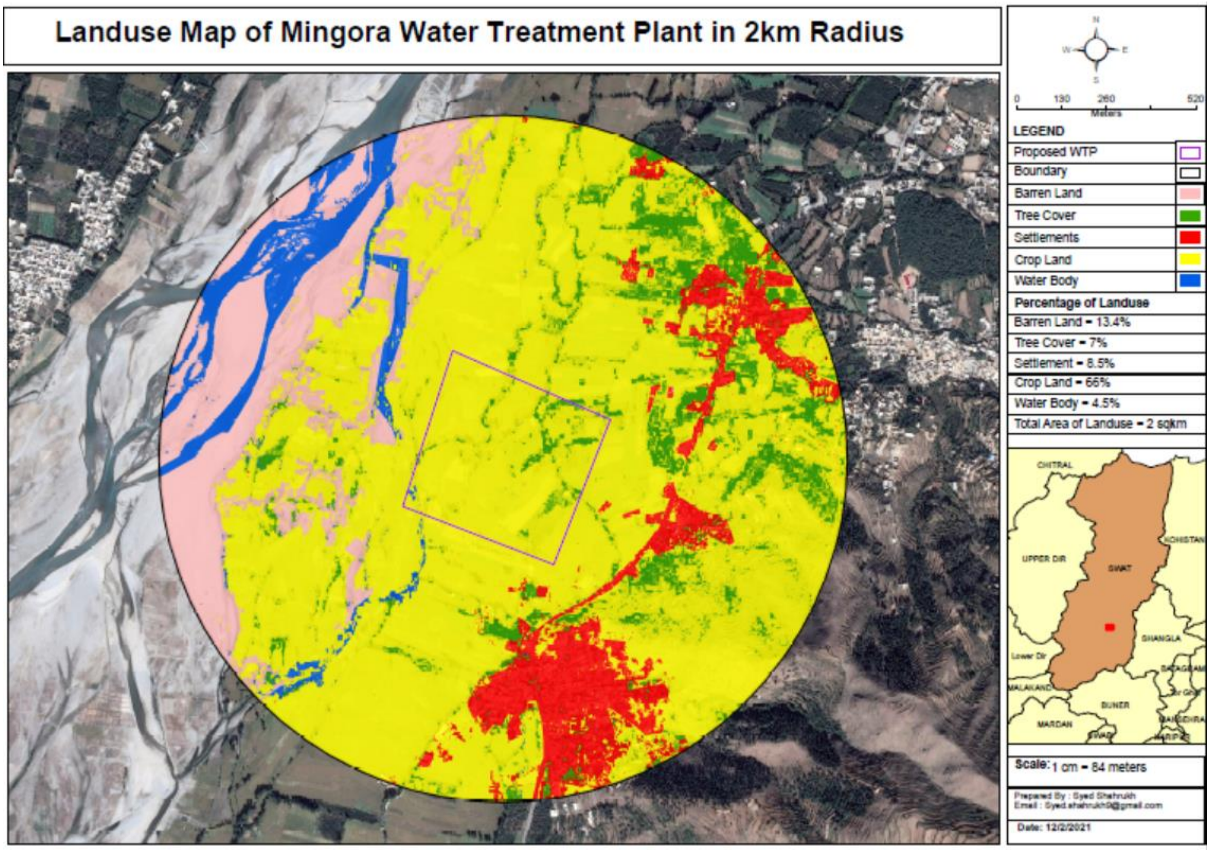


Figure 4-18 Sampling Locations for Air, Noise & Water Monitoring

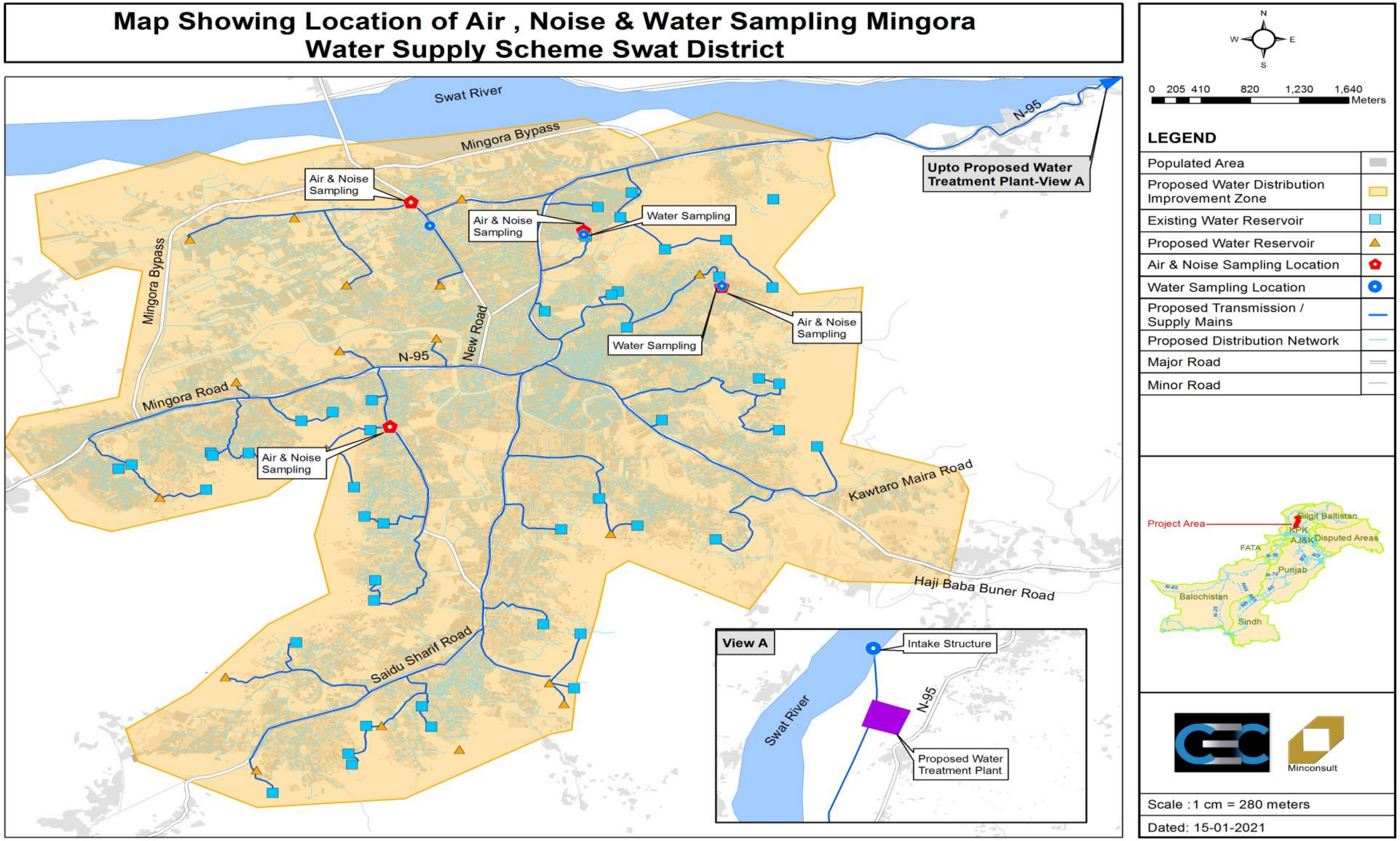


Figure 4-19: Typical setting and existing land use of project site

	
Typical run of river bed view opposite to the proposed water treatment plant, Mingora	Residential structures in the vicinity of proposed water treatment plant, Mingora
	
Plantation of herbaceous plants and trees around the boundary line of proposed water treatment plant, Mingora	Pictorial view of proposed water treatment plant, Mingora
	
Tree plantation on the boundary line of proposed water treatment plant, Mingora	High voltage transmission towers

4.3 Ecological Environment

245. In order to identify ecological resources, ecological baseline survey was carried out by EDCM team. Detailed surveys were conducted for project scoping during mid of August, 2020. Swat share three major ecological zones of the Himalaya-Karakorum-Hindukush System however due to urbanization at higher pace ecological environment is degrading and mixed class of sub-urban and hilly terrain is increasing.

246. There is no protected area/critical habitat in the vicinity of the project area. Most of avian species are found in large numbers as there were many places of shelters for their breeding and other activities. Bird game activities are quite low in the study area due to previous cease fire in Swat valley back in 2009. No migratory birds or their routes were found near the project site.

247. Fizaghat pheasantry was established in 1997 over an area of 2 kanal. It is situated at a distance of about 5 km from Mingora city. The peasantry plays an important role in promoting education, awareness, recreation, and captive breeding of important wildlife birds. The pheasantry houses 11 species including pheasants and partridge. Because of its location and easy accessibility, the pheasantry is visited by large number of visitors including students and general public for recreation and awareness.

4.3.1 Flora

248. The present flora of the cultivated areas around Mingora is exotic. The common trees are Phulai, Honey Mesquite, Ber, Jand, Mulberry, Indian rosewood, Tamarisk and blue gum. The most common shrubs Turmeric, Small red poppy and spear grass. Dominant flora species in the project area shown in Table 4.12 below.

Table 4—12: Existing Flora in Mingora

Scientific Name		Common Name	IUCN Status
Tree	*Acacia modesta*	Phulai	Data Deficient (DD)
	Prosopis glandulosa	Honey Mesquite	Least Concern (LC)
	Ziziphus mauritiana	Ber	Least Concern (LC)
	Prosopis cineraria	Jand	Data Deficient (DD)
	Morus	Mulberry	Data Deficient (DD)
	Dalbergia sissoo	Indian rosewood	Data Deficient (DD)
	Tamarix	Tamarisk	Data Deficient (DD)
	Eucalyptus globulus	Blue gum	Least Concern (LC)
Shrub	*Curcuma longa*	Turmeric	Data Deficient (DD)
	Papaver rhoeas	Small red poppy	Least Concern (LC)
	Heteropogon contortus	spear grass	Data Deficient (DD)
Grass	*Digitaria sanguinalis*	crabgrass	Data Deficient (DD)
	Carthamus balearicus	Wild Safflower	Near Threatened (NT)

Source: EDCM Ecology Survey, August 2020

4.3.2 Fauna

249. The fauna present in the Mingora City is provided in **Table 4.13** below.

Table 4—13: Existing Fauna in Mingora

Scientific Name	Common Name	IUCN Status
Herpestes edwardsii	Indian Grey Mongoose	Least Concern (LC)
Canis Aureus	Golden Jackal	Least Concern (LC)
Capra aegagrus	Wild Goat	Vulnerable (VU)
Phasianus colchicus	Pheasant	Least Concern (LC)
Naja Nigricollis	Black-necked Spitting Cobra	Data Deficient (DD)
Equus asinus × Equus caballus	Mule	Data Deficient (DD)

Source: EDCM Survey, August, 2020

250. Important avian species found in the vicinity of the project area are mentioned below in the Table 4.14 with their diversity status.

Table 4—14: Avifauna of the Project area[7]

Birds		
Scientific Name	**Local Name**	**Status**
Aythya baeri	Shingare	Summer Migrant, Rare
Apus	Lagarai	Migratory, Rare
Calidris ferruginea	Tum Tel	Summer migrant, common
Ardea cinerea	Bagh	Resident, Rare
Ciconia	Zanrai	Resident, Common
Columba rupestris	Shna Kautara	Summer migrant, common
Coturnix coturnix	Batair	Resident, Common
Grus antigone	Deng	Migratory, Common
Gallicrex cinerea	Khwar chargai	Resident, Common
Acridotheres tristis	Kharoo	Resident, Common
Corvus splendens	Kargha	Resident, Common

[7]Pathan, Amir Jan, Shahroz Khan, Naveed Akhtar, and Kausar Saeed. "Diversity and Distribution of Avian Fauna of Swat, Khyber Pakhtunkhwa, Pakistan." *Advances in Zoology* 2014 (2014).

Birds		
Scientific Name	**Local Name**	**Status**
Pycnonotus atriceps	Balbala	Resident, Common
Motacilla citreola	Sper lakai	Resident, Common
Regulus regulus	Tan tanai	Resident, Common
Pelecanus crispus	Batha	Summer Migrant, Common
Phoenicopterus minor	Deng	Summer Migrant, Common
Psittacula himalayana	Toti	Migratory, Common

4.3.3 Aquatic Fish

251. The project proposed intake site is located about 62 km upstream of Amandara Barrage and 710m downstream of Matta Bridge across River Swat on main Nowshehra-Chakdara-Chitral (NCC) road. The intake is located on the left end of the river Major species of Barilius vagra, Puntius sophore, Cirrhinus mrigala, Tor macrolepis, Carassius auratus, Glyptothorax cavia, Glyptothorax sufii, Gagata pakistanica, Mystus bleekeri, Clupisoma naziri, Channa punctatus, Ompok pabda and Mastacembelus armatus are found in swat river. The worth mentions fish is the Trout (Oncorhynchus mykiss) can be found in upper reach of the streams. This specie is common in the surface water of the area. However population of fisheries is countinoualsy decreasing due toincreased water pollution and reduces environmental flows.

252. The Mingora Greater Water Supply Scheme project is run of the river project to be constructed on Swat River located in District Swat. The intake site is located about 62 km upstream of Amandara Barrage and 710m downstream of Matta bridge across River Swat on main Nowshehra-Chakdara-Chitral (NCC) road. The total water demand at intake is 46cusec for the proposed project. Hydrologic information relevant for the hydropower project area and available in the Swat valley includes Kalam and Chakdara on the Swat River. Both stations are operated by Surface Water Hydrology Project (SWHP). The most relevant information about the hydrological station at Chakdara. For the determination of the mean monthly ecological flow, a formula [8]representing a function of the available mean monthly discharges and the mean annual discharges was used, maximum flow is available 150676 cusecs in the month of July while minimum flow 1230 cusecs in the month of January are available in river Swat.

253. Based on the available data, it can be safely concluded that sufficient environmental flows are available for downstream ecological life. Therefore, downstream water availability will not compromised and enough water water would be flowing downstream in Swat River to maintain ecological flows.

8 The above formula was developed by CEMAGREF, agricultural and Environmental Engineering Research, of France and was also used for the feasibility study of the Gabral-Kalam Hydropower Project and. It is also recommended by the International Association of Small Hydropower /Water Inteake structures.

4.4 Socio-Economic Environment

254. This section includes a summary of the prevailing socio-economic conditions in the project area and the population that will be potentially affected by the project. To ascertain the socio economic condition of the project area, primary and secondary data was collected including social and physical infrastructure in the project area.

255. To assess the socioeconomic conditions of the project area, total 3 FGDs conducted on Water Supply system in Mingora. Consultation sessions were carried out with the local community of Charbagh, Babuzai and Khawzkhela particularly with the land owners whom land will be acquired for laying of transmission line. In addition, the secondary data, including Economic Survey of Pakistan (2018-19), Bureau of Statistics (2017-18), District Population Census 2017 of KPK, Crop Reporting Services KP (2017-18) and MICS of KP have been consulted.

256. Detailed surveys were conducted for project scoping during Mid-August, 2020. For the purpose of the environmental and social assessment and sensitive receptor data collection, a two-kilometer-wide, corridor along the proposed project site has been considered as the area of influence. Most of the field data collection was carried out within this corridor though where relevant data was also collected from a wider area along the proposed project site. The reason for selecting this corridor is to cover those areas that have a potential to be affected by the project activities.

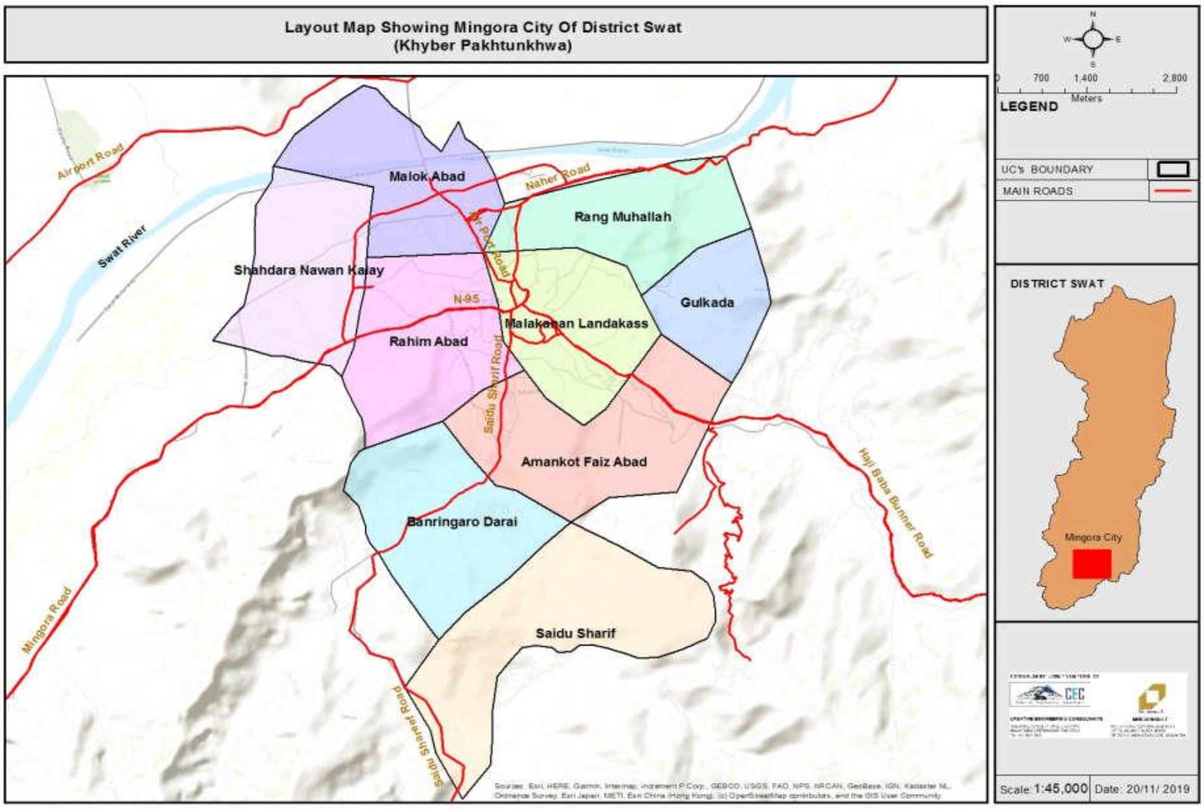
4.4.1 Administrative Setup

257. The project is located in Mingora city, district headquarter of Swat. The town is situated in the lower areas of Hindu Kush about 170 Km northeast of Peshawar. Mingora is the 3rd largest city in the province with a population of 331,091 and the economic, social and cultural center of district Swat. It is located at an altitude of 950 meters and about 2 kilometers away from Saidu Sharif, the present administrative capital of Swat. The city of Mingora serves as a gateway to the popular tourist destinations like Kalam valley, Kumrat valley, Maydan, Bahrain, Marghazar, Miandam, Malam Jabba and Saidu Sharif. In Mingora city, water and sanitation services company (WSSC) is operational in nine (9) union councils (UCs). The names of the UCs under the jurisdiction of WSSC Swat are as follow:

- UC-1 - Nawakalay/ Shadara
- UC-2 - Banr/ Usmanabad
- UC-3 - Malook Abad
- UC-4 – Rang Mohallah / Gumbat Maira
- UC-5 - Malakanan Landy Kass
- UC-6 - Rahimabad
- UC-7 - Amankot/ Faizabad
- UC-8 - Panr / Gulkada
- UC-9 - Saidu Sharif/ Shagai

258. A map showing the above UCs under the jurisdiction of WSSC Swat is given below in

Figure 4-20 Union Councils under jurisdiction of WSSC Swat



259. District swat is divided into seven tehsils including Babuzai,, Matta, Khwaza Khela, Barikot, Kabal, Charbagh and Bahrain. WTP site is located in Tehsil Khawazakhela While transmission line is passing from Tehsil Khawazakhela. Each Tehsil comprises certain numbers of Union councils. There are 65 Union councils in District Swat: 56 rural and 9 urban.

260. District administration is headed by the Deputy Commissioner (DC), who is assisted by district heads of departments. The main district departments include: administration, judiciary, police, education, health, communication and works, agriculture, forest, irrigation, telecommunication and livestock. The head of each district department is responsible for the performance of his department and is generally designated as the Deputy Director or District Officer.

261. These areas consist of small residential colonies with poor road access. Inside the city area, the proposed transmission main will run along the main Madyan road.

4.4.2 Demography and Population

262. The population of Swat district in 1998 was 1,257,602. The district's annual growth rate is estimated at 3.24 % per year, and the population of Swat district is 2,309,570 according to the 2017 census. That is making it the third-largest district of Khyber Pakhtunkhwa after Peshawar and Mardan District. Swat is populated mostly by mainly Yousafzai Pashtuns and Kohistani communities. The language spoken in the valley is Pashto, with a minority of Torwali and Kalami speakers in the Swat Kohistan region of Upper Swat.

Districts	Headquarters	Area (km^2)	Population (2017)	Density (people/km^2)
Swat	Saidu Sharif	5,337	2,309,570	433

*Source District wise population Census 2017 by Pakistan Bureau of Statistics: Government of Pakistan.

4.4.3 Religion

263. In swat 99.5% of people belong to Islam. Over welling majority of the people of swat district or Muslim belonging to hanfi school of Sunni sect, a small number of population in urban areas following irani pattern of Shiasim. An eligible proportion of the population belongs to other religions, including Christians, Hinduism, Qadyani, and Ahmadis.

264. Swat religious history dates back 324-195 BC to Buddhism and it was a famous center of Buddhist religion. After a Buddhist phase the Hindu religion reasserted itself, so that at the time of the Muslim conquest (1000 AD) the population was solidly Hindu. In 1023, Mahmud of Ghazni attacked Swat and crushed the last Hindu King, Raja Gira in battle, along with much of Swat's population9.

4.4.4 Cultural and Archaeological sites

265. No archaeological and cultural site will be disturbed during the distribution of water supply network. However, if any archaeological antiquity discovered Archeological Chance Find procedure shall be adopted.

266. Swat valley conquered by Alexander the great in 327 BC, and over the following centuries by the Indo-Greek, Saka, Parthian, Kushan, Sasanid and Hephthalite kings, was a prosperous region. It constituted a trading center between the plains of Gandahara and the mountains of the northern areas looking towards Central Asia, and at the same time a great Center of Buddhist culture with an ample scattering of Buddhist monasteries, representing an important stopover on the way to the holy places of Buddhism, traversed by numerous Chinese pilgrims (including Faxian in the 5th century A.D., Sangyun in the 6th, Xuanzang in the 7th and Huizhao in the 8th).The most famous of all the Chinese pilgrims, Hsuan-Tsang who graced the valley by his presence in the 7th century A.D, mentioned 1400 monasteries in Swat, which eloquently confirmed the extensive remains of the Buddhist period. Even today over 400 Buddhist stupas and monasteries may still be seen in ruins in Swat covering an area of about 160 square km. The Buddhists built mostly their stupas and monasteries higher on the hills with the aim that agricultural economy may not suffer and also to provide a sort of protection and security to them from the invaders.[10]

267. The Swat Museum is on the east side of the G.T road, halfway between Mingora and Saidu Sharif. Japanese aid has given a facelift to its seven galleries which now contain an excellent collection of Gandhara sculptures taken from some of the Buddhist sites in Swat. The galleries have been rearranged and labeled to illustrate the Buddha's life story. Terracotta figurines and utensils, beads, precious stones, coins, weapons and various metal objects are present from ancient Gandhara. The ethnographic section displays the finest examples of local embroidery, carved wood, and tribal jewelry. It is also under renovation with funds from the Pakistani-Italian debt swap agreement.

268. One of the most important Buddhist relics in Swat is near the museum. The stupa, which dates from the 2nd century BC, was possibly built by the Mauryan emperor

[9] https://en.wikipedia.org/wiki/Swat_District

[10] http://www.valleyswat.net/tourism/archaeology.html#:~:text=A%20fairly%20large%20number%20of,all%20over%20the%20Swat%20Valley.&text=Even%20today%20over%20400%20Buddhist,of%20about%20160%20square%20km.

Ashoka to house some of the ashes of the Buddha. In subsequent centuries, it was enlarged five times by encasing the existing structure in a new shell. Italian excavators working in 1955 exposed the successive layers of the stupa, each layer illustrating a stage in the evolution of building techniques.

269. Centered upon the upper portions of the Swat River, Swat was a major center of early Buddhist thought as part of the Gandhara kingdom, and today is littered with ruins from that era. Swat was home to the last isolated pockets of Gandharan Buddhism, which lasted until the 10th century, well after most of the area had converted to Islam. Until 1969, Swat was part of the Yusafzai State of Swat, a self-governing princely state. The region was seized by the Pakistani Taliban in late 2007, and its tourist industry decimated until Pakistani control over Swat was re-established in mid-2009. Swat's capital is Saidu Sharif, though the largest city, and main commercial center, is the nearby city of Mingora.

4.4.5 Ethnicities in Project Area

270. The primary data collected by the EDCM team during IEE baseline survey and public consultation shows the following ethnic diversity in the project area. None of these castes may be considered as indigenous people (IP) based on ADB SPS definition. The ethnicities present in the project area are provided in **Table 4.15** below.

Table 4—15: Ethnicities in Project Area

Settlement	Caste/ Tribe	Decision Making Process in Settlements	Locally Used Language
Khawazakhela	Azi Khel	Court of Law, Within caste group	Pashto
Charbagh	Yousafzai	Court of Law, Within caste group	Pashto
Bodigram	Yousafzai	Court of Law, within caste group	Pashto
Gharibabad	Yousafzai	Court of Law	Gujro, a mix of Pashto
Sangota	Yousafzai	Court of Law, within caste group	Gujro, a mix of Pashto

4.4.6 Languages

271. The primary native languages spoken in Swat are Pashto, Torwali and Kalami, though English is used in the city's educational institutions, while Urdu is understood throughout the district. The district of Swat is overwhelmingly Pashto-speaking; though the Torwali-speaking minority is concentrated in Swat's old place Saidu Sharif.

272. Pushto is the main language of the project area with over 90.2% of population speaking in Pashto and is easily understood among all the population in the surveyed settlements. Other dominant language in the project area is kohistani which comprises around 8.5% of the total population.

4.4.7 Main Sources of Livelihood/Income

273. Most of the people are farmers in villages. They are engaged in agriculture either directly or indirectly. Industrial labour has increased after the establishment of factories in different places of the district. Some people are engaged in business and government service also. Therefore, the people of the project area are good in socioeconomic point of view on the overall basis. Agriculture is one among the livelihood sources but it cannot sustain their living. Harnessing of ground water (aquifer) in the form of tube wells is quite expensive. Average land holdings are very small. The people also supplement their income by rearing of goats, sheep and cows on a limited scale. Large number of people earns their livelihood by operating their own transport. While some people run shops. However, some are working in Middle East. Fairly over 50 % of younger generation serves Pakistan Army.

4.4.8 Transport

274. The project is located in Mingora city, district headquarter of Swat. The town is situated in the lower areas of Hindu Kush about 170 Km northeast of Peshawar. Mingora city acts as a tourist center for Swat Valley. It is also a market town for the fertile Swat Valley.

275. Proposed Project is located in Mingora City District Headquarter of Swat. The town is situated in the lower areas of Hindu Kush about 170 Km northeast of Peshawar. Mingora city acts as a tourist center for Swat Valley. It is also a market town for the fertile Swat. Main transports available in the project area are ford wagon, Suzuki and Taxies.

4.4.9 Distance to nearest airport from project site

276. The airport to the Mingora City is the Saidu Shareef Airport; It is situated near the Swat River and between the villages of Dherai and Kanju in Khyber-Pakhtunkhwa.

4.4.10 Industry

277. Tourism and agriculture are major industries in the project area. The city of Mingora serves as a gateway to the popular tourist destinations like Kalam valley, Kumrat valley, Maydan, Bahrain, Marghazar, Miandam, Malam Jabba and Saidu Sharif. Major agriculture produce of the area are Swat Apple and Swat Peaches. Swat is famous for peach production mostly grown in the valley bottom plains and accounts for about 80% of the peach production of the country. Mostly, in the national markets with a brand name of "Swat Peaches". The supply starts from April and continues till September because of a diverse range of varieties grown.

4.4.11 Health Care

278. For health care, facilities including hospitals, dispensaries are available within project area in Mingora city (i.e. Jalil International Hospital).

4.4.12 Literacy Rate

279. Swat is famous for its educated and development oriented people. Swat has good literacy rate of 88.6% in 2015.It has excellent ground for education and infrastructure improving its image as a well preserving touristic site. In the last few years, Swat has seen great changes in all aspects of its society including an increase in education, modern health care centers and a new university, along with private sector colleges.

4.4.13 Education

280. Being part of urban UC Dungram Sangota, local community at Mingora City has access to educational facilities. A number of technical colleges and universities are also present in the area of influence. Both primary and secondary schools for boys and girls are available in the project area. Govt primary school Gharibabad Bandai, Future Model School, GPS Balalai, Excessior College Swat, Sangota Public School, GBHS Ahngo Dherai Swat, Khyber Public School, Danish Public School, Government College of Management Sciences and Govt Primary School are educational institutes in Mingora city.

4.4.14 Types of Dwellings

281. Housing conditions of the respondents have been analyzed according to the type of houses in which they were residing. The house or building constructed with concrete or burnt bricks fall in pacca category whereas house or building constructed with burnt bricks with mud comes under semi-pacca category while house constructed with mud bricks or temporary wooden logs etc. are categorized as kacha house. Project area population is mostly living in semi-pacca and pacca houses.

4.4.15 Energy Supplies

282. The residents of project area are reliant on electricity available from the grid through PESCO (Peshawar Electric Supply Company) Swat located at a distance of 6.5 Km.

4.4.16 Major Source of Drinking Water

283. The major sources of drinking water within the vicinity of the project area include community tube wells, individual and communal hand pumps. Water supply scheme is available in the project area.

4.4.17 Social Amenities in the project area

284. During the field survey, the access/ availability of the social amenities/ basic infrastructure in the vicinity of the proposed site was asked from the surveyed households as well as physically observed at site. It was noted that facilities such as Electricity, Sui Gas, Water Supply, Telephone, sewerage drainage, school are available in the settlement or in its vicinity.

4.4.18 Locations of Existing Surface Tanks

285. The current water supply source in Mingora city is based on ground water tube wells with approximately 64 number of existing tube wells. Rapid depletion of ground water table has been observed during recent years, with approximately 40 feet of draw down observed in some parts of Mingora city during last year. The depleting ground water levels have been a cause of concern for the city threatening the reliability of supply to the residents of the city. Therefore, a reliable surface water source is deemed necessary for Mingora city. The proposed Mingora Greater Water Supply Scheme, a surface water-based scheme from River Swat, is considered as a more sustainable and reliable alternative to the current source of ground-water based supply.

286. As per the data collected from WSSC Swat, there are 48 number of existing water storage reservoirs in Mingora city under the jurisdiction of WSSC Swat. All of these existing water storage reservoirs are surface water tanks. Each of the existing water storage reservoir will be supplied treated water via a dedicated supply main. Based on the hydraulic model of the proposed transmission main and supply mains, the water storage reservoirs with elevation levels in the range of 1030 MSL will get uninterrupted water supply via a gravity system. While the remaining reservoirs, located at slightly higher elevation than 1030 MSL, will be fed through a pumping system. In order to minimize the operational cost of pumping system, solarization of those pumping houses is proposed. The solar pumps will have capacity to run 12 hours on solar energy as well as conventional electric supply as a back-up and alternate energy source.

287. Solar panels on pumping stations are proposed for the purpose of getting clean renewable solar energy. The electricity produced from Solar panels / Sheets will be used to operate pumps. The solar system is designed in such a way that all lights working net metering systems. PV cells are panels that can be attached to a roof or wall. Each cell is made from one or two layers of semiconducting material, usually silicon. When light shines on the cell, it creates an electric field across the layers. The stronger the sunshine, the more electricity is produced. However, PV cells do not need direct sunlight to work - they can still generate some electricity even on a cloudy day. Cells come in a variety of shapes and colours, from grey "solar tiles" that look like roof tiles to panels and transparent cells that can be used on conservatories. The system converts solar radiation into direct current (DC) at the solar panel and feeds it into an inverter where it in turn is converted to alternating current (AC) and fed into the fuse box to power the household. Excess supply is either fed back down the electrical supply line and into the grid, or into battery back-up banks. The solar system installation will be done by reputable national level solar system supplier firms. These companies have all the technical expertise and knowhow to ensure all the safety measures put in place at time of procurement, installation and later at the operation stage.

288. Beside the 48 number of existing water reservoirs, new surface and overhead water storage reservoirs/tanks were proposed to provide a minimum storage equivalent to demand of one-day covering the entire population of Mingora City. The location for the proposed water reservoirs were selected in close coordination with WSSC Swat. 10 new surface water reservoirs and 8 overhead water tanks are being proposed to supply treated water to customers and increase daily storage capacity of the distribution system in the city. Moreover, these reservoirs will also help to serve the areas that are facing shortfall in water supply or currently not served at all. All the proposed water storage reservoirs are Reinforced Cement Concrete (R.C.C) type.

289. Based on the condition assessment of the existing surface water reservoirs, some of the existing reservoirs are proposed for demolition and reconstruction due to their old age and bad structural condition. These tanks will have increased capacity when reconstructed to be able to cater to the storage and distribution requirements.

Table 4—16 Details of Existing Surface Tanks (To be Demolished & Reconstructed)

Existing Tanks Name	Existing Capacities (US Gallons)	Proposed Capacities (US Gallons)
Khan Mohallah Shahdara	65,000	200,000
Gulkada (1) Near Epi Office	50,000	200,000
Baligaram Bar Kaly	50,000	100,000
Malook Abad (Volta) Zamarood	100,000	200,000
Khuja Abad	30,000	150,000
Bailtullah Mohallah (Lower)	30,000	100,000
Bacha Mohallah	50,000	200,000
Barama Qawnaj	30,000	150,000
Gujar Abad Mohallah	10,000	50,000
Kargal Tank	10,000	50,000
Rangmuhallah Chowk	50,000	100,000
Akram Mohallah Shahdara	10,000	50,000
Usmakhil Amankot	30,000	100,000
Mohammad Gul Shaheed	15,000	100,000
Aziz Abad Tank Raja Abad Ishaq	50,000	150,000
Rahmanabad Tank	10,000	50,000
Afsar Abad Saidu Tank	50,000	100,000
Sharif Abad Dehrai Tank	50,000	150,000

4.6 Findings of Social Due Diligence

290. The Consolidated Social Due Diligence Report (SDDR) has been prepared as a document of land acquisition and resettlement related impacts of the subprojects selected under the proposed Khyber Pakhtunkhwa Cities Improvement Project (KPCIP) to be financed by the Asian Development Bank (ADB). The SDDR has been prepared by the social safeguard team of the Project Management Unit (PMU), KPCIP under the Local Government Department (LG) Government of Khyber Pakhtunkhwa (KP) as the executing agency (EA) for the proposed KPCIP project.

291. As per ADB Safeguard Policy Statement (SPS-2009), the LAR impacts are considered significant if 200 or more persons experience significant impacts that are physically displaced from housing and lose 10% or more of their income-generating resources. As far as overall KPCIP is concerned, it is a stand-alone project and falls in the IR category B as no DPs will face physical dislocation from housing or lose 10% or more of their resources that are income-generating. Based on this DDR screening proposed project falls in IR category B and IP Category C.

292. The DDR team carefully reviewed the project documents and consultations with the project staffs and consultants for the presence of any IPs communities. It was found that the entire population is Muslims and they did not consider themselves to be called any other type of population such as indigenous peoples as the ADB's SPS 2009 describes the IPs to be. As the Project is not entailed any significant impact on indigenous peoples owing to the nonexistence of the IP, hence the IP (Indigenous peoples) category "C" will stand here as reflected in. Therefore, an Indigenous Peoples Development Plan (IPDP) is not required for this Project.

293. Details of findings of Due Diligence Work for Mingora water treatment plant and water supply network has been summarized in **Table 4-17.**

Table 4.17: Due Diligence Work for Mingora water treatment plant and water supply network

Sr. #	City	Project	IR/IP Category	Remarks
1	Mingora	Mingora Greater water supply scheme including new water treatment plan (WTP) intake structure, transmission and distribution network	B (IR) & C (IP)	**Screening results:** a) Construction of water supply in the length of 20 km. The components also include the intake structures, treatment plant, and water reservoir, 10 no of surface tank and 8 nos. of OHRs. b) The proposed ROW of water supply line is 3 meters and will be established in the government and private land. c) **Land Acquisition**: The land acquisition is under process, Section 4 of LAA 1894 notified on 11th May 2020 and Section 5 of LAA is notified in June, 2021. d) The subproject will have the impact on 15 acres of land, crops and trees. e) Total compensation cost of land worked out by revenue department is PKR 2.7 billion.

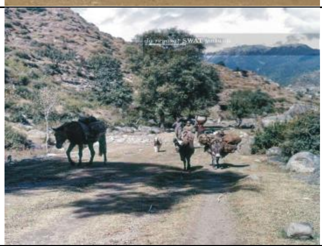
4.7 Sensitive Receptor Mapping

294. During this first step of the study, the spatial and sectorial dimensions of the study were determined. This included defining and demarcating the study area and determining the prominent environmental and socioeconomic aspects to be studied. In addition to reviewing the project details, a reconnaissance field visits were also carried out as part of this step followed by the detail social and environmental surveys. Detailed surveys were conducted for project scoping during the mid of August 2020.

295. For the purpose of the environmental and social assessment and sensitive receptor data collection, the area falling within a two-kilometer radius from the proposed project site has been considered as the study area. Most of the field data collection was carried out within this corridor though where relevant data was also collected from a wider area along the proposed project site. The reason for selecting this area is to cover those points that have a potential to be affected by the project activities.

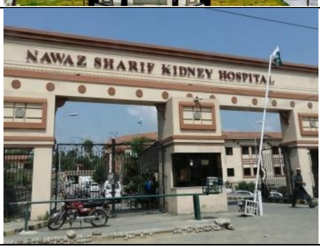
Sensitive Receptors within the radius of 2 km from the proposed Water Treatment Plant & 20Km Transmission main

Sr No	Pictorial View	Coordinates	Distance from site (meters)	Description
1.		X: 72.437478 Y: 34.925634	993	Bodigram ground
2.		X: 72.464226 Y: 34.931794	1520	Bright future model school
3.		X: 72.463133 Y: 34.925744	960	GPS
4.		X: 72.464249 Y: 34.920700	1036	GPS Gharib Abad Bandai

Sr No	Pictorial View	Coordinates	Distance from site (meters)	Description
5.		X: 72.451442 Y: 34.916918	150	Abshaar Hotel Swat
6.		X: 72.451771 Y: 34.913938	500	GGPS
7.		X: 72.448541 Y: 34.904023	1670	GPS Lande Alamganj
8.		X: 72.446065 Y: 34.893652	580	GPS Balalai
9.		X: 72.446367 Y: 34.881128	880	Cadet College Swat
10.		X: 72.438535 Y: 34.873598	570	Play ground
11.		X: 72.440494 Y: 34.861967	550	Quyoom Market Dakorak

Sr No	Pictorial View	Coordinates	Distance from site (meters)	Description
12.		X: 72.441041 Y: 34.859658	570	Masjid Amir Noshad
13.		X: 72.441793 Y: 34.852294	540	University of Swat
14.		X: 72.435824 Y: 34.833580	360	GPS Boys, Kaimal Pur
15.		X: 72.427537 Y: 34.816892	250	GPS
16.		X: 72.422662 Y: 34.801326	710	Excelsior College Swat
17.		X: 72.418847 Y: 34.799639	510	Sangota Public School
18.		X: 72.420801 Y: 34.798820	720	Manglor Police Station

Sr No	Pictorial View	Coordinates	Distance from site (meters)	Description
19.		X: 72.396342 Y: 34.791022	180	Dar ul Qaza
20.		X: 72.394421 Y: 34.792347	40	Shingerdar Stupa Swat
21.		X: 72.392248 Y: 34.792008	15	Swat Wonder World Amusement Park
22.		X: 72.364372 Y: 34.790843	190	Hayatabad
23		X: 72.36832 Y: 34.78995	16	Motorway Express
25		X: 72.337790 Y: 34.784592	45	GBHS Ahingaro Dherai Swat
26		X: 72.348955 Y: 34.780961	25	Khyber Public School

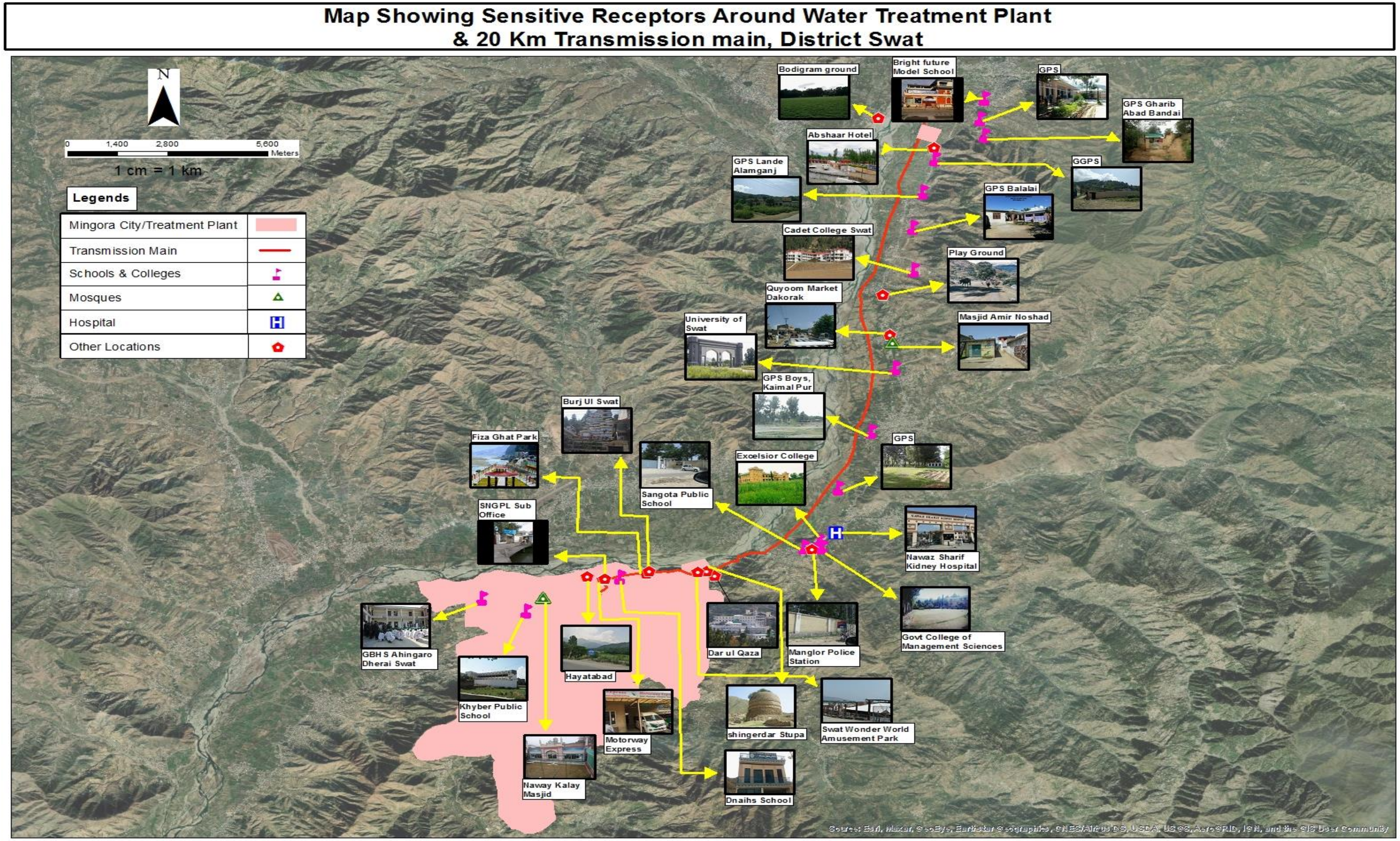
Sr No	Pictorial View	Coordinates	Distance from site (meters)	Description
28		X: 72.353305 Y: 34.784549	12	Naway Kalay Masjid
31		X: 72.372669 Y: 34.790762	17	Danish School System
32		X: 72.368702 Y: 34.790091	20	SNGPL Sub Office
33		X: 72.373896 Y: 34.791414	30	Shell Gas Station
34		X: 72.379186 Y: 34.791610	17	Burj Ul Swat
35		X: 72.379823 Y: 34.792264	20	Fiza Ghat Park
36		X: 72.426725 Y: 34.803606	880	Nawaz Sharif Kidney Hospital

Sr No	Pictorial View	Coordinates	Distance from site (meters)	Description
37		X: 72.423434 Y: 34.799651	890	Govt College of Management Sciences

296. The map below shows the spatial distribution of the sensitive receptors, which were identified and studied in the field, with respect to the location of the proposed Water Treatment Plant & 20 Km Transmission main, District Swat

Figure 4-21 Nearest Receptors in Project Area

Figure 4-22 Nearest Receptors in Project Area



5 Analysis of Alternatives

5.1 Overview

297. Project alternatives have been studied as a part of this IEE process. Alternatives analysis has been conducted in detail to foresee environment, economic and social impact of each alternative. This chapter also provides an overview of the various commercially available technologies for the distribution of water supply in an environmentally sound manner and is successfully running in developed countries in particular and recommends the most suitable set of options for Mingora city keeping in view their water demand and institutional capacity.

298. Project alternatives has been studied keeping in view number of parameters including no project option, selection of intake source, route of transmission main, distribution system, treatment plant selection and technology alternatives for water distribution.

299. The development of the proposed water supply network is based on detailed feasibility assessments focusing on assessing the city requirements with regards to population and demand for next thirty years and then determining the most suitable and effective technology and location for development of the required infrastructure.

300. This process of analysis of the different alternatives for development/extension of the water storage tanks and water distribution network ensures that a well-informed decision is taken regarding the selection of the most optimal option amongst the possible options that are brought into consideration.

5.2 No Project Option

301. If 'no project' option is triggered, it will result in loss of all positive impacts caused that project will pose on Mingora city; such as improved and sustainable potable water availability to citizens of Mingora for next thirty years, the project will reduce abstraction of ground water from tube wells and water bores omitting chances of ground water depletion. At the most clean potable water will reduce water borne disease and ultimately reduced pressure on health care system.

302. Furthermore, project implementation will also create job opportunities during construction, thereby improving the socioeconomic condition of the local people and help in improving their quality of life. Thus, the 'no project' option is not a viable option.

5.3 Alternatives Types

303. The availability of alternatives ensures to a degree that a comparative analysis will lead to a well informed decision regarding the selection of the most optimal option among all that are brought into consideration. The analysis for the Mingora Water Supply and water treatment plant lays a primary emphasis on factors influencing economic viability, environmental sustainability and social acceptability that may arise from the execution of the project, during both construction and operation.

304. Two key components of this particular analysis are:

a) Site Selection and

b) Technology Selection

305. There are some aspects of the analysis in which site and technology selection are interrelated. These will also be described below.

5.4 Site Selection Alternatives

306. There are many different, often inter-related, criteria that go into the selection of an appropriate method for water distribution. These include technical, environmental, geological-hydro geological, operational, economic, social and political factors. Environmental Sensitivity (Hydrology, Climate, Fault/fractures, Soil/topography, flora/fauna, and agriculture/nature conservation) is one of criteria which plays critical role while making decision with respect to water supply scheme selection and site for treatment plant.

Environmental Sensitivity (Climate, Nature Conservation)

307. Pollution of ambient environment and ground water is one concern.

308. Wind and rain are common climatic factors influencing site selection. For high rainfall areas, effective storm water diversion is essential to minimize interference with distribution network operations.

309. Locations with higher potential for nature conservation or agriculture should not be considered, e.g., wetlands etc.

Infrastructure

310. This primarily includes the water supply infrastructure to and from the site, and may also include the road access to the potential site.

Site capacity and operability

311. Identified distribution mechanism should have better capability.

312. Site topography and ground features should be conducive to water supply scheme operations.

Land Acquisition, Cost

313. Each location has its monetary value, and certain due processes for its acquisition.

314. Existing and possible future developments, residential etc., adjacent to the site should be considered.

Social Acceptability

315. The location identified should be accepted socially.

5.4.1 Site alternatives

316. As per previous feasibility designs of this scheme and a PC-1 prepared by Public Health Engineering Department (PHED), a 40 kilometers long transmission main was proposed with the intake point located near Bagh Dheri. During the concept design stage of this project, keeping in view the land acquisition and constructability issues, two other options for intake structure were explored that provided different routes for the pipe alignment. The purpose of the additional options was mainly to reduce the length of the transmission main to avoid crossing the populated urban areas. Hydraulic model, using Bentley's Water CAD software, was run for all the three options using the approximate elevations available on google earth. A comparative analysis was carried out including life cycle cost analysis, to come up with the most suitable, technically feasible, and cost effective solution for this project. The three different options for transmission main are described below:

Option 1 – Fully Gravity Based System

- Option 1 comprises of a full gravity-based system with a proposed raw water intake located at BaghDheri. This option is based on the previously completed feasibility studies and PC-1by Public Health Engineering Department, and has an approximate length of 40 km. The elevation at the source, Bagh Dheri, is approximately 1220 MSL.
- This option will have an ability to serve water to all resident population residing up to 1100m MSL i.e. approximately 95% of the population in Mingora city will be served with this option.

Option 2 – Hybrid System (Gravity + Solar Pumping)

- Option 2 is based on a combination of both gravity and pumping system (preferably solar pumping).
- Proposed Raw Water Intake structure is located at downstream of KhwazaKhela at an elevation of approx. 1080 MSL, and the route of the proposed transmission main under this option will eliminate the congested urban areas of Khwazakhela and Gulibagh.
- Proposed transmission main is approximately 20 km long, which will serve the population residing in Mingora city up to 1030m MSL i.e. approx. 85% of the total population of Mingora City will be served with this option. The length of the proposed transmission main under Option 2 is reduced by 50% when compared to the length in Option 1.
- For the remaining population, small scale solar pumping solution is proposed in which pumping station will be required to fill the water storage tanks located at high elevations (i.e. more than 1030m MSL)

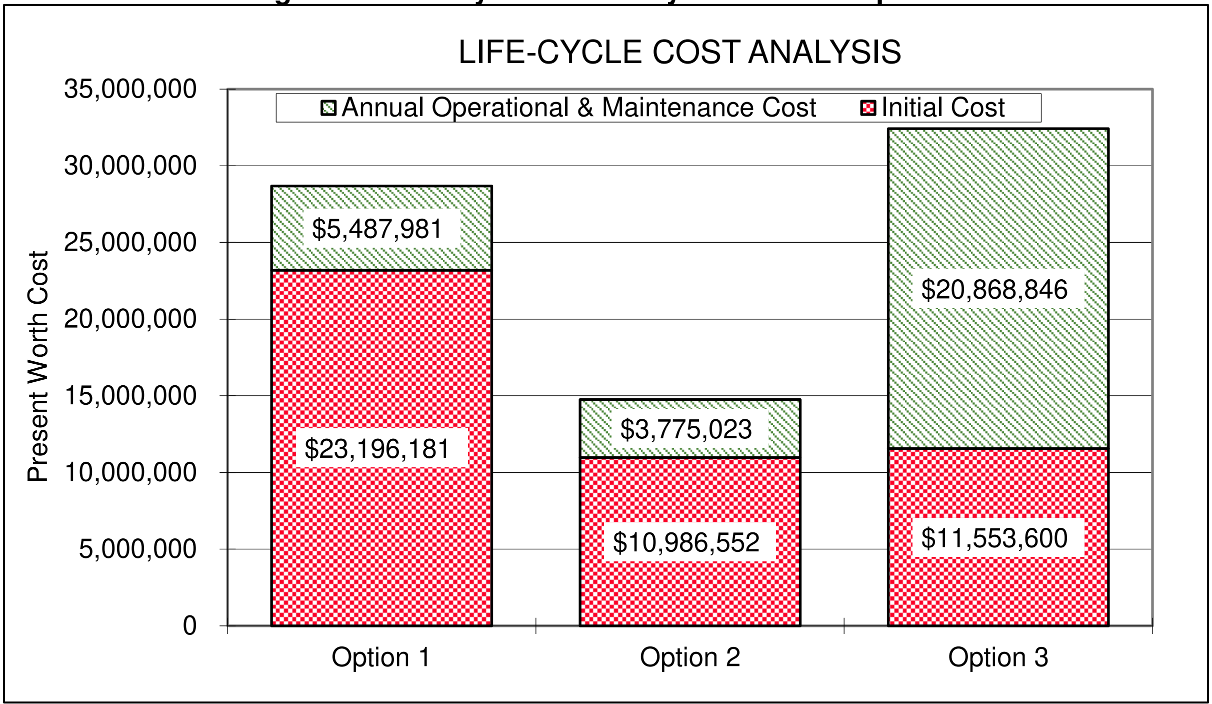
Option 3 – Pumping Based System

- In this option, a complete pumping-based system is proposed. The purpose of exploring this option is to further minimize the length of the transmission main, and thus to avoid the extensive land acquisition along the length of the transmission main as required in Options 1 and 2.
- Proposed intake structure for Option 3 is located at the downstream of Charbagh.
- The nearest available location for treatment plant is 8 km away from the city, hence 8Km of transmission main will be proposed.
- Water will be conveyed from treatment plant to Mingora city through a proposed pumping system.
- System will be designed in a way to run on solar for 6 hours a day and remaining on electricity. Extensive area for solar panels and pumping facility is required for Option 3.
- The option is effective in the context of savings in land acquisition but the operation and maintenance is very huge keeping in mind the extensive pumping.

317. A concept level Life cycle cost comparison assessment was carried out for all the above three options. The purpose of the life cycle cost comparison is to find the most cost-effective option with respect to the full life cycle of the project i.e. 30 years. The chart presented below illustrates the life cycle cost comparison results for the three different options as discussed above. The chart indicates that the capital cost of option 1 is huge due to the 40km length of the proposed transmission main. However, the capital cost of option 2 and 3 are almost same. The operation and maintenance (O&M) cost for option 3 is huge due to continuous pumping involved while the O&M cost for

option 2 is least between the three options. The chart indicates that Option 2 is the most recommended option for the proposed transmission main with less capital and O&M cost as compared to the other two options.

Figure 5-1 Life cycle cost analysis for three options



318. Further to the life cycle cost comparison, further comparison of the three options was carried out with respect to other relevant parameters. These include parameters such as cost (both capital and operational cost), ease of construction, energy requirements, land acquisition requirements, and ease of operation. Table 5.1 below shows the general comparison of the three different options with respect to these parameters.

319. In addition, a weighted score analysis was carried out for the three options by assigning a weighted score to each option based on the score for each of the relevant parameters. The results of the comparison and weighted score are shown below in Table 5.2. The option securing a maximum score will be considered and proposed as the preferred option. The parameters selected for weighted score analysis mainly include capital cost, O&M cost, social and environmental issues, land acquisition requirements, and energy requirements. As shown in Table 5.2, Option 2 secured the maximum score i.e. 80 as compared to option 1 and 3 with scores of 40 and 55 respectively. Option 2 is therefore considered to be the most preferred option for the proposed transmission main for Mingora Greater Water supply scheme.

Table 5—1 Comparison table for different options

Sr No.	Parameter	Option 1	Option 2	Option 3
1	Length of transmission main (km)	40	20	8
2	Energy requirement	Minimum	Average	Maximum
3	Population served by gravity (%)	95	80	15
4	Land acquisition for transmission main +TP + Solar panels (Acres)	395	178	148
5	Diameter for proposed Transmission main	37 Inches	40 Inches	40 Inches
6	Preferred Option based on Life cycle cost (LCC)		✓	

Table 5—2 Weightage ratios and scores for different options

S. No	Parameters	Weightage	Scoring Values	Option 1 (Gravity)	Option 2 (Hybrid)	Option 3 (Pumping)
1	**Capital Cost** Total capital cost of each of the considered option? Higher Capital cost will take a minimum score.	20%	0: Maximum Capital Cost 10: Medium Capital Cost 20: Minimum Capital Cost	**0**	**20**	**10**
2	**Operation and Maintenance of the project** Is the option easy and less costly to operate and maintain with less skilled people required High O&M cost for the job will have minimum score	20%	0: Maximum O&M Cost 10: Medium O&M Cost 20: Minimum O&M Cost	**10**	**20**	**0**
3	**Social Issues:** Are there any inhabitants on proposed option? How much cultivated area will be disturbed? How population/ houses will be disturbed? Less social issues with secure higher score	15%	5: Adverse Issues 10: Potential Issues 15: Minimal Issues	**5**	**10**	**15**
4	**Environment Issues:** Presence of Rare, threatened, or endangered ecosystems associated with this option? Other issues related to environment	15%	5: Adverse Issues 10: Potential Issues 15: Minimal Issues	**5**	**10**	**15**
5	**Land Acquisition/Availability** Will land acquisition be required? How much land acquisition will be required for this option?	15%	5: Huge Land acquisition will be required 10: Average Land acquisition will be required 15: Minimum Land acquisition will be required	**5**	**10**	**10**
6	**Energy Requirements** Total energy requirements for this option? Is this option energy efficient or not?	15%	5: High Energy requirements 10: Average Energy requirements 15: Low Energy requirements	**15**	**10**	**5**
		100%	**Total Score:**	**40**	**80**	**55**

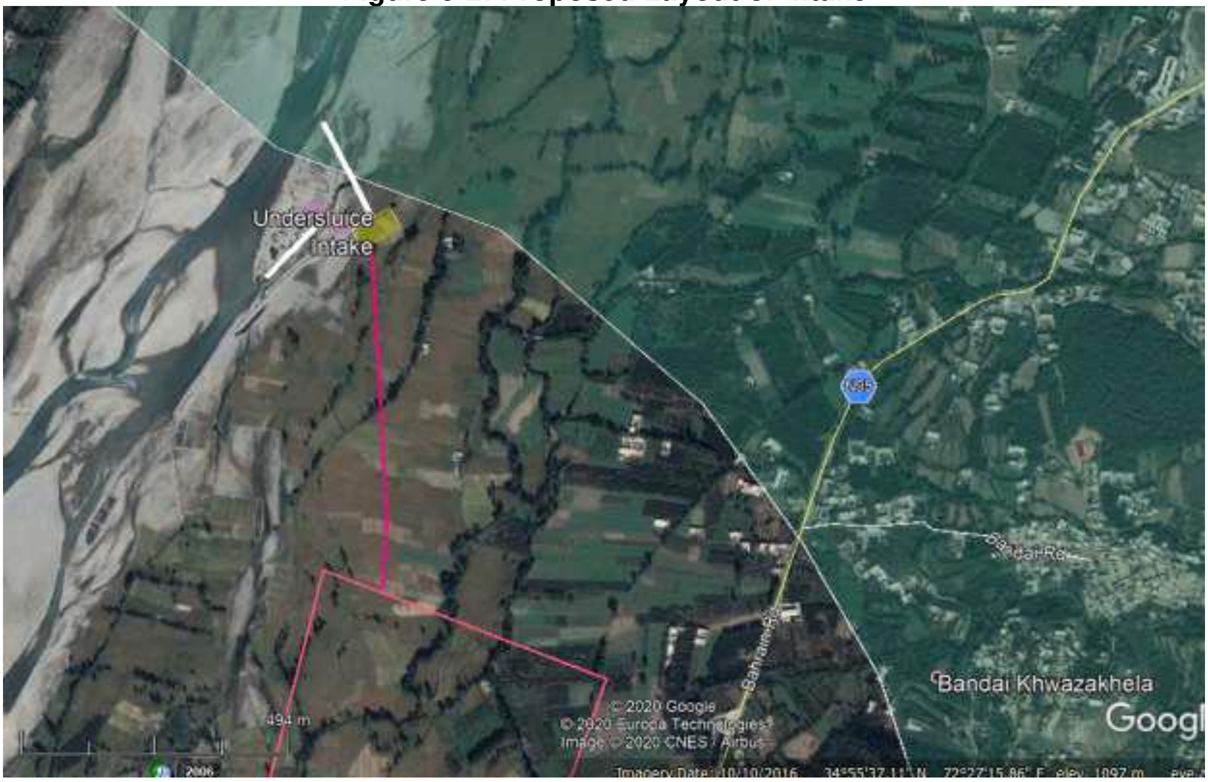
321. The analysis for site alternatives was carried out for surface water intakes. Mingora City has a requirement of water supply that is envisaged to be fulfilled by diverting flows from Swat River to Mingora City. The identified location of intake site is located in a wide river reach/floodplain about 600 m. The natural river bed slope prevailing in the study reach is between of 1 in 200 to 1 in 250

322. The project proposed intake site is located about 62 km upstream of Amandara Barrage and 710m downstream of Matta Bridge across River Swat on main Nowshehra-Chakdara-Chitral (NCC) road. Coordinates of proposed intake is given below in Table 5-3.

Table 5—3 Proposed Intake Location

Location	Northing (dms)	Easting (dms)
Intake	34°56'9.35"	72°27'4.14"

Figure 5-2: Proposed Layout of Intake



5.4.2 Technology Selection

323. The proposed water treatment plant has been designed based on the ultimate water flow of 46 cusec (30 MGD).In addition to design flow 10 % of flow has been additionally added for friction and other losses. Similar to the site selection of the water treatment plant, the selection of suitable technology from the available alternatives is also a process which takes into account multiple factors that revolve around the economic viability, environmental sustainability and social acceptability of the plant. The selection criterion is based on the following factors categorized as follows.

Source Water and Required Treated Water Quality

- The appropriate treatment processes required at the plant will be determined by the nature and concentration of organic and inorganic constituents of the source water. The selected water treatment system must ensure the adequate removal of these constituents to acceptable target levels, i.e. NEQS levels.

Land Availability and Topography

- The availability of land and the topography of the plant site with reference to the system hydraulic requirements are the principal physical constraints, which govern the selection of the treatment technology.

Cost

- The expense occurring for the construction (initial capital cost) and operation (running or operational cost) of the equipment plays a key role in determining its feasibility and suitability.

Operational Complexity

- Skills required for the routine operation and maintenance of the treatment system should be locally available. The proposed system must have easy operation and maintenance procedures.

- The selected system should employ equipment of minimal complexity. Locally manufactured mechanical equipment should be preferred where possible.

Nuisance/Pollution

- The degree of odour and noise must be below the nuisance thresh-hold, especially, with reference to the proximity of the treatment system to the build-up areas.

- Potential for ground water contamination is also a factor.

5.4.3 Available Technologies for Treatment System

324. The applicable treatment processes for treatment of surface water with turbidity and suspended solids' loads are:

a) Conventional Water Treatment

b) Membrane Filtration (through Ultra-Filtration).

325. These processes have been discussed in detail as under:

5.4.4 Conventional Water Treatment

326. Conventional water treatment comprises coagulation, flocculation and clarification followed by filtration and disinfection (illustration given below).

327. Since turbidity is caused by very fine particles in water that have inherited low settling velocity which takes a long time to settle down. This requires very large size settling tanks which becomes uneconomical for large capacity water works. In order to enhance the settling velocity and to economize/optimize the sizes of sedimentation basin, chemicals known as coagulants are added in the raw water. With the addition of coagulant, the negatively charged particles of clay and bacteria, surrounds the positively charged action (Al+3, in case of Alum a most commonly used coagulant) to form flocs, which have higher settling velocity than the discrete particles of clay and cells of micro organization. Thus turbidity, bacteria and viruses are removed and inactivated through sedimentation followed by filtration and disinfection.

Figure 5-3 Typical process train for surface water treatment by conventional treatment

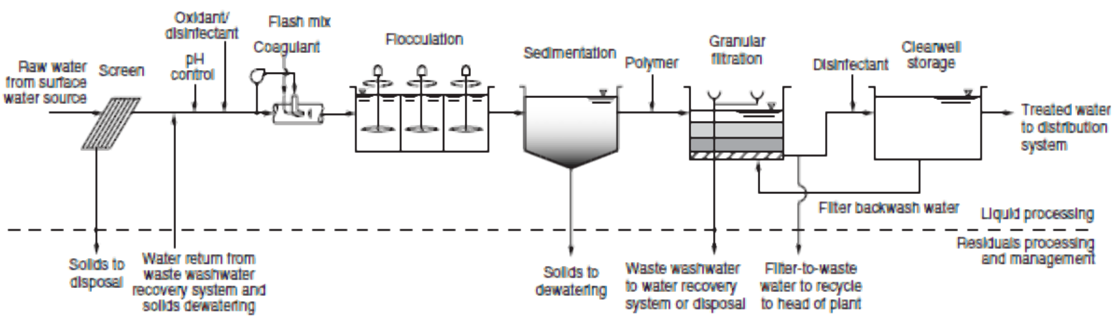


Table 5—4 Merits and Demerits of conventional treatment

Merits	Demerits
The conventional water treatment plants are comparatively easy to operate than membrane systems. The system involves more civil work construction; therefore, local construction material is used to a greater extent. This provides job opportunities. The coagulation and flocculation process removes some heavy metals (if present in water). The coagulation and flocculation followed by sedimentation reduce total organic carbon.	The land area requirement is more than membrane system. Filtrate quality varies at the start and end of filter run. Due to use of chemicals as coagulant, the residuals disposal is problematic because of environmental issues.

5.4.5 Membrane Filtration

328. Membrane filtration, microfiltration and ultra-filtration are also used for the removal of turbidity / particulates, bacteria and virus. The filtration through membrane takes place by separation of particulate from water while raw water passes through membranes under pressure. Most of the membranes are operated at pressure differential less than 15 psi (35 ft). The removal efficiency depends upon pore size. The former (micro-filtration membrane) has larger pore size than the later one (ultra-filtration membrane) and consequently has less removal efficiency. Therefore, ultra-filtration is used to meet the drinking water quality requirement. However, it has certain benefits over the conventional treatment, although there are some demerits in this technology (illustration given below).

Figure 5-4Typical process train for surface water treatment by membrane filtration

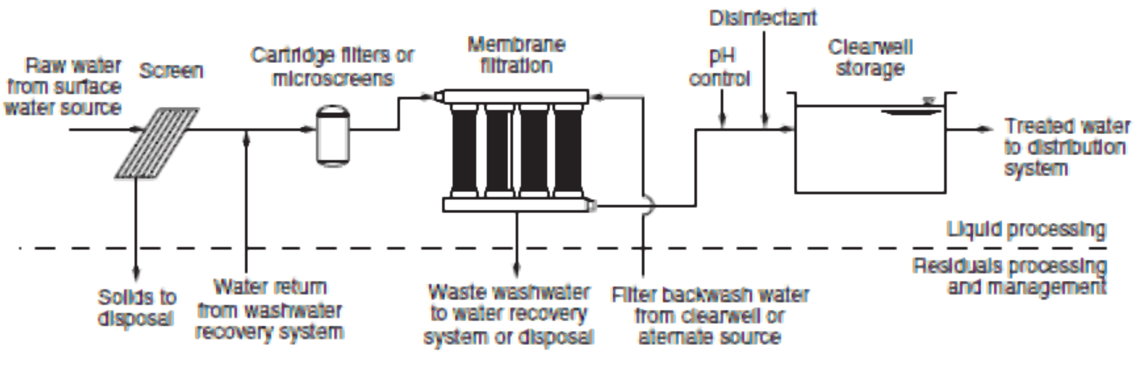


Table 5—5 Merits and Demerits of Membrane Filtration

Merits	Demerits
• The removal of small particles is independent of pre-treatment conditions and water turbidity. The pores in the membranes are smaller than giardia cysts and cryptosporidium oocysts and are generally uniform in size. Therefore, UF membranes provide a predictable physical barrier to the cyst-sized particles, when the membranes are intact; • The membrane system can produce low turbidity water, generally less than 0.1 NTU; • There are no turbidity variations or particle break through, as long as there are no breaks in the membrane or seals; • The water quality is uniform, unlike conventional filtration, where the turbidity is different at the beginning of the filter run and at the end of the run; and • Since in the membrane system, coagulants are rarely used, its residuals are less problematic than the residuals of conventional water treatment.	• Although small particle removal through membrane system is independent of raw water quality and pre-treatment, the operator may need to reduce the membrane flux rate or decrease the time interval between backwashing, when the turbidity level increases, thus the operator will have to be careful in this regard; • It is assumed that the turbidity in source water will vary seasonally especially in monsoon season it will be higher than the average value round the year. At such variations, the operation will be complex; • As an alternate to membrane flux, the pre-treatment such as coagulation and sedimentation will be required as uf membranes best perform for the turbidity of around 10 NTU; • A lower temperature requires higher operating pressure to maintain same filtered water flow rate. Thus an understanding of the automatic control system is necessary for the operators; • UF productivity is more sensitive to precise operation of the instrumentation; it requires chemical cleaning for the removal of material from the surface of membranes, which are not removed by backwashing; • The UF membrane system does not remove heavy metals, if present in raw water; • Pre-treatment with coagulation and settling will be required for the removal of high turbidity and total organic carbon; and • Its removal efficiency of total organic carbon (TOC) without coagulation is very less. The TOC is a DPB precursor.

329. The above-mentioned merits and demerits indicate that UF membranes are more complex in operation and maintenance, and the productivity is depending on automation. The experience of existing water treatment plants shows that automation is difficult to keep in order for a long time, without skilled maintenance. Further to this, the turbidity level in treated water, as per Pakistan National Standards for drinking water is <5.0 NTU, which is achievable through conventional water treatment plant. Also, since raw water may contain TOC together with high turbidity which can be removed with conventional treatment; with coagulation, flocculation and clarification. For turbidity level of 100 NTU, which may be present in source water, the flocculation, coagulation will be required; both for conventional filtration as well as membrane filtration. Hence under this situation, the cost estimation indicates that with the adoption of membrane filtration coupled with coagulation, the capital cost will be more.

330. In view of above scenario, conventional water treatment plant has been proposed for the treatment of source water which is in line with the treatment being adopted in other surface water treatment plants in operation in Karachi, Islamabad, Faisalabad and Rawalpindi.

5.4.6 Available Technologies for Filtration

331. The conventional water treatment further involves two types of filtration:

a) Slow sand filtration
b) Rapid gravity (sand) filtration.

332. Slow sand filtration is operated at low filtration rate, generally 10 m^3/m^2/day, whereas the normal filtration rate of latter filtration is 120 m3/m2/day. Further comparison of these two is given in the table below.

Table 5—6 Comparison of Rapid Gravity (Sand) Filters and Slow Sand Filters

Factors	Slow Sand Filters	Rapid Gravity (Sand) Filters
Nominal rate of filtration	10 m^3/m^2/day	120 m^3/m^2/day
Raw water turbidity	Perform well at 10 – 50 NTU	Perform at higher turbidity, preceded by flocculation and coagulation
Size of bed	Large, ½ acres	Small, 1/100 to 1/10 acre
Depth of bed	12 in. of gravel, 42 in. of sand	18 in. of gravel, 30 in. of sand
Size of sand	0.25 to 0.3 to 0.35 mm effective size, 2 to 2.5 to 3 coefficient of uniformity	0.45 mm and higher effective size, 1.5 and lower coefficient of uniformity
Under drainage system	Split tile laterals laid in coarse stone and discharging into tile or concrete main drains	Filter nozzles installed in RCC slab
Loss of head	0.06 m initial to 1.2 m final	0.3 m initial to 2.4 or 2.7 m final
Length of run between cleanings	20 to 30 to 60 days	12 to 24 to 72 hrs

Factors	Slow Sand Filters	Rapid Gravity (Sand) Filters
Penetration of suspended matter	Superficial	Deep
Method of cleaning	Scrapping, washing and replacing	Backwashing
Maximum raw-water turbidity	10 NTU	Unlimited with proper pretreatment
Preparatory treatment of water	Generally none	Coagulation, flocculation and sedimentation
Supplementary treatment of water	Chlorination	Chlorination
Cost of construction	High	Low
Operational Cost	Low	High

333. The merits and demerits in the Table 5.6 above indicates that slow sand filters perform well at turbidity up to 10 NTU, otherwise coagulation, flocculation and clarification will be required whereas rapid sand filters perform well at high turbidity level; proceeded by coagulation, flocculation and clarification. Also, the capital cost of slow sand filters is much higher than rapid gravity filters. Moreover, slow sand filters are outdated, due to higher capital cost and land area requirement. Furthermore, Slow Sand Filtration is preferred for small communities. The existing surface water treatment plants in Karachi, Islamabad, Faisalabad and Rawalpindi are based on rapid gravity filtration that supplies bulk water to their residents. Based on the comparative analysis, rapid sand filters have been selected as the preferred technology for this project.

5.5 Conclusion & Environment Perspective of Alternatives

334. Conventional Water Treatment Plant (CWTP) is simpler and environmental friendly as compared to complex Membrane Filtration (MF).Energy requirements for CWTP is lower as compared to (MF) which can reach 0.3 KWh/m3 of treated water. Fewer chemicals required for conventional treatment plant as cleaning of rapid sand filters use treated water for backwash while for Membrane Water Filtration System acid/alkaline chemicals are required for treating fouled membranes. Waste water generated during back wash of sand filters can be drained into municipal drain while waste water generated during cleaning of MWFS has chemicals which need further treatment and cannot be drained into municipal drain. Conventional System involve Civil Works that last up to 50 years while Membrane System needs to be replaced every 5 years. Moreover, Conventional System is less complex and requires less technical expertise in compare to Membrane Systems which need careful supervision.

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6 Potential Environmental Impacts and Mitigation Measures

335. Potential impacts arising from design, construction and operation phase of Mingora City Greater water supply scheme and construction of water treatment plant have been identified and assessed on the basis of field data, secondary data, expert opinion and examining previous similar projects in Pakistan. These include effects on physical, biological and socio-economic environments. Impacts associated with design, construction, operation and phases of project components such as intake locations, intake sources, transmission mains, water treatment plant, distribution networks, storage tanks have been detailed in the section. The impact assessment of proposed Mingora City Greater water supply scheme and construction of water treatment plant has been carried in accordance with the requirements of KP EPA, 2014, Pak EPA-1997 and ADB SPS, 2009.

336. The impact assessment of proposed WTP and Greater water supply scheme has been carried in accordance with the requirements of KP EPA, 2014, Pak EPA-1997 and ADB SPS, 2009. According to ADB's Safeguard Policy Statement (SPS) 2009, a Rapid Environmental Assessment (REA) Checklist was prepared for the proposed water treatment plant and gravity water supply scheme to determine the scope of the IEE'.

337. Impact-screening matrices during development phases i.e. project design; construction and operation are presented below.

6.1 Methodology for Impact Screening

338. The methodology for assessing the risk level associated with each potential impact is presented below.

339. Risk is assessed as the likelihood that the activity will have an effect on the environment as well as the consequence of the effect occurring. It is often described like this:

Risk = Likelihood × Consequence

Likelihood Scale

Likelihood	Definition	Scale
Certain	Will certainly occur during the activity at a frequency greater than every week if preventative measures are not applied	5
Likely	Will occur more than once or twice during the activity but less than weekly if preventive measures are not applied	3
Unlikely	May occur once or twice during the activity if preventive measures are not applied	2
Rare	Unlikely to occur during the project	1

Consequence Scale

Consequence	Definition	Score
Catastrophic	The action will cause unprecedented damage or impacts on the environment or surrounding communities	5
Major	The action will cause major adverse damage on the environment or surrounding communities	3
Moderate	No or minimal adverse environmental or social impacts	2
Minor	No or minimal adverse environmental or social impacts	1

Risk Score Table

	Consequence				
Likelihood		Catastrophic	Major	Moderate	Minor
	Certain	**25**	**15**	**10**	5
	Likely	**15**	**9**	6	3
	Unlikely	**10**	**6**	4	2
	Rare	5	3	2	1

Risk: **Significant:** 15-25
Medium: 6-10
Low 1-5

340. Any 'Medium' to 'Significant' risk requires an environmental management measure to manage the potential environmental risk. Judgment will be required concerning the application of an environmental management measure to mitigate low risk situations.

6.2 Design/Pre-Construction Phase

Impact Screening Matrix

341. The 'activity wise' screening of potential impacts during the design/pre-construction phase is provided in **Table 6.1** below.

Table 6—1: 'Activity Wise' screening of possible Impacts during Design/Pre-Construction phase

S/No.	Potential Issue	Likelihood (Certain, Likely, Unlikely, Rare)	Consequence (Catastrophic, Major, Moderate, Minor)	Risk Level (Significant, Medium, Low)	Residual Impact (Short term, Long term)
1	Improper selection of intake source and reduce ecological flows	Likely	Moderate	Medium	Long Term
2	Improper design of water treatment plant and distribution network including supply mains	Likely	Moderate	Medium	Long Term
3	Improper location of water treatment plant and storage tanks	Likely	Moderate	Medium	Long Term
4	Improper designing of water treatment plant and distribution networks including transmission mains	Likely	Moderate	Medium	Long Term
5	Lack of integration of IEE/EMP requirements into Construction bid documents	Likely	Moderate	Medium	Short Term
6	Contractor's Environmental Safeguards Capacity	Likely	Moderate	Medium	Short Term
7	Improper location of worker camps leading to improper disposal of solid waste and sewage and privacy issues for residents in project area.	Likely	Moderate	Medium	Short Term
8	Cultural Heritage & Religious Sites, Social Infrastructure	Unlikely	Moderate	Low	No residual Impact
9	Land acquisition and resettlement impacts	Likely	Moderate	Medium	Long Term
10	Impacts due to natural hazards	Unlikely	Moderate	Low	No residual Impact
11	Impacts due to existing utilities	Likely	Moderate	Low	No residual Impact

6.2.1 Improper selection of intake source and reduce ecological flows

Impacts

342. Improper selection of intake sources may lead to impacts which may have long lasting impact on hydraulics and environmental flows of streams. Reduced downstream water availability shall deprive end user or it may disrupt environmental/ecological characteristics of streams. Further streams are the sources of ground water charging in the vicinity and downstream of catchment area.

343. Furthermore if source water availability is not analyzed during design it may disrupt uninterrupted raw water supply to WTP.

- The unpredictable bending of river reach in a wider extent creates problems to site an adequate location for water intake. It is to be noted that the flow depth in central part of the river is more compared to the depth at side banks. Site visit revealed that near the river banks at proposed intake location a gravel/cobble shelf has been developed along the right bank which causes the flow to bend towards the left. In the absence of a proper retaining wall the mender can shift the gravel/cobble shelf from right to left bank as it progresses further downstream.

- Based on catchment area comparison w.r.t. Chakdara, flood at intake site is evaluated as 4,020 cumecs. It is pertinent to mention here that return period for 2010 flood (4,020 cumecs) is 2,400 year, and for same return period, based on Kalam data flood evaluated as 1,733 cumecs. Based on nearest station and data availability, Chakdara station data is selected for Intake structure design, and structural stability of the intake will be checked for 500 year return period (3,288 cumecs).

- The intake structure will draw water from the Swat River through the coming into action of the approach channel. The intake is located on the left end of the river and is inclined at an angle of about 53 deg to the axis of approach channel. The intake is 16 m long and 3 m wide. The crest level of the intake will be 1 meter higher than crest level of the undersluice part. Intake is designed for diversion capability of1.3cumecs (46 cusecs). The left abutment of the intake extends 71 m upstream of the vertical face of the intake to an existing retaining wall. The crest block has a 1:3 sloping glacis which has 7.5 m long cistern of 0.8meterthickness and a downstream sloping end sill. The cistern delivers water to a sump of size 6x6 m, where 3 m delivery pipe carries water downstream to water treatment plant.

- The whole structure is made of reinforced concrete. The length of the under sluice is proposed to be 16.10m. A 2m long concrete floor extends upstream of the intake with a 2m deep and 0.3m thick cutoff wall. Bligh‟s Creep ratio is 13, which is satisfactory. A 0.5m thick and 3m long stone apron downstream of the stilling basin is provided. The two concrete abutments are 0.25 meter thick.

- The Intake is conceived as a gravity structure. The concrete weight will counteract the uplift pressures all along its length from upstream to downstream. It is however considered beneficial to provide a concrete wall 4.5 meters deep which will reduce the uplift pressure by a concrete wall at the downstream end could be examined. Khosla‟s charts were used to have a first order estimate of reduction benefit. The condition which prevails for a long time and impose more serious criterion for judging the uplift effects is the normal high flow season.

Mitigation Measures

- Detailed Catchment studies shall be conducted as part of designing intake flow from sources.
- Runoff volume calculations shall be carried on periodic basis to ensure water supplies from intake structure
- Periodic flow measurement on Swat River shall be carried out to ascertain the continuous water availability for the project.
- PMU KPCIP will ensure that design of intake structure is carried out with minimal impact of aquatic life and ecological flows.

6.2.2 Improper design of water treatment plant and distribution networks including transmission main

Impacts

344. The possibility exists that in case the not designed in accordance with international standards and guidelines11 for water and sanitation it could result in multiple potential impacts that could adversely affect the settlements of project area.

345. If intake structure is not designed adequately and raw water contain high sediment load shall foul the WTP and increase maintenance cost of WTP.

346. If WTP is not designed properly and filtered water will not meet NEQS it will not fulfill the ultimate purpose of project to provide safe drinking water to the residents of Mingora city.

347. If distribution mains and supply network is not designed properly it will increase chances of pipe bursting, leakages, reduce water delivery to particular residents and may ignite multiple social issues.

348. If treatment and disposal for sludge and waste water generated during operation of WTP has not been proposed may cause adverse impacts to settlements and ground water contamination.

349. Inadequate/improper water metering system will reduce revenue generation for TMA/WSSC

350. Improper designing and monitoring may also increase water theft which ultimately effectiveness of the system.

Mitigation Measures

351. The following design related measures will be implemented to ensure the project activities does not result in unanticipated, long term and potentially irreversible impacts:

- The design criteria are mainly based on the standards and specifications of Pakistan available andAmerican National Standard Institute and AISC. Where required, international best practices were also considered in establishing the design criteria for the proposed water supply system and water treatment plant.
- Intake structure shall be designed adequately to reduce sediment load and

[11] https://www.ifc.org/wps/wcm/connect/83217cd8-b9a5-4383-97b5-5af26182b3b8/2007+Water+and+Sanitation.pdf?MOD=AJPERES&CVID=m3CdtQr

uninterrupted raw water supply to WTP

- The treatment process will be employed that biological contaminants and suspended solids are brought in the limits set forth in Pakistan Standards and WHO Guideline values for Drinking Water. A Conventional surface water treatment plant (rapid gravity filtration) is proposed for the treatment of source water. With the conventional treatment, the turbidity can be reduced to the limit of < 5 NTU, as per Pakistan Standard for Drinking Water Quality.

- To cater maintenance and shutdown during back wash Maximum filtration rate during one filter Backwash will be 150.9$m^3/m^2/d$. Each train will consist of separate plain sedimentation tank, flash mixer, flocculation basin, clarifier. Both trains will have a combine filtration unit. The reason of providing two trains to provide uninterrupted water supply

- A SCADA system has been proposed to check compliance and monitoring of WTP components. Process instrumentation will be provided to facilitate monitoring. SCADA system has been proposed for the proper monitoring, control and recording of data related to the plant. Central SCADA control room has been provided inside the Administration building and SCADA system will enable plant operators to efficiently operate the plant.

- A smooth bearing for RCC slabs on the walls has been provided with 0.20- inch cement sand plaster (1:3), finished with a floating coat of neat cement and covered with Kraft paper. Under beams, 0.75-inch-thick bed plate of (1:2:4) plain cement concrete, finished with a smooth surface as above shall be provided. The sides and top of slabs and beams in contact with walls shall be painted with thick coat of hot bitumen at 0.35 psf proposed from the top of pipe to reduce chances theft and pipe bursting due to traffic loads.

- Before commissioning water supply network shall be tested on 1.5 times the designed pressure to check leakages.

- Treatment and disposal for sludge and waste water generated during operation of WTP shall be proposed and residual management is shall be proposed to avoid waste management issues.

- Water metering system shall be proposed to reduce theft and water wastage.

6.2.3 Improper location of Intake structure water treatment plant and storage tanks

Impacts

352. If location of intake structure and WTP are not carefully selected considering topography, geology and catchment of watershed results in degradation of channel embankments reduce water flow or increased chances of structure settlement due to weak geological conditions/weak bearing capacity of soil at intake locations and WTP location.

353. The Mingora gravity water supply scheme is developed on gravity. The raw water shall be conveyed to WTP under gravity and the distribution network is also primarily designed on gravity. If location/elevation of intake structures, WTP and storage tanks are not located while maintaining minimum head the system will require high energy for pumping water to the desired WTP or storage tanks.

Mitigation Measures

354. The following mitigation measures will be implemented:

- Factors such aside capacity, accessibility, acceptability, stability, environmental sensitivity, land use, socio-economic receptors and climate hazards have been studied and site has been selected accordingly.

- The water treatment plant has been proposed to be constructed at the left bank of River Swat at about 20 km Upstream of Mingora City, District Swat, Khyber Pakhtunkhwa (KP).

- Location of the Intake has been selected, after considering the natural conditions, consumers and construction difficulties including topography and geology. The detailed considerations for the selection of intake site are as follows.

  - Suitability of the Intake structure type
  - Geological and Topographic conditions
  - Technically most suitable site to supply water to consumers
  - Minimum Environmental Degradation

- Each of the existing water storage reservoirs will be supplied treated water via a dedicated supply main. Based on the hydraulic model of the proposed transmission main and supply mains, the water storage reservoirs with elevation levels in the range of 1030 MSL will get uninterrupted water supply via a gravity system. While the remaining reservoirs, located at slightly higher elevation than 1030 MSL, will be fed through a pumping system.

6.2.4 Lack of integration of IEE/EMP requirements into Construction bid documents

Impacts

355. The bidding documents must reflect the requirement to select a qualified and experienced Contractor from the perspective of ensuring implementation of required safeguards during project development.

Mitigation Measures

356. The proposed ‘Safeguards unit’ that will be developed at the PMU will be assigned the task to check that design and bid documents are responsive to key environmental, social and safety considerations, and that the proposed method of work reflects the boundaries defined in the EMP. The bid documents must include the EMP and its implementation cost must be reflected in the BOQ.

357. IEE/EMP implementation and monitoring requirements must be part of bidding documents and necessary contractual binding must be agreed by project contractors before award of contract.

358. Project contractors shall have qualified and experienced environmental staff to plan, arrange, implement, monitor and report IEE/EMP requirements.

6.2.5 Material Haul Routes

Impacts

359. Hauling of material can have significant impacts on the community, public safety, traffic congestion, air quality and lifespan of the Mingora cityroad ways.

Mitigation Measures

360. The construction vehicles hauling materials along the Mingora city roads and anywhere where there are sensitive receptors such as hospitals, schools and/or roadside residences will be limited and the PMU in collaboration with the focal agencies will establish a route plan to minimize this disruption which shall be appended to the EMP.

6.2.6 Contractor's Environmental Safeguards Capacity

Impacts

361. Lack of contractor's environmental safeguard capacity or selection of environment non-responsive contractors may result in failure of EMP implementation and may be a source of number of non-compliances.

362. The responsibility of the PMU KP LGERDD in collaboration with the focal agencies is to review and finalize the bidding documents relating to environmental issues.

363. Contractors that do not possess the required capacity for safeguards management must not be pre-qualified and selected.

Mitigation Measures

364. PMU KP LGERDD shall review the contractor capacity with respect to safeguard management and contracts shall be awarded accordingly.

365. The Contractor will be required to define an Occupational and Environmental Health and Safety procedure for all work, including work camp operation, management of cement dust, and use of Personal Safety Equipment. These procedures shall be developed and approved by the PMU in collaboration with the focal agencies before the Contractor commences any physical works on ground.

366. PMU KP LGERDD shall ensure the project contractors are selected on merit and necessary funds has been allocated in the contract documents for EMP implementation and monitoring.

6.2.7 Identification of Locations for Labor Camps and ancillary facilities

Impacts

367. The duration of the construction activity for the greater water supply scheme and WTP Construction is expected to be 24 months and a considerable amount of work force will be engaged. As a result, worker camps will need to be developed and ancillary facilities will need to be provided such as electricity, washrooms for labor with suitable effluent and sewage disposal facilities as well as water for their everyday use for drinking and bathing etc.

Mitigation measures

368. In order to prevent a nuisance, specific locations shall be designated for development of the labor camps. All necessary facilities and amenities shall be provided in these camps such as resting area, drinking water, electricity, supply of water.

369. Solid and liquid effluent waste disposal facilities shall also be designed to cater waste of administration/office building etc.

370. The use of proper planning while identifying locations for the labor camps will ensure there is minimal disturbance to all key receptors and the traffic is not disrupted by labor camps being set up roadside next to the construction sites.

6.2.8 Cultural Heritage &Religious Sites, Social Infrastructure

Impacts

371. No temples or religious sites are located in proximity of proposed WTP Mingora while distribution networks will be laid within TMA RoW.

372. The nearest sensitive receptors already identified in the project areas have been mapped and a minimum buffer distance of 250 meters from all boundaries of the WTP site will be maintained. As a result, no major significant impact will be expected from the works on any social infrastructure. However, consideration will be made not to construct at night, from 7 pm onwards till 6 am in the morning, to avoid nuisances.

Mitigation Measures

373. No mitigation measures are required.

6.2.9 Land Acquisition and Resettlement Impacts

Impacts

374. The project involves the Construction of water supply in the length of 20 km. The components also include the intake structures, treatment plant and water reservoir.10 nos of surface tanks and 08 nos of OHRs will be constructed on private land. The subproject will have the impact on 342 kanals of land, crops and trees. The land acquisition is under process, Section 4 of LAA 1894 was notified on 11th May 2020 and Section 5 of LAA notified in June, 2021. Land Acquisition and Resettlement Plan (LARP) is prepared in order to ensure that adequate compensation will be provided to project affected people. Major land acquisition and resettlement impact is related to laying of 20 KM transmission line which will pass through orchards and agricultural lands. Landowners of the area are of the view the project design consultant shall revisit the proposed alignment either along the river bed or along the road instead of passing from their fields. There may be chance of social nuisance if land acquisition and resettlement impacts are not properly addressed up to the satisfaction of affected people.

Mitigation Measures

375. The PMU KP LGERDD shall ensure the following:

- PMU KPCIP social safeguard unit and local district administration/revenue department will ensure that grievances and reservations of project affected people are adequately addressed.
- Due payment to all land owners must be paid before mobilization of construction contractors.
- Social safeguard unit shall ensure that project affected people has been paid following appropriate procedures and there are no grievances about land acquisition process.
- PMU will ensure that no land acquisition issue left before start of construction works and grievances are adequately addressed.

6.2.10 Impacts due to Natural hazards

Impacts

376. Earthquake loads has been computed according to Uniform Building Code (UBC) and Building Code of Pakistan Seismic Provision 2005 with Mingora having Zone factor Z = 0.30. No fault lines or significantly fractured geologic structure is present that may allow unpredictable settlement/land sliding.

377. WTP Site is located outside of flood plain, however, in case of high precipitation; there are chances of flash flooding at intake points. Diversion shall be provided to limit impact of flash flooding on intake structures.

Mitigation Measures

- The PMU KP LGERDD shall ensure the proposed infrastructure shall be designed keeping in view the seismic zone building considerations.
- Infrastructure shall be designed to withstand high speed winds.
- Surface water diversion shall be included in the design to protect intake structures from flash flooding.
- Extreme precipitation events analysis shall be performed for i.e. 100 years, to predict and manage impacts of flash flooding on intake structures.
- On site waste storage at loading bay shall be kept to minimum during high precipitation events.
- Emergency response plan shall be prepared by construction and operation phase contractors and will be submitted to PMU for approval to manage impacts of natural hazards such as earth quakes and floods.

6.3 Construction Phase

Impact Screening Matrix

378. The screening of potential impacts during the construction phase is provided in Table 6.2 below.

Table 6—2: Screening of Possible Impacts during Construction Phase

S/No.	Potential Issue	Likelihood (Certain, Likely, Unlikely, Rare)	Consequence (Catastrophic, Major, Moderate, Minor)	Risk Level (Significant, Medium, Low)	Residual Impact (Short term, Long term)
1	Construction of water treatment plant and other structures not in accordance with finalized design	Unlikely	Major	Medium	Long term
2	Construction of water distribution networks and Transmission Mains	Likely	Moderate	Medium	Short term
3	Impacts on surface water quality	Likely	Moderate	Medium	Short term
4	Degradation of air quality due to construction works	Likely	Moderate	Medium	Short term
5	Potential accidents and injuries to communities in project area during construction works and Road closure/Increased traffic congestion in populated areas	Likely	Moderate	Medium	Short term
6	Injuries to workers from lack of necessary training and/or not using PPEs etc.	Likely	Moderate	Medium	Short term
7	High noise levels from construction activities	Likely	Moderate	Medium	Short term
8	Improper handling and/or disposal of hazardous and non-hazardous waste	Likely	Moderate	Medium	Short term
9	Untreated disposal of effluent from worker camps and batching plant(s)	Likely	Moderate	Medium	Short term
10	Soil Contamination	Likely	Moderate	Medium	Short term
11	Employment Conflicts	Likely	Moderate	Medium	Short term
12	Communicable diseases incl. COVID-19	Likely	Moderate	Medium	Short term

S/No.	Potential Issue	Likelihood (Certain, Likely, Unlikely, Rare)	Consequence (Catastrophic, Major, Moderate, Minor)	Risk Level (Significant, Medium, Low)	Residual Impact (Short term, Long term)
13	Vegetation and Wildlife Loss	Unlikely	Moderate	Low	No residual Impact
14	Historical/Archaeological Sites	Unlikely	Moderate	Low	No residual Impact
15	Construction of Administration Building and Other Infrastructure	Likely	Moderate	Medium	Short term
16	Site Restorations	Likely	Moderate	Medium	Short term

Critical Risk Level
Significant Risk Level
Medium Risk Level
Low Risk Level

6.3.1 Construction of water treatment plant and other structures not in accordance with finalized design

Impacts

379. If the proposed WTP, intake structures and water supply networks is not developed in accordance with the finalized design and its corresponding design parameters, it could lead to a number of unanticipated impacts such as in adequate water supply, degraded water quality and choking of water distribution networks or ground water contamination due to mishandling wastage (sludge/solid waste) from WTP etc.

Mitigation measures

380. The following mitigation measures will be implemented:

- Method statements must be prepared by the Contractor and approved by the Construction Supervision Consultant (CSC) prior to commencement of construction works.
- The CSC must closely monitor the construction works being conducted by the Contractor to ensure the finalized design is implemented in full and the WTP design is developed completely in compliance of the approved finalized designs.
- Any deviation by the Contractor from following the finalized design must be immediately highlighted and corrective measures must be implemented to ensure full compliance with the finalized design of the WTP.
- PMU KP LGE RDD shall ensure that construction activities are being carried out in compliance to project design following best international practices. It will closely review and monitor the activities of CSC and contractors involved in construction activities.

6.3.2 Construction of Transmission Mains and Distribution Network

Impacts

381. Construction activity of water distribution network and transmission main will be conducted along the roads and in the agriculture fields. The work will be conducted by a team of 5 workers at each site. Excavation for water supply networks will be carried out in all type of soil i.e very stiff to hard salty clays, poorly graded gravels with silt/limestone.

382. Trench will be excavated using excavator and where it is not feasible will be done manually. Excavated soil will be placed along the trench. A bed of sand of 150 mm thick will be prepared at the bottom and pipes will be placed and laying of local sand around water supply line shall be done. Excavated soil will be backfilled and compacted. Where the pipes are laid in the roadway, handheld pneumatic drill will be used to break the road surface.

383. The pipeline network within Mingora are to be laid along the roads. The excavated soil, placed along the trench may get disturbed due to wind, rain water and the movement of workers, vehicles and pedestrians, and spill onto road way – disturbing road users, creating dust, road safety issues, etc., and also into nearby open drains.

384. Details of excavated soil from scarification of existing road pavement structures, excavation of earthen/rock material for Mingora water supply networks provided below.

Table 6.3: Details of Excavated Material for Construction of water distribution networks and Transmission Mains

Description	Quantity (CM)	Mode of Disposal
Scarification Of Existing Road Pavement Structure	45801.62	Disposal of the unsuitable material of Road pavement Structure at designated source
Excavation for water supply line	633,530.96	Usable material will be used as backfill Unsuitable material will disposed of at designated place
Back filling with suitable excavated material	316,765.48	Excavated material shall be utilized for back filling
Additional Material required for backfilling	93,253.87	-
laying of local sand around water supply line	223511.60	Will be borrowed from local sources

Source: EDCM Design Report, 2020

385. Construction of the pipelines involves quite simple techniques of civil works, the invasive nature of excavation will result to impacts to the sensitive receptors of sub project locations such as residents, business and community in general.

386. These anticipated impacts are temporary and for short duration. Physical impacts will be reduced by the method of working and scheduling of work, whereby the project components will be (i) constructed by small teams working at a time; (ii) any excavation done near sensitive area like school, religious places and house will be protected as per standard construction practices.

Mitigation measures

387. Mitigation measures adopted for construction of water supply networks and transmission main are provided below:

- Prior to starting of work, the contractor shall prepare a method statement for water supply pipeline works. This shall be simple and explain the contractor's work process that is actually conducted on site, with safety and safeguard concerns.
- Method Statement is very important, particularly for water supply pipeline works along the roads.
- Method Statement can be prepared for each stretch (say 1 km) /specific site based on the project area.
- Method Statement shall be in a Table format with appended site layout map and cover the following:
    - Work description
    - No. of workers (skilled & unskilled)
    - Details of Plant, equipment & machinery, vehicles
    - Work duration (total, and activity-wise, for example for pipe laying, from excavation to road resurfacing/testing)
    - PPE (helmet, gloves, boots, etc.) details for each type of work
    - Details of materials at each site (type & quantity)
    - Risks/hazards associated with the work (for example, Trench excavation will have risks such as trench collapse, persons/vehicles falling into trench, structural risk to nearby buildings, damage to buildings, infrastructure etc.)
    - Construction waste/debris generated (details & quantity)
    - Detail the sequence of work process (step-by-step) including specific details of each work
    - Contractor's supervision & management arrangements for the work
    - Emergency: Designate (i) responsible person on site, and (ii) first aider
    - Typical site layout plan including pipe trenching, placement of material, excavated earth, barricading etc.

388. The following shall be included in the site layout plan:

- Provide barricading/security personnel at the site to prevent entry/trespassing of pedestrian/vehicles into the work zone.
- Location of temporary stockpiles and provision of bunds

  - Separation of stockpiles areas with workers/vehicle movement paths to avoid disturbing the stockpiled soil
  - Wetting of soil to arrest dust generation by sprinkling water
  - Waste/surplus soil utilization and disposal plan – indicate expected duration of temporary stockpiling along the trench at each site and identify final surplus soil utilization/disposal site in consultation with CSC/PMU.
- PMU KPCIP will ensure the identification of disposal sites for unsuitable excavated material in consultation with WSSC Swat.
- CSC will inspect and monitor the borrow material areas prior to procurement to ensure that it is being used in sustainable way and no significant disfiguration of landscape is going on at quarry site.
- Stock piling of excavated material at places that are congested will be avoided as these piles can create traffic issues and public nuisance.
- Already available quarry sites for additional backfill material will be utilized. Development of new quarry site will be discouraged.
- Record of borrow materials will be maintained including details of quarry site, agreement and necessary approvals from concerned government authorities.

6.3.3 Degradation of Ambient Air Quality

Impacts

389. The proposed WTP development will involve large scale earth works and transporting and dumping large quantities of dry material. This will likely lead to an increase in SPM (Suspended Particulate Matter) in and around the construction zones.

390. Potential sources of particulate matter emission during construction activities include earthworks (dirt or debris pushing and grading), exposed surfaces, exposed storage piles, truck dumping, hauling, vehicle movement on unpaved roads, combustion of liquid fuel in equipment and vehicles, land excavation, and concrete mixing and batching.

391. Vehicles carrying construction material are expected to result in increased SPM levels near the haul roads. This can be of potential importance if the vehicles pass through the areas with a high concentration of sensitive receptors, such as residential areas, in this particular case.

392. At the construction yard, the dust levels are also expected to increase due to unloading of construction materials. It shall be ensured that most of the excavated material will be used within the project, with minimal cut and fill material to come from outside the site.

393. Poor air quality due to the release of contaminants into the workplace can result in possible respiratory irritation, discomfort, or illness to workers. Employers shall take appropriate measures to maintain air quality in the work area.

394. The quantity of dust that will be generated on a particular day will depend on the magnitude and nature of activity and the atmospheric conditions prevailing on the day. Due to the uncertainty in values of these parameters, it is not possible to calculate the quantity from a ‘bottom-up’ approach, that is, from adding PM10 emissions from every

activity on the construction site separately. Typical and worst-case PM10 emissions from construction sites have been estimated12 as 0.27 mega gram per hectare per month of activity (Mg/ha-month) and 1.04 Mg/ha-month, respectively.

Mitigation Measures

395. The following mitigation measures will be adopted for preservation of the environment:

- At the WTP site and the immediately adjoining areas, water will be sprinkled every three hours and at a higher frequency if felt necessary, at all construction sites to suppress dust emissions.
- All heavy equipment and machinery shall be fitted in full compliance with the national and local regulations.
- Stockpiled soil and sand shall be slightly wetted before loading, particularly in windy conditions.
- Fuel-efficient and well-maintained haulage trucks shall be employed to minimize exhaust emissions.
- Vehicles transporting soil, sand and other construction materials shall be covered with tarpaulin.
- Limitations to speeds of such vehicles as felt necessary. Transport through densely populated area shall be avoided.
- Concrete plants to be controlled in line with statutory requirements and shall not be close to sensitive receptors.
- Stack height of generators will be at least 3 meters above the ground.
- Project traffic will maintain maximum speed limit of 20 km/hr. on all unsealed roads within project area.
- A minimum distance of 300 meters will be ensured between batching plant(s) and the nearest community.
- The need for large stockpiles shall be minimized by careful planning of the supply of materials from controlled sources. Stockpiles shall not be located within 50 m of schools, hospitals or other public amenities and shall be covered with tarpaulin when not in use and at the end of the working day to enclose dust. If large stockpiles (>25m^3) of crushed materials are necessary, they shall be enclosed with side barriers and also covered when not in use.
- Dust emissions due to road travel shall be minimized through good construction practices (such as keeping stock piles down wind and away from communities) and sprinkling water over the access road.
- Maintaining levels of contaminant dusts, vapors and gases in the work environment at concentrations below those recommended as TWA-TLV's (threshold limit value)—concentrations to which most workers can be exposed repeatedly (8 hours/day, 40 hrs./week, week-after week), without sustaining adverse health

[12] Gaffney, G. and Shimp, D. 1997. *Improving PM$_{10}$ Fugitive Dust Emission Inventories*. Sacramento, CA. California Air Resource Board. <www.arb.ca.gov/emisinv/pubs/pm10tmp.pdf>

effects.

- Developing and implementing work practices to minimize release of contaminants into the work environment including:
  - Direct piping of liquid and gaseous materials
  - Minimized handling of dry powdered materials; Enclosed operations
  - Local exhaust ventilation at emission/release points
  - Vacuum transfer of dry material rather than mechanical or pneumatic conveyance
  - Indoor secure storage, and sealed containers rather than loose storage
- Where ambient air contains several materials that have similar effects on the same body organs (additive effects).

6.3.4 Fugitive Dust Control

396. The source wise fugitive control measures are provided in **Table 6.4** below. The Dust Management Plan has been attached as **Annexure G**.

Table 6—4: Control measures for Fugitive Dust emissions

Source	Control Measures
Earth Moving	For any earth moving that is to take place in the immediate vicinity from the site boundary, watering must be conducted as required to prevent visible dust emissions
Disturbed Surface Areas	Apply dust suppression measures (clear vegetation only from areas where work is to commence, plant or mulch areas that will not receive traffic, construct artificial wind breaks or wind screens) frequently to maintain a stabilized surface. Areas that cannot be stabilized, such as wind driven dust, must have an application of water at least twice a day
Inactive Disturbed Surface Areas	Apply dust suppressants (clear vegetation only from areas where work is to commence, plant or mulch areas that will not receive traffic, construct artificial wind breaks or wind screens) in sufficient quantity and frequency to maintain a stabilized surface
Unpaved Roads	Periodic sprinkling on all roads used for any vehicular traffic at least twice per day during active operations and restrict vehicle speed to 20 km/h.
Open Storage Piles	Apply water to at least 80 percent of the surface areas of all open storage piles on a daily basis when there is evidence of wind driven fugitive dust or install an enclosure all along the storage piles Tarpaulin sheet shall be provided on the storage piles to avoid dust emissions.
Track-out Control	Wash down of construction vehicles (particularly tires) prior to departure from site.

6.3.5 Vehicular & Equipment Emissions

397. It shall be ensured that the following measures are taken to control emissions from vehicles being used in the construction activity:

- Periodically check and conduct maintenance of the construction machinery and haul vehicles. Generators, compressors and vehicles used during construction works will be maintained in a good condition to ensure that emissions are kept to a minimum level.
- Regularly change the engine oil and use new engines/machinery/equipment having good efficiency and fuel burning characteristics.
- Controlled technology generator and batching plants will be used to avoid excessive emissions.
- Burning of wastes at any site will not be allowed.
- The stack height of generators will be at least 3 meters above the ground.
- Training of the technicians and operators of the construction machinery and drivers of the vehicles.
- All type of machinery and generator must comply with the NEQS. Vehicles, which are not in compliance with NEQS are not allowed to use.
- Periodic emission monitoring of vehicles, generator and batching plants is proposed.
- Project activities shall be planned to avoid harsh weather conditions.
- Idling time will be 3 to 5 minutes.
- Fuel-efficient and well-maintained vehicles shall be employed to minimize exhaust emissions.

6.3.6 Increased Traffic and Community Health and Safety

Impacts

398. The WTP development will involve the use of considerable heavy machinery at the project site along with posing the risk of community members falling into trenches. In addition, the risk to commuters on the road during the construction works will be significant and thus a number of precautionary measures will be necessary to minimize the risk of possible accidents. Community Health & Safety may be compromised during road travel particularly in night hours if adequate barriers and lighting is not provided at construction sites.

Mitigation Measures

399. The following mitigation measures will be implemented:

- Work areas outside the project site, especially where machinery is involved, will be barricaded and will be constantly monitored to ensure that local residents, particularly children stay away while excavated areas being prepared for WTP related infrastructure will also be cordoned off. Also, no machinery will be left unattended, particularly in running condition.

- Local communities in the project area will be briefed on traffic safety, especially women who are the main care providers to children.
- Speed limit of 20 km/hr. will be maintained by all project related vehicles and nighttime driving of project vehicles will be limited where possible.
- Educate drivers on safe driving practices to minimize accidents and to prevent spill of hazardous substances and other construction materials during transport.
- Contractor must take proper safety measures (placing warning tapes around excavations) to avoid people, especially children, accidentally falling into excavations.
- Traffic diversions shall be avoided as much as possible. If these are unavoidable then it shall be of short duration with limited impact on traffic flow.
- Material stock piling and parking of machinery along the roads shall be avoided. Contractors shall identify suitable places for material stock piling and parking of machinery.
- All the working platforms must be cordon off with special care by well-trained skilled workers.
- Contractor will prepare construction management plan which will include the hazard prevention and safety plan, which will address health and safety of the people in the project area.
- PMU KP LGERDD shall ensure the contractor staffs working in the project are well trained and educated in the Health, Safety and Environment (HSE) hazards associated with their duties, and that of the public, in the project area.

6.3.7 Occupational Health and Safety (OHS)

Impacts

400. There is invariably an OHS risk when construction works for the WTP and laying of transmission lines are conducted, and precautions will be needed to ensure the safety of the workers. Occupational Health and Safety Plan has been attached as **Annexure D.**

401. The major OHS hazards expected during the proposed activities are as follows:[13]

Accident Hazards

- Falls from height, especially when standing/working on ladders;
- Slips, trips and falls, especially while carrying heavy or bulky loads;
- Cuts and injuries caused by sharp instruments and tools;
- Hazard of suffocation from asphyxiate gases released or from oxygen deficiency, during maintenance and cleaning operations;

[13] https://www.ilo.org/wcmsp5/groups/public/---ed_protect/---protrav/---safework/documents/publication/wcms_192256.pdf

- Burns caused by hot parts of equipment, steam lines etc., by release of hot water or steam;
- Electric traumas, caused by defective installations and equipment, especially portable;
- Musculoskeletal injury (especially of back), resulting from lifting and moving of heavy loads;

Physical Hazards

- Exposure to cold and/or heat stress, as a result of rapid movement between cold and hot areas;
- Exposure to UV radiation during welding operations;

Chemical Hazards

- Exposure to various chemicals, such as: adhesives, caulking compounds, fluxes (solder), hydrochloric acid, zinc chloride, tar and solvents, various greases and inorganic lead;

Biological Hazards

- Exposure to parasites, such as hookworm, ascaris, and various mites, chiggers and ticks;

Ergonomic, psychosocial and organizational factors

- Psychological stress due to dissatisfaction at work due to issues with peers, superiors etc.;
- General ill feeling as a result of work in confined spaces and development of 'sick building syndrome';

Mitigation Measures

402. The Contractor will be required to prepare and implement an effective OHS Plan that is supported by trained OHS personnel and emergency response facilities. Construction contracts will include standard OHS measures and contractors will be bound to implement these fully.

403. Monitoring will be required to ensure that the health and safety plan based on contract specifications is followed.

- Cement feed hopper areas will be inspected daily to ensure compliance with the requirement of dust masks.
- Surfaces (including flooring and work surfaces) in camps, kitchens, dining areas and workshops shall be solid and easy to clean. Flooring for work camps must be float finished concrete or better.
- All drivers engaged by Contractors must hold a valid license for the vehicle they are operating.
- Work in confined space shall be executed with available safety standards. Adequate monitoring and equipment shall be available to detect deficient oxygen

levels.

- The Contractor shall submit to the Engineer of CSC for approval an emergency evacuation plan and practice the procedure annually.

- The Contractor shall submit to the Engineer of CSC for approval a site layout plan, identifying work areas, accommodation, kitchen, dining area, sanitary facilities, location of generators, plant and vehicle parking, transport routes through the camp, pedestrian routes through the camp, evacuation routes, emergency exits, batching plants, storage areas, waste facilities etc.

- Fire extinguishers shall be provided throughout camps and work sites. Fire extinguishers shall be inspected monthly and maintained as necessary.

- An adequate and reliable supply of safe drinking water shall be made available at readily accessible and suitable places including at all camps.

- The Contractor shall take samples from each supply of drinking water and arrange for analysis of these samples at EPA certified laboratory prior to its use by the Contractor's staff. The results of these tests for each supply must be submitted to the Engineer of CSC and must demonstrate that each water supply meets national and World Health Organization standards for drinking water.

- The Contractor shall provide and maintain adequate hygienic kitchens which are sheltered and separated from the living quarters. Kitchens shall include raised and washable surfaces suitable for food preparation.

- The Contractor shall provide and maintain adequate hygienic dining areas for staff. Work places and camps shall be provided with both natural& artificial light. Artificial lighting shall be powered by generator in the event of power cuts.

- Public sensitization training shall be provided to workers to avoid social conflicts between residents and the construction contractor, Occurrence of any such impacts can be avoided by community sensitive project planning and implementation and through effective involvement of local administration.

- All OHS protocols shall be implemented in true letter and spirit.

- Contractor must appoint an OHS resource to implement, monitor and report the HSE management plan to concerned authorities.

- Contractor must ensure the provision of first aid facility at construction site and camps through hiring medics and establishing a dispensary at the campsite.

- Reasonable number of first aid kits shall be available on construction sites and within contractor camps.

- Site personnel will be provided appropriate type of personal protective equipment (PPEs). Contractor will ensure consistent use of PPEs.

404. Based on the type of hazard applicable during the proposed works at site, the following mitigation measures as per IFC guidelines for Occupational Health and Safety (OH&S) must be implemented:14

Mitigation Measures for Physical Hazards

Rotating and Moving Equipment

405. Injury or death can occur from being trapped, entangled, or struck by machinery parts due to unexpected starting of equipment or unobvious movement during operations. Mitigation measures related to rotating and moving equipment on workers are provided below:

- Designing machines to eliminate trap hazards and ensuring that extremities are kept out of harm's way under normal operating conditions.
- Where a machine or equipment has an exposed moving part or exposed pinch point that may endanger the safety of any worker, the machine or equipment shall be equipped with, and protected by, a guard or other device that prevents access to the moving part or pinch point. Guards shall be designed and installed in conformance with appropriate machine safety standards.
- Turning off, disconnecting, isolating, and de-energizing (Locked Out and Tagged Out) machinery with exposed or guarded moving parts, or in which energy can be stored (e.g. compressed air, electrical components) during servicing or maintenance.
- Designing and installing equipment, where feasible, to enable routine service, such as lubrication, without removal of the guarding devices or mechanisms.

Vibration

406. Exposure to hand-arm vibration from equipment such as hand and power tools, or whole-body vibrations from surfaces on which the worker stands or sits, should be controlled through choice of equipment, installation of vibration dampening pads or devices, and limiting the duration of exposure. Limits for vibration and action values. Exposure levels shall be checked on the basis of daily exposure time and data provided by equipment manufacturers.

407. Other sources of vibration at construction site are rollers, compactors or any loose part of machinery exposure which may cause serious injury or workplace sickness. No equipment and machinery with loose or vibratory parts will be allowed to work. Such issues will be fixed through maintenance of the machinery on periodic basis. Use of rollers for land grading will be carried out during day times and with intermittent intervals to reduce the impacts of vibration on surrounding environment

Electrical

408. Exposed or faulty electrical devices, such as circuit breakers, panels, cables, cords and hand tools, can pose a serious risk to workers. Overhead wires can be struck by metal devices, such as poles or ladders, and by vehicles with metal booms. Vehicles or grounded metal objects brought into close proximity with overhead wires can result

[14] https://www.ifc.org/wps/wcm/connect/1d19c1ab-3ef8-42d4-bd6b-cb79648af3fe/2%2BOccupational%2BHealth%2Band%2BSafety.pdf?MOD=AJPERES&CVID=ls62x8l

in arcing between the wires and the object, without actual contact. Recommended actions include:

- Marking all energized electrical devices and lines with warning signs;
- Locking out (de-charging and leaving open with a controlled locking device) and tagging-out (warning sign placed on the lock) devices during service or maintenance;
- Checking all electrical cords, cables, and hand power tools for frayed or exposed cords and following manufacturer recommendations for maximum permitted operating voltage of the portable hand tools; ·
- Double insulating / grounding all electrical equipment used in environments that are, or may become, wet; using equipment with ground fault interrupter (GFI) protected circuits; ·
- Protecting power cords and extension cords against damage from traffic by shielding or suspending above traffic areas; ·
- Conducting detailed identification and marking of all buried electrical wiring prior to any excavation work.

Eye Hazards

409. Solid particles from a wide variety of industrial operations, and/or a liquid chemical spray may strike a worker in the eye causing an eye injury or permanent blindness. Recommended measures include:

- Use of machine guards or splash shields and/or face and eye protection devices, such as safety glasses with side shields, goggles, and/or a full-face shield. Specific Safe Operating Procedures (SOPs) may be required for use of sanding and grinding tools and/or when working around liquid chemicals. Frequent checks of these types of equipment prior to use to ensure mechanical integrity is also good practice. Machine and equipment guarding shall conform to standards published by organizations such as CSA, ANSI and ISO.

Welding/Hot Work

410. Welding creates an extremely bright and intense light that may seriously injure a worker's eyesight. In extreme cases, blindness may result. Additionally, welding may produce noxious fumes to which prolonged exposure can cause serious chronic diseases. Recommended measures include: ·

- Provision of proper eye protection such as welder goggles and/or a full-face eye shield for all personnel involved in, or assisting, welding operations. Additional methods may include the use of welding barrier screens around the specific work station (a solid piece of light metal, canvas, or plywood designed to block welding light from others). Devices to extract and remove noxious fumes at the source may also be required. ·
- Special hot work and fire prevention precautions and Standard Operating Procedures (SOPs) shall be implemented if welding or hot cutting is undertaken outside established welding work stations, including 'Hot Work Permits, stand-by fire extinguishers, stand-by fire watch, and maintaining the fire watch for up to one hour after welding or hot cutting has terminated. Special procedures are required for hot work on tanks or vessels that have contained flammable materials.

Industrial Vehicle Driving and Site Traffic

411. Poorly trained or inexperienced industrial vehicle drivers have increased risk of accident with other vehicles, pedestrians, and equipment. Industrial vehicles and delivery vehicles, as well as private vehicles on-site, also represent potential collision scenarios. Industrial vehicle driving and site traffic safety practices include:

- Training and licensing industrial vehicle operators in the safe operation of specialized vehicles such as forklifts, including safe loading/unloading, load limits.
- Ensuring drivers undergo medical surveillance.
- Ensuring moving equipment with restricted rear visibility is outfitted with audible back-up alarms.
- Establishing rights-of-way, site speed limits, vehicle inspection requirements, operating rules and procedures (e.g. prohibiting operation of forklifts with forks in down position), and control of traffic patterns or direction.
- Restricting the circulation of delivery and private vehicles to defined routes and areas, giving preference to 'one-way' circulation, where appropriate.

Ergonomics, Repetitive Motion, Manual Handling

412. Injuries due to ergonomic factors, such as repetitive motion, overexertion, and manual handling, take prolonged and repeated exposures to develop, and typically require periods of weeks to months for recovery. These OHS problems shall be minimized or eliminated to maintain a productive workplace. Controls may include:

- Facility and workstation design with 5th to 95th percentile operational and maintenance workers in mind.
- Use of mechanical assists to eliminate or reduce exertions required to lift materials, hold tools and work objects, and requiring multi-person lifts if weights exceed thresholds.
- Selecting and designing tools that reduce force requirements and holding times and improve postures. ·
- Providing user adjustable workstations.
- Incorporating rest and stretch breaks into work processes and conducting job rotation.
- Implementing quality control and maintenance programs that reduce unnecessary forces and exertions.
- Taking into consideration additional special conditions such as left-handed persons.

Working at Heights

413. Fall prevention and protection measures shall be implemented whenever a worker is exposed to the hazard of falling more than two meters; into operating machinery; into water or other liquid; into hazardous substances; or through an opening in a work surface. Fall prevention / protection measures may also be warranted on a case-

specific basis when there are risks of falling from lesser heights. Fall prevention may include:

- Installation of guardrails with mid-rails and toe boards at the edge of any fall hazard area. ·
- Proper use of ladders and scaffolds by trained employees. ·
- Use of fall prevention devices, including safety belt and lanyard travel limiting devices to prevent access to fall hazard area, or fall protection devices such as full body harnesses used in conjunction with shock absorbing lanyards or self-retracting inertial fall arrest devices attached to fixed anchor point or horizontal life-lines. ·
- Appropriate training in use, serviceability, and integrity of the necessary PPE.
- Inclusion of rescue and/or recovery plans, and equipment to respond to workers after an arrested fall.

Fire and Explosions

414. Fires and or explosions resulting from ignition of flammable materials or gases can lead to loss of property as well as possible injury or fatalities to project workers. Prevention and control strategies include:

- Fuel storage areas and generators will have secondary containment in the form of concrete or brick masonry bunds. The volume of the containment area shall be equal to 120% of the total volume of fuel stored.
- Storing flammables away from ignition sources and oxidizing materials. Further, flammables storage area shall be:
    - Remote from entry and exit points into camps
    - Away from facility ventilation intakes or vents
    - Have natural or passive floor and ceiling level ventilation and explosion venting
    - Use spark-proof fixtures
    - Be equipped with fire extinguishing devices and self-closing doors, and constructed of materials made to withstand flame impingement for a moderate period of time ·
- Defining and labeling fire hazards areas to warn of special rules (e.g. prohibition in use of smoking materials, cellular phones, or other potential spark generating equipment).
- Providing specific worker training in handling of flammable materials, and in fire prevention or suppression.
- Emergency Response Plan has been attached as **Annexure E**.

Corrosive, oxidizing, and reactive chemicals

415. Corrosive, oxidizing, and reactive chemicals present similar hazards and require similar control measures as flammable materials. However, the added hazard of these chemicals is that inadvertent mixing or intermixing may cause serious adverse reactions. This can lead to the release of flammable or toxic materials and gases, and may lead directly to fires and explosions. These types of substances have the additional hazard of causing significant personal injury upon direct contact, regardless of any intermixing issues. The following controls shall be observed in the work environment when handling such chemicals: ·

- Corrosive, oxidizing and reactive chemicals shall be segregated from flammable materials and from other chemicals of incompatible class (acids vs. bases, oxidizers vs. reducers, water sensitive vs. water based, etc.), stored in ventilated areas and in containers with appropriate secondary containment to minimize intermixing during spills. ·

- Workers who are required to handle corrosive, oxidizing, or reactive chemicals shall be provided with specialized training and provided with, and wear, appropriate PPE (gloves, apron, splash suits, face shield or goggles, etc.).

- Where corrosive, oxidizing, or reactive chemicals are used, handled, or stored, qualified first-aid shall be ensured at all times. Appropriately equipped first-aid stations shall be easily accessible throughout the place of work, and eye-wash stations and/or emergency showers shall be provided close to all workstations where the recommended first-aid response is immediate flushing with water.

Mitigation Measures for Biological Hazards

416. Biological agents represent potential for illness or injury due to single acute exposure or chronic repetitive exposure. Biological hazards can be prevented most effectively by implementing the following measures: ·

- The contractor shall review and assess known and suspected presence of biological agents at the place of work and implement appropriate safety measures, monitoring, training, and training verification programs.

- Project contractor must provide good working and sanitation conditions at camp and wok sites. Disease surveillance shall be carried out to identify any exposure to parasites, such as hookworm, ascaris, and various mites, chiggers, ticks and dengue.

- Measures to eliminate and control hazards from known and suspected biological agents at the place of work shall be designed, implemented and maintained in close co-operation with the local health authorities and according to recognized international standards.

6.3.8 High Noise Levels

Impacts

417. The WTP installation and transmission line development will result in different construction equipment and machineries. jack hammer, cutter, and excavator and haul trucks etc. being used which will generate high noise levels at the project site and in the project area.

418. The detailed mapping of sensitive receptors has been conducted and the types of receptors and their respective distances from the work sites are provided earlier. However, any required mitigation measures that shall be proposed will be to control potential impacts on noise to prevent any long-term impacts within the project area.

419. The assessment of the noise impacts on the sensitive receptors that have been identified at various locations in the project area depends upon:

- Characteristics of noise source (instantaneous, intermittent or continuous in nature)
- Time of day at which noise occurs, and
- Location of noise source

420. Each construction activity has its unique noise characteristics due to use of different equipment items. The potential sources of noise during the preparation, construction, and worksite closure phases for the WTP works include equipment, machinery, and transportation used for the construction activities. The equipment used for construction will be the major source of noise.

421. The construction activities will include use of a large number of trucks, generators, excavators etc., which can generate significant noise.

422. Since various modern machines are acoustically designed to generate low noise levels, any high noise levels that might be generated will only be for a short duration during the construction phase.

423. Depending on the construction equipment used and its distance from the receptors, the community and the workers may typically be exposed to intermittent and variable noise levels. During the day, such noise results in general annoyance and can interfere with sleep during the night. In general, human sound perception is such that a change in sound level of 3 dB is just noticeable, a change of 5 dB is clearly noticeable, and a change of 10 dB is perceived as a doubling or halving of sound level.

424. Due to the various construction activities, there will be temporary noise impacts in the immediate vicinity of the project site. The movement of heavy vehicles, loading, transportation and unloading of construction materials produces significant noise during the construction stage. However, these increased noise levels will prevail only for a short duration during the construction phase.

425. The Table 6.5 below represents typical noise levels from various construction equipment items. It shall be noted that the values indicated in the table may differ depending on the brand and age of machinery provided/used by construction contractors.

Table 6—5: Construction Equipment Noise Ranges, dB (A)

Equipment	Peak Noise Range at 15 m	Typical Peak Sound Level in a Work Cycle[a] at 15 m	Typical 'Quieted Equipment' Sound Level[b] at 15 m	Construction Phase		
				Earthworks	Structures	Installation
Batching plant	82-86	84	81		Y	
Concrete mixers	76-92	85	82		Y	
Cranes	70-94	83	80		Y	Y
Excavators	74-92	85	82	Y		
Front loader	77-94	85	82	Y	Y	Y
Water bowsers	85-93	88	85	Y	Y	Y
Graders	72-92	85	82	Y		
Bulldozers	65-95	85	80	Y		
Pavers	87-89	88	80	Y		
Pumps	68-72	76	75	Y	Y	Y
Diesel generators	72-82	81	77		Y	Y
Drilling machines	82-98	90	87		Y	Y
Compressors	74-88	81	71		Y	
Dumpers	77-96	88	83	Y	Y	
Dump/flatbed Truck	75-85	80	77	Y	Y	Y

Sources: USEPA, 1971; http://www.waterrights.ca.gov/EIRD/text/Ch11-Noise.pdf; http://www.lacsd.org/LWRP%202020%20Facilities%20Plan%20DEIR/4_6_Noise.pdf; http://newyorkbiz.com/DSEIS/CH18Construction.pdf

Notes:

a. Where typical value is not cited in literature, mean of the peak noise range is assumed

b. Quieted equipment can be designed with enclosures, mufflers, or other noise-reducing features. Where data is not available, a 3 dB reduction is assumed

426. Precise information on the type, quantity and location of equipment to be used during the construction phase is not available at this stage and will be dependent on the working methods of the selected contractors. However, preliminary calculations have been conducted to provide a general magnitude of the noise levels during various construction phases.

427. Furthermore, no equipment which is generating high noise levels will be permitted to work at site. Moreover, equipments and machineries noise shall be reduced to minimum after 100-150 meters.

428. Nearest sensitive receptors with respect to noise are the settlements of UCs of Khawazakhela, Charbagh and Sangota during laying of water supply pipeline. Maximum noise shall be generated while using mechanical/potable Jack hammer for cutting hard surfaces but this activity is limited as proposed only for cutting hard surfaces.i.e. concrete, however, excavators shall also be utilized for trenching along main roads, while in streets and congested areas, manual excavation has been proposed which do not produce noise. No sensitive receptors are present close to the proposed location of WTP therefore, no impact from noise has been envisaged.

429. The mitigation measures listed below shall be implemented to minimize noise levels during the construction activity as far as possible.

Mitigation Measures

430. The following mitigation measures will be implemented:

- Equipment noise will be reduced at source by proper design, maintenance and repair of construction machinery and equipment. Noise from vehicles and power generators will be minimized by use of proper silencers and mufflers.
- Excessive noise emitting equipment will not be allowed to operate and will be replaced.
- Blowing of horns will be prohibited on access roads to work sites.
- As a rule, the operation of heavy equipment shall be conducted in daylight hours.
- Construction equipment, which generates excessive noise, shall be enclosed or fitted with effective silencing apparatus to minimize noise.
- Well-maintained haulage trucks will be used with speed controls.
- Use of ear plug and ear muffs must be ensured during construction. No employee shall be exposed to a noise level greater than 85 dB(A) for a duration of more than 8 hours per day without hearing protection. In addition, no unprotected ear shall be exposed to a peak sound pressure level (instantaneous) of more than 140 dB(C).
- Prior to the issuance of hearing protective devices as the final control mechanism, use of acoustic insulating materials, isolation of the noise source, and other engineering controls shall be investigated and implemented, where feasible.
- Periodic medical hearing checks shall be performed on workers exposed to high noise levels.
- Grievance redress mechanism will be established.
- All the equipment and machinery used during construction phase shall be well maintained and in compliance with NEQS.

6.3.9 Hazardous and Non-Hazardous Waste Management

Impacts

431. During construction/civil works potential sources of waste will include spoils generated during pipeline laying cells excavation, excavation waste for other civil works, domestic wastes (solid & wastewater), fuel or oil leakages or spills, onsite effluents from vehicle wash & cleaning, and cement spills.

432. Waste disposal of materials containing contents of both hazardous and non-hazardous nature such as scrap wood, bricks, concrete, asphalt, plumping fixtures, piping, insulation (asbestos and non-asbestos), metal scraps, oil, electrical wiring and components, chemicals, paints, solvents etc. can potentially become a serious environmental issue, particularly with the local contractors. To avoid any potential issue, the PMU in collaboration with focal agencies will need to impose adequate internal controls.

433. Domestic wastes generated during construction of Mingora Greater Water Supply Scheme will include sewage, grey water (from kitchen, laundry, and showers), kitchen wastes, combustible wastes and recyclable wastes from contractor camps.

Mitigation measures

434. A waste management plan will be developed prior to the start of construction. This plan will cater to sorting of hazardous and non-hazardous materials prior to disposal, placing of waste bins at the project sites for waste collection and an onsite hazardous waste storage facility i.e. designated area with secondary containment.

435. Licensed waste contractors will be engaged to dispose off all non-hazardous waste material that cannot be recycled or reused.

- Excavated material from water distribution network cells will be stored at site and it will be used as cover after laying of transmission lines.
- All types of combustible and non-combustible waste including plastic or glass bottles and cans will be temporarily stored on site and later sold/handed over to a waste/recycling contractor who will utilize these wastes for recycling purposes.
- Waste management training for all site staff to be included in Contractor's training plan.
- Fuel storage areas and generators will have secondary containment in the form of concrete or brick masonry bunds. The volume of the containment area shall be equal to 120% of the total volume of fuel stored.
- Fuel and hazardous material storage points must be included in camp layout plan to be submitted for approval. Hazardous material storage areas shall include a concrete floor to prevent soil contamination in case of leaks or spills. Fuel tanks will be checked daily for leaks and all such leaks will be plugged immediately.
- Designated vehicles/plant wash down and refueling points must be included in camp layout plan to be submitted for approval.
- Hazardous waste will be initially stored on site at designated area and then handed over to EPA certified contractor to final disposal.
- Record of waste generation and transfer shall be maintained by project contractors.

- Spill kits, including sand buckets (or other absorbent material) and shovels must be provided at each designated location.
- At the time of restoration, septic tanks will be dismantled and backfilled with at least 1m of soil cover keeping in view landscape of surrounding natural surface.
- It will be ensured that after restoration activities, the campsite is clean and that no refuse has been left behind.
- Clinical wastes will be temporarily stored onsite separately and will be handed over to approve waste contractor for final disposal.
- Training will be provided to personnel for identification, segregation and management of waste.

6.3.10 Camp & Batching Plant Effluent

Impacts

436. The staff and labor camps for the construction of the proposed WTP and Water supply scheme will be a source of wastewater generated from the toilets, washrooms and the kitchen. The wastewater will not meet the national environmental standards and will therefore need treatment prior to disposal.

437. The project sites where construction is being conducted must not be treated by the project staff and/or labor as a public toilet or for disposal of camp effluent.

Mitigation measures

- It will be ensured that no untreated effluent is released to the environment.
- A closed sewage treatment system including soak pits and septic tank will be constructed to treat the effluent from the construction/labor camps.
- Sewage treatment system will be installed at each respective labor camp based on the number of laborers residing at the respective camp.
- Wastewater from laundry, kitchen washings and showers will be disposed-off into soak pits or septic tank (where soak pit cannot be constructed) and after treatment it will disposed of in TMA provided drains in the project area.
- Soak pits will be built in absorbent soil and shall be located 300 m away from a water well, hand pump or surface water body. Soak pits in non-absorbent soil will not be constructed.
- Ensure that the soak pits remain covered all the time and measures are taken to prevent entry of rainwater into them.
- Sprinkling of grey water or sewage will not be allowed; in case the septic tank gets filled with sludge, septic tank shall be emptied through vacuum truck and material shall be transferred to treatment facility or approved municipal drain.
- Water being released from any batching plant(s) must be treated as per requirements of NEQS prior to release to sewerage system/any other water body.
- Sewage at the end of construction period to be disposed of in nearest municipal drains after getting approval from concerned municipal authorities.

6.3.11 Soil Erosion and Sedimentation

Impacts

438. The works proposed for development of the WTP and Water supply scheme may result in soil erosion and sedimentation. Spoils will be generated from the excavation activities, particularly during construction of transmission lines. Potential impacts from spoils and their disposal are (i) land for disposal of spoil, (ii) potential erosion from the spoil areas and spoil material reaching the waterways, and (iii) aesthetic impacts. Excavated soil from water distribution network cells excavation will be stored at site and it will be used as cover after laying of transmission lines.

Mitigation measures

439. Any drainage structures, culverts or pipes crossing the project site may need to be modified or protected and the detailed designs must make provisions to protect or re-provision all infrastructures that may be affected by the construction works.

6.3.12 Soil Contamination

Impacts

440. During the project construction, spills of fuel, lubricants and chemicals can take place while transferring from one container to another or during refueling. Also, during maintenance of equipment and vehicles, through leakages from equipment and containers and as a result of traffic accidents.

441. Depending on the nature of the material, location of spill and quantity of spill, the soil can get contaminated.

Mitigation measures

- It will be ensured that spill prevention trays are provided and used during refueling. Also, on-site maintenance of construction vehicles and equipment will be avoided as far as possible. In case on-site maintenance is unavoidable, tarpaulin or other impermeable material will be spread on the ground to prevent contamination of soil.
- Regular inspections will be carried out to detect leakages in construction vehicles and equipment and all vehicles will be washed in external commercial facilities.
- Fuels, lubricants and chemicals will be stored in covered bounded areas, underlain with impervious lining. Appropriate arrangements, including shovels, plastic bags and absorbent materials will be available near fuel and oil storage areas.

6.3.13 Employment Conflicts

Impacts

442. The proposed construction of WTP and Water supply scheme is likely to create any significant permanent job opportunities. Even unskilled and semi-skilled employment opportunities that are likely to be created will be for a short period, while the water supply scheme project is constructed. As persons with relevant skills may be available locally, people from the project area are likely to fill a significant number of the semi-skilled and skilled jobs.

443. This issue of provision of jobs can become particularly problematic if it is perceived by the local population that a significant number of construction-related jobs opportunities are not given to people from the local community. This can result in friction between local residents and construction workers from outside of the community.

Mitigation measures

- The Construction Contractor will adopt a transparent hiring policy. Prior to the commencement of the construction activity, the local communities in the project area will be informed of the employment policy in place and number of people that can be employed for this project.

- It will be ensured that maximum number of unskilled and semi-skilled jobs will be provided to the residents of the project area.

- The PMU-KP LGERDD will ensure a balanced process of employment of the communities in the project area with preference given to those most directly affected by the project.

6.3.14 Communicable diseases incl. COVID-19

Impacts

444. Communicable diseases such as COVID-19 and HIV may be introduced due to the immigration of workers associated with the project.

Mitigation measures

445. A communicable diseases prevention program will be prepared for construction workers or residents near the construction sites.

COVID-19 specific measures

- All workers must perform complete sanitization at the site as per SOPs/guidelines issued by WHO and the national guidelines issued by the Government of Pakistan (GOP)[15].

- All workers must wear a mask as soon as they arrive at site and must keep wearing it at all times while present at the work site/hospital premises. The WHO guidelines on bio-safety and use of masks are provided as **Annexure K** and **Annexure L.**

- As soon as workers arrive at work site, their body temperature must be checked and in case any worker is assessed to be running a fever or suffering from a flu or cough, he must be informed to leave immediately and self-isolate for a two week period and not report for work until this two week mandatory period has been completed.

- At the work site(s), social distancing measures must be strictly implemented and gathering of workers at any location at the work site(s) must be strictly forbidden. In case of workers not taking this measure seriously, strict penalties must be imposed to ensure implementation.

- The work tasks must be divided into shifts, as far as possible, to reduce the workforce present at the work site(s) at any one moment and improve the working speed/efficiency.

- All workers will be strictly advised to wash their hands as frequently as practicable and not to touch their face during work.

- A supply of safe drinking water will be made available and maintained at the project site(s).

[15]https://covid.gov.pk/guideline

- COVID-19 awareness sign boards must be installed at the camp clinic and at the work site(s).
- Contact details of all workers will be kept in a register on site in order to efficiently trace and manage any possible workers that might experience symptoms of COVID-19.
- Prohibition of entry for local community/any unauthorized persons at work sites.
- Proper hygiene practices in the toilets and washrooms will be implemented with proper and adequate use of soaps and disinfectant spray.
- Social distancing must be maintained during the pick-up and dropping off of workers from their residences to and from the work site(s).

COVID-19 specific measures GOP

Advice for Site Managers:

- Every construction project shall make proper arrangements for uninterrupted building services including but not restricted to, electricity, fuel, water supply, water disposal and sanitation, communication links, washrooms with hand hygiene and shower facility and with proper and adequate supply of soaps and disinfectants.
- Workers shall not use biometric attendance machines or crowd during attendance, entry or exit to the premises of the construction site.
- Ensure the availability of the thermal gun at the entry and exit of the construction site and no worker shall be allowed without getting his/her temperature checked.
- Site manager must maintain a register of all contact details with NID number and addresses of all present at the site in case a follow up or tracing and tracking of contacts is required at a later stage.
- Develop the employee roaster to decrease the number of people on the site very day. Split the shifts of the workers in morning and evening with limit of each shift to 8 working hours.
- Every worker must change into standard working attire at the time of commencement of duty and change back to their regular dress after taking shower when their duty hours end.
- In addition to all other internationally recognized safety precaution for construction workers and other staff, every individual must be provided with a face mask. It must be ensured that everyone during his or her presence at the site continues to wear the mask. Face mask shall be replaced as and when soiled or otherwise removed. Outer surface of face mask must not be touched with hands.
- Non-essential work trainings must be postponed avoiding gathering of people.
- Ensure the physical distance by creating more than one route of entry and exit to the site.
- Instruct the workers to inform the construction manager (or authorities) if
  - They develop any symptoms of cough, flu or fever.

- They have been exposed to someone suspected or confirmed with COVID 19.
- They have met someone who has a travel history of COVID 19 endemic country. They have travelled in last couple of days or plan to travel soon.

▪ All incidences of appearance of the symptoms of COVID-19 shall be immediately documented and maintained at the site and information regarding which shall be immediately communicated through e-mail or else, to the designated health facility, and the sick worker shall be transported to the health facility for further advice and action. The site manager must establish a link with a nearby healthcare facility with arrangements for quick transportation of workers in case of an emergency.

▪ Persuade the workers to inform the authorities for their safety and of other if they observe any signs and symptoms in a colleague.

▪ Do not allow any worker at the construction site who has the symptoms.

▪ Display the awareness banners about hand hygiene and physical distancing, where you can, around the work site.

▪ Everyone on the construction site must observe sneezing and coughing etiquettes. Workers shall be requested and required to wash their hands as frequently as practicable and shall also be advised not to touch their face with their hands during work.

▪ Workers must maintain no less than two arm lengths between them before, during after work at all the times. They shall not make physical contact and shall be required to maintain separate personal gears and assets which must be clearly labelled and stored without intermix.

▪ Only sanitize-able dinning surfaces shall be used, which must be cleaned before each service. Food must be heated to a temperature to no less than 70ºC before consumption and shall preferably be served in disposable utensils. If reusable utensils are used, these must be washed with soap and water immediately after use and stored at a safe place.

▪ The lunch breaks and stretch breaks of the workers must be staggered to avoid the clustering of workers. Workers must not sit at less than 2 meters distance while having meals and while any other activity requiring interpersonal communications.

▪ In the wake of current restrictions on transportations site mangers will ensure safe transport arrangements for worker which shall not be crowded and shall have social distancing in place during the entire process from pickups till drops at destination.

▪ In case of workers sleeping in at the site of construction, a safe distance of 2 meters must be ensured in the sleeping rooms.

▪ A supply of safe drinking water must be made available at the project site and maintained.

▪ Adequate ventilation shall be provided in dining areas, resting places and sleeping areas.

Advice for Construction Workers:

- All possible and prescribed measures shall be taken to ensure your and others health. Enter your contact details in the register maintained at the site, in case a follow up or tracing and tracking of contacts is required at a later stage.
- Follow hygiene practices at washrooms and shower facility with proper and adequate use of soaps and disinfectants.
- Every worker must change into standard working attire at the time of commencement of duty and change back to their regular dress after taking shower when their duty hours end.
- In addition to all other internationally recognized safety precaution for construction workers and other staff, every individual must use face mask. Face mask shall be replaced as and when soiled or otherwise removed. Outer surface of face mask must not be touched with hands.
- Workers shall wash their hands as frequently as practicable and shall not to touch their face with their hands during work.
- Everyone on the construction site must observe sneezing and coughing etiquettes.
- Workers must maintain no less than two arm lengths between them before, during after work at all the times. They shall not make physical contact and shall be required to maintain separate personal gears and assets which must be clearly labelled and stored without intermix.
- Sick worker shall immediately inform the site manager and must get medical advice from nearby health Centre.
- Only sanitize able dinning surfaces shall be used. Food must be heated to a temperature to no less than 70 ^{o}C before consumption and shall preferably be in disposable utensils. If reusable utensils are used, these must be washed with soap and water immediately after use and stored at a safe place.
- Do not sit at less than 2 meters distance while having meals and while any other activity requiring interpersonal communications.
- Do not use biometric attendance machines or crowd during attendance, entry or exit to the premises of the construction site.
- Use safe transport arrangements which shall not be crowded and should have social distancing in place during the entire process from pickups till drops at destination.
- In case sleeping in at the site of construction, a safe distance of 2 meters must be ensured in the sleeping rooms.

Deliveries or Other Contractors Visiting the Site:

- Non-essential visits to the construction sites shall be cancelled or postponed.
- Delivery workers or other contractors who need to visit the construction site must go through temperature check before entering and shall be given clear instructions

for precautions to be taken while on site.

- Designate the workers, with protective gears or at least gloved and mask, to attend to the deliveries and contractors.
- Make alcohol-based hand sanitizer (at least 70%) available for the workers handling deliveries.
- Instruct the visiting truck drivers to remain in their vehicles and whenever possible make use of contactless methods, such as mobile phones, to communicate with your workers.

6.3.15 Vegetation and Wildlife Loss

Impacts

446. The WTP site located in a rural environment in the outskirts of Mingora city with limited human settlements and activities. The WTP site is located on a flat piece of land on bank of river. Some of this flat land is used for agricultural and livestock purposes and the rest is generally occupied by shrubs and bushes and thus contains limited vegetation cover and limited wildlife of any significance.

447. No impact on vegetation and wildlife is expected due to very few vegetation cover within project site. There are only minor shrubs and bushes that will be cleared up, if felt necessary, during the site preparation stage of the project.

Mitigation measures

- Consideration has been given to the visual appearance of the WTP site during operation and at the time of closure of the site and its impact on the surrounding land forms. Necessary plantation will be carried out, which will act as buffer zone from surrounding environment. Reasonable area has been allocated for plantation within and at boundary of facility to improve landscape of the area.
- Inside the boundary wall, tree plantation will be conducted to create an environmental barrier between the external and internal environment. Indigenous tree plantation will be carried out, which will serve as the buffer zone. Green belt has been provided in project key plan. For the WTP, to present a clean and aesthetically pleasing view, buffer zone with tree plantation and landscaped berms will be developed. Plantation will commence as one of the earliest activities of site development. Once the design of WTP is approved and necessary funds have been mobilized, plantation activity will be started in collaboration with Swat Development Authority (SDDA) may outsource the activity separately.
- Camp/s will be located in existing clearings; as much as possible.
- Off-road travel will be strictly prohibited and observance of this will be monitored during execution of the project. and
- Vehicles speed will be regulated and monitored to avoid excessive dust emissions.
- No hunting or killing of animals will be permitted.
- No cutting down of vegetation or using vegetation or trees as firewood will be permitted.

6.3.16 Historical/Archaeological Sites

Impacts

448. No historical/archaeological sites have been identified in the project area or project site.

Mitigation measures

449. If evidence of any archaeological remains is found during the construction activities, the excavation work will be stopped immediately, and necessary next steps taken to identify the archaeological discovery based on the 'Chance Find' procedures provided as **Annexure F**.

6.3.17 Construction of Administration Building and Other Infrastructure

Impacts

450. Mingora WTP will have 2-storey admin building, chemical building, chlorination building, workshop, laboratory and internal roads to accommodate various operations of the facility.

451. Internal roads will be constructed for transport of chemicals, and maintenance equipment and machinery, in the plant area, metaled roads will be constructed. The width of metaled portion will be 4 m.

452. Soil erosion is main impact during construction of building infrastructure and associated road network. Construction of roads or other facilities has also been historically perceived and in some cases has actually led to soil erosion. The possibility of soil erosion has been assessed in detail in the following paragraphs.

453. The possibility of soil erosion from a human activity increases when soil particles are detached from the soil mass. This is true for agricultural lands where a certain landscape is changed and the area is left exposed to wind and water erosion and also for dirt tracks which are developed through continual use by vehicles and the soil surface is subject to continual erosion for as long as the track is used. However, these cases are different from scenarios in which the soil surface initially disturbed is sealed or compacted by engineering means. For example, metalled roads are not subject to soil erosion, similarly neither will the gravel-topped roads which will be compacted to sustain loads.

454. Other environmental impacts from construction of building and other infrastructure include construction debris, unattended concrete and cement waste, brick waste, littering and empty cement bags which required to be disposed off as per waste management plan. Flooring works will add to slurry waste resulting from grinding activities. Noise from mixing plants, steel fixing works, wood works is another source of environmental nuisance which need to be managed. Use of generators, vehicles and machinery may be source of air pollution if not managed.

455. On the basis of the above it can be assessed that on a macro level environmental impacts from construction of buildings and associated infrastructure including roads will not be a significant issue as all these impacts will be managed through implementation of site specific EMMP prepared by contracors and approved by CSC/PMU.

Mitigation measures

- Following are the mitigation measures that will be employed to mange impacts from construction of building and associated infrastructure.
- Water will be sprinkled regularly to suppress dust emissions. Off road travelling of vehicles will be prohibited.
- Stock piles will be appropriately located and out of wind to avoid dust emissions. Dry dusty materials shall be sprinkled with water and properly covered to avoid dust emissions.
- No cement and concrete waste will be left unattended. Construction debris will not be thrown from height to avoid dust emissions. Return unpaved areas to original or improved contours following construction.
- Solid waste generated from construction of admin building will be managed through site specific EMMP and no waste will be stored at site to improve housekeeping at site and to avoid environmental nuisance.
- Set protocols for proper and regular maintenance of construction machinery, vehicles and generators. Generators that will be used will be placed at suitable locations.
- Contractor will not be allowed to store bulk quantities of fuel or hazardous material at site.
- Any fuel or chemicals stored at site (in small quantities) will be stored at designated site and containers/storage vessels be properly marked for their contents. Storage area will be provided with hard impervious surface and secondary containment.
- Equipment and machinery with loose vibratory parts will not be allowed to use. Used equipment and machinery will be in compliance to NEQS.
- Waste bins will be provided at appropriate places to mange waste. Daily housekeeping of the construction area will be carried out.
- Equipment and machinery with loose vibratory parts will not be allowed to use. Used equipment, vehicles and machinery will be in compliance to NEQS.

6.3.18 Site restorations

Impacts

456. After completion of construction activity the project facilities will be restored as close to its original condition as possible. One of the important tool is the photographic record of project facilities e.g., campsite(s) prior to set-up will be taken and will be compared after site restoration.

457. Unattended construction waste and excavated material along the RoW of transmission and water supply mains will be source of bad aesthitcs within city. Before closure of typical construction day area need to be cleared from all type of waste and construction material.

Mitigation measures

- Demobilization of all equipment and machinery;
- Disposal of any waste material remaining at the time of completion of the operation;
- Backfilling of all excavation followed by compactions;
- Dismantling and removal of fence or barriers surrounding the campsite area; and
- General restoration of the site area including landscaping and restoration of drainage where required.
- PMU KPCIP through CSC will ensure that restoration of construction works at intake structures, water transmission and supply mains will be carried out by contractors.
- PMU KPCIP will ensure periodic monitoring of such restorations.
- Contractors will develop site restoration protocols and will submit to CSC/PMU for review and approval.
- Construction site restoration protocols will be part of bidding documents and constructions contracts.

458. Construction contractor will add restorations costs into BOQs.

6.4 Impacts Associated With Operation of WTP

459. The potential impacts from operation of the WTP are provided as **Table 6.6** below.

Operation Phase

Table 6—6: Screening of Possible Impacts during Operation Phase

S/No.	Potential Issues	Likelihood (Certain, Likely, Unlikely, Rare)	Consequence (Catastrophic, Major, Moderate, Minor)	Risk Level (Significant, Medium, Low)	Residual Impact (Short term, Long term)
1	**Reduce downstream water availability**	Likely	Major	Medium	Long term
2	**Generation of Sludge**	Likely	Major	Medium	Long term
3	**Water system leaks and water discharges**	Unlikely	Major	Medium	Long term

S/No.	Potential Issues	Likelihood (Certain, Likely, Unlikely, Rare)	Consequence (Catastrophic, Major, Moderate, Minor)	Risk Level (Significant, Medium, Low)	Residual Impact (Short term, Long term)
	during flushing				
4	Generation of waste water during backwash of filter	Likely	Major	Medium	Long term
5	Generation of objectionable Odor and impact on air quality	Likely	Major	Medium	Long term
6	Occupational Health and Safety	Likely	Major	Medium	Long term
7	Generation of solid waste	Likely	Major	Medium	Long Term
8	Improved drinking water availability	Positive impacts expected			Long term positive residual impact
9	Improvements in Public Health	Positive impacts expected			Long term positive residual impact

Critical Risk Level

Significant Risk Level

Medium Risk Level

Low Risk Level

Positive Impacts

6.4.1 Reduce downstream water availability

Impacts

460. Reduced downstream water availability shall deprive end user or it may disrupt environmental/ecological characteristics of streams. Further streams are the sources of ground water charging in the vicinity and downstream of catchment area. Pankora River is major tributary of Swat River and it merges into Swat River at Kulangi Post. The River then flows south-westward into Peshawar plain and joins the Kabul River.

Mitigation measures

- The catchments area is drained by Swat River and its tributaries. The Panjkora River joins River Swat downstream of Hisar / Totakan at Sharbatai. The river discharge increases in summer because of more snow melting due to rise in temperature.
- Detailed Catchment studies has been conducted as part of designing intake flow from sources. The average daily rainfall data for 39 years (from 1981 to 2019) was collected and analyzed to get the rainfall values of 2, 5, 10, 50- & 100-year return period. Rainfall Runoff model for watershed, basin model for computation of runoff volumes has been analyzed.
- The maximum flow is available 150676 cusecs in the month of July while minimum flow 1230 cusecs in the month of January are available in river Swat. Based on the available data, it can be safely concluded that sufficient environmental flows are available for downstream ecological life. Moreover, the sources have enough water availability for uninterrupted water supply of WTP.
- Water withdraw from streams shall be done without warranting reduced ecological flow. Water withdraw record shall be maintained.
- PMU KPCIP/WSSC Swat will ensure that water withdraw from the streams shall not disrupt the ecological flows.
- Periodic flow and catchment studies shall be carried during operation phase of the project.

6.4.2 Generation of Sludge and wash water

Impacts

461. During the operation phase of proposed WTP the residual waste includes sludge which drained off from the plain sedimentation tanks and clarifiers; and wash water produced from backwashing of rapid gravity filters.

462. About 90% suspended particles and turbidity is removed in the clarifiers. The sludge is formed due to (i) suspended solid particles which coalesce together on the mixing of coagulants and (ii) the coagulant themselves add to the sludge concentration in terms of solids. The solid concentration of clarified sludge ranges from 1 to 2% of the sludge volume while the total sludge volume is in the range of 2 to 3 % of the product water; and

463. The solid concentration in the wash water of filter beds generally ranges from 0.05 to 0.5% and these solids are only 10% of the total solids generated due to turbidity and coagulants.

Mitigation measures

464. The residual disposal is carried out through:

a) Settled Sludge

465. Two circular sludge holding tanks (one for each train) have been proposed with a diameter of 10 m. The sludge of plain sedimentation tanks and clarifiers shall be discharge to the by pumping sludge holding tanks. The sludge from the holding tanks shall be transported into nearby landfill site.

b) Wash Water

466. The wash water received from filter beds, contains a little number of solids. The wash water shall be discharged into drain. The same practice is also being followed at Rawal Lake Filtration Plant, Rawalpindi and Sang Jani Water Treatment Plant, Islamabad.

6.4.3 Water system leaks and water discharges during flushing

Impacts

467. Water system leaks can reduce the pressure of the water system compromising its integrity and ability to protect water quality (by allowing contaminated water to leak into the system) and increasing the demands on the source water supply, the quantity of chemicals, and the amount of power used for pumping and treatment. Leaks in the distribution system can result from improper installation or maintenance, inadequate corrosion protection, settlement, stress from traffic and vibrations, frost loads, overloading, and other factors.

468. Water supply lines may be periodically flushed to remove accumulated sediments or other impurities that have accumulated in the pipe. Flushing is performed by isolating sections of the distribution system and opening flushing valves or, more commonly, fire hydrants to cause a large volume of flow to pass through the isolated pipeline and suspend the settled sediment. The major environmental aspect of water pipe flushing is the discharge of flushed water, which may be high in suspended solids, residual chlorine, and other contaminants that can harm surface water bodies. Recommended measures to prevent, minimize, and control impacts from flushing of mains include:

Mitigation Measures

- Ensure construction meets applicable standards and industry practices
- Conduct regular inspection and maintenance;
- Implement a leak detection and repair program (including records of past leaks and unaccounted-for water to identify potential problem areas);
- Consider replacing mains with a history of leaks of with a greater potential for leaks because of their location, pressure stresses, and other risk factors.
- Discharge the flush water into a municipal sewerage system with adequate capacity;
- Discharge the flush water into a separate storm sewer system
- Minimize erosion during flushing, for example by avoiding discharge areas that are susceptible to erosion and spreading the flow to reduce flow velocities

6.4.4 Handling of Hazardous Chemicals and Chlorine Release

Impacts

469. The proposed water treatment involves the use of chemicals for coagulation and disinfection. Chemical used for coagulation will be Alum ($Al_2SO_4.14H_2O$) while for chlorination sodium hypochlorite shall be used. The Material Data Safety Sheet (MSDS) for Alum and Sodium Hypochlorite is added as **Annexure N.**

470. Alum may cause eye/skin irritation and Prolonged or repeated contact with Alum dust may cause redness, dryness Over-exposure and itching of the skin (dermatitis) while dusts of aluminum sulfate hydrate if inhaled may probably cause irritation of the nose, throat and respiratory tract based on pH.

471. Vaporsof Sodium Hypochlorite may irritate the respiratory system and cause coughing, asthmatic breathing and breathlessness. It is also corrosive to skin and eyes. The product contains a substance which is very toxic to aquatic organisms.

472. Possible air emissions from water treatment plant can be accidental chlorine release when sodium hypochlorite accidentally mixed with any acid but in proposed WTP sodium hypochlorite shall be mixed with water therefore chances of air emissionis not envisaged.

Mitigation measures

- Chemical building has been proposed to house the facilities like storage of Alum, Lime and polymer, dose preparation facilities and dosing pumps
- A chemical house has been provided to accommodate the solution tanks, Alum Bags and other chemicals (if required). Monorail and overhead crane have been provided for handling of the chemicals.
- For chlorination Sodium Hypochlorite (NaOCl) will be stored in chlorination building, in which sodium hypochlorite will be mixed with water, and the solution of sodium hypochlorite and water will be fed in the chlorine contact tank through dosing pumps. In the chlorination building, monorail (capacity of 2 Ton) will be installed for the handling of sodium hypochlorite drums.
- Store sodium hypochlorite in cool, dry, and dark conditions for no more than one month, and use equipment constructed of corrosion-resistant materials
- Minimize the amount of chlorination chemicals stored on site while maintaining a sufficient inventory to cover intermittent disruptions in supply;
- Mandatory health and medical check-ups for all employees especially workers working at chemical building as they shall be exposed to Alum and Sodium hypochlorite
- Provision of PPEs to the workers working in chemical building.
- Use corrosion-resistant piping, valves, metering equipment, and any other equipment coming in contact with gaseous or liquid chlorine, and keep this equipment free from contaminants, including oil and grease.

Accidental Release Measures (Alum)

- **Small spill and leak:** Shovel into clean, dry, labelled containers and cover. Flush area with water. Do not get water inside containers or on spilled material

- **Large spill and leak** Prevent solids from mixing with water or entering sewers or waterways. Shovel into clean, dry, labelledcontainers and cover. If liquid is present, dike with inert material (sand, earth, etc.). Consider in situneutralization and disposal. Ensure adequate decontamination of tools and equipment following cleanup. Comply with Federal, Provincial/State and local regulations on reporting releases.Deactivating Chemicals: Lime, limestone, soda ash, sodium bicarbonate, dilute sodium hydroxide, diluteaqua ammonia

Accidental Release Measures (Sodium Hypochlorite)

- Flush away small spillages with plenty of water.

- Large Spillages: Absorb with sand or other inert absorbent. Pick up with vacuum or absorbent solid, store in closed container for disposal.

6.4.5 Occupational Health and Safety

Impacts

473. There are considerable risks associated with the operation of the proposed WTP site from an occupational health and safety perspective, keeping in view the scope of work to be conducted on a daily basis and the use of heavy machinery to be involved in the daily operations. Unless suitable precautionary protocols in accordance with international good practices are put in place, there is a high risk of injury and accidents taking place at the WTP site during its day-to-day operations. Draft Occupational Health and Safety Plan have been attached as **Annexure D.**

Mitigation Measures

474. In order to ensure a safe and healthy working environment for the employees of the WTP and all its auxiliary facilities, the following measures have to be strictly enforced, implemented and monitored:

- Designation of an Environment, Health and Safety (EHS) officer dedicated to the site;

- All employees must be able to reach their work stations safely. All path, walkways, staircases, ladders and platforms must be stable and suitable for the tasks to be undertaken;

- Strict use of Personal Protective Equipment (PPE) by all personnel (e.g. inspectors at the Dosing tank, sludge handler, material handler and waste compactor operators) must be ensured.

- Mandatory training of all employees, including sub-contractors, on Health and Safety Practices for WTP and its auxiliary facilities. Tool Box talks are also recommended;

- Develop a written program (i.e. health information, instruction and training) which sets forth procedures, equipment, personal protective equipment, and work practices that are capable of protecting employees from the health hazards of working in a WTP and its auxiliary facilities;

- Control of inhalation exposure to hazardous substances by the effective use of general ventilation within Chemical and sludge handling and Local Exhaust Ventilation (LEV) the appropriate use of respiratory protective equipment (RPE);
- Accidental fires must be addressed immediately. Appropriate operational procedures Emergency plan (including fire management) must be developed and implemented;
- Availability of first-aid kits and vehicles that can be used to bring any injured employee to the nearest doctor in cases of accidents;
- Mandatory reporting of all accidents or incident of near misses of accidents and immediate adoption of corrective measures; and
- Management must provide all the necessary financial and manpower resources for the implementation and enforcement of all health and safety programs and activities of the project;
- PMU KPCIP and WSSC Swat through CSC will ensure the implementation of SOPs issued by GoP and WHO related to COVID-19.
- Regular training and orientation on safety practices will be implemented to impart knowledge of safe and efficient working environment. Furthermore, regular health checkups of all employees including contract workers will be conducted. Effective and proper housekeeping is recommended to reduce dust exposures to its direct vicinity. Heat levels must be monitored as well. Spot checks shall be done to ensure that workers' welfare is addressed especially during summer months.

6.4.6 Generation of solid waste

Impacts

475. Solid waste generated by water treatment operation include process residuals like sludge, wash water and domestic waste which include sewage, grey water (from kitchen, laundry, and showers), combustible wastes and recyclable wastes from laboratory, chemical buildings and workshops.

476. Detailed impact assessment and mitigation measures for sludge and wash water has been provided in section 6.4.2.

477. Sewage and grey water from Admin building, chemical building and workshops shall be drained into nearest municipal drain.

478. Recyclable waste generated from administration building, chemical building and workshop will be paper, cardboard and small plastic items, empty chemical bags and chemical drums, iron and tin items. These items shall be stored temporarily and sent to recycling facilities located in Swat or Peshawar.

479. Non recyclable waste such as demolition waste, food waste, debris, non-hazardous chemicals shall be transported to landfill site for ultimate disposal.

480. Hazardous waste generated during WTP operation will be fuel or oil stains, leakage or chemical spill during activities. Hazardous waste shall be stored briefly and after that shall be transported for disposal.

Mitigation measures

481. A waste management plan for operation phase will be developed. This plan will cater to sorting of hazardous and non-hazardous materials prior to disposal, placing of waste bins at the project sites for waste disposal and an onsite hazardous waste storage area.

482. Licensed waste contractors will be engaged to dispose of all non-hazardous waste material that cannot be recycled or reused.

- All types of combustible and non-combustible waste including plastic or glass bottles and cans will be temporarily stored on site and later sold/handed over to a waste/recycling contractor who will utilize these wastes for recycling purposes.
- Waste management training for all WTP staff to be included in training plan.
- Fuel storage areas and generators (if required) will have secondary containment in the form of concrete or brick masonry bunds. The volume of the containment area shall be equal to 120% of the total volume of fuel stored.
- Fuel and hazardous material storage points must be included in camp layout plan to be submitted for approval. Hazardous material storage areas shall include a concrete floor to prevent soil contamination in case of leaks or spills. Fuel tanks will be checked daily for leaks and all such leaks will be plugged immediately.
- Designated drains for vehicles/plant wash down shall be constructed and layout plan to be submitted for approval.
- Hazardous waste will be initially stored on site at designated area and then handed over to EPA certified contractor to final disposal.
- Record of waste generation and transfer shall be maintained by project contractors.
- Spill kits, including sand buckets (or other absorbent material) and shovels must be provided at each designated location.
- Clinical wastes will be temporarily stored onsite separately and will be handed over to approve waste contractor for final disposal.
- Training will be provided to personnel for identification, segregation and management of waste.
- The structure of a Framework waste management plan has been prepared for the project and attached as **Annexure M.**
- WSSC Swat be required to prepare waste management plan for the site in light of guidelines provided in the waste management plan and submit to PMU for approval.

6.4.7 Improved drinking water availability

Impacts

483. The continued supply of treated quality water by proposed project will be an indispensable facility in Mingora City. The proposed Project will facilitate the domestic as well as commercial water requirements of people living in Swat. With the

replacement of outlived/rusted pipeline water shortages and leakage/wastage issues shall also be resolved. Moreover, the proposed GWSS will provide Improved and sustainable potable water availability to citizens of Mingora for next thirty years. The project will reduce abstraction of ground water from tube wells and water bores omitting chances of ground water depletion and reduce operation cost for WSSC Swat.

484. Behavior change campaigns will include workshops on water conservation, media campaign for using services of WSSC Swat and enforcing regulations with respect to illegal bores and water theft. Metering system will be installed to control exploitation of ground water. Further after implementation of project all households will be connected with water distribution network hence eliminating need of private tube wells/bores.

485. Furthermore, project implementation will also create job opportunities during construction, thereby improving the socioeconomic condition of the local people and help in improving their quality of life. Thus, the 'no project' option is not a viable option

Mitigation measures

- No measures required.

6.4.8 Improvements in Public Health

Impacts

486. The clean potable water will reduce water borne disease, improve public health and ultimately reduced pressure on health care system

Mitigation measures

- No measures required.

6.5 Cumulative Impacts

487. Based on the scoping exercise of the site and based on discussions with the public sector agencies responsible for development in the project area. Other infrastructure works are planned to be conducted in the WTP project area while these project works shall be conducted that includes offices, chemical storage room and SCADA. Thus, no cumulative impacts are expected.

6.6 Indirect and Induced Impacts

488. The potential impact of development of the WTP in the project area has been examined, which indicated that the existing and planned infrastructure such as water supply, wastewater collection and treatment, municipal solid waste collection and disposal will be adequate to accommodate any potential population intake as a result of the proposed WTP development. Impacts on the environment from air emissions, traffic and community noise have also been assessed and have found to be acceptable and within the carrying capacities of the environmental media.

489. Thus, negative indirect and induced impacts from the proposed WTP works are not expected. Instead it provides the safe drinking water availability to the community.

7 Environmental Management Plan & Institutional Requirements

7.1 Introduction

490. The IEE has identified potential impacts that are likely to arise during development of Mingora Greater water supply scheme in detail, both negative and positive impacts at each stage of the project. To minimize the effects of adverse impacts the IEE has recommended mitigation measures in the EMP. The proposed mitigation measures have been based on the understanding of the sensitivity and behavior of environmental receptors in the project area, the legislative controls that apply to the project and a review of good industry practices for projects of similar nature. For residual impacts (impacts remaining after applying the recommended mitigation measures) and for impacts in which there can be a level of uncertainty in prediction at the IEE stage, monitoring measures have been recommended to ascertain these impacts during the course of the project activities.

491. The Environmental Management Plan (EMP) is developed to eliminate and/or mitigate the impacts envisaged at the design, construction and operation stages.

492. The detailed EMP provided in this document as Table 7.1 ensures that development of Mingora Greater water supply scheme has no detrimental effect on the surrounding environment. The Plan shall act as a guideline for incorporating environmental measures to be carried out by the contractors engaged for the proposed project. It shall also be used for other parties concerned for mitigating possible impacts associated with each project and will form part of the Contract documents to be considered alongside the specifications. This Plan shall act as the Environmental Management and Monitoring Plan during the construction and operation phase of the project and will allow for prompt implementation of effective corrective measures.

7.2 Environmental Management Plan (EMP)

493. The EMP attached with this report ensures the following:

- Delivery of the prescribed environmental outcomes during all phases of this sub-project;
- Formulating a system for compliance with applicable legislative requirements and obligations and commitments for this sub-project;
- Ensure that project design process incorporates best practice environmental design and sustainability principles to minimize potential impacts of construction on the environment and community.
- Ensure that the construction work procedures minimize potential impacts on the environment and community.
- Develop, implement and monitor measures that minimize pollution and optimize resource use.

7.3 Objectives of EMP

494. The EMP provides a delivery mechanism to address potential impacts of the project activities, to enhance project benefits and to outline standardized good practice to be adopted for all project works. The EMP has been prepared with the objectives of:

- Defining the roles and responsibilities of the project proponent for the implementation of EMP and identifying areas where these roles and responsibilities can be shared with other parties involved in the execution and monitoring of the project;

- Outlining mitigation measures required for avoiding or minimizing potential negative impacts assessed by environmental study;
- Developing a monitoring mechanism and identifying requisite monitoring parameters to confirm effectiveness of the mitigation measures recommended in the study;
- Defining the requirements for communication, documentation, training, monitoring, management and implementation of the mitigation measures.

7.4 Environmental Management/Monitoring and Reporting

495. During the construction phase, the overall responsibility for the implementation and monitoring of the EMP rests with the Project Director (PD), Project Management Unit (PMU), and KPLGE&RDD. The PD at the PMU, using the Construction Supervision Consultant (CSC), will supervise the implementation of the proposed mitigation measures and monitor the implementation progress in the field.

496. During the operation phase, the overall responsibility for the implementation and monitoring of the EMP rests with CEO WSSC Swat. For initial two years of WTP operation, relevant contractor will be responsible for running of relevant plant (e.g. WTP operation, handling of materials, Sludge handling, distribution of water, communal water requirement etc.) and also responsible for implementation of EMP. This requirement will be reflected in the bidding document of such Contractors/Suppliers. Furthermore, these Contractors will train designated staff of WSSC Swat with respect to technical matters as well as EMP requirements.

497. The specific roles and responsibilities for environmental management and monitoring are provided in **Table 7.1** below. The expected costs for implementing any required mitigation measures are provided in **Table 7.7** below.

7.4.1 Inclusion of EMP in Contract documents

498. In order to make Contractors fully aware and responsible of the implications of the EMP and to ensure compliance, it is recommended that mitigation measures be treated separately in the tender documentation and that payment milestones shall be linked to performance, measured by execution of the prescribed mitigation measures. Such a procedure will help ensure adequate management of project impacts is carried out during the construction and operation phases, where a consistent approach will be expected on behalf of the Contractor and its sub-contractors so that data and information collected from monitoring programs is comparable with baseline monitoring data.

499. The Contractor shall be made accountable through contract documents and/or other agreements for fulfilling the environmental safeguard obligations and delivering on the environmental safeguard components of the Project. Contractors shall be prepared to co-operate with the executing agency and supervising consultants and local population for the mitigation of adverse impacts. After the EMP's inclusion in the contract documents, the Contractor will be bound to implement the EMP and will engage appropriately trained environmental and social management staff to ensure the implementation and effectiveness of the mitigation measures.

500. The Contractor is required to bid for executing the EMP, including the recommended mitigation measures and monitoring programs, as part of its Bill of Quantities (BoQ).

7.5 Institutional Arrangements

501. The environmental management plan will require involvement of the following organizations for its implementation during construction and operation phase of project:

7.5.1 Role of PMU, KP LGE&RDD

502. The PMU will:

- Provide support to ADB missions;
- Coordinate activities with all stakeholders, review consultants, proposals, and provide overall guidance during various stages of project preparation;
- Manage and ensure safeguard due diligence and disclosure requirements including resettlement and environmental safeguards in accordance with ADB's Safeguard Policy Statement (2009) and KP government requirements;
- Manage and ensure effective implementation of the gender action plan;
- Ensure submission of all IEE requirements as per law by responsible entities; and
- Monitoring of activities of the entire project.

7.5.2 Role of the ADB

503. The ADB will:

- Support the coordination and administration of the project;
- Provide guidance to PMU and Swat on implementation issues and project design;
- Disclose all safeguards documents, and monitor safeguards implementation;
- Monitor and report project performance;
- Conduct periodic review of the project;

7.5.3 Role of Construction Supervision Consultant (CSC)

504. The CSC will be responsible for the following items:

- Incorporates into the project design the environmental protection and mitigation measures identified in the EMP for the design stage;
- Assists PMU to ensure that all environmental requirements and mitigation measures from the IEE and EMP are incorporated in the bidding and contracts documents.
- Prior to construction, reviews the updated SSEMPs prepared by the contractor.
- Undertakes environmental management capacity building activities for relevant project focal staff.

7.5.4 Role of KP EPA

505. The KP EPA will have the following responsibilities with regards to this Mingora Greater Water Supply Scheme project:

- Provides regulatory compliance works for the project.

- Reviews and approves environmental assessment report of Water supply and WTP construction, submitted by PMU.
- Issues environmental clearance certification for the Project based on their mandate and regulations.
- Undertakes monitoring of the project's environmental performance based on their mandate.

7.5.5 Role of Project Contractor

506. The project contractor will be responsible for following items:

- Implementation of, or adherence to, all provisions of the IEE and EMP;
- Preparation of site specific EMPs as required. EMP will be prepared by Contractor's Environment Specialist, site incharge, HSE staff and project technical team before their mobilization and it will be submitted to Engineer of construction supervision consultant/PMU for review and approval.
- Preparation of site specific EMPs as required. Site Specific EMP Guide & Template for Guidance to Contractor has been attached as **Annexure H**.
- Contractor's environmental performance will rest with the person holding the highest management position within the contractor's organization. Reporting to their management, the contractor's site managers will be responsible for the effective implementation of the EMP.
- The Contractor will be required to have qualified Environmental Specialists in their team to ensure all mitigation measures are implemented during the different development phases of the project.

7.5.6 Role of WSSC Swat

507. The WSSC Swat will be responsible for following items:

- Implementation of, or adherence to, all provisions of the IEE and EMP.
- Preparation of site specific EMPs for operations phase.
- WSSC Swat will be responsible to ensure that contractors engaged during operation phase of Greater water supply scheme are executing activities in compliance to IEE/EMP.
- WSSC Swat will be required to have qualified Environmental Specialist designated for WTP to ensure all mitigation measures are implemented in true letter and spirit.
- WSSC Swat will design and drive behaviour change campaigns to increase public participation and cooperation. Public cooperation will be extended through incentives and penalties to the public.
- Behaviour change campaigns include workshops on water conservation, media campaigns for using services of WSSC Swat, and enforcing regulations with respect to illegal bores and water theft. Water metering system will be installed and periodic surveillance will be carried out to identify illegal connections/bores and such connections/bores will be discontinued.

- WSSCC Swat will plan customer feedback surveys in order to ensure sustainable service delivery and to remove gaps in the system.

7.6 Monitoring Parameters

508. A monitoring plan for the construction phase of the project, indicating environmental parameters, frequency and applicable standards is provided below as Table 7.3 below.

509. During the procurement/pre-construction period, the monitoring activities will focus on (i) checking the contractor's bidding documents, particularly to ensure that all necessary environmental requirements have been included; and (ii) checking that the contract documents' references to environmental mitigation measures requirements have been incorporated as part of contractor's assignment and making sure that any advance works are carried out in good time.

510. During the construction period, the monitoring activities will focus on ensuring that any required environmental mitigation measures are implemented to address possible impacts.

511. In general, the construction impacts will be manageable, and no insurmountable impacts are predicted, provided that the EMP is implemented to its full extent as required in the Contract documents. However, experience suggests that some Contractors may not be familiar with this approach or may be reluctant to carry out some measures. For the proposed project, in order that the Contractor is fully aware of the implications of the EMP and to ensure compliance, environmental measures must be costed separately in the tender documentation and listed as BoQ items, and that payment milestones must be linked to environmental performance, vis a vis the carrying out of the EMP.

512. The effective implementation of the EMP will be audited as part of the loan conditions by ADB, and as part of regulatory/NOC compliance by KP EPA. In this regard, the PMU/CSC will guide the design engineers and Contractors on the environmental aspects and necessary EMP documentation. Monitoring during operation phase will be carried out by WSSC Swat with support from PMU.

7.7 Environmental Training

7.7.1 Capacity Building and Training

513. Capacity building and training programs are necessary for the project staff in order to control the negative impacts resulting from the project construction and during its operation phase. They will also require trainings on monitoring and inspecting of such a project for environmental impacts and for implementation of mitigation measures.

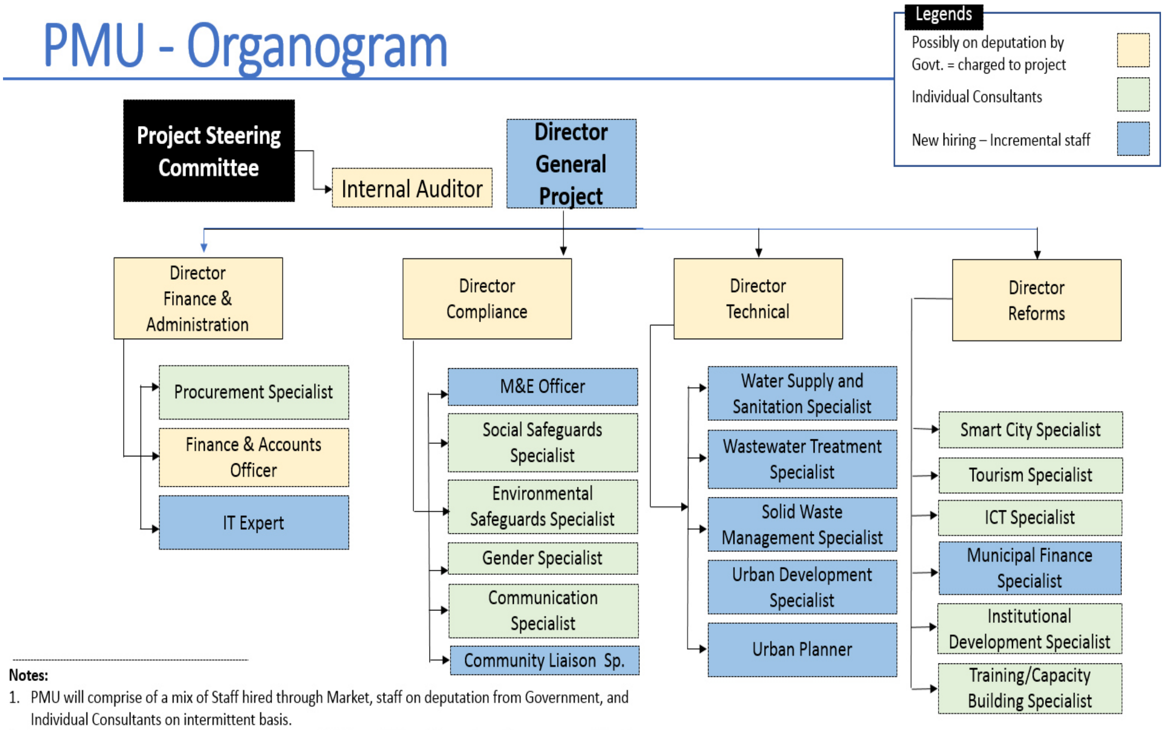
514. The details of this capacity building and training program are presented in the **Table 7.7** below.

7.7.2 Environmental Staffing and Reporting Requirements

515. EMP implementation will be responsibility of all project stakeholders including PMU, WSSC Swat, Project Construction contractors, O&M contractor and other suppliers' involved in the project. Requirement of environmental staffing will be part of bidding documents and necessary cost will be allocated as BOQ item by the bidder. PMU will maintain environmental safeguard staffing (Environmentalist/Environment Associate) for construction and operation phase of the project to monitor and supervise EMP implementation and performance. Environment expert will also be part of CSC technical team and will produce bi-weekly and monthly environmental compliance reports during construction phase. Environment expert of CSC will be responsible to

monitor the implementation of EMP during construction phase by project contractors. Project contractors will also hire sufficient environmental officers to implement the EMP requirements and prepare necessary EMP documentation. Project contractor EMP staff will prepare daily environmental reports and submit to CSC for approval and record. WSSC will hire qualified environmental specialist during operation phase of the project who will be responsible for EMP implementation and reporting by WSSC Swat and its O&M contractors during operation. Monthly environmental compliance report will be prepared by WSSC Swat and circulated to concerned authorities. Further third party environmental monitoring consultant will be hired on intermittent basis to monitor the EMP implementation and to report environmental non-compliances.

Figure 7-1: Proposed Organogram of PMU KPCIP



Notes:

1. PMU will comprise of a mix of Staff hired through Market, staff on deputation from Government, and Individual Consultants on intermittent basis.
2. The Project Director, Deputy Project Director, and DPD, and GMs will be assisted by support staff having relevant qualification and experience

Table 7—1: Environmental Management Plan

Project Activities	Section	Impact	Mitigation Measures Recommended	Responsibility		Timing
				Execution	Monitoring	
Design/Pre-Construction Phase	1.1	Improper selection of intake source and reduce ecological flows	▪ Khawazakhela Intake location for intake/ source water was initially identified as potential sources for this surface water project. ▪ Detailed Catchment studies have been conducted as part of designing intake flow from sources. The average daily rainfall data for 49 years (from 1961 to 2009) was collected and analyzed to get the rainfall values of 2, 5, 10, 50- & 100-year return period. Rainfall Runoff model for watershed, basin model for computation of runoff volumes has been analyzed. • Runoff volume calculations shall be carried on periodic basis to ensure water supplies from intake structure ▪ PMU KPCIP will ensure that design of intake structure is carried out with minimal impact of aquatic life and ecological flows	EDCM	PMU	BC: during detailed designing of the sub-project
	1.2	Improper design of water treatment plant and distribution networks including	▪ Limit maximum through-screen design intake velocity to limit entrainment of aquatic organisms ▪ Avoid construction of water intake structures in sensitive ecosystems ▪ Intake structure shall be designed adequately to reduce sediment load and uninterrupted raw water supply to WTP	EDCM	PMU	BC: during detailed designing of the sub-project

Project Activities	Section	Impact	Mitigation Measures Recommended	Responsibility		Timing
				Execution	Monitoring	
		transmission main	▪ Design water containment and diversion structures to allow unimpeded movement of fish and other aquatic organisms and to prevent adverse impacts on water quality ▪ The treatment process will be employed that biological contaminants and suspended solids are brought in the limits set forth in Pakistan Standards and WHO Guideline values for Drinking Water. A Conventional surface water treatment plant (rapid gravity filtration) is proposed for the treatment of source water. With the conventional treatment, the turbidity can be reduced to the limit of < 5 NTU, as per Pakistan Standard for Drinking Water Quality. ▪ To cater maintenance and shutdown during back wash of filters two process trains have been proposed each having treated water. Each train will consist of separate plain sedimentation tank, flash mixer, flocculation basin, and clarifier. Both trains will have a combine filtration unit. The reason of providing two trains to provide uninterrupted water supply ▪ A SCADA system has been proposed to check compliance and monitoring of WTP components. ▪ 1.2 meter cover has been proposed from the top of pipe to reduce chances theft and pipe bursting due to traffic loads.			

Project Activities	Section	Impact	Mitigation Measures Recommended	Responsibility		Timing
				Execution	Monitoring	
			▪ Before commissioning water supply network shall be tested on 1.5 times the designed pressure to check leakages. ▪ Treatment and disposal for sludge and waste water generated during operation of WTP shall be proposed and residual management is be proposed to avoid waste management issues. ▪ Water metering system shall be proposed to reduce theft and water wastage			
	1.3	Improper location of Intake structure water treatment plant and storage tanks	▪ Factors such as site capacity, accessibility, acceptability, stability, environmental sensitivity, land use, socio-economic receptors and climate hazards have been studied and site has been selected accordingly. ▪ The location of WTP is predefined as the land is already been acquired by PHED and the proposed WTP is located adjacent to surface water. ▪ Location of the Intake has been selected, after considering the natural conditions, consumers and construction difficulties including topography and geology. The detailed considerations for the selection of intake site are as follows. ▪ Suitability of the Intake structure type	PMU	-	BC: during detailed designin g of the sub-project

Project Activities	Section	Impact	Mitigation Measures Recommended	Responsibility		Timing
				Execution	Monitoring	
			▪ Geological and Topographic conditions ▪ Technically most suitable site to supply water to consumers ▪ Minimum Environmental Degradation • Proposed Raw Water Intake structure is located at downstream of KhwazaKhela at an elevation of approx. 1080 MSL, and the route of the proposed transmission main under this option will eliminate the congested urban areas of Khwazakhela and Gulibagh. • Proposed transmission main is approximately 20 km long, which will serve the population residing in Mingora city up to 1030m MSL i.e. approx. 85% of the total population of Mingora City will be served with this option. For the remaining population, small scale solar pumping solution is proposed in which pumping station will be required to fill the water storage tanks located at high elevations (i.e. more than 1030m MSL			
	1.4	Lack of integration of IEE/EMP requirements into Construction	▪ The proposed 'Safeguards unit' that will be developed at the PMU will be assigned the task to check that design and bid documents are responsive to key environmental, social and safety considerations, and that the proposed method of work reflects the boundaries defined in the EMP. The bid	EDCM	PMU	BC: during detailed designin g of the sub-

Project Activities	Section	Impact	Mitigation Measures Recommended	Responsibility		Timing
				Execution	Monitoring	
		bid documents	documents must include the EMP and its implementation cost must be reflected in the BOQ. ▪ IEE/EMP implementation and monitoring requirements must be part of bidding documents and necessary contractual binding must be agreed by project contractors before award of contract. ▪ Project contractors shall have qualified and experienced environmental staff to plan, arrange, implement, monitor and report IEE/EMP requirements			project
	1.5	Material Haul Routes	▪ The construction vehicles hauling materials along the Mingora city roads and anywhere where there are sensitive receptors such as hospitals, schools and/or roadside residences will be limited and the PMU in collaboration with the focal agencies will establish a route plan to minimize this disruption which shall be appended to the EMP	EDCM	PMU	BC: during detailed designin g of the sub-project
	1.6	Inadequate Contractor's Environmental Safeguards Capacity	▪ PMU KP LGERDD shall review the contractor capacity with respect to safeguard management and contracts shall be awarded accordingly. ▪ The Contractor will be required to define an Occupational and Environmental Health and Safety procedure for all work, including work camp operation, management of cement	PMU	-	BC: during detailed designin g of the sub-project

Project Activities	Section	Impact	Mitigation Measures Recommended	Responsibility		Timing
				Execution	Monitoring	
			dust, and use of Personal Safety Equipment. These procedures shall be developed and approved by the PMU in collaboration with the focal agencies before the Contractor commences any physical works on ground. ▪ PMU KP LGERDD shall ensure the project contractors are selected on merit and necessary fundshasbeen allocated in the contract documents for EMP implementation and monitoring			
	1.7	Identification of Locations for Labor Camps and ancillary facilities	▪ In order to prevent a nuisance, specific locations shall be designated for development of the labor camps. All necessary facilities and amenities shall be provided in these camps such as resting area, drinking water, electricity, supply of water. ▪ Solid and liquid effluent waste disposal facilities shall also be designed to cater waste of administration/office building etc. ▪ The use of proper planning while identifying locations for the labor camps will ensure there is minimal disturbance to all key receptors and the traffic is not disrupted by labor camps being set up roadside next to the construction sites	PMU		BC: during detailed designin g of the sub-project
	1.8	Land Acquisition	The PMU KP LGERDD shall ensure the following:	EDCM	PMU	

Project Activities	Section	Impact	Mitigation Measures Recommended	Responsibility		Timing
				Execution	Monitoring	
		and Resettlement Impacts	▪ PMU KPCIP social safeguard unit and local district adminsteration/revenue department will ensure that grievances and reservations of project affected people are adequately addressed. ▪ Due payment to all land owners must be paid before mobilization of construction contractors. ▪ Social safeguard unit shall ensure that project affected people has been paid following appropriate procedures and there are no grievances about land acquisition process. ▪ PMU KPCIP will expedite the process of land acquisition for proposed 16 surface tanks. ▪ PMU will ensure that no land acquisition issue left before start of construction works and grievances are adequately addressed.			
	1.9	Impacts due to Natural hazards	▪ The PMU KP LGERDD shall ensure the proposed infrastructure shall be designed keeping in view the seismic zone 3 building considerations. ▪ Infrastructure shall be designed to withstand high speed winds.	EDCM	PMU	BC: during detailed designin g of the sub-project

Project Activities	Section	Impact	Mitigation Measures Recommended	Responsibility		Timing
				Execution	Monitoring	
			▪ Surface water diversion shall be included in the design to protect intake strcuturesfrom flash flooding. ▪ Extreme precipitation events analysis shall be performed for i.e. 100 years, to predict and manage impacts of flash flooding on intake structures. ▪ On site waste storage at loading bay shall be kept to minimum during high precipitation events. ▪ Emergency response plan shall be prepared by construction and operation phase contractors and will be submitted to PMU for approval to manage impacts of natural hazards such as earth quakes and floods			
Construction Phase	2.1	Construction of water treatment plant and other structures not in accordance with finalized design	▪ Method statements must be prepared by the Contractor and approved by the Construction Supervision Consultant (CSC) prior to commencement of construction works. ▪ The CSC must closely monitor the construction works being conducted by the Contractor to ensure the finalized design is implemented in full and the WTP design is developed completely in compliance of the approved finalized	Contractor	CSC, PMU	DC

Project Activities	Section	Impact	Mitigation Measures Recommended	Responsibility		Timing
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			designs. ▪ Any deviation by the Contractor from following the finalized design must be immediately highlighted and corrective measures must be implemented to ensure full compliance with the finalized design of the WTP, Intake Structure and water supply. ▪ PMU KP LGE RDD shall ensure that construction activities are being carried out in compliance to project design following best international practices. It will closely review and monitor the activities of CSC and contractors involved in construction activities.			
	2.2	Construction of water supply networks and transmission main	Mitigation measures adopted for construction of water supply networks and transmission main are provided below: ▪ Prior to starting of work, the contractor shall prepare a method statement for water supply pipeline works. This shall be simple and explain the contractor's work process that is actually conducted on site, with safety and safeguard concerns.			

Project Activities	Section	Impact	Mitigation Measures Recommended	Responsibility		Timing
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			▪ Method Statement is very important, particularly for water supply pipeline works along the roads. ▪ Method Statement can be prepared for each stretch (say 1 km) /specific site based on the project area. ▪ Method Statement shall be in a Table format with appended site layout map and cover the following: ○ Work description ○ No. of workers (skilled & unskilled) ○ Details of Plant, equipment & machinery, vehicles ○ Work duration (total, and activity-wise, for example for pipe laying, from excavation to road resurfacing/testing) ○ PPE (helmet, gloves, boots, etc.) details for each type of work ○ Details of materials at each site (type & quantity) ○ Risks/hazards associated with the work (for example, Trench excavation will have risks such as trench			

Project Activities	Section	Impact	Mitigation Measures Recommended	Responsibility		Timing
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			collapse, persons/vehicles falling into trench, structural risk to nearby buildings, damage to buildings, infrastructure etc.) ○ Construction waste/debris generated (details & quantity) ○ Detail the sequence of work process (step-by-step) including specific details of each work ○ Contractor's supervision & management arrangements for the work ○ Emergency: Designate (i) responsible person on site, and (ii) first aider ○ Typical site layout plan including pipe trenching, placement of material, excavated earth, barricading etc. ▪ The following shall be included in the site layout plan: ○ Provide barricading/security personnel at the site to prevent entry/trespassing of pedestrian/vehicles into the work zone.			

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<tr><th rowspan="2">Project Activities</th><th rowspan="2">Section</th><th rowspan="2">Impact</th><th rowspan="2">Mitigation Measures Recommended</th><th colspan="2">Responsibility</th><th rowspan="2">Timing</th></tr>
<tr><th>Execution</th><th>Monitoring</th></tr>
<tr><td></td><td></td><td></td><td>o Location of temporary stockpiles and provision of bunds
o Separation of stockpiles areas with workers/vehicle movement paths to avoid disturbing the stockpiled soil
o Wetting of soil to arrest dust generation by sprinkling water
o Waste/surplus soil utilization and disposal plan – indicate expected duration of temporary stockpiling along the trench at each site and identify final surplus soil utilization/disposal site in consultation with CSC/PMU.
▪ PMU KPCIP will ensure the identification of disposal sites for unsuitable excavated material in consultation with CSC/WSSC Swat.
▪ CSC will inspect and monitor the borrow material areas prior to procurement to ensure that it is being used in sustainable way and no significant disfiguration of landscape is going on at quarry site.
▪ Stock piling of excavated material at places that are congested will be avoided as these</td><td></td><td></td><td></td></tr>
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<tr><th rowspan="2">Project Activities</th><th rowspan="2">Section</th><th rowspan="2">Impact</th><th rowspan="2">Mitigation Measures Recommended</th><th colspan="2">Responsibility</th><th rowspan="2">Timing</th></tr>
<tr><th>Execution</th><th>Monitoring</th></tr>
<tr><td rowspan="2"></td><td></td><td></td><td>piles can create traffic issues and public nuisance.
▪ Already available quarry sites for additional backfill material will be utilized. Development of new quarry site will be discouraged.
▪ Record of borrow materials will be maintained including details of quarry site, agreement and necessary approvals from concerned government authorities</td><td></td><td></td><td></td></tr>
<tr><td>2.3</td><td>Degradation of air quality due to construction works</td><td>▪ At the WTP and the immediately adjoining areas, water will be sprinkled every three hours and at a higher frequency if felt necessary, at all construction sites to suppress dust emissions.
▪ All heavy equipment and machinery shall be fitted in full compliance with the national and local regulations.
▪ Stockpiled soil and sand shall be slightly wetted before loading, particularly in windy conditions.
▪ Fuel-efficient and well-maintained haulage trucks shall be employed to minimize exhaust emissions.
▪ Vehicles transporting soil, sand and other construction materials shall be covered with</td><td>Contractor</td><td>CSC, PMU</td><td>DC</td></tr>
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Project Activities	Section	Impact	Mitigation Measures Recommended	Responsibility		Timing
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			tarpaulin. ▪ Limitations to speeds of such vehicles as felt necessary. Transport through densely populated area shall be avoided. ▪ Concrete plants to be controlled in line with statutory requirements and shall not be close to sensitive receptors. ▪ Stack height of generators will be at least 3 meters above the ground. ▪ Project traffic will maintain maximum speed limit of 20 km/hr. on all unsealed roads within project area. ▪ A minimum distance of 300 meters will be ensured between batching plant(s) and the nearest community. ▪ The need for large stockpiles shall be minimized by careful planning of the supply of materials from controlled sources. Stockpiles shall not be located within 50 m of schools, hospitals or other public amenities and shall be covered with tarpaulin when not in use and at the end of the working day to enclose dust. If large stockpiles (>25m^3) of crushed materials are necessary, they shall be enclosed with side barriers and also covered			

Project Activities	Section	Impact	Mitigation Measures Recommended	Responsibility		Timing
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			when not in use. ▪ Dust emissions due to road travel shall be minimized through good construction practices (such as keeping stock piles down wind and away from communities) and sprinkling water over the access road. ▪ Maintaining levels of contaminant dusts, vapors and gases in the work environment at concentrations below those recommended as TWA-TLV's (threshold limit value)—concentrations to which most workers can be exposed repeatedly (8 hours/day, 40 hrs./week, week-after week), without sustaining adverse health effects. ▪ Developing and implementing work practices to minimize release of contaminants into the work environment including: o Direct piping of liquid and gaseous materials o Minimized handling of dry powdered materials; Enclosed operations o Local exhaust ventilation at emission/release points o Vacuum transfer of dry material rather than mechanical or pneumatic			

Project Activities	Section	Impact	Mitigation Measures Recommended	Responsibility		Timing
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			conveyance o Indoor secure storage, and sealed containers rather than loose storage ▪ Where ambient air contains several materials that have similar effects on the same body organs (additive effects). It shall be ensured that the following measures are taken to control emissions from vehicles being used in the construction activity: ▪ Periodically check and conduct maintenance of the construction machinery and haul vehicles. Generators, compressors and vehicles used during construction works will be maintained in a good condition to ensure that emissions are kept to a minimum level. ▪ Regularly change the engine oil and use new engines/machinery/equipment having good efficiency and fuel burning characteristics. ▪ Controlled technology generator and batching plants will be used to avoid excessive emissions. ▪ Burning of wastes at any site will not be			

Project Activities	Section	Impact	Mitigation Measures Recommended	Responsibility		Timing
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			allowed. ▪ The stack height of generators will be at least 3 meters above the ground. ▪ Training of the technicians and operators of the construction machinery and drivers of the vehicles. ▪ All type of machinery and generator must comply with the NEQS. Vehicles, which are not in compliance with NEQS are not allowed to use. ▪ Periodic emission monitoring of vehicles, generator and batching plants is proposed. ▪ Project activities shall be planned to avoid harsh weather conditions. ▪ All heavy equipment, machinery and vehicle shall be fitted in full compliance with the national and local regulations. ▪ Idling time will be limited 3 to 5 minutes.			
	2.4	Increased Traffic and Community Health and Safety	▪ A comprehensive traffic management plan (TMP) must be developed and implemented;	Contractor	CSC, PMU	DC

Project Activities	Section	Impact	Mitigation Measures Recommended	Responsibility		Timing
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			▪ As part of the TMP, it will be ensured that the movement of heavy vehicles used during laying of pipeline is minimized during the peak traffic hours of the day in order to prevent congestion and accidents as far as possible; ▪ Furthermore, the movement of heavy vehicles within Mingora city during laying of pipeline must be restricted to specific routes containing least number of sensitive receptors and low traffic volumes. ▪ Work areas outside the project site, especially where machinery is involved, will be barricaded and will be constantly monitored to ensure that local residents, particularly children stay away while excavated areas being prepared for laying of pipelines will be cordoned off. Also, no machinery will be left unattended, particularly in running condition. ▪ Local communities in the project area will be briefed on traffic safety, especially women who are the main care providers to children. ▪ Temporary walkways shall be constructed on trenches for providing passage commuters. ▪ Speed limit of 20 km/hr. will be maintained by all project related vehicles and nighttime driving of project vehicles will be limited where possible. ▪ Educate drivers on safe driving practices to minimize accidents and to prevent spill of hazardous substances and other construction materials during transport.			

Project Activities	Section	Impact	Mitigation Measures Recommended	Responsibility		Timing
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			▪ Contractor must take proper safety measures (placing warning tapes around excavations) to avoid people, especially children, accidentally falling into excavations. ▪ All the working platforms must be cordon off with special care by well-trained skilled workers. ▪ Contractor will prepare construction management plan which will include the hazard prevention and safety plan, which will address health and safety of the people in the project area. ▪ PMU KP LGERDD shall ensure the contractor staff working in the project are well trained and educated in the Health, Safety and Environment (HSE) hazards associated with their duties, and that of the public, in the project area			
	2.5	Injuries to workers from lack of necessary training and/or not using PPEs etc.	**General** ▪ The Contractor will be required to prepare and implement an effective OHS Plan that is supported by trained first aid personnel and emergency response facilities. Construction contracts will include standard OHS measures and contractors will be bound to implement these fully. ▪ Monitoring will be required to ensure that the OHS plan based on contract specifications is followed. ▪ Cement feed hopper areas will be inspected daily to ensure compliance with the	Contractor	CSC, PMU	DC

Project Activities	Section	Impact	Mitigation Measures Recommended	Responsibility		Timing
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			requirement of dust masks. ▪ Surfaces (including flooring and work surfaces) in camps, kitchens, dining areas and workshops shall be solid and easy to clean. Flooring for work camps must be float finished concrete or better. ▪ All drivers engaged by Contractors must hold a valid license for the vehicle they are operating. ▪ Work in confined space shall be executed with available safety standards. Adequate monitoring and equipment shall be available to detect deficient oxygen levels. ▪ The Contractor shall submit to the Engineer of CSC for approval an emergency evacuation plan and practice the procedure annually. ▪ The Contractor shall submit to the Engineer of CSC for approval a site layout plan, identifying work areas, accommodation, kitchen, dining area, sanitary facilities, location of generators, plant and vehicle parking, transport routes through the camp, pedestrian routes through the camp, evacuation routes, emergency exits, batching plants, storage areas, waste facilities etc. ▪ Fire extinguishers shall be provided throughout camps and work sites. Fire extinguishers shall be inspected monthly and			

Project Activities	Section	Impact	Mitigation Measures Recommended	Responsibility		Timing
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			maintained as necessary. ▪ An adequate and reliable supply of safe drinking water shall be made available at readily accessible and suitable places including at all camps. ▪ The Contractor shall take samples from each supply of drinking water and arrange for analysis of these samples at EPA certified laboratory prior to its use by the Contractor's staff. The results of these tests for each supply must be submitted to the Engineer of CSC and must demonstrate that each water supply meets national and World Health Organization standards for drinking water. ▪ The Contractor shall provide and maintain adequate hygienic kitchens which are sheltered and separated from the living quarters. Kitchens shall include raised and washable surfaces suitable for food preparation. ▪ The Contractor shall provide and maintain adequate hygienic dining areas for staff. Work places and camps shall be provided with both natural& artificial light. Artificial lighting shall be powered by generator in the event of power cuts. ▪ Public sensitization training shall be provided to workers to avoid social conflicts between residents and the construction contractor, Occurrence of any such impacts can be			

Project Activities	Section	Impact	Mitigation Measures Recommended	Responsibility		Timing
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			avoided by community sensitive project planning and implementation and through effective involvement of local administration. ▪ All HSE protocols shall be implemented in true letter and spirit. ▪ Contractor must appoint an HSE resource to implement, monitor and report the HSE management plan to concerned authorities. ▪ Contractor must ensure the provision of first aid facility at construction site and camps through hiring medics and establishing a dispensary at the campsite. ▪ Reasonable number of first aid kits shall be available on construction sites and within contractor camps. ▪ Based on the type of hazard applicable during the proposed works at site, the following mitigation measures as per IFC guidelines for Occupational Health and Safety (OH&S) must be implemented:16 **Mitigation Measures for Physical Hazards** ▪ Rotating and Moving Equipment ▪ Designing machines to eliminate trap hazards and ensuring that extremities are kept out of harm's way under normal			

[16] https://www.ifc.org/wps/wcm/connect/1d19c1ab-3ef8-42d4-bd6b-cb79648af3fe/2%2BOccupational%2BHealth%2Band%2BSafety.pdf?MOD=AJPERES&CVID=ls62x8l

Project Activities	Section	Impact	Mitigation Measures Recommended	Responsibility		Timing
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			operating conditions. ▪ Where a machine or equipment has an exposed moving part or exposed pinch point that may endanger the safety of any worker, the machine or equipment shall be equipped with, and protected by, a guard or other device that prevents access to the moving part or pinch point. Guards shall be designed and installed in conformance with appropriate machine safety standards. ▪ Turning off, disconnecting, isolating, and de-energizing (Locked Out and Tagged Out) machinery with exposed or guarded moving parts, or in which energy can be stored (e.g. compressed air, electrical components) during servicing or maintenance. ▪ Designing and installing equipment, where feasible, to enable routine service, such as lubrication, without removal of the guarding devices or mechanisms. **Vibration** ▪ Exposure to hand-arm vibration from equipment such as hand and power tools, or whole-body vibrations from surfaces on which the worker stands or sits, should be controlled through choice of equipment, installation of vibration dampening pads or devices, and limiting the duration of exposure. Limits for vibration and action values. Exposure levels shall be checked on			

Project Activities	Section	Impact	Mitigation Measures Recommended	Responsibility		Timing
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			the basis of daily exposure time and data provided by equipment manufacturers. **Electrical** ▪ Marking all energized electrical devices and lines with warning signs; ▪ Locking out (de-charging and leaving open with a controlled locking device) and tagging-out (warning sign placed on the lock) devices during service or maintenance; ▪ Checking all electrical cords, cables, and hand power tools for frayed or exposed cords and following manufacturer recommendations for maximum permitted operating voltage of the portable hand tools; · ▪ Double insulating / grounding all electrical equipment used in environments that are, or may become, wet; using equipment with ground fault interrupter (GFI) protected circuits; · ▪ Protecting power cords and extension cords against damage from traffic by shielding or suspending above traffic areas; · ▪ Conducting detailed examination and marking of all buried electrical wiring prior to any excavation work. ▪ Appropriate labeling of service rooms housing high voltage equipment (‘electrical			

Project Activities	Section	Impact	Mitigation Measures Recommended	Responsibility		Timing
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			hazard') and where entry is controlled or prohibited; · **Eye Hazards** ▪ Use of machine guards or splash shields and/or face and eye protection devices, such as safety glasses with side shields, goggles, and/or a full-face shield. Specific Safe Operating Procedures (SOPs) may be required for use of sanding and grinding tools and/or when working around liquid chemicals. Frequent checks of these types of equipment prior to use to ensure mechanical integrity is also good practice. Machine and equipment guarding shall conform to standards published by organizations such as CSA, ANSI and ISO. **Welding/Hot Work** ▪ Provision of proper eye protection such as welder goggles and/or a full-face eye shield for all personnel involved in, or assisting, welding operations. Additional methods may include the use of welding barrier screens around the specific work station (a solid piece of light metal, canvas, or plywood designed to block welding light from others). Devices to extract and remove noxious fumes at the source may also be required. · ▪ Special hot work and fire prevention precautions and Standard Operating Procedures (SOPs) shall be implemented if			

Project Activities	Section	Impact	Mitigation Measures Recommended	Responsibility		Timing
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			welding or hot cutting is undertaken outside established welding work stations, including 'Hot Work Permits, stand-by fire extinguishers, stand-by fire watch, and maintaining the fire watch for up to one hour after welding or hot cutting has terminated. Special procedures are required for hot work on tanks or vessels that have contained flammable materials. **Industrial Vehicle Driving and Site Traffic** ▪ Training and licensing industrial vehicle operators in the safe operation of specialized vehicles such as forklifts, including safe loading/unloading, load limits. · ▪ Ensuring drivers undergo medical surveillance. · ▪ Ensuring moving equipment with restricted rear visibility is outfitted with audible back-up alarms. · ▪ Establishing rights-of-way, site speed limits, vehicle inspection requirements, operating rules and procedures (e.g. prohibiting operation of forklifts with forks in down position), and control of traffic patterns or direction. · ▪ Restricting the circulation of delivery and private vehicles to defined routes and areas, giving preference to 'one-way' circulation, where appropriate.			

Project Activities	Section	Impact	Mitigation Measures Recommended	Responsibility		Timing
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			▪ Ergonomics, Repetitive Motion, Manual Handling ▪ Facility and workstation design with 5th to 95th percentile operational and maintenance workers in mind. ▪ Use of mechanical assists to eliminate or reduce exertions required to lift materials, hold tools and work objects, and requiring multi-person lifts if weights exceed thresholds. ▪ Selecting and designing tools that reduce force requirements and holding times and improve postures. ▪ Providing user adjustable workstations. ▪ Incorporating rest and stretch breaks into work processes and conducting job rotation. · ▪ Implementing quality control and maintenance programs that reduce unnecessary forces and exertions. · ▪ Taking into consideration additional special conditions such as left-handed persons. ▪ Working at Heights ▪ Installation of guardrails with mid-rails and toe boards at the edge of any fall hazard area. · ▪ Proper use of ladders and scaffolds by trained employees. ·			

Project Activities	Section	Impact	Mitigation Measures Recommended	Responsibility		Timing
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			▪ Use of fall prevention devices, including safety belt and lanyard travel limiting devices to prevent access to fall hazard area, or fall protection devices such as full body harnesses used in conjunction with shock absorbing lanyards or self-retracting inertial fall arrest devices attached to fixed anchor point or horizontal life-lines. · ▪ Appropriate training in use, serviceability, and integrity of the necessary PPE. · ▪ Inclusion of rescue and/or recovery plans, and equipment to respond to workers after an arrested fall. **Fire and Explosions** ▪ Storing flammables away from ignition sources and oxidizing materials. Further, flammables storage area should be: ▪ Remote from entry and exit points into camps ▪ Away from facility ventilation intakes or vents ▪ Have natural or passive floor and ceiling level ventilation and explosion venting ▪ Use spark-proof fixtures ▪ Be equipped with fire extinguishing devices and self-closing doors, and constructed of materials made to withstand flame impingement for a moderate period of time. ▪ Defining and labeling fire hazards areas to			

Project Activities	Section	Impact	Mitigation Measures Recommended	Responsibility		Timing
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			warn of special rules (e.g. prohibition in use of smoking materials, cellular phones, or other potential spark generating equipment). ▪ Providing specific worker training in handling of flammable materials, and in fire prevention or suppression. ▪ Corrosive, oxidizing, and reactive chemicals ▪ Corrosive, oxidizing and reactive chemicals should be segregated from flammable materials and from other chemicals of incompatible class (acids vs. bases, oxidizers vs. reducers, water sensitive vs. water based, etc.), stored in ventilated areas and in containers with appropriate secondary containment to minimize intermixing during spills. ▪ Workers who are required to handle corrosive, oxidizing, or reactive chemicals shall be provided with specialized training and provided with, and wear, appropriate PPE (gloves, apron, splash suits, face shield or goggles, etc.). ▪ Where corrosive, oxidizing, or reactive chemicals are used, handled, or stored, qualified first-aid shall be ensured at all times. Appropriately equipped first-aid stations shall be easily accessible throughout the place of work, and eye-wash stations and/or emergency showers shall be provided close to all workstations where the recommended			

Project Activities	Section	Impact	Mitigation Measures Recommended	Responsibility		Timing
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			first-aid response is immediate flushing with water. **Mitigations for Biological Hazards** ▪ The Contractor shall review and assess known and suspected presence of biological agents at the place of work and implement appropriate safety measures, monitoring, training, and training verification programs. ▪ Project contractor must provide good working and sanitation conditions at camp and wok sites. Disease surveillance shall be carried out to identify any exposure to parasites, such as hookworm, ascaris, and various mites, chiggers, ticks and dengue. ▪ Measures to eliminate and control hazards from known and suspected biological agents at the place of work shall be designed, implemented and maintained in close co-operation with the local health authorities and according to recognized international standards.			
	2.6	High noise levels from construction activities	▪ Equipment noise will be reduced at source by proper design, maintenance and repair of construction machinery and equipment. Noise from vehicles and power generators will be minimized by use of proper silencers and mufflers. ▪ Excessive noise emitting equipment will not	Contractor	CSC, PMU	DC

Project Activities	Section	Impact	Mitigation Measures Recommended	Responsibility		Timing
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			be allowed to operate and will be replaced. ▪ Blowing of horns will be prohibited on access roads to work sites. ▪ Manual excavation has been proposed for congested areas to reduce generation of noise. ▪ Limited use of jack hammer in populated areas. ▪ As a rule, the operation of heavy equipment shall be conducted in daylight hours. ▪ Construction equipment, which generates excessive noise, shall be enclosed or fitted with effective silencing apparatus to minimize noise. ▪ Well-maintained haulage trucks will be used with speed controls. ▪ Use of ear plug and ear muffs must be ensured during construction. No employee shall be exposed to a noise level greater than 85 dB(A) for a duration of more than 8 hours per day without hearing protection. In addition, no unprotected ear shall be exposed to a peak sound pressure level (instantaneous) of more than 140 dB(C).			

Project Activities	Section	Impact	Mitigation Measures Recommended	Responsibility		Timing
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			▪ Prior to the issuance of hearing protective devices as the final control mechanism, use of acoustic insulating materials, isolation of the noise source, and other engineering controls shall be investigated and implemented, where feasible. ▪ Periodic medical hearing checks shall be performed on workers exposed to high noise levels. ▪ Grievance redress mechanism will be established. ▪ All the equipment and machinery used during construction phase should be well			
	2.7	Improper handling and/or disposal of hazardous and non-hazardous waste	▪ Excavated material from trenches will be stored at site and it will be used as fill/cover material after laying of pipelines while access spoil shall be transported to spoil disposal site if required. ▪ Excavated material generated during construction of WTP components i.e. sedimentation tanks, reservoir, etc will be used as a fill material with in WTP location and access spoil shall be transported to spoil disposal site if required. ▪ All types of combustible and non-combustible waste including plastic or glass bottles and cans will be temporarily stored on site and	Contractor	CSC, PMU	DC

Project Activities	Section	Impact	Mitigation Measures Recommended	Responsibility		Timing
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			later sold/handed over to a waste/recycling contractor who will utilize these wastes for recycling purposes. ▪ Waste management training for all site staff to be included in Contractor's training plan. ▪ Fuel storage areas and generators will have secondary containment in the form of concrete or brick masonry bunds. The volume of the containment area should be equal to 120% of the total volume of fuel stored. ▪ Fuel and hazardous material storage points must be included in camp layout plan to be submitted for approval. Hazardous material storage areas shall include a concrete floor to prevent soil contamination in case of leaks or spills. Fuel tanks will be checked daily for leaks and all such leaks will be plugged immediately. ▪ Designated vehicles/plant wash down and refueling points must be included in camp layout plan to be submitted for approval. ▪ Hazardous waste will be initially stored on site at designated area and then handed over to EPA certified contractor to final disposal. ▪ Record of waste generation and transfer shall			

Project Activities	Section	Impact	Mitigation Measures Recommended	Responsibility		Timing
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			be maintained by project contractors. ▪ Spill kits, including sand buckets (or other absorbent material) and shovels must be provided at each designated location. ▪ At the time of restoration, septic tanks will be dismantled and backfilled with at least 1m of soil cover keeping in view landscape of surrounding natural surface. ▪ It will be ensured that after restoration activities, the campsite is clean and that no refuse has been left behind. ▪ Clinical wastes will be temporarily stored onsite separately and will be handed over to approved waste contractor for final disposal. ▪ Training will be provided to personnel for identification, segregation and management of waste. ▪ The structure of a Framework waste management plan has been prepared for the project and attached as Annexure M and contractors will be required to prepare waste management plan for the site in light of guidelines provided in the waste management plan and submit to PMU for approval			

Project Activities	Section	Impact	Mitigation Measures Recommended	Responsibility		Timing
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	2.8	Untreated disposal of effluent from worker camps and batching plant(s) and construction sites	▪ It will be ensured that no untreated effluent is released to the environment. ▪ A closed sewage treatment system including soak pits and septic tank will be constructed to treat the effluent from the construction/labor camps. ▪ Sewage treatment system will be installed at each respective labor camp based on the number of laborers residing at the respective camp. ▪ Wastewater from laundry, kitchen washings and showers will be disposed-off into soak pits or septic tank (where soak pit cannot be constructed) and after treatment it will disposed of in TMA provided drains in the project area. ▪ Soak pits will be built in absorbent soil and shall be located 300 m away from a water well, hand pump or surface water body. Soak pits in non-absorbent soil will not be constructed. ▪ Ensure that the soak pits remain covered all the time and measures are taken to prevent entry of rainwater into them. ▪ Sprinkling of grey water or sewage will not be allowed; in case the septic tank gets filled with	Contractor	CSC, PMU	DC

Project Activities	Section	Impact	Mitigation Measures Recommended	Responsibility		Timing
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			sludge, septic tank shall be emptied through vacuum truck and material shall be transferred to treatment facility or approved municipal drain. ▪ Water being released from any batching plant(s) must be treated as per requirements of NEQS prior to release to sewerage system/any other water body. ▪ Sewage at the end of construction period to be disposed of in nearest municipal drains after getting approval from concerned municipal authorities			
	2.9	Soil Contamination	▪ It will be ensured that spill prevention trays are provided and used during refueling. Also, on-site maintenance of construction vehicles and equipment will be avoided as far as possible. In case on-site maintenance is unavoidable, tarpaulin or other impermeable material will be spread on the ground to prevent contamination of soil. ▪ Regular inspections will be carried out to detect leakages in construction vehicles and equipment and all vehicles will be washed in external commercial facilities. ▪ Fuels, lubricants and chemicals will be stored in covered bounded areas, underlain with impervious lining. Appropriate arrangements, including shovels, plastic bags and absorbent	Contractor	CSC, PMU	DC

Project Activities	Section	Impact	Mitigation Measures Recommended	Responsibility		Timing
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			materials will be available near fuel and oil storage areas.			
	2.10	Employment Conflicts	▪ The Construction Contractor will adopt a transparent hiring policy. Prior to the commencement of the construction activity, the local communities in the project area will be informed of the employment policy in place and number of people that can be employed for this project. ▪ It will be ensured that maximum number of unskilled and semi-skilled jobs will be provided to the residents of the project area. ▪ The PMU will ensure a balanced process of employment of the communities in the project area with preference given to those most directly affected by the project.	Contractor	CSC, PMU	DC
	2.11	Communicable diseases incl. COVID-19	▪ A communicable diseases prevention program will be prepared for construction workers or residents near the construction sites. **COVID-19 specific measures** ▪ All workers must perform complete sanitization at the site as per SOPs/guidelines issued by WHO. ▪ All workers must wear a mask as soon as they arrive at site and must keep wearing it at	Contractor	CSC, PMU	DC

Project Activities	Section	Impact	Mitigation Measures Recommended	Responsibility		Timing
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			all times while present at the work site/hospital premises. ▪ As soon as workers arrive at work site, their body temperature must be checked and in case any worker is assessed to be running a fever or suffering from a flu or cough, he must be informed to leave immediately and self-isolate for a two week period and not report for work until this two week mandatory period has been completed. ▪ At the work site(s), social distancing measures must be strictly implemented and gathering of workers at any location at the work site(s) must be strictly forbidden. In case of workers not taking this measure seriously, strict penalties must be imposed to ensure implementation. ▪ The work tasks must be divided into shifts, as far as possible, to reduce the workforce present at the work site(s) at any one moment and improve the working speed/efficiency. ▪ All workers will be strictly advised to wash their hands as frequently as practicable and not to touch their face during work. ▪ A supply of safe drinking water will be made available and maintained at the project			

Project Activities	Section	Impact	Mitigation Measures Recommended	Responsibility		Timing
				Execution	Monitoring	
			site(s). ▪ COVID-19 awareness sign boards must be installed at the clinic premises and at the work site(s). ▪ Contact details of all workers will be kept in a register on site in order to efficiently trace and manage any possible workers that might experience symptoms of COVID-19. ▪ Prohibition of entry for local community/any unauthorized persons at work sites. ▪ Proper hygiene practices in the toilets and washrooms will be implemented with proper and adequate use of soaps and disinfectant spray. ▪ Social distancing must be maintained during the pick-up and dropping off of workers from their residences to and from the work site(s). ▪ Adequate ventilation shall be provided in dining areas, resting places and sleeping areas.			
	2.12	Vegetation and Wildlife Loss	▪ Consideration has been given to the visual appearance of the WTP site during operation. Necessary plantation will be carried out, which will act as buffer zone from surrounding environment. Reasonable area has been	Contractor	CSC, PMU	DC

Project Activities	Section	Impact	Mitigation Measures Recommended	Responsibility		Timing
				Execution	Monitoring	
			allocated for plantation to improve landscape of the area. ▪ Off-road travel will be strictly prohibited and observance of this will be monitored during execution of the project. and ▪ Vehicles speed will be regulated and monitored to avoid excessive dust emissions. ▪ No hunting or killing of animals will be permitted. ▪ No cutting down of vegetation or using vegetation or trees as firewood will be permitted.			
	2.13	Historical/Archaeological Sites	▪ If evidence of any archaeological remains is found during the construction activities, the excavation work will be stopped immediately, and necessary next steps taken to identify the archaeological discovery based on the 'Chance Find' procedures provided as **Annexure F**.	Contractor	CSC, PMU	DC
	2.14	Construction of Admin Building and other infrastructure	▪ Water will be sprinkled regularly to suppress dust emissions. Off road travelling of vehicles will be prohibited. ▪ Stock piles will be appropriately located and out of wind to avoid dust emissions. Dry dusty	Contractor	CSC, PMU	DC

Project Activities	Section	Impact	Mitigation Measures Recommended	Responsibility		Timing
				Execution	Monitoring	
			materials shall be sprinkled with water and properly covered to avoid dust emissions. ▪ No cement and concrete waste will be left unattended. Construction debris will not be thrown from height to avoid dust emissions. Return unpaved areas to original or improved contours following construction. ▪ Solid waste generated from construction of admin building will be managed through site specific EMMP and no waste will be stored at site to improve housekeeping at site and to avoid environmental nuisance. ▪ Set protocols for proper and regular maintenance of construction machinery, vehicles and generators. Generators that will be used will be placed at suitable locations. ▪ Contractor will not be allowed to store bulk quantities of fuel or hazardous material at site. ▪ Any fuel or chemicals stored at site (in small quantities) will be stored at designated site and containers/storage vessels be properly marked for their contents. Storage area will be provided with hard impervious surface and secondary containment.			

Project Activities	Section	Impact	Mitigation Measures Recommended	Responsibility		Timing
				Execution	Monitoring	
			▪ Equipment and machinery with loose vibratory parts will not be allowed to use. Used equipment and machinery will be in compliance to NEQS. ▪ Waste bins will be provided at appropriate places to mange waste. Daily housekeeping of the construction area will be carried out.			
	2.15	Site restoration	▪ Demobilization of all equipment and machinery; ▪ Disposal of any waste material remaining at the time of completion of the operation; ▪ Backfilling of all excavation followed by compactions; ▪ Dismantling and removal of fence or barriers surrounding the campsite area; and ▪ General restoration of the site area including landscaping and restoration of drainage where required. ▪ PMU KPCIP through CSC will ensure that restoration of construction works at intake	Contractor	CSC, PMU	DC

Project Activities	Section	Impact	Mitigation Measures Recommended	Responsibility		Timing
				Execution	Monitoring	
			structures, water transmission and supply mains will be carried out by contractors. ▪ PMU KPCIP will ensure periodic monitoring of such restorations. ▪ Contractors will develop site restoration protocols and will submit to CSC/PMU for review and approval. ▪ Construction site restoration protocols will be part of bidding documents and constructions contracts. ▪ Construction contractor will add restorations costs into BOQs. ▪			
Operation Phase	3.1	Reduce downstream water availability	▪ Detailed Catchment studies has been conducted as part of designing intake flow from sources. The average daily rainfall data for 49 years (from 1961 to 2009) was collected and analyzed to get the rainfall values of 2, 5, 10, 50- & 100-year return period. Rainfall Runoff model for watershed, basin model for computation of runoff volumes has been analyzed.	O&M Contractor/ WSSC Swat	WSSC Swat, PMU	DC

<table>
<tr><th rowspan="2">Project Activities</th><th rowspan="2">Section</th><th rowspan="2">Impact</th><th rowspan="2">Mitigation Measures Recommended</th><th colspan="2">Responsibility</th><th rowspan="2">Timing</th></tr>
<tr><th>Execution</th><th>Monitoring</th></tr>
<tr><td rowspan="2"></td><td></td><td></td><td>▪ The flow measurement for Khawazakhel Intake was 46.Details of flow measurement are mention in Table 3:11 maximum flow is available 150676 cusecs in the month of July while minimum flow 1230 cusecs in the month of January are available in river Swat. Based on the available data, it can be safely concluded that sufficient environmental flows are available for downstream ecological life. Moreover, the sources has enough water availability for uninterrupted water supply for WTP</td><td></td><td></td><td></td></tr>
<tr><td>3.2</td><td>Generation of Sludge and wash water</td><td>▪ The residual disposal is carried out through:
a) Settled Sludge
▪ Two circular sludge holding tanks (one for each train) hake been proposed with a diameter of 10 m. The sludge of plain sedimentation tanks and clarifiers shall be discharge to the by pumping sludge holding tanks. The sludge from the holding tanks shall be transported into nearby landfill site.
b) Wash Water
▪ The wash water received from filter beds, contains a little number of solids. The wash water shall be discharged into drain. The same practice is also being followed at Rawal Lake Filtration Plant, Rawalpindi and Sang Jani Water Treatment Plant, Islamabad.</td><td>O&M Contractor/ WSSC Swat</td><td>WSSC Swat, PMU</td><td>DO</td></tr>
</table>

Project Activities	Section	Impact	Mitigation Measures Recommended	Responsibility		Timing
				Execution	Monitoring	
	3.3	Water system leaks and water discharges during flushing	▪ Ensure construction meets applicable standards and industry practices;8 ▪ Conduct regular inspection and maintenance; ▪ Implement a leak detection and repair program (including records of past leaks and unaccounted-for water to identify potential problem areas); ▪ Consider replacing mains with a history of leaks of with a greater potential for leaks because of their location, pressure stresses, and other risk factors. ▪ Discharge the flush water into a municipal sewerage system with adequate capacity; ▪ Discharge the flush water into a separate storm sewer system ▪ Minimize erosion during flushing, for example by avoiding discharge areas that are susceptible to erosion and spreading the flow to reduce flow velocities	O&M Contractor/ WSSC Swat	WSSC Swat, PMU	DO
	3.4	Handling of Hazardous Chemicals and Chlorine Release	▪ Chemical building has been proposed to house the facilities like storage of Alum, Lime and polymer, dose preparation facilities and dosing pumps	O&M Contractor/ WSSC Swat	WSSC Swat, PMU	DO

Project Activities	Section	Impact	Mitigation Measures Recommended	Responsibility		Timing
				Execution	Monitoring	
			▪ A chemical house of has been provided to accommodate the solution tanks, Alum Bags and other chemicals (if required). Monorail and overhead crane have been provided for handling of the chemicals. ▪ For chlorination Sodium Hypochlorite (NaOCl) will be stored in chlorination building, in which sodium hypoclorite will be mixed with water, and the solution of sodium hypochlorite and water will be fed in the chlorine contact tank through dosing pumps. In the chlorination building, monorail (capacity of 2 Ton) will be installed for the handling of sodium hypochlorite drums. ▪ Store sodium hypochlorite in cool, dry, and dark conditions for no more than one month, and use equipment constructed of corrosion-resistant materials ▪ Minimize the amount of chlorination chemicals stored on site while maintaining a sufficient inventory to cover intermittent disruptions in supply; ▪ Use corrosion-resistant piping, valves, metering equipment, and any other equipment coming in contact with gaseous or liquid chlorine, and keep this equipment free from contaminants, including oil and grease			
	3.5	Occupational Health and Safety	In order to ensure a safe and healthy working environment for the staff of the WTP and all its	O&M Contractor/ WSSC	WSSC Swat, PMU	DO

Project Activities	Section	Impact	Mitigation Measures Recommended	Responsibility		Timing
				Execution	Monitoring	
			auxiliary facilities, the following measures have to be strictly enforced, implemented and monitored: ▪ PMU KPCIP and WSSC Swat through CSC will ensure the implementation of SOPs issued by GoP and WHO related to COVID-19. ▪ Designation of an Environment, Health and Safety (EHS) officer dedicated to the site; ▪ All employees must be able to reach their work stations safely. All path, walkways, staircases, ladders and platforms must be stable and suitable for the tasks to be undertaken; ▪ Strict use of Personal Protective Equipment (PPE) by all personnel (especially staff working in Laboratory/chemical building and workshop) must be ensured. ▪ Mandatory training of all employees, including sub-contractors, on Health and Safety Practices for WTP and its auxiliary facilities. Tool Box talks are also recommended; ▪ Mandatory health and medical check-ups for all employees especially workers working at chemical building as they shall be exposed to Alum and Sodium hypochlorite ▪ Develop a written program (i.e. health information, instruction and training) which sets forth procedures, equipment, personal protective	Swat		

Project Activities	Section	Impact	Mitigation Measures Recommended	Responsibility		Timing
				Execution	Monitoring	
			equipment, and work practices that are capable of protecting employees from the health hazards of working in WTP and its auxiliary facilities; ▪ Mandatory monitoring of air quality and noise levels in the chemical building and workshop to maintain the same within local standards and whenever possible near ambient levels; ▪ Control of inhalation exposure to hazardous substances by the effective use of general ventilation within chemical building and chlorination building Local Exhaust Ventilation (LEV) the appropriate use of respiratory protective equipment (RPE); ▪ Accidental fires must be addressed immediately. Firefighting plan shall be develop and extinguishers shall be placed at appropriate location. ▪ Emergency plan (including fire management) must be developed and implemented; ▪ Availability of first-aid kits and vehicles that can be used to bring any injured employee to the nearest doctor in cases of accidents; ▪ Adequate ventilation shall be provided in dining areas, resting places and sleeping areas. ▪ Mandatory reporting of all accidents or incident of			

Project Activities	Section	Impact	Mitigation Measures Recommended	Responsibility		Timing
				Execution	Monitoring	
			near misses of accidents and immediate adoption of corrective measures; and ▪ Management must provide all the necessary financial and manpower resources for the implementation and enforcement of all health and safety programs and activities of the project; ▪ Regular training and orientation on safety practices will be implemented to impart knowledge of safe and efficient working environment. Furthermore, regular health checkups of all employees including contract workers will be conducted. Effective and proper housekeeping is recommended. Heat levels must be monitored as well. Spot checks shall be done to ensure that workers' welfare is addressed especially during summer months			
	3.6	Generation of Solid waste from WTP	A waste management plan will be developed prior to the start of construction. This plan will cater to sorting of hazardous and non-hazardous materials prior to disposal, placing of waste bins at the project sites for waste disposal and an onsite hazardous waste storage facility i.e. designated area with secondary containment. ▪ Licensed waste contractors will be engaged to dispose off all non-hazardous waste material that cannot be recycled or reused.	O&M Contractor/ WSSC Swat	WSSC Swat, PMU	DO

Project Activities	Section	Impact	Mitigation Measures Recommended	Responsibility		Timing
				Execution	Monitoring	
			▪ All types of combustible and non-combustible waste including plastic or glass bottles and cans will be temporarily stored on site and later sold/handed over to a waste/recycling contractor who will utilize these wastes for recycling purposes. ▪ Waste management training for all WTP staff to be included in training plan. ▪ Fuel storage areas and generators (if required) will have secondary containment in the form of concrete or brick masonry bunds. The volume of the containment area shall be equal to 120% of the total volume of fuel stored. ▪ Fuel and hazardous material storage points must be included in camp layout plan to be submitted for approval. Hazardous material storage areas shall include a concrete floor to prevent soil contamination in case of leaks or spills. Fuel tanks will be checked daily for leaks and all such leaks will be plugged immediately. ▪ Designated drains for vehicles/plant wash down shall be constructed and layout plan to be submitted for approval.			

Project Activities	Section	Impact	Mitigation Measures Recommended	Responsibility		Timing
				Execution	Monitoring	
			▪ Hazardous waste will be initially stored on site at designated area and then handed over to EPA certified contractor to final disposal. ▪ Record of waste generation and transfer shall be maintained by project contractors. ▪ Spill kits, including sand buckets (or other absorbent material) and shovels must be provided at each designated location. ▪ Clinical wastes will be temporarily stored onsite separately and will be handed over to approve waste contractor for final disposal. ▪ Training will be provided to personnel for identification, segregation and management of waste.			

CSC	Construction Supervision Consultant
BC	Before Construction
DC	During Construction
PMU	Project Management Unit
DO	During Operation

Table 7—2: 'Pre-Construction 'Environmental Monitoring Plan for Baseline Development

Parameter to be measured	Objective of Monitoring	Parameters to be Monitored	Measurements	Location	Frequency	Responsibility
Surface Water Quality	To establish baseline of surface water quality	NEQS/WHO Standards	Water samples for comparison against NEQS parameters	Intake, upstream and downstream locations of streams	Once	CSC
Ambient Air Quality	To establish baseline air quality levels	CO, NO_2 & PM_{10} (particulate matter smaller than 10 microns) concentration at receptor level	1-hr and 24-hr concentration levels	At three random receptor locations in the project area , both upwind and downwind	Once	CSC
Ambient Noise	To establish baseline noise levels	Ambient noise level near receptors in project area	A-weighted noise levels – 24 hours, readings taken at 15 s intervals over 15 min. every hour, and then averaged	At three random receptor locations in the project area	Once	CSC
Groundwater Quality in vicinity of project area	To establish groundwater quality in project area	Groundwater quality in project area	Water samples for comparison against NEQS parameters	At two locations around the WTP site in the project area	Once	CSC

Table 7—3: Construction Phase Monitoring Requirements

Project Activity and Potential Impact	Objective of Monitoring	Parameters to be Monitored	Measurements	Location	Frequency	Responsibility
Noise Disturbance due to noise from construction activity	To determine the effectiveness of noise abatement measures on sound pressure levels	Ambient noise level at different locations in project area	A-weighted noise levels – 24 hours, readings taken at 15 s intervals over 15 min. every hour at 15 m from receptors, and then averaged	At three random receptor locations in project area	Quarterly basis on a typical working day	Contractor's Environmental officer, CSC
Air Quality Dust emissions from construction vehicles and equipment	To determine the effectiveness of dust control program on dust at receptor level	CO,NO_2& PM_{10} (particulate matter smaller than 10 microns) concentration at receptor level	1-hr and 24-hr concentration levels	At three random receptor locations in project area	Quarterly basis on a typical working day	Contractor's Environmental officer, CSC
		Visible dust	Visual observation of size of dust clouds, their dispersion and the direction of dispersion	Construction site	Once daily during peak construction period	Contractor's Environmental officer, CSC
Surface Water Quality	To determine the effectiveness of mitigation measures	As per WHO/NEQS	Water samples for comparison against NEQS parameters	Intake, upstream and downstream locations of streamsl	Quarterly basis on a typical working day	Contractor's Environmental officer, CSC

Project Activity and Potential Impact	Objective of Monitoring	Parameters to be Monitored	Measurements	Location	Frequency	Responsibility
Safety precautions by Safety workers	To prevent accidents for workers and general public	Number of near miss events and accidents taking place	Visual inspections	Construction site	Once Daily	Contractor's Environmental officer, CSC
Soil Contamination	To prevent contamination of soil from oil and toxic chemical spills and leakages	Incidents of oil and toxic chemical spills	Visual inspections	At construction site and at vehicle and machinery refuelling & maintenance areas	Once a month	Contractor's Environmental officer, CSC
Solid Waste & Effluent disposal Insufficient procedures for waste collection, storage, transportation and disposal	To check the availability of waste management system and implementation	Inspection of solid and liquid effluent generation, collection, segregation, storage, recycling and disposal will be undertaken at all work sites in project area	Visual inspections	At work sites in project area	Once daily	Contractor's Environmental officer, CSC

Table 7—4: 'Operation Phase' Environmental Monitoring Plan

Parameter to be measured	Objective of Monitoring	Parameters to be Monitored	Measurements	Location	Frequency	Responsibility
Surface Water Quality at Intake structure	To determine the effectiveness of mitigation measures	As per WHO/NEQS	Water samples for comparison against NEQS parameters	Intake, upstream and downstream locations of streams	Bi-annual basis on a typical working day	WSSC Swat
Water Quality at Distribution network	To ensure good water quality is provided to customers	As per WHO/NEQS	Water samples for comparison against NEQS parameters	Water samples from surface tanks, and OHRs	Quarterly basis	WSSC Swat
Sludge and Wash water	To assess whether Sludge and wash water generated during operation of WTP is disposing as per procedure.	Sludge and wash water	Analysis of Sludge and wash water	Sludge holding tank Sand Filters	Bi-annual	WSSC Swat
Solid Waste Management Plan	To assess that solid waste generated from WTP and GWSS operation is managed as per IEE/EMP requirements	Solid waste inventory is being maintained	Solid waste inventory audit	Each component of WTP	Monthly	WSSC Swat

Table 7—5: Capacity Development and Training Programme

Provided by	Organized by	Contents and Methodology	Target Audience	Venue	Duration
Pre-construction Phase PMC offering specialized services in environmental management and monitoring	CSC & PMU	Short seminars and courses on: Environmental Management Plan and Environmental Monitoring Plan Methodology: Participatory approach with a before and after quiz or survey to measure the effectiveness of the program	Contractor staff	WSSC Office, Swat	One day long training seminar including group exercise/workshop
Construction Phase PMC offering specialized services in social management and monitoring	CSC & PMU	Short seminar on Environmental risks associated with construction phase. Development of Environmental Performance Indicators Occupational Health and Safety (OHS) issues Methodology: Participatory approach with a before and after quiz or survey to measure the effectiveness of the program	Contractor staff	WSSC Office, Swat	One day long training seminar including group exercise/workshop
Operation Phase Water Treatment Plant Operator authorized representative or 3rd party trainer	WSSC Swat & PMU	Short seminars on Environmental risks associated with operation phase. Development of Environmental Performance Indicators/ Occupational Health and Safety (OHS) issues Methodology: Participatory approach with a before and after quiz or survey to measure the effectiveness of the program	O&M contractor	Training Hall of WTP facility	One day long training seminar including group exercise/workshop

7.8 Environmental Management Costs

516. The Table 7.6 below provides cost estimates for 'Pre-Construction phase' monitoring while Tables 7.7 and 7.8 provides cost estimates for 'Construction phase' and 'Operation phase' monitoring of key environmental parameters.

517. The costs associated with implementation of the EMP and the necessary mitigation measures are provided as Table 7.9 below. The Table 7.10 below provides the 'Capacity development and training programmer' for project contractors for the proposed Mingora Greater Water Supply Scheme development.

Table 7—6: Annual Cost Estimates for 'Pre-Construction Phase' Environmental Monitoring[17]

Monitoring Component	Parameters	Quantity	Amount PKR	Details
Surface water Quality	NEQS/WHO	6 (once only at 3 locations for 02 streams)	180,000	6 readings @ PKR 30,000 per sample
Air Quality	CO, NO_2, SO_2, O_3 PM_{10}	3 (Once only at 3 locations)	90,000	3 readings @ PKR 30,000 per sample
Noise Levels	dB(A)	3 (Once only at 3 locations)	90,000	3 readings @ PKR 30,000 per reading
Ground Water Quality	NEQS	2 (Once only at 2 locations)	60,000	2 readings @ PKR 30,000 per sample
Contingencies			21,000	5% of monitoring cost
Total (PKR)			**441,000**	

[17] For air quality monitoring: 'Passive samplers' such as test tubes can be used or 'Active samplers' with sorbent turbes can also be used.

[29] For noise monitoring: sampling equipment with duration greater than 1 hour can be used.

Table 7—7: Annual Cost Estimates for 'Construction Phase' Environmental Monitoring[18]

Monitoring Component	Parameters	Quantity	Amount PKR	Details
Surface Water Quality	NEQS/WHO	24 (Quarterly at 3 locations for 02 streams)	720,000	24 readings @ PKR 30,000 per sample
Air Quality	CO, NO_2, PM_{10}	12 (Quarterly basis at 3 locations)	360,000	12 readings @ PKR 30,000 per sample
Noise Levels	dB(A)	12 (Quarterly basis at 3 locations)	360,000	12 readings @ PKR 30,000 per reading
Contingencies			72,000	5% of monitoring cost
Total (PKR)			**1512,000**	

Table 7—8: Annual Cost Estimates for 'Operation Phase' Environmental Monitoring

Monitoring Component	Parameters	Quantity	Amount PKR	Details
Surface Water Quality at Intake structure	NEQS/WHO	12 (bi-annual only at 3 locations for 02 streams)	360,000	12 readings @ PKR 30,000 per sample
Water Quality at distribution network	NEQS/WHO	24 (Quarterly at 06 location of surface water reservoirs and OHRs)	720,000	24 readings @ PKR 30,000 per sample
Sludge	NEQS	2 (bi-annual basis)	60,000	2 readings @ PKR 30,000 per sample
Wash water	NEQS	2 (bi-annual basis)	60,000	2 readings @ PKR 30,000 per sample
Contingencies			60,000	5% of monitoring cost
Total (PKR)			**1260,000**	

Table 7—9: Estimated Costs for EMP Implementation

Item	Sub-Item	Estimated Total Cost (PKR)
Staff, audit and monitoring cost[19]	1 person for 24 months (@ 100,000 per month)	**2,400,000**
Monitoring Activities	Provided separately in Tables 7.7 and 7.8.	-
Mitigation Measures	As prescribed under EMP and IEE.	**40,00,000**
(i) Water sprinkling	To suppress dust emissions	800,000
(ii) Solid waste collection &disposal	From construction sites (based on initial estimates)	700,000
(iii) Plantation around project boundary to provide buffer	To plant vegetation all along the SWTP boundary to limit odor emissions	15,00,000
(iv) Chemicals/pesticides to prevent/minimize disease vector generation	Chemicals to be injected into the influent streams in order to minimize/prevent disease vector generation	10,00,000
Contingencies	5% of EMP implementation cost	320,000
Total Estimated Cost (PKR)		**6,720,000**

[19] To cover staff cost of expense of environmental specialist for contractor

Table 7—10: Capacity Development and Training Programme for Project Contractor(s)

Provided by	Organized by	Contents and Methodology	No. of training events	Duration	Cost (PKR)
Pre-construction Phase Monitoring Consultants/Organizations offering specialized services in environmental management and monitoring	CSC & PMU	Short seminars and courses on: Environmental Management Plan and Environmental Monitoring Plan Methodology: Participatory approach with a before and after quiz or survey to measure the effectiveness of the program	Two seminars for Contractor management staff and project staff	1 day	100,000/Training
Construction Phase Monitoring Consultants/Organizations offering specialized services in environmental management and monitoring	CSC & PMU	Short seminars on Environmental risks associated with construction phase. Development of Environmental Performance Indicators Occupational Health and Safety (OHS) issues Methodology: Participatory approach with a before and after quiz or survey to measure the effectiveness of the program	Two seminars for Contractor management staff and project staff dealing in environment and social issues	1 day	100,000/Training
Operation Phase **Water Treatment Plant Operator authorized representative or 3rd party trainer**	PHED	Short seminars on Environmental risks associated with operation phase. Development of Environmental Performance Indicators Occupational Health and Safety (OHS) issues Methodology: Participatory approach with a before and after quiz or survey to measure the effectiveness of the program	Bi-annual seminars	1-2 Day	600,000/Year
Total			**800,000 (PKR 0.8 million)**		

8 Public Consultation and Information Disclosure

518. This section describes the process and outcomes of the consultations carried out with various groups of stakeholders as part of the environmental and social assessment. It includes a brief discussion on the concerns expressed by the stakeholders during the consultation meetings and responses provided in order to address the concerns through necessary mitigation measures.

519. The specific objectives of the consultation were: (i) obtaining local and indigenous knowledge about the environment and people living in the project area; (ii) interaction with the project affected population and other stakeholders for the collection of primary and secondary data on environment and people; and (iii) engaging stakeholders for maximization of the project benefits.

520. The public consultation process was carried out by the KPCIP-EDCM team from start in May, 2020, March, 2021 and May-June, 2021. Mainly key informants were consulted for these meetings which were carried out in an open and frank atmosphere conducive to appreciation of the basic elements of the project and dissemination of information on beneficial and adverse impacts and mitigation for adverse impacts.

521. The stakeholders were also briefed by Environment Associate Mr Asad Jan and Senior Sociologist PMU Hashmat Khan as well. Total 7 FGDs was conducted in seies at Community Center, Daral-ul-Aloom School in Khwazakhela, local hujra and Hujra of Sohrab Khan in charbagh and AC office Charbagh and DC office Mingora. Consultations were carried with local notables and people of Charbagh, Babuzai and Khawzakhela participated in these sessions. Information on positive and negative impacts associated with constructional and operational stage and proper mitigation of adverse impacts were shared at these consultations.

8.1 Identification of Stakeholders

522. Stakeholders are considered to be individuals or organizations which have an interest in the proposed project or knowledge that will provide insight into issues or affect decision making related to the proposed project. On the basis of interest and role criteria there are two types of stakeholders for the proposed project as described below.

8.1.1 Primary Stakeholders

523. The primary stakeholders are primarily the Project Affected Persons (PAPs) and general public including women residing in the project area - for example, people living in the project area particularly those affected by the footprint of proposed Mingora water supply scheme and WTP installation at Mingora City. These are the people who are directly exposed to the project’s impacts though in most cases they may not be receiving any direct benefit from the project. In Mingora water supply scheme, owners of land which will be acquired for laying of transmission line is major primary stakeholders. Series of consultaion sessions were carried out with primary stakeholders to brief them about the project and to seek their observation/suggestions. Primary Stakeholders from below Mouzas/Bandai were consulted.

Sr. No	Tehsil	Bandai/Mouza
1	Khawzakhela	Khawzakhela, Gashkor
2	Charbagh	Charbagh, Alamjang, Gulibagh,, Dakorak
3	Babuzai	Sangota, Mingora

8.1.2 Secondary Stakeholders

524. The secondary stakeholders are typically institutional stakeholders – for instance, related government department/agencies, local government, and organizations that may not be directly affected by the project; however, they may influence the project and its design. In the case of the proposed WTP and greater water supply scheme site development, the secondary stakeholders are as follows:

- Irrigation Department
- C&W Department
- Fisheries Department
- KP Highway Department
- Public Health Department
- Representatives of local communities
- Water and Sanitation Services Company, Swat
- Public at large

8.1.3 Key stakeholders

525. The stakeholders considered possessing the ability to significantly influence a project, or who are critical to the success of a project are considered key stakeholders. Key stakeholders may be from the primary and/or secondary stakeholder groups. In this context of the proposed project development, these are considered to be local leaders (MNAs), influential community members (Mashars) and other local representatives including Imams of mosques and teachers of local schools.

8.2 Information Disclosure and Consultation

8.2.1 Scope of Consultations

526. All consultations were carried out in accordance with the 'meaningful consultation' guidelines of ADB's SPS 2009 and their outcome is discussed in the proceeding sections. Consultations were also held with the PMU, KPCIP and the design consultants.

527. As part of the present environmental and social assessment, detailed consultations with different stakeholders were conducted through focus group discussions (FGDs) with the communities, including women in the project area. Separate meetings were held with the institutional stakeholders in the form of one-to one meetings i.e. with EPA, WSSC Swat, Deputy Commissioner Malakand and ACs of Tehsils Khawzakhela, Charbagh and Babuzai etc. Specially, prepared consultation Performa was used during the data collection. Details of this consultation process are described in the Table 8.1 below. Photographs of institutional stakeholders are provided in **Figure 8.1.** Photographs of FGDs are provided in **Figure 8.2.**

Table 8—1: List of FGDs Consultation and Concerns

Sr. No.	Date	Location of Consultation	Total No. of Participants	Comments/Concerns	Consultant Response
1	22/03/2021	Community Center in Khwazakhela, Swat	60	– There is no sufficient water available to cater the needs of Mingora city. – Water supply shall be provided to locals residing close to the Water treatment plant site. – Main transmission line shall be re-aligned to avoid lands which is only source of livelihood in the area. – The transmission line shall be laid along the river bed or along the road. Project design consultant shall revisit the alignment of transmission lines. – Due compensation shall be paid as per market rate and up to satisfaction of land owners. – Survey form should be simple and in local language.	• The new water supply network will improve the current situation of water tanks and pipeline network. All the damaged or repairable pipeline and water tanks will be replaced with new structures. • Project will ensure uninterrupted water supply to the residents of Mingora. • After installation of new water supply network, sufficient water will be supplied to every house in the parameter and hence water shortage will no longer exist and thus the burden on water pumps will lower as well • Mingora greater water supply scheme and installation of water Treatment Plant is proposed for the sole purpose to provide enough water supply to the residents of the city so they can fulfill their water needs just enough. • Due to drop in pressure for gravity scheme water supply cannot be provided to nearby residents of the STP. • PMU KPCIP will ensure that due compensation will be paid to land owners whom land will be acquired for laying of transmission line.
2	23 March 2021	Daral-ul-Aloom School in Khwazakhela, Swat	Approx. 80	– The existing water supply is not sufficient to cater the needs of	• After installation of new water supply network, sufficient water will be supplied to every house in the

Sr. No.	Date	Location of Consultation	Total No. of Participants	Comments/Concerns	Consultant Response
				nearby localities in terms of water demand. – Job opportunities shall be provided for the locals and they shall be educated about the new technologies to be installed at Mingora water supply scheme and installation of Water Treatment Plant. – Over population has increased water demand. Govt. shall invest in clean water supply. – Due compensation shall be paid as per market rate and upto satsification of land owners	perimeter and hence water shortage will no longer exist and thus the burden on water pumps will lower as well. • PMU KPCIP will ensure that due compensation will be paid to project affected people. • Locals will be preferred for jobs provision as this is both socially and economically favored and feasible. • Mingora water supply is proposed for the sole purpose to provide enough water supply to the residents of the city so they can fulfill their water needs just enough. • Water quality at outlet of proposed water treatment plant will be monitored and any leakages into the water supply network shall also be noticed.
3	15 April 2021	Local Hujra in Charbagh, Swat	Approx. 25	– There is no sufficient water available to cater the needs of Mingora city. – Water supply shall be provided to locals residing close to the Water treatment plant site. – Due compensation shall be paid as per market rate and up to satisfaction of land owners	• Project will ensure uninterrupted water supply to the residents of Mingora. • Due to drop in pressure and based on technical grounds water supply cannot be provided to nearby residents of the STP. • PMU KPCIP will ensure that due compensation will be paid to land owners whom land will be acquired for laying of transmission line.

Sr. No.	Date	Location of Consultation	Total No. of Participants	Comments/Concerns	Consultant Response
4	15 April 2021	Hurrah of Shoran Khan (Influential) in Charbagh, Tehsil	10	– Local Jirga representing whole DPS of water supply scheme shall be formulated. – Local Jirga will coordinate with PMU KPCIP for concerns and reservations.	• Local Jirga will be formulated to resolve and settle DPS concerns and reservations.
5	21 April 2021	Office of Assistant Commissioner Tehsil Charbagh, Swat	30	– Project orientation should be provided to local Jirga.	• Presentation on project orientation was provided to local Jirga.
6	26 April 2021	DC Office Mingora, Swat	40	– The land rates finalized by DC/LAC for acquiring the land is not acceptable to the DPs. – Most of the land to be acquired under the subproject is agricultural, which is the main source of income of the DPs. The subproject will greatly diminish the livelihoods through agricultural means which is also being passed on from and to generations. – The proposed pipeline of 20km from Khwazakhela to Babuzai includes agricultural track. The DPs complain that the pipeline does not provide output in the form of water to their lands. – The track of the proposed 20km pipeline was thought by the DPs to be fenced throughout on both sides, this was a huge problem as they feared that this may make the land inaccessible to the owner.	• Land rates finalized by DC/LAC are as per market rate. • PMU KPCIP will ensure that due compensation will be paid to land owners whom land will be acquired for laying of transmission line. • Due to drop in pressure for gravity scheme water supply cannot be provided to nearby residents of the STP. • PMU KPCIP representative detailed the DPs that there will be no fencing along the transmission line as it is only misinformation provided to them.

Table 8—2: Consultations with Government Stakeholders

Sr. No.	Date	Department of Consultation	Designation of Person	Comments/Concerns	Consultant Response
1	4-2-20	EPA Head Office Peshawar	DD-EIA	The design and project implementation should be in compliance with the KPEPA 2014 and NEQS. Project proponent should obtain the approval before to start any activity at site.	After the detail design and all mandatory financial arrangement project proponents will make a liaison with EPA for necessary applicable approval.
2	4-2-20	PkHA	DD-Env.& reset	The designer should also assess the carrying capacity of road network of the area before selection of the final site	All physical structures and road network assessment is also part of the feasibility and will be considered during the detail design.
3	19-10-20	PkHA	Director-1 (Maintenance)	He emphasized the importance of ensuring environmental safeguards through conducting thorough and comprehensive Environmental Assessments. If any roads providing access to various project area require rehabilitation or expansion and fall under PKHA jurisdiction, he advised and assured that all relevant protocols will be followed and department should be consulted.	All necessary protocols will be followed and comprehensive IEE report will be prepared. Department will be consulted prior to start of any road repair/reconstruction work for the subproject.
4	20-10-20	Irrigation Department	Director & Other Staff	He expressed optimism over the various different subprojects of KPCIP, anticipating a synchronized effect of the different waste management, sewerage treatment, water supply and green urban spaces subprojects that will ultimately influence a positive change in the different cities' natural environments and the lives of their many residents.	Consultation response of KP irrigation department has been noted and it will be made part of IEE report.

Figure 8-1: Consultations with Institutional Stakeholders

	
Design team meeting with WSSC Swat officials	Consultation with DD-EIA, KP-EPA
	
PMU officials meeting with CEO WSSC Swat	Consultation with Irrigation Department
	
Meeting with Director-I PKHA (Pakhtunkhwa Highways Authority)	Meeting with Acting Director (EPA site office, Swat)

Figure 8-2: Focus Group Discussions (FGDs) for Mingora Greater water supply scheme

Discussion of Local Jirga at DC Office, Mingora

Consultation session at Dar-ul-Aloom School Charbagh

Conusltation session at Community center Khawzkhela

Consultation session at Local Hujra Charbagh

Discussion of Local Jirga at AC office Charbagh

Consultation at community center Khawkhela

8.2.2 Response from Safeguard Team

528. Project safeguard team made sure that the affected people were given full surety regarding their demands.

529. The people directly affected from the project were told on spot that they will be given payment of their acquitted land after completion of the entire process and that they will be called to DC office and the cheques will be issued in the name of each land owner of the proposed project site to make sure no one misses out on their right.

530. Project will ensure uninterrupted water supply to the residents of Mingora.

- After installation of new water supply network, sufficient water will be supplied to every house in the perimeter and hence water shortage will no longer exist and thus the burden on water pumps will be lower as well.

531. PMU KPCIP will ensure that due compensation will be paid to project affected people.

532. The people indirectly affected from the project were told about the new technological installation in the project area as installation of new engineered WTP and Mingora water supply will reduce the water contamination and demand issue and hence reduction in spreading of different waterborne diseases.

533. The people were made sure that their demands reach to the higher authorities and that the basic life amenities be provided to them once work on project gets initiated.

8.2.3 Basic data of affected people

534. The major affected people from Mingora Greater Water Supply Scheme are land owners whose land will be acquired for the project. As it is new land acquisition for the project therefore LARP in compliance to ADB SPS, 2009 will be prepared. Section 5 under Land Acquisition Act, 1894 for the project has been notified dated 28 June, 2021. There will be about 342 Kanal land in Tehsils Khazakhela, Charbagh and Babuzai that will be acquired. Consultation Plan for Construction and Operation Phase

535. Consultation plan for construction and operation phase of Mingora Greater water supply scheme & Surface Water Treatment Plant project will be prepared in order to take response of project stakeholders and general public about the project. Periodic consultations and community feedback surveys will be carried out to develop positive perception about the project. Intended stakeholders for such consultations will be all stakeholders that are consulted at the time of IEE preparation and KPCIP PRF processing. Record of such consultations will be maintained at PMU/WSSC Swat offices and necessary changes in operational modalities will be introduced in the system in light of the response provided by the consultees.

9 Grievance Redressal Mechanism

9.1 General

536. The ADB Policy (SPS 2009) requires establishment of a local grievance redress mechanism to receive and facilitate resolution of the Displaced/Affected Persons concerns and grievances regarding the project's social and environment performance. The measures have been identified to mitigate any potential environmental and social impacts to be caused due to implementation of the water supply and WTP installation works.

537. However, in spite of best efforts, there is chance that the individuals / households affected by the project or other stakeholders are dissatisfied with measures adopted to address adverse social impacts of the project. To address, such situation an effective Grievance Redress Mechanism (GRM) will be established to ensure timely and successful implementation of the project. It will also provide a public forum to the aggrieved to raise their objections and the GRM will address such issues adequately. It will receive, evaluate and facilitate the resolution of displaced persons' concerns, complaints and grievances about the social and environmental performance at the level of the project.

538. The GRM will aim to investigate charges of irregularities and complaints receive from any displaced persons and provide a time-bound early, transparent and fair resolution to voice and resolve social and environmental concerns link to the project.

539. The PMU shall make the public aware of the GRM through public awareness campaigns. The name of contact person(s) and his/her phone number, PMU contact numbers will serve as a hotline for complaints and shall be publicized through the media and placed on notice boards outside their offices, construction camps of contractors, and at accessible and visible locations in the project area. The project information brochure will include information on the GRM and shall be widely disseminated throughout the project area. Grievances can be filed in writing, via web-based provision or by phone with any member of the PMU.

540. First tier of GRM. The PMU is the first tier of GRM which offers the fastest and most accessible mechanism for resolution of grievances. The PMU staff for environment and social safeguards will be designated as the key officers for grievance redressal. Resolution of complaints will be completed within seven (7) working days. Investigation of grievances will involve site visits and consultations with relevant parties (e.g., affected persons, contractors, traffic police, etc.). Grievances will be documented and personal details (name, address, date of complaint, etc.) will be included, unless anonymity is requested. A tracking number will be assigned for each grievance, including the following elements:

- Initial grievance sheet (including the description of the grievance), with an acknowledgement of receipt handed back to the complainant when the complaint is registered;
- Grievance monitoring sheet, mentioning actions taken (investigation, corrective measures);
- Closure sheet, one copy of which will be handed to the complainant after he/she has agreed to the resolution and signed-off.
- The updated register of grievances and complaints will be available to the public at the PMUoffice, construction sites and other key public offices in the project area. The grievance remain unresolved shall be escalated to the second tier.

541. **Second Tier of GRM.** The PMU will activate the second tier of GRM by referring the unresolved issue (with written documentation) to the Water Sanitation and Services Company (WSSC), Swat who will pass unresolved complaints upward to the Grievance Redress Committee (GRC). The GRC will be established by WSSC Swat before start of site works. The GRC will consist of the following persons: (i) Project Director; (ii) representative of District Government; (iii) representative of the affected person(s); (iv) representative of the local Deputy Commissioners office (land); and (v) representative of the KPEPA (for environmental-related grievances). A hearing will be called with the GRC, if necessary, where the affected person can present his/her concerns/issues. The process will facilitate resolution through mediation. The local GRC will meet as necessary when there are grievances to be addressed. The local GRC will suggest corrective measures at the field level and assign clear responsibilities for implementing its decision within fifteen (15) working days. The contractor will have observer status on the committee. If unsatisfied with the decision, the existence of the GRC will not impede the complainant's access to the Government's judicial or administrative remedies.

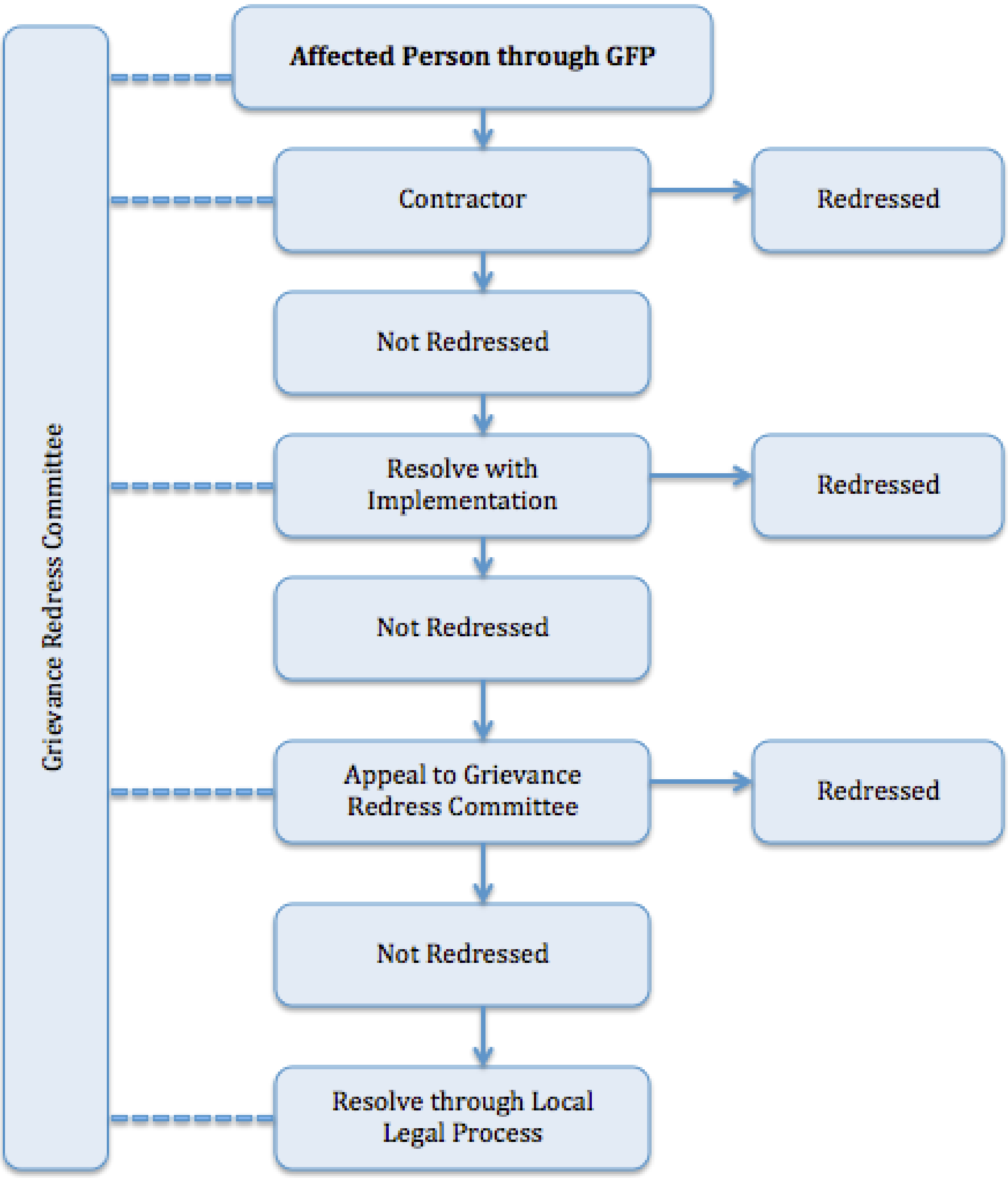
542. The functions of the local GRC are as follows: (i) resolve problems and provide support to affected persons arising from various environmental issues and including dust, noise, utilities, power and water supply, waste disposal, traffic interference and public safety as well as social issues and land acquisition (temporary or permanent); asset acquisition; and eligibility for entitlements, compensation and assistance; (ii) reconfirm grievances of displaced persons, categorize and prioritize them and aim to provide solutions within a month; and (iii) report to the aggrieved parties about developments regarding their grievances and decisions of the GRC.

543. The WSSC Swat officers will be responsible for processing and placing all papers before the GRC, maintaining a database of complaints, recording decisions, issuing minutes of the meetings and monitoring to see that formal orders are issued and the decisions carried out.

544. **Third tier of GRM**. In the event that a grievance cannot be resolved directly by the PMU (first tier) or GRC (second tier), the affected person can seek alternative redressed through the district or sub-district committees as appropriate. The PMU or GRC will be kept informed by the district, municipal or provincial authority. The grievance redress mechanism and procedure are depicted in the **Figure 9.1** below. The monitoring reports of the EMP and RP implementation will include the following aspects pertaining to progress on grievances: (i) Number of cases registered with the GRC, level of jurisdiction (first, second and third tiers), number of hearings held, decisions made, and the status of pending cases; and (ii) lists of cases in process and already decided upon may be prepared with details such as Name, ID with unique serial number, date of notice, date of application, date of hearing, decisions, remarks, actions taken to resolve issues, and status of grievance (i.e., open, closed, pending).

545. In order to provide greater clarity, the pictorial description of the GRM is provided in **Figure 9.1** below.

Figure 9-1: Grievance Redressal Mechanism



10 Conclusion and Recommendations

546. The development of the proposed Water treatment Plant and Mingora greater water Supply scheme in Mingora is of high significance considering the urgent need for improving the water distribution network in Mingora city.

547. Primary and secondary data has been collected and used to assess the environmental impacts of the Project. This IEE report highlights all potential environmental impacts associated with the Project and recommends mitigation measures and monitoring mechanisms. Any environmental impacts associated with the project need to be properly mitigated, through the existing institutional arrangements defined in this report.

548. The majority of the environmental impacts are associated with the construction phase and as well as in operation phase of the project since these will be long term, such as dust generation due to excavation of pipe distribution network. Generation of sludge from settling tanks etc., to name a few.

549. The implementation of mitigation measures during this period will be the responsibility of the Contractor. Therefore, the required environmental mitigation measures will have to be clearly defined in the bidding and contract documents, and appropriately qualified environmental staff retained by the Consultant to supervise the implementation process. The EMP includes measures to minimize project impacts due to noise and air pollution, waste generation etc.

550. The EMP contained within this IEE document is considered sufficient for issuance as part of the Contracts to the successful bidder(s) and for subsequent use during the project works. It should be mentioned that prior to the commencement of works, this EMP must be further updated by the Contractor into site specific EMPs (SSEMPs) for review and approval of ADB. In these SSEMPs, aspects such as a detailed traffic management plan, identification of locations for disposal of debris and spoil and any other details which shall become available later must be included for efficient implementation of all proposed mitigation measures and the subsequent monitoring of these measures.

551. Based on the above, this report concludes that there are no potential adverse environmental impacts from proposed WTP and associated distribution/supply network. Impacts of less significance can be mitigated to an acceptable level by adequate implementation of the mitigation measures identified and suggested, hence, no significant or unacceptable change in the baseline environmental conditions will occur. Similarly, the project will have a visible positive impact on the socio-economic conditions of the local residents in terms of uninterrupted treated water supply and it will fix existing bottleneck of the system. Mitigation measures to help alleviating potential identified impacts have been recommended and an EMP has been provided for implementation of these mitigation measures. Further PMU KPCIP will ensure that selected construction contractor has contractual obligation with respect to EMP implementation. Also WSSC Swat will ensure appropriate staffing and budgeting for effective implementation and monitoring of project EMP.

552. Based on the findings of the IEE, the subproject is unlikely to cause any significant, irreversible or unprecedented environmental impacts. The potential impacts localized, temporary in nature and can be addressed through proven mitigation measures. Hence, the classification of the subproject as Category B per ADB SPS, 2009 is confirmed. No further study or assessment is required at this stage.

Recommendations:

553. Below are the recommendations:

- Obtain statutory clearances prior to award of contract and ensure conditions/requirements are incorporated in the subproject design and documents;
- Upon mobilization of the contractors, PMU to provide a safeguards orientation per IEE and project administration manual
- Contractor to appoint environmental safeguards nodal person responsible for environmental safeguards compliance, occupational health and safety and core labor standards

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ANNEXURES

Annexure A
REA Checklist

Rapid Environmental Assessment (REA) Checklist

Instructions:

(i) The project team completes this checklist to support the environmental classification of a project. It is to be attached to the environmental categorization form and submitted to the Environment and Safeguards Division (RSES) for endorsement by the Director, RSES and for approval by the Chief Compliance Officer.

(ii) This checklist focuses on environmental issues and concerns. To ensure that social dimensions are adequately considered, refer also to ADB's (a) checklists on involuntary resettlement and Indigenous Peoples; (b) poverty reduction handbook; (c) staff guide to consultation and participation; and (d) gender checklists.

(iii) 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/Khyber Pakhtunkhwa Cities improvement project (Mingora)

Sector Division: Mingora Greater Water Supply Scheme

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		√	
• Wetland		√	
• Mangrove		√	
• Estuarine		√	

Screening Questions	Yes	No	Remarks
• Buffer zone of protected area		√	
• Special area for protecting biodiversity		√	There is no special area for the protection of biodiversity although the city has a rich biodiversity
• Bay		√	
B. Potential Environmental Impacts Will the Project cause…			
▪ pollution of raw water supply from upstream wastewater discharge from communities, industries, agriculture, and soil erosion runoff?	√		Impact would be mitigated by suggesting and implementing mitigation measures in the EMP
▪ impairment of historical/cultural monuments/areas and loss/damage to these sites?		√	
▪ hazard of land subsidence caused by excessive ground water pumping?		√	
▪ social conflicts arising from displacement of communities?	√		Impact would be mitigated by suggesting and implementing mitigation measures in the EMP
▪ conflicts in abstraction of raw water for water supply with other beneficial water uses for surface and ground waters?		√	However, Impact would be mitigated by suggesting and implementing mitigation measures in the EMP
▪ unsatisfactory raw water supply (e.g. excessive pathogens or mineral constituents)?	√		Water treatment would be required at the source
▪ inadequate protection of intake works or wells, leading to pollution of water supply?	√		Fencing would be required in the design for intake structures
▪ over pumping of ground water, leading to salinization and ground subsidence?		√	
▪ excessive algal growth in storage reservoir?	√		Treatment would be required at the source
▪ increase in production of sewage beyond capabilities of community facilities?	√		Usage of water would increase resulting in increase of wastewater discharge
▪ inadequate disposal of sludge from water treatment plants?	√		Sludge treatment should be the part of the project
▪ inadequate buffer zone around pumping and treatment plants to alleviate noise and other possible nuisances and protect facilities?		√	

Screening Questions	Yes	No	Remarks
▪ impairments associated with transmission lines and access roads?	✓		Infrastructure needs to be rehabilitated at the end of project and access road should not be blocked
▪ health hazards arising from inadequate design of facilities for receiving, storing, and handling of chlorine and other hazardous chemicals.	✓		Health hazards should be mitigated by reducing exposure to hazardous chemicals through proper storage and usage, if required
▪ health and safety hazards to workers from handling and management of chlorine used for disinfection, other contaminants, and biological and physical hazards during project construction and operation?	✓		Best management and safety practices should be adopted to protect workers from any biological or physical hazards and can be managed through engineering and administrative controls.
▪ dislocation or involuntary resettlement of people?	✓		
▪ disproportionate impacts on the poor, women and children, Indigenous Peoples or other vulnerable groups?	✓		
▪ noise and dust from construction activities?	✓		Noise and dust from construction can be minimized and managed with adequate mitigation measures.
▪ increased road traffic due to interference of construction activities?	✓		Problems such traffic congestion during construction can be managed through engineering and administrative controls.
▪ continuing soil erosion/silt runoff from construction operations?	✓		Mitigation measures (temporary silt traps) will be adopted to minimize soil erosion/silt runoff.
▪ delivery of unsafe water due to poor O&M treatment processes (especially mud accumulations in filters) and inadequate chlorination due to lack of adequate monitoring of chlorine residuals in distribution systems?	✓		Residual chlorine should be maintained up to the end-user
▪ delivery of water to distribution system, which is corrosive due to inadequate attention to feeding of corrective chemicals?		✓	
▪ accidental leakage of chlorine gas?	✓		Emergency Response Plan should be prepared as a part of EMP and implemented
▪ excessive abstraction of water affecting downstream water users?		✓	Water source is River Swat
▪ competing uses of water?		✓	Not envisioned

Screening Questions	Yes	No	Remarks
▪ increased sewage flow due to increased water supply	√		Water usage would be increased resulting in increase in sewage discharge
▪ increased volume of sullage (wastewater from cooking and washing) and sludge from wastewater treatment plant		√	Not envisioned
▪ large population influx during project construction and operation that causes increased burden on social infrastructure and services (such as water supply and sanitation systems)?	√		However, the contractor shall ensure hiring of local labor and sustainable water usage.
▪ social conflicts if workers from other regions or countries are hired?		√	Not expected, though the contractor shall ensure to hire labors from local community.
▪ risks to community health and safety due to the transport, storage, and use and/or disposal of materials such as explosives, fuel and other chemicals during operation and construction?	√		Strict implementation of safety measures by suggesting in the EMP will reduce these impacts
▪ community safety risks due to both accidental and natural hazards, especially where the structural elements or components of the project are accessible to members of the affected community or where their failure could result in injury to the community throughout project construction, operation and decommissioning?	√		The installation of structural element should be the part of the project.

Annexure B

Questionnaires for Conducting FGDs & Surveys

Focal Group Discussion (FGDs)

Project Name:

Venue:

Sr no ____

Date:

Sr no	Name	Profession	CNIC	Moza/Village UC, Tehsil & District	Signature/Thumb
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					

SOCIO ECONOMIC AND RESETTLEMENT SURVEY FOR KPCIP SUB PROJECTS

Date: ____________

Sr No. ____________

1. Identification

1.1 Name of Respondent ____________ 1.2 Father's Name ____________

1.3 Respondent CNIC No: ____________ 1.4 Tribe ____________

1.5 Address: Village: ____________ Town: ____________

Tehsil: ____________ District: ____________ Province: ____________

1.6 Demographic Profile of Respondent (Children up to 10 yrs (#): M ,FM =T)

Sr. No.	Relationship with Respondent (See codes)	Sex Male=1 Female= 2	Age (Yrs.)	Education (See Codes)	Name of Business/ Occupation (See Codes)		Income From Business/ Occupation (Rs./ Annum)		Diseases During Last Year (See codes)
					Main	Secondary	Main	Secondary	
1	SELF								
2									
3									
4									
5									
6									
7									
8									
9									
10									

*Other: Rent from property, remittances, net sale of items during a year, net income from agriculture etc.

Demographic Codes:

Relationship: 1=Self, 2=Wife, 3=Son, 4=Daughter, 5=Father, 6=Mother, 7=Brother, 8=Sister, 9=Grand Father, 10=Grand Mother, 11=Bhabhi, 12=Nephew, 13=Father-in-Law, 14=Mother- in-Law, 15=Others

Sex: 1=Male, 2=Female

Education: 1= Primary 2= Middle 3= Matric, 4= Intermediate, 5= BA/BSc, 6= MA/MSc, 7=LLB, 8=Engineer, 9=MBBS, 10=Technical Diploma, 11=Dars-e-Nizami, 12=CanRead Quran, 13= Can Insert Signatures, 14= Illiterate,

Occupations: 1=Agriculturist, 2=Shopkeeper, 3= Trader, 4= Govt. Servant, 5=Private Servant, 6=Timber Labour, 7=General Labour, 8=Livestock, 9=Fishing, 10= 8=Driver, 11=Health Related, 12=Educator/Teacher, 13=House-Maid, 14= House Wife, 15=Gone Abroad, 16=Gone out City within Pakistan

Diseases: 1=Diarrhea, 2=Measles, 3=Hepatitis, 4=Typhoid, 5=HIV/AIDS, 6=Polio, 7=Cholera, 8=Tuberculosis, 9=Heart Disease, 10=No Disease,

1.7 Are you member of any village Community organization ____ 1. Yes ☐ 2. No ☐

1.8 If yes, which of the following organizations?

i. Religious ____ ii. Political ____ iii. Law & Order ____
iv. Educational (formal/informal) ____
v. Community Organization ____ vi. Local Jirga
vii. Youth Organization ____ viii. Any other ____

2. Land Utilization

Land	Acre	Kanal	Marla
Total Area owned			
Total Cultivated Area			
Area Under Rabi(winter) Crops			
Area Under Kharif (summer) Crops			
Uncultivated Area			
Waste land			
Area Under Farm Houses			
Barren Land			

2.1 Cropping Pattern, Yield and Cost

Sr. No.	Major Crops	Area Sown		Average. Production (Kgs)	Price/40 kgs (Rs.)	Total Cost Incurred (Rs.)
		Acre	Kanal			
1	Wheat					
2	Maize					
3	Cotton					
4	Rice					
5	Sugarcane					
6	Orchards					
7	Other (________________)					
8	Grand Total:					

2.2 Land Tenure Status: ☐ Owner ☐ Tenant ☐ Share Cropper ☐ Leaser

2.3 Land Rent (Rs. / acre) ____________

3. **Possession of Household Goods**

Item	No.	Value (Rs.)	Item	No.	Value (Rs.)
Television			Car		
Washing machine			Van/Pickup		
Geyser			Gas Cylinder		
Electric fan			VCR/DVD Player		
Electric iron			Dish Antenna/Cable Connection		

Item	No.	Value (Rs.)	Item	No.	Value (Rs.)
Sewing machine			Telephone/Mobile		
Radio/tape recorder			Electric Water Pump		
Motor cycle/ scooter			Computer		
Other ______			Other ______		
Total:			Total:		

4. Average Monthly Expenditure on Food and Non-Food Items

4.1 Monthly Expenditure on Food & Non-Food Items (Rs.)

a) Expenditures on Food Items

Sr. No.	Item	Qty. / Month	Expenditure (Rs.)
1.	Wheat / Atta (Flour)		
2.	Maize Flour		
3.	Ghee		
4.	Sugar		
5.	Legumes		
6.	Vegetables		
7.	Tea Leaves		
8.	Milk		
9.	Other Specify		
10.	Total:		

b) Exp. On Non-Food Items:

1.	Fire wood		
2.	Gas Cylinder		
3.	Kerosene Oil		
4.	Washing Material		
5.	Other Specify		
6.	Total:		

4.2	Expenditure on clothes and shoes during last year:		Rs.
4.3	Occasional expenses during last year (such as meeting social obligation expenditure)		Rs.
4.4	Av. Monthly utility bills for:	Electricity (Rs.)	
	Communication (Rs.)	Water (Rs.)	
4.5	Annual Expenditure on Health Care (Rs.):		

5. **Social Organizations**

5.1 Specify the existing village/social organizations in your area and state their functional status?

Sr. No.	Name of Organization	Category	Registered/ Unregistered	Functions
1		Religious		
2		Educational		
3		Skill Development		
4		Social Welfare		
5		Women Organization		
6		Other		

6. Leadership Pattern

6.1 Which type of people is influential in village matters and how they decide these matters?

Sr.#	Person / Status	Decision Pattern
1	MPA / MNAs	
2	Head of Tribe	
3	Spiritual / Religious Leader	
4	Land Lord / Lumber Dar	
5	School Teacher	
6	Community Leader	
7	Government Official	
8	Retd. Government Official	
9	Any other (specify)	

6.2 Were their decisions considered final and implemented successfully? ☐ 1. Yes ☐ 2. No

i) Level of acceptability (%) _______ ii) Successful implementation (%) ___________

6.3 Are the general relationship among people in the locality essentially based upon?

1. Competition _______________ 2. Conflict _______________
3. Co-operation _______________ 4. Don't Know ___________

6.4 Were you involved in any dispute in the past 5 years? ☐ 1. Yes ☐ 2. No

6.5 If yes, what was the nature of dispute and how was it resolved

Nature of Dispute	Method of Resolution
1. ________________	____________________
2. ________________	____________________
3. ________________	____________________

7. **Credit**

7.1 Have you obtained credit during last year? Yes [ ], No. [ ], if yes, source of credit:

Formal [ ], Informal [ ]

7.2 Please write the name of relevant source

Formal source (s) ____________

Informal source (s) ____________

Percentage of interest ____________

7.3 Purpose of Loan (Tick)

Purchase House	[ ]	Rs. ________
Business	[ ]	Rs. ________
Repair of House	[ ]	Rs. ________
Medicare of Family Member	[ ]	Rs. ________
Family/ Social matters	[ ]	Rs. ________
Farm inputs	[ ]	Rs. ________
Livestock	[ ]	Rs. ________
Other (specify)	[ ]	Rs. ________

7.4 Mode of repayment (Tick the relevant)

1) One time [ ] 2) Through installments [ ],

i) Quarterly installments [ ] ii) Six-monthly [ ],
iii) Annual [ ] iv) Other (specify) ________

7.5 How much repayment has been made so far? a) 100%[ ], b)75% [ ], c) 50% [ ], d) 25% [ ], Less than 25 % [ ]

8. **Housing Conditions**

8.1 Do you have your own house?

1) Yes ____ 2) No. ____

If yes then

8.2 Total Area of the house: square ft. Present Value (Rs)________.

Type of Room	No. of Room	Katcha (tick)	Pacca (tick)	Semi Pacca (tick)
Living rooms				
Animal shed				
Other shed				
Bathroom				
Latrine				
- Open				
- Flush				

- Other

8.3 Other Assets

Area (Ft.)

Shop(Sq. ft): L _ _ W _
Khokha: ________
Electric Pump / Hand Pump (No.): ________
Hydropower Generator: ________
Other (________) (No.): ________

8.4 Trees

- Mature Fruit Trees (No.): ________ ________
- Mature Shade Trees (No.) ________ ________

9. Access to Social Amenities (Tick)

Social Amenities	Available	Satisfactory	Non-Satisfactory	No Access
Electricity				
Sui Gas				
Water Supply				
Telephone				
Sewerage/Drainage				
BHU				
School				
Others				

10. Livestock Inventory

Livestock	No.	Present Value (Rs.)
Buffaloes		
Cows		
Horse		
Donkey		
Mule		
Sheep		
Goat		
Poultry		
Other		

11. Women's Participation and Decision Making in Different Activities

11.1 Women participation in different household activities:

Activities	Participation (%)	Decision Making (%)
Household activities		

Child caring	[ ]	[ ]
Farm/Crop activities	[ ]	[ ]
Livestock rearing	[ ]	[ ]
Sale & Purchase of properties	[ ]	[ ]
Social obligations (marriage, birthday & other functions)	[ ]	[ ]
Local representation (councilor/ political gathering)	[ ]	[ ]
Others	[ ]	[ ]

11.2 Women issues in the project area

____

____

11.3 Women views about the project

____

____

12. Perceptions of Respondents for Action Associated with the Project

	Increase	Decrease
Employment opportunities	[ ]	[ ]
Marketing facilities opportunities	[ ]	[ ]
Living standard	[ ]	[ ]
Unemployment	[ ]	[ ]
Income generating activities	[ ]	[ ]
Mobility (Access to Resources)	[ ]	[ ]
Quality of drinking water	[ ]	[ ]
Agriculture water	[ ]	[ ]
Trend of fish farm	[ ]	[ ]

Other specify______________________________

13. **General Remarks of the Respondents**

14. **Resettlement Part**

14.1 Do you feel any resettlement impact? Yes ______ No

If yes then

Category	Area Acre	Kanal	Value of Land (Rs.)	Remarks
Cultivated				
Uncultivated				
Grazing				
Barren Land				
Waste Land				
Other				
Total				

14.2 Affected Cropping Area

Yes ______ No ______

If yes then

Name of Crop	Acre	Kanal	Value (Rs.)
Rabi			
Kharif			
Total:			

14.3 Affected residential structures

Name of Structure	Types of Structures			Area		Value of Structure
	Kacha	Pacca	Semi Pacca	Sq. ft.	Rft.	
Houses						
Boundary Wall						
Other						

14.4 Impact on Farm House

Yes ______ No ______

If yes then

Name	Type of Farm House			Area		Value (Rs.)
	Kacha	Pacca	Semi Pacca	Sq.ft	Rft.	
Rooms						
Cattle Shed						
Boundary Wall						
Other						

14.5 Impact of Tube wells

Yes ______ No ______

If yes then

Types of Tube wells	No.	Value (Rs.)
Electric		
Diesel		
Turbine		
Other		
Total:		

14.6 Impact on Utility

Yes ______ No ______

If yes then

Types	Nos. / Area
Electric poles	
Transformer	
Transmission line	
Telephone	
Other	
Total:	

14.7 Impact on Community Structure

Name	Yes	No	Value (Rs.)
Schools			
Mosque			
Graveyard			
Health Centre			
Shrine			
Others			
Total:			

14.8 How to shift shrines / graveyards?

____

____

14.9 Miscellaneous Impacts of the Project

____

____

14.10 Do you have any alternate residence place?

Yes [ ] No [ ]

If yes then (tick relevant)

Own Land / House	Yes/No	Location	Distance from current residence (km)
Tenancy			
Relative			
Other			

14.11 Mode of Payment

Land for land ____________
Cash compensation ____________
Kind ____________
Other ____________

15. Project

____

____

16. Views / Comments of Interviewers

____

____

Name & Signature of Interviewer: ____________________ Date: __________

Annexure C
Environmental Baseline Monitoring

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AMBIENT PARTICULATE MATTERS MONITORING REPORT

Reference Number	KPCIP/ENV/159-2020		
Project Name:	Khyber Pakhtunkhwa Cities Improvement Project	**Site Address:**	Mingora Greater Water Supply Scheme, Mingora, District Swat, Kpk
Monitoring Date:	07-09-2020	**Reporting Date:**	17-09-2020
Source:	Ambient Air	**Monitoring Instrument:**	AQMS65, Serial # 1310
Location:	Airport Road, Mingora		
GPS Coordinates:	72.351859 34.786704		

Sr. No	Time	Parameters		Results (Average 24 Hrs)	
		$PM_{2.5}$	PM_{10}	$PM_{2.5}$	PM_{10}
		Units			
	Hours	(μg/m^3)	(μg/m^3)		
1	09:30 AM	25	75.4	19.93 (μg/m^3)	63.22 (μg/m^3)
2	10:30 AM	17.4	77.7		
3	11:30 AM	23.2	72.9		
4	12:30 PM	23.6	74.2		
5	01:30 PM	23.0	74		
6	02:30 PM	21.1	84.5		
7	03:30 PM	23.9	82		
8	04:30 PM	24.6	76.2		
9	05:30 PM	23.5	76.4		
10	06:30 PM	21.3	73		
11	07:30 PM	21.1	70.9		
12	08:30 PM	18.5	68.2		
13	09:30 PM	13.3	63.1		
14	10:30 PM	10.4	60.2		
15	11:30 PM	18.3	57.4		
16	12:30 AM	16.6	54.9		
17	01:30 AM	17.0	53.2		
18	02:30 AM	21.5	50.1		
19	03:30 AM	22	49.4		
20	04:30 AM	22.5	43.1		
21	05:30 AM	22.6	42.2		
22	06:30 AM	20.4	44.9		
23	07:30 AM	14.2	47.2		
24	08:30 AM	13.4	46.3		
NEQSAA				35 (μg/m^3)	150 (μg/m^3)
WHO				25 (μg/m^3)	50 (μg/m^3)

NEQSAA: National Environmental Quality Standards for Ambient Air

Note:

- Selected measurement units were μg/m^3 otherwise stated.
- Quality was assured through self calibration of the instrument.
- The values were representing of monitoring conditions prevailing during the monitoring hours.
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Signature of Analyst:

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AMBIENT PARTICULATE MATTERS MONITORING REPORT

Reference Number	KPCIP/ENV/159-2020		
Project Name:	Khyber Pakhtunkhwa Cities Improvement Project	**Site Address:**	Mingora Greater Water Supply Scheme, Mingora, District Swat, Kpk
Monitoring Date:	08-09-2020	**Reporting Date:**	17-09-2020
Source:	Ambient Air	**Monitoring Instrument:**	AQMS65, Serial # 1310
Location:	Amankot Road		
GPS Coordinates:	72.350281 34.767061		

Sr. No	Time	Parameters		Results (Average 24 Hrs)	
		$PM_{2.5}$	PM_{10}	$PM_{2.5}$	PM_{10}
		Units			
	Hours	(μg/m³)	(μg/m³)		
1	10:00 AM	23.9	71.1	18.80 (μg/m3)	58.92 (μg/m3)
2	11:00 AM	16.3	73.4		
3	12:00 PM	22.1	68.6		
4	01:00 PM	22.5	69.9		
5	02:00 PM	21.9	69.7		
6	03:00 PM	20	80.2		
7	04:00 PM	22.8	77.7		
8	05:00 PM	23.5	71.9		
9	06:00 PM	22.4	72.1		
10	07:00 PM	20.2	68.7		
11	08:00 PM	20	66.6		
12	09:00 PM	17.4	63.9		
13	10:00 PM	12.2	58.8		
14	11:00 PM	9.3	55.9		
15	12:00 AM	17.2	53.1		
16	01:00 AM	15.5	50.6		
17	02:00 AM	15.9	48.9		
18	03:00 AM	20.4	45.8		
19	04:00 AM	20.9	45.1		
20	05:00 AM	21.4	38.8		
21	06:00 AM	21.5	37.9		
22	07:00 AM	19.3	40.6		
23	08:00 AM	13.1	42.9		
24	09:00 AM	12.3	42		
	NEQSAA			35 (μg/m³)	150 (μg/m³)
	WHO			25 (μg/m³)	50 (μg/m³)

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AMBIENT PARTICULATE MATTERS MONITORING REPORT

Reference Number	KPCIP/ENV/159-2020	Site Address:	Mingora Greater Water Supply Scheme, Mingora, District Swat, Kpk
Project Name:	Khyber Pakhtunkhwa Cities Improvement Project		
Monitoring Date:	09-09-2020	Reporting Date:	17-09-2020
Source:	Ambient Air	Monitoring Instrument:	AQMS65, Serial # 1310
Location:	Near Masjid Usmanabad		
GPS Coordinates:	72.37149 34.779293		

Sr. No	Time	Parameters		Results (Average 24 Hrs)	
		$PM_{2.5}$	PM_{10}	$PM_{2.5}$	PM_{10}
		Units			
	Hours	($\mu g/m^3$)	($\mu g/m^3$)		
1	10:30 AM	21.9	77.3	16.83 ($\mu g/m^3$)	65.12 ($\mu g/m^3$)
2	11:30 AM	14.3	79.6		
3	12:30 PM	20.1	74.8		
4	01:30 PM	20.5	76.1		
5	02:30 PM	19.9	75.9		
6	03:30 PM	18	86.4		
7	04:30 PM	20.8	83.9		
8	05:30 PM	21.5	78.1		
9	06:30 PM	20.4	78.3		
10	07:30 PM	18.2	74.9		
11	08:30 PM	18	72.8		
12	09:30 PM	15.4	70.1		
13	10:30 PM	10.2	65		
14	11:30 PM	7.3	62.1		
15	12:30 AM	15.2	59.3		
16	01:30 AM	13.5	56.8		
17	02:30 AM	13.9	55.1		
18	03:30 AM	18.4	52		
19	04:30 AM	18.9	51.3		
20	05:30 AM	19.4	45		
21	06:30 AM	19.5	44.1		
22	07:30 AM	17.3	46.8		
23	08:30 AM	11.1	49.1		
24	09:30 AM	10.3	48.2		
NEQSAA				35 ($\mu g/m^3$)	150 ($\mu g/m^3$)
WHO				25 ($\mu g/m^3$)	50 ($\mu g/m^3$)

NEQSAA: National Environmental Quality Standards for Ambient Air

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AMBIENT PARTICULATE MATTERS MONITORING REPORT

Reference Number	KPCIP/ENV/159-2020		
Project Name:	Khyber Pakhtunkhwa Cities Improvement Project	**Site Address:**	Mingora Greater Water Supply Scheme, Mingora, District Swat, Kpk
Monitoring Date:	10-09-2020	**Reporting Date:**	17-09-2020
Source:	Ambient Air	**Monitoring Instrument:**	AQMS65, Serial # 1310
Location:	Near Madrasa Rahimia, Shahdara		
GPS Coordinates:	72.36478 34.784182		

Sr. No	Time	Parameters		Results (Average 24 Hrs)	
		$PM_{2.5}$	PM_{10}	$PM_{2.5}$	PM_{10}
		Units			
	Hours	(μg/m^3)	(μg/m^3)		
1	11:00 AM	27.6	80.7	22.53 (μg/m^3)	68.52 (μg/m^3)
2	12:00 PM	20	83		
3	01:00 PM	25.8	78.2		
4	02:00 PM	26.2	79.5		
5	03:00 PM	25.6	79.3		
6	04:00 PM	23.7	89.8		
7	05:00 PM	26.5	87.3		
8	06:00 PM	27.2	81.5		
9	07:00 PM	26.1	81.7		
10	08:00 PM	23.9	78.3		
11	09:00 PM	23.7	76.2		
12	10:00 PM	21.1	73.5		
13	11:00 PM	15.9	68.4		
14	12:00 AM	13	65.5		
15	01:00 AM	20.9	62.7		
16	02:00 AM	19.2	60.2		
17	03:00 AM	19.6	58.5		
18	04:00 AM	24.1	55.4		
19	05:00 AM	24.6	54.7		
20	06:00 AM	25.1	48.4		
21	07:00 AM	25.2	47.5		
22	08:00 AM	23	50.2		
23	09:00 AM	16.8	52.5		
24	10:00 AM	16	51.6		
		NEQSAA		35 (μg/m^3)	150 (μg/m^3)
		WHO		25 (μg/m^3)	50 (μg/m^3)

NEQSAA: National Environmental Quality Standards for Ambient Air

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AMBIENT GASEOUS MONITORING REPORT

Reference Number	KPCIP/ENV/159-2020		
Project Name:	Khyber Pakhtunkhwa Cities Improvement Project	**Site Address:**	Mingora Greater Water Supply Scheme, Mingora, District Swat, Kpk
Monitoring Date:	07-09-2020	**Reporting Date:**	17-09-2020
Source:	Ambient Air (Gaseous)	**Monitoring Instrument:**	AQMS65, Serial # 1310
Location:	Airport Road, Mingora		
GPS Coordinates:	72.351859 34.786704		

Sr. No	Time	Parameters			
		CO	NO	NO_2	SO_2
		Units			
	Hours	(mg/m^3)	(µg/m^3)	(µg/m^3)	(µg/m^3)
1.	09:30 AM	0.8	13.23	14.44	16.55
2.	10:30 AM	0.82	13.25	16.21	16.92
3.	11:30 AM	0.78	13.1	16.88	18.18
4.	12:30 PM	0.93	13.19	17.53	19.48
5.	01:30 PM	0.92	13.17	17.81	19.72
6.	02:30 PM	0.94	13.9	19.05	20.34
7.	03:30 PM	0.96	13.01	20.15	20.78
8.	04:30 PM	1.0	13.14	20.23	20.9
9.	05:30 PM	0.89	13.18	21.65	22.31
10.	06:30 PM	0.87	12.77	18.57	20.81
11.	07:30 PM	0.77	12.4	16.42	20.12
12.	08:30 PM	0.74	12.19	15.33	16.36
13.	09:30 PM	0.69	12.11	15.47	17.01
14.	10:30 PM	0.67	12.1	14.58	16.41
15.	11:30 PM	0.7	11.71	14.13	16.95
16.	12:30 AM	0.64	11.3	13.64	17.25
17.	01:30 AM	0.6	10.86	13.61	16.88
18.	02:30 AM	0.59	11.38	13.44	16.64
19.	03:30 AM	0.63	11.68	13.3	16.5
20.	04:30 AM	0.64	12.18	13.55	15.37
21.	05:30 AM	0.65	12.55	13.13	15.11
22.	06:30 AM	0.69	12.5	13.04	15.86
23.	07:30 AM	0.71	12.92	12.88	15.22
24.	08:30 AM	0.77	12.85	12.81	9.58
Average Concentration		**0.76**	**12.52**	**15.74**	**17.55**
NEQSAA		**05 (24 hr)**	**40 (24 hr)**	**80 (24 hr)**	**120 (24 hr)**
WHO		---	---	**200 (24 hrs)**	**20 (24 hrs)**

NEQSAA: National Environmental Quality Standards for Ambient Air

Note:

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- Quality was assured through self calibration of the instrument.
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Project Name:	Khyber Pakhtunkhwa Cities Improvement Project	**Site Address:**	Mingora Greater Water Supply Scheme, Mingora, District Swat, Kpk
Monitoring Date:	08-09-2020	**Reporting Date:**	17-09-2020
Source:	Ambient Air (Gaseous)	**Monitoring Instrument:**	AQMS65, Serial # 1310
Location:	Amankot Road		
GPS Coordinates:	72.350281 34.767061		

Sr. No	Time	Parameters			
		CO	NO	NO_2	SO_2
		Units			
	Hours	(mg/m^3)	(µg/m^3)	(µg/m^3)	(µg/m^3)
1.	10:00 AM	0.92	19.48	18.19	19.07
2.	11:00 AM	0.94	19.5	19.96	19.44
3.	12:00 PM	0.9	19.35	20.63	20.7
4.	01:00 PM	1.05	19.44	21.28	22
5.	02:00 PM	1.04	19.42	21.56	22.24
6.	03:00 PM	1.06	20.15	22.8	22.86
7.	04:00 PM	1.08	19.26	23.9	23.3
8.	05:00 PM	1.12	19.39	23.98	23.42
9.	06:00 PM	1.01	19.43	25.4	24.83
10.	07:00 PM	0.99	19.02	22.32	23.33
11.	08:00 PM	0.89	18.65	20.17	22.64
12.	09:00 PM	0.86	18.44	19.08	18.88
13.	10:00 PM	0.81	18.36	19.22	19.53
14.	11:00 PM	0.79	18.35	18.33	18.93
15.	12:00 AM	0.82	17.96	17.88	19.47
16.	01:00 AM	0.76	17.55	17.39	19.77
17.	02:00 AM	0.72	17.11	17.36	19.4
18.	03:00 AM	0.71	17.63	17.19	19.16
19.	04:00 AM	0.75	17.93	17.05	19.02
20.	05:00 AM	0.76	18.43	17.3	17.89
21.	06:00 AM	0.77	18.8	16.88	17.63
22.	07:00 AM	0.81	18.75	16.79	18.38
23.	08:00 AM	0.83	19.17	16.63	17.74
24.	09:00 AM	0.89	19.1	16.56	12.1
Average Concentration		**0.88**	**18.77**	**19.49**	**20.07**
NEQSAA		**05 (24 hr)**	**40 (24 hr)**	**80 (24 hr)**	**120 (24 hr)**
WHO		---	---	**200 (24 hrs)**	**20 (24 hrs)**

NEQSAA: National Environmental Quality Standards for Ambient Air

Note:

- Selected measurement units were mg/m^3 and µg/m^3 otherwise stated.
- Quality was assured through self calibration of the instrument.
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AMBIENT GASEOUS MONITORING REPORT

Reference Number	KPCIP/ENV/159-2020		
Project Name:	Khyber Pakhtunkhwa Cities Improvement Project	**Site Address:**	Mingora Greater Water Supply Scheme, Mingora, District Swat, Kpk
Monitoring Date:	09-09-2020	**Reporting Date:**	17-09-2020
Source:	Ambient Air (Gaseous)	**Monitoring Instrument:**	AQMS65, Serial # 1310
Location:	Near Masjid Usmanabad		
GPS Coordinates:	72.37149 34.779293		

Sr. No	Time	Parameters: CO	NO	NO_2	SO_2
		Units			
	Hours	(mg/m^3)	($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)
1.	10:30 AM	0.88	19.01	17.17	16.35
2.	11:30 AM	0.9	19.03	18.94	16.72
3.	12:30 PM	0.86	18.88	19.61	17.98
4.	01:30 PM	1.01	18.97	20.26	19.28
5.	02:30 PM	1	18.95	20.54	19.52
6.	03:30 PM	1.02	19.68	21.78	20.14
7.	04:30 PM	1.04	18.79	22.88	20.58
8.	05:30 PM	1.08	18.92	22.96	20.7
9.	06:30 PM	0.97	18.96	24.38	22.11
10.	07:30 PM	0.95	18.55	21.3	20.61
11.	08:30 PM	0.85	18.18	19.15	19.92
12.	09:30 PM	0.82	17.97	18.06	16.16
13.	10:30 PM	0.77	17.89	18.2	16.81
14.	11:30 PM	0.75	17.88	17.31	16.21
15.	12:30 AM	0.78	17.49	16.86	16.75
16.	01:30 AM	0.72	17.08	16.37	17.05
17.	02:30 AM	0.68	16.64	16.34	16.68
18.	03:30 AM	0.67	17.16	16.17	16.44
19.	04:30 AM	0.71	17.46	16.03	16.3
20.	05:30 AM	0.72	17.96	16.28	15.17
21.	06:30 AM	0.73	18.33	15.86	14.91
22.	07:30 AM	0.77	18.28	15.77	15.66
23.	08:30 AM	0.79	18.7	15.61	15.02
24.	09:30 AM	0.85	18.63	15.54	9.38
Average Concentration		**0.84**	**18.30**	**18.47**	**17.35**
NEQSAA		**05 (24 hr)**	**40 (24 hr)**	**80 (24 hr)**	**120 (24 hr)**
WHO		---	---	**200 (24 hrs)**	**20 (24 hrs)**

NEQSAA: National Environmental Quality Standards for Ambient Air

Note:

- Selected measurement units were mg/m^3 and $\mu g/m^3$ otherwise stated.
- Quality was assured through self calibration of the instrument.
- The values were representing of monitoring conditions prevailing during the monitoring hours.
- The measurements were carried out on client request.
- The client is responsible lawful usage of reported data in future.
- The report is not valid for court.

Integrated Environment Laboratory

Signature of Analyst:

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AMBIENT GASEOUS MONITORING REPORT

Reference Number	KPCIP/ENV/159-2020		
Project Name:	Khyber Pakhtunkhwa Cities Improvement Project	**Site Address:**	Mingora Greater Water Supply Scheme, Mingora, District Swat, Kpk
Monitoring Date:	10-09-2020	**Reporting Date:**	17-09-2020
Source:	Ambient Air (Gaseous)	**Monitoring Instrument:**	AQMS65, Serial # 1310
Location:	Near Madrasa Rahimia, Shahdara		
GPS Coordinates:	72.36478 34.784182		

Sr. No	Time	Parameters			
		CO	NO	NO_2	SO_2
		Units			
	Hours	(mg/m^3)	($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)
25.	11:00 AM	0.83	15.93	14.59	13.88
26.	12:00 PM	0.85	15.95	16.36	14.25
27.	01:00 PM	0.81	15.8	17.03	15.51
28.	02:00 PM	0.96	15.89	17.68	16.81
29.	03:00 PM	0.95	15.87	17.96	17.05
30.	04:00 PM	0.97	16.6	19.2	17.67
31.	05:00 PM	0.99	15.71	20.3	18.11
32.	06:00 PM	1.03	15.84	20.38	18.23
33.	07:00 PM	0.92	15.88	21.8	19.64
34.	08:00 PM	0.9	15.47	18.72	18.14
35.	09:00 PM	0.8	15.1	16.57	17.45
36.	10:00 PM	0.77	14.89	15.48	13.69
37.	11:00 PM	0.72	14.81	15.62	14.34
38.	12:00 AM	0.7	14.8	14.73	13.74
39.	01:00 AM	0.73	14.41	14.28	14.28
40.	02:00 AM	0.67	14	13.79	14.58
41.	03:00 AM	0.63	13.56	13.76	14.21
42.	04:00 AM	0.62	14.08	13.59	13.97
43.	05:00 AM	0.66	14.38	13.45	13.83
44.	06:00 AM	0.67	14.88	13.7	12.7
45.	07:00 AM	0.68	15.25	13.28	12.44
46.	08:00 AM	0.72	15.2	13.19	13.19
47.	09:00 AM	0.74	15.62	13.03	12.55
48.	10:00 AM	0.8	15.55	12.96	11.91
Average Concentration		**0.79**	**15.22**	**15.89**	**15.09**
NEQSAA		**05 (24 hr)**	**40 (24 hr)**	**80 (24 hr)**	**120 (24 hr)**
WHO		---	---	**200 (24 hrs)**	**20 (24 hrs)**

NEQSAA: National Environmental Quality Standards for Ambient Air

Note:

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NOISE LEVEL MONITORING REPORT

Reference Number	KPCIP/ENV/159-2020		
Project Name:	Khyber Pakhtunkhwa Cities Improvement Project	**Site Address:**	Mingora Greater Water Supply Scheme, Mingora, District Swat, Kpk
Monitoring Date:	07-09-2020	**Reporting Date:**	17-09-2020
Source:	Ambient Noise	**Monitoring Instrument:**	Noise Meter-IEC651-Type-2
Location:	Airport Road, Mingora		
GPS Coordinates:	72.351859 34.786704		

Sr. No.	Monitoring Time	Unit	Minimum	Maximum	Leq
1.	09:30 AM	dB(A)	60.1	62.6	61.3
2.	10:30 AM		59.9	62.4	61.1
3.	11:30 AM		59.7	62.2	60.9
4.	12:30 PM		59.5	62	60.7
5.	01:30 PM		59.3	61.7	60.5
6.	02:30 PM		59	61.5	60.2
7.	03:30 PM		58.8	61.3	60.05
8.	04:30 PM		58.6	61.1	59.8
9.	05:30 PM		58.4	60.9	59.6
10.	06:30 PM		58.2	60.7	59.4
11.	07:30 PM		58	60.4	59.2
12.	08:30 PM		57.7	60.2	58.9
13.	09:30 PM		57.5	60	58.7
14.	10:30 PM		57.3	59.8	58.5
15.	11:30 PM		57.1	59.6	58.3
16.	12:30 AM		56.9	59.4	58.1
17.	01:30 AM		56.7	59.2	57.9
18.	02:30 AM		56.5	59	57.7
19.	03:30 AM		56.3	58.8	57.5
20.	04:30 AM		56.1	58.5	57.3
21.	05:30 AM		55.8	58.3	57.05
22.	06:30 AM		55.6	58.1	56.8
23.	07:30 AM		55.4	57.9	56.6
24.	08:30 AM		55.2	57.7	56.4
NEQS limit : 65 dB					
WHO limit: 70 dB					

NEQS: National Environmental Quality Standards **WHO:** World Health Organization
Leq: Log Equivalent Continuous Sound Level
Note:

- Selected measurement units were dB (A) otherwise stated.
- Quality was assured through self calibration of the instrument.
- The values were representing of monitoring conditions prevailing during the monitoring hours.
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NOISE LEVEL MONITORING REPORT

Reference Number	KPCIP/ENV/159-2020		
Project Name:	Khyber Pakhtunkhwa Cities Improvement Project	**Site Address:**	Mingora Greater Water Supply Scheme, Mingora, District Swat, Kpk
Monitoring Date:	08-09-2020	**Reporting Date:**	17-09-2020
Source:	Ambient Noise	**Monitoring Instrument:**	Noise Meter-IEC651-Type-2
Location:	Amankot Road		
GPS Coordinates:	72.350281 34.767061		

Sr. No.	Monitoring Time	Unit	Minimum	Maximum	Leq
1.	10:00 AM	dB(A)	55.2	60.1	57.6
2.	11:00 AM		55	59.9	57.4
3.	12:00 PM		54.8	59.7	57.2
4.	01:00 PM		54.6	59.5	57.05
5.	02:00 PM		54.4	59.2	56.8
6.	03:00 PM		54.1	59	56.5
7.	04:00 PM		53.9	58.8	56.3
8.	05:00 PM		53.7	58.6	56.1
9.	06:00 PM		53.5	58.4	55.9
10.	07:00 PM		53.3	58.2	55.7
11.	08:00 PM		53.1	57.9	55.5
12.	09:00 PM		52.8	57.7	55.2
13.	10:00 PM		52.6	57.5	55.05
14.	11:00 PM		52.4	57.3	54.8
15.	12:00 AM		52.2	57.1	54.6
16.	01:00 AM		52	56.9	54.4
17.	02:00 AM		51.8	56.7	54.2
18.	03:00 AM		51.6	56.5	54.05
19.	04:00 AM		51.4	56.3	53.8
20.	05:00 AM		51.2	56	53.6
21.	06:00 AM		50.9	55.8	53.3
22.	07:00 AM		50.7	55.6	53.1
23.	08:00 AM		50.5	55.4	52.9
24.	09:00 AM		50.3	55.2	52.7
NEQS limit : 65 dB					
WHO limit: 70 dB					

NEQS: National Environmental Quality Standards **WHO:** World Health Organization

Leq: Log Equivalent Continuous Sound Level

Note:

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NOISE LEVEL MONITORING REPORT

Reference Number	KPCIP/ENV/159-2020		
Project Name:	Khyber Pakhtunkhwa Cities Improvement Project	Site Address:	Mingora Greater Water Supply Scheme, Mingora, District Swat, Kpk
Monitoring Date:	09-09-2020	Reporting Date:	17-09-2020
Source:	Ambient Noise	Monitoring Instrument:	Noise Meter-IEC651-Type-2
Location:	Near Masjid Usmanabad		
GPS Coordinates:	72.37149 34.779293		

Sr. No.	Monitoring Time	Unit	Minimum	Maximum	Leq
1.	10:30 AM	dB(A)	53.1	57	55.05
2.	11:30 AM		52.9	56.8	54.8
3.	12:30 PM		52.7	56.6	54.6
4.	01:30 PM		52.5	56.4	54.4
5.	02:30 PM		52.3	56.1	54.2
6.	03:30 PM		52	55.9	53.9
7.	04:30 PM		51.8	55.7	53.7
8.	05:30 PM		51.6	55.5	53.5
9.	06:30 PM		51.4	55.3	53.3
10.	07:30 PM		51.2	55.1	53.1
11.	08:30 PM		51	54.8	52.9
12.	09:30 PM		50.7	54.6	52.6
13.	10:30 PM		50.5	54.4	52.4
14.	11:30 PM		50.3	54.2	52.2
15.	12:30 AM		50.1	54	52.05
16.	01:30 AM		49.9	53.8	51.8
17.	02:30 AM		49.7	53.6	51.6
18.	03:30 AM		49.5	53.4	51.4
19.	04:30 AM		49.3	53.2	51.2
20.	05:30 AM		49.1	52.9	51.0
21.	06:30 AM		48.8	52.7	50.7
22.	07:30 AM		48.6	52.5	50.5
23.	08:30 AM		48.4	52.3	50.3
24.	09:30 AM		48.2	52.1	50.1

NEQS limit : 65 dB

WHO limit: 70 dB

NEQS: National Environmental Quality Standards **WHO:** World Health Organization
Leq: Log Equivalent Continuous Sound Level
Note:

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NOISE LEVEL MONITORING REPORT

Reference Number	KPCIP/ENV/159-2020		
Project Name:	Khyber Pakhtunkhwa Cities Improvement Project	**Site Address:**	Mingora Greater Water Supply Scheme, Mingora, District Swat, Kpk
Monitoring Date:	10-09-2020	**Reporting Date:**	17-09-2020
Source:	Ambient Noise	**Monitoring Instrument:**	Noise Meter-IEC651-Type-2
Location:	Near Madrasa Rahimia, Shahdara		
GPS Coordinates:	72.36478 34.784182		

Sr. No.	Monitoring Time	Unit	Minimum	Maximum	Leq
1.	11:00 AM	dB(A)	52.2	56.2	54.2
2.	12:00 PM		52	56	54
3.	01:00 PM		51.8	55.8	53.8
4.	02:00 PM		51.6	55.6	53.6
5.	03:00 PM		51.4	55.3	53.35
6.	04:00 PM		51.1	55.1	53.1
7.	05:00 PM		50.9	54.9	52.9
8.	06:00 PM		50.7	54.7	52.7
9.	07:00 PM		50.5	54.5	52.5
10.	08:00 PM		50.3	54.3	52.3
11.	09:00 PM		50.1	54	52.05
12.	10:00 PM		49.8	53.8	51.8
13.	11:00 PM		49.6	53.6	51.6
14.	12:00 AM		49.4	53.4	51.4
15.	01:00 AM		49.2	53.2	51.2
16.	02:00 AM		49	53	51
17.	03:00 AM		48.8	52.8	50.8
18.	04:00 AM		48.6	52.6	50.6
19.	05:00 AM		48.4	52.4	50.4
20.	06:00 AM		48.2	52.1	50.15
21.	07:00 AM		47.9	51.9	49.9
22.	08:00 AM		47.7	51.7	49.7
23.	09:00 AM		47.5	51.5	49.5
24.	10:00 AM		47.3	51.3	49.3

NEQS limit : 65 dB

WHO limit: 70 dB

NEQS: National Environmental Quality Standards **WHO:** World Health Organization

Leq: Log Equivalent Continuous Sound Level

Note:

- Selected measurement units were dB (A) otherwise stated.
- Quality was assured through self calibration of the instrument.
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WATER ANALYSIS REPORT

Reference Number	KPCIP/ENV/159-2020		
Project Name:	Khyber Pakhtunkhwa Cities Improvement Project.	**Site Address:**	Mingora Greater Water Supply Scheme, Mingora, District Swat, Kpk
Sampling Date:	07-09-2020	**Reporting Date:**	17-09-2020
Source:	Tap Water	**Sampling Done by:**	Analyst
Location:	Jamia Masjid Nawakaly,	**Analysis Method:**	APHA/USEPA Standard Methods
GPS Coordinates:	72.35325 34.78456		

Sr. No.	Parameters	Standard Methods	Units	NDWQS	Results
1	pH	APHA-4500H+ B	--	6.5-8.5	7.4
2	Taste & Odor	In-house	--	Non Objectionable	Non Objectionable
3	Color	APHA-2120 B/C	TCU	<15	4
4	Turbidity	APHA-2130 B	NTU	<5	5
5	Total Coliform	APHA-9222 B	0 Number/100 mL	0 Number/100 mL	0
6	E-Coli	APHA-9222 D	0 Number/100 mL	0 Number/100 mL	0
7	Total Dissolved Solids (TDS)	APHA-2540 C	mg/L	≤1000	237
8	Total Hardness	APHA-2340 C	mg/L	≤500	81
9	Nitrate	APHA-4500 NO3 B	mg/L	≤50	2.1
10	Nitrite	APHA-4500 NO2 B	mg/L	≤3	0.03
11	Ammonia	APHA-4500-NH3-B	mg/L	----	N.D
12	Arsenic	APHA-3500 As B	mg/L	<0.05	N.D
13	Antimony	APHA-3500 Sb B	mg/L	<0.005	N.D
14	Barium	APHA-3500 Ba B	mg/L	0.7	N.D
15	Chloride	APHA-4500 Cl- B	mg/L	250	79
16	Fluoride	APHA-4500 F-C	mg/L	<1.5	0.81
17	Aluminum	APHA-3500 Al B	mg/L	≤0.2	N.D
18	Manganese	APHA-3500-Mn B	mg/L	≤0.5	N.D
19	Mercury	APHA-3500-Hg B	mg/L	0.001	N.D
20	Iodine	-	mg/L	----	0.08
21	Zinc	APHA-3500-Zn B	mg/L	5	0.73
22	Boron	APHA-4500 B-C	mg/L	0.7	N.D
23	Chromium	APHA-3500 Cr B	mg/L	≤0.05	N.D
24	Selenium	APHA-3500 Se C	mg/L	≤0.5	N.D

NDWQS: National Drinking Water Quality Standards

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WATER ANALYSIS REPORT

Reference Number	KPCIP/ENV/159-2020		
Project Name:	Khyber Pakhtunkhwa Cities Improvement Project.	**Site Address:**	Mingora Greater Water Supply Scheme, Mingora, District Swat, Kpk
Sampling Date:	09-09-2020	**Reporting Date:**	17-09-2020
Source:	Tap Water	**Sampling Done by:**	Analyst
Location:	Masjid Usmanabad,	**Analysis Method:**	APHA/USEPA Standard Methods
GPS Coordinates:	72.375149 34.779293		

Sr. No.	Parameters	Standard Methods	Units	NDWQS	Results
1	pH	APHA-4500H+ B	--	6.5-8.5	7.4
2	Taste & Odor	In-house	--	Non Objectionable	Non Objectionable
3	Color	APHA-2120 B/C	TCU	<15	6
4	Turbidity	APHA-2130 B	NTU	<5	4
5	Total Coliform	APHA-9222 B	0 Number/100 mL	0 Number/100 mL	0
6	E-Coli	APHA-9222 D	0 Number/100 mL	0 Number/100 mL	0
7	Total Dissolved Solids (TDS)	APHA-2540 C	mg/L	≤1000	241
8	Total Hardness	APHA-2340 C	mg/L	≤500	84
9	Nitrate	APHA-4500 NO3 B	mg/L	≤50	1.9
10	Nitrite	APHA-4500 NO2 B	mg/L	≤3	0.03
11	Ammonia	APHA-4500-NH3-B	mg/L	----	N.D
12	Arsenic	APHA-3500 As B	mg/L	<0.05	N.D
13	Antimony	APHA-3500 Sb B	mg/L	<0.005	N.D
14	Barium	APHA-3500 Ba B	mg/L	0.7	N.D
15	Chloride	APHA-4500 Cl- B	mg/L	250	73
16	Fluoride	APHA-4500 F-C	mg/L	<1.5	0.83
17	Aluminum	APHA-3500 Al B	mg/L	≤0.2	N.D
18	Manganese	APHA-3500-Mn B	mg/L	≤0.5	N.D
19	Mercury	APHA-3500-Hg B	mg/L	0.001	N.D
20	Iodine	-	mg/L	----	0.06
21	Zinc	APHA-3500-Zn B	mg/L	5	0.73
22	Boron	APHA-4500 B-C	mg/L	0.7	N.D
23	Chromium	APHA-3500 Cr B	mg/L	≤0.05	N.D
24	Selenium	APHA-3500 Se C	mg/L	≤0.5	N.D

NDWQS: National Drinking Water Quality Standards

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WATER ANALYSIS REPORT

Reference Number	KPCIP/ENV/159-2020		
Project Name:	Khyber Pakhtunkhwa Cities Improvement Project.	**Site Address:**	Mingora Greater Water Supply Scheme, Mingora, District Swat, Kpk
Sampling Date:	10-09-2020	**Reporting Date:**	17-09-2020
Source:	Surface Water	**Sampling Done by:**	Analyst
Location:	Existing Water Tank Shahdara	**Analysis Method:**	APHA/USEPA Standard Methods
GPS Coordinates:	72.364787 34.783798		

Sr. No.	Parameters	Standard Methods	Units	NDWQS	Results
1	pH	APHA-4500H+ B	--	6.5-8.5	7.6
2	Taste & Odor	In-house	--	Non Objectionable	Non Objectionable
3	Color	APHA-2120 B/C	TCU	<15	6
4	Turbidity	APHA-2130 B	NTU	<5	4
5	Total Coliform	APHA-9222 B	0 Number/100 mL	0 Number/100 mL	0
6	E-Coli	APHA-9222 D	0 Number/100 mL	0 Number/100 mL	0
7	Total Dissolved Solids (TDS)	APHA-2540 C	mg/L	≤1000	249
8	Total Hardness	APHA-2340 C	mg/L	≤500	87
9	Nitrate	APHA-4500 NO3 B	mg/L	≤50	2.2
10	Nitrite	APHA-4500 NO2 B	mg/L	≤3	0.06
11	Ammonia	APHA-4500-NH3-B	mg/L	----	N.D
12	Arsenic	APHA-3500 As B	mg/L	<0.05	N.D
13	Antimony	APHA-3500 Sb B	mg/L	<0.005	N.D
14	Barium	APHA-3500 Ba B	mg/L	0.7	N.D
15	Chloride	APHA-4500 Cl- B	mg/L	250	83
16	Fluoride	APHA-4500 F-C	mg/L	<1.5	0.9
17	Aluminum	APHA-3500 Al B	mg/L	≤0.2	N.D
18	Manganese	APHA-3500-Mn B	mg/L	≤0.5	N.D
19	Mercury	APHA-3500-Hg B	mg/L	0.001	N.D
20	Iodine	-	mg/L	----	0.09
21	Zinc	APHA-3500-Zn B	mg/L	5	0.78
22	Boron	APHA-4500 B-C	mg/L	0.7	N.D
23	Chromium	APHA-3500 Cr B	mg/L	≤0.05	N.D
24	Selenium	APHA-3500 Se C	mg/L	≤0.5	N.D

NDWQS: National Drinking Water Quality Standards

Integrated Environment Laboratory

Signature of Analyst:

FOR ENVIRONMENTAL MONITORING, ANALYSIS & SURVEYS

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Environmental Protection Agency (EPA-KPK) Certified

Annexure D

Occupational Health and Safety Plan

General

Occupational Health and Safety covers all personnel working under the project and will be in line with the World Bank/IFC EHS guidelines on health and safety.

The Occupational Health and Safety program will aim to ensure that the workplace is safe and healthy by: addressing the hazards and risks at the workplace; outlining the procedures and responsibilities for preventing, eliminating and minimizing the effects of those hazards and risks; identifying the emergency management plans for the workplace or workplaces; and, specifying how consultation, training and information are to be provided to employees at various workplaces.

Some of the risks/hazards associated with workplaces are due to working close to or at sites associated with the various project construction activities. Other risks associated with the project construction phase include risk of increase of vector borne and other different diseases.

The following sections will be implemented during the construction phase to address and ensure workers' health and safety.

a. Screening and regular unannounced checking of workers

As per the procedure for hiring workers, all contractors and labor agencies are required to make all prospective workers undergo medical tests to screen for diseases and sicknesses, prior to selection and employment of any worker. The contractor is also responsible for ensuring that no worker who has a criminal record is employed at the project site. It will be ensured that all workers undergo medical tests to screen diseases at source and at sites in consultation with the designated Health Officer.

In addition to this, the Project Management will also undertake sudden, unannounced checks on workers to look for diseases such as HIV, STDs, and hepatitis and take necessary steps as mandated by the Contractual agreement between the Contractor and the Worker(s).

b. Minimizing hazards and risks at the workplace.

To ensure safety at all work sites, the following will be carried out:

i. Installation of signboards and symbols in risky and hazardous areas, to inform workers to be careful.

ii. Construction of barricades around construction sites and deep excavated pits, to cordon off and deter entry of unauthorized personnel and workers into these areas.

iii. Providing a safe storage site/area for large equipment such as power tools and chains, to prevent misuse and loss.

iv. Proper Housekeeping: Ensuring that materials are all stacked, racked, blocked, interlocked, or otherwise secured to prevent sliding, falling, or collapse. Brick stacks will not be more than 7 feet in height and for concrete blocks they will not be more than 6 feet high.

v. Removing all scrap timber, waste material and rubbish from the immediate work area as the work progresses.

vi. Where scaffolds are required, ensuring that each scaffold or its components shall be capable of supporting its own weight and at least 4 times the maximum intended load applied or transmitted to it. The platform/scaffold plank shall be at least 15 inches wide and 1.5 inches thick. The rope should be capable of supporting at least 6 times the maximum intended load applied or transmitted to that rope. Pole scaffolds over 60 feet in height shall be designed by a registered professional engineer and shall be constructed and loaded in accordance with that design. Where scaffolds are not provided, safety belts/safety nets shall be provided;

vii. Ensure that all ramps or walkways are at least 6 feet wide, having slip resistance threads and not inclined at more than a slope of 1 vertical and 3 horizontal.

viii. Stacking away all excavated earth at least 2 feet from the pit to avoid material such as loose rocks from falling back into the excavated area and injuring those working inside excavated sites.

ix. Constructing support systems, such as bracing to adjoining structures that may be endangered by excavation works nearby.

x. Only a trained electrician to construct, install and repair all electrical equipment to prevent risks of electrical shocks and electrocution.

xi. Install fire extinguishers and/or other fire-fighting equipment at every work site to prepare for any accidental fire hazards.

c. Provision of Personal Protective Equipment

Risks to the health and safety of workers can be prevented by provision of Personal Protective Equipment (PPEs) to all workers. This will be included in the construction cost for each Contractor. Depending on the nature of work and the risks involved, contractors must provide without any cost to the workers, the following protective equipment:

i. High visibility clothing for all personnel during road works must be mandatory.

ii. Helmet shall be provided to all workers, or visitors visiting the site, for protection of the head against impact or penetration of falling or flying objects.

iii. Safety belt shall be provided to workers working at heights (more than 20 ft.) such as roofing, painting, and plastering.

iv. Safety boots shall be provided to all workers for protection of feet from impact or penetration of falling objects on feet.

v. Ear protecting devices shall be provided to all workers and will be used during the occurrence of extensive noise.

vi. Eye and face protection equipment shall be provided to all welders to protect against sparks.

vii. Respiratory protection devices shall be provided to all workers during occurrence of fumes, dusts, or toxic gas/vapor.

viii. Safety nets shall be provided when workplaces are more than 25 feet (7.5 m) above the ground or other surfaces where the use of ladders, scaffolds, catch platforms, temporary floors or safety belts is impractical.

The specific PPE requirements for each type of work are summarized below.

Table E.1 PPE Requirement List

Type of Work	PPE
Elevated work	Safety helmet, safety belt (height greater than 20 ft.), footwear for elevated work.
Handling work safety	Helmet, leather safety shoes, work gloves.
Welding and cutting work	Eye protectors, shield and helmet, protective gloves.
Grinding work	Dust respirator, earplugs, and eye protectors.
Work involving handling of chemical substances	Dust respirator, gas mask, chemical-proof gloves. Chemical proof clothing, air-lined mask, eye protectors.
Wood working	Hard hat, eye protectors, hearing protection, safety footwear, leather gloves and dust respirator.
Blasting	Hard hat, eye and hearing protection.
Concrete and masonry work	Hard hat, eye protectors, hearing protection, safety footwear, leather gloves and dust respirator.
Excavation, heavy equipment, motor graders, and bulldozer operation	Hard hat, safety boots, gloves, hearing protection.
Quarries	Hard hat, eye protectors, hearing protection, safety footwear, leather gloves and dust respirator.

d. Procedures to Deal with Emergencies such as Accidents, Sudden Illness and Death of Workers

First aid kits will be made available at all times throughout the entire construction period by the respective contractors. This is very important, because most work sites will be at some distance from the nearest hospital. In addition to the first aid kits, the following measures should be in place:

i. Provision of dispensaries by the individual EPC contractor.

ii. A vehicle shall be on standby from the Project Office so that emergency transportation can be arranged to take severely injured/sick workers to the nearest hospital for immediate medical attention.

iii. A designated Health Officer/worker for the Project will be identified as a focal person to attend to all health and safety related issues. This employee's contact number will be posted at all work sites for speedy delivery of emergency services. The focal person shall be well versed with the medical system and facilities available at the hospital.

iv. Communication arrangements, such a provision of radios or mobile communication for all work sites, for efficient handling of emergencies, will be made.

e. Record Maintenance and Remedial action

The Project Management will maintain a record of all accidents and injuries that occur at the work site. This work will be delegated by the contractor to the site supervisor and regularly reviewed every quarter by project management. Reports prepared by the contractor shall include information on the place, date and time of the incident, name of persons involved, cause of incident, witnesses present and their statements. Based on such reports, the management can jointly identify any unsafe conditions, acts or procedures and recommend for the contractor to undertake certain mitigate actions to change any unsafe or harmful conditions.

f. Compensation for Injuries and Death

Any casualty or injury resulting from occupational activities should be compensated as per the local labor laws. Where compensation is sought by the injured party, proper procedures for documentation of the case will be followed, including a detailed report on the accident, written reports from witnesses, report of the examining doctor and his/her recommendation for treatment. Each individual contractor will be responsible for ensuring compensation for the respective workers.

g. Awareness Programs

The Project management will undertake awareness programs through posters, talks, and meetings with the contractors to undertake the following activities:

i. Dissemination sessions will clarify the rights and responsibilities of the workers regarding interactions with local people (including communicable disease risks, such as HIV/AIDS), work site health and safety, waste management (waste separation, recycling, and composting), and the illegality of poaching.

ii. Make workers aware of procedures to be followed in case of emergencies such as informing the focal health person who in turn will arrange the necessary emergency transportation or treatment.

h. Nomination of a Health and Safety Focal Person

Within each site (especially if different sites are being implemented by different contractors), a Health and Safety Focal Person will be appointed. The Terms of Reference for the focal person will mainly be as follows:

i. Function as the focal person/representative for all health and safety matters at the workplace;

ii. Responsible for maintaining records of all accidents and all health and safety issues at each site, the number of accidents and its cause, actions taken and remedial measures undertaken in case of safety issues;

iii. Be the link between the contractor and all workers and submit grievances of the workers to the contractor and instructions/directives on proper health care and safety from the contractors back to the workers;

iv. Ensure that all workers are adequately informed on the requirement to use Personal Protective Equipment and its correct use;

v. Also responsible for the first aid kit and making sure that the basic immediate medicines are readily available.

Annexure E

Emergency Response Plan

F.1 PURPOSE

The purpose of this Emergency Response Procedure is to provide measures and guidance for the establishment and implementation of emergency preparedness plans for the project. The aim of the Emergency Response Procedure is to:

(i) Ensure all personnel and visitors to the office/job sites are given the maximum protection from unforeseen events.

(ii) Ensure all personnel are aware of the importance of this procedure to protection of life and property.

F.2 EMERGENCY PREPARATION AND RESPONSE MEASURE SCOPE

The emergency management program is applied to all Project elements and intended for use throughout the Project life cycle. The following are some emergencies that may require coordinated response.

(i) Construction Accident

(ii) Road & Traffic Accident

(iii) Hazardous material spills

(iv) Structure collapse or failure

(v) Trauma or serious illness

(vi) Sabotage

(vii) Fire

(viii) Environmental Pollution

(ix) Loss of person

(x) Community Accident

F.3 RESPONSIBILITIES

The detailed roles and responsibilities of certain key members of the Emergency Response team available to assist in emergency are provided in **Table F.1** below.

Table F.1 Emergency Response Team

Action Group	Responsibility
Emergency Coordinator	Overall control of personnel and resources. The Emergency Coordinator will support and advise the Site Safety Supervision as necessary. Serves as public relations spokes persons, or delegates to some staff member the responsibility for working with news media regarding any disaster or emergency. Also assure proper coordination of news release with appropriate corporate staff or other designated people.
Site Safety Supervision (Emergency Commander)	Overall responsibility for activating emergency plan and for terminating emergency actions. Be alternative of emergency response chairpersons. Disseminates warnings and information as required to ensure all people in the immediate area have been warned and evacuated either by alarms or by word of mouth. Supervise the actions of the Emergency Response Team to ensure all persons are safe from the danger. Notify outside authorities if assistance is required. Carries the responsibility for coordinating actions including other organizations in accordance with the needs of the situation. Ensure maximum co-operation and assistance is provided to any outside groups called to respond to an emergency. Establish and appoint all emergency organization structure and team. Assures adequate delegation of responsibilities for all key positions of assistants on the Project to assist with any foreseeable emergency. Ensure resources available to purchase needed emergency response equipment and supplies. Assures that all persons on the Emergency Response Team aware and fully understand their individual responsibilities for implementing and supporting the emergency plan. Establish the emergency drill schedule of all identified emergency scenarios, track the status and evaluate the emergency.

Action Group	Responsibility
	The Emergency Commander shall ensure that senior management personnel have been reported of the emergency as soon as practical after the event.
Security Team	Ensure that the exit route is regularly tested and maintained in good working order. Maintain station at the security gate or most suitable location to secure the area during any emergency such that only authorized personnel and equipment may enter, prevent access to the site of unauthorized personnel. Assist with strong/activation of services during an emergency. Ensure vehicles and obstructions are moved to give incoming emergency vehicles access to the scene, if ambulance or emergency services are attending the site, ensure clear access and personnel are located to direct any incoming emergency service to the site of emergency.
Rescue & Medical Team	Protect the injured from further danger and weather. Provide treatment to the victim(s) to the best of their ability by first aid and then transfer to hospital. Remain familiar with the rescue activities and rescue apparatus. Assist outside medical services personnel when they arrive
General Administration Team	▪ Response to support any requested general facilities for assisting Emergency Response Team in their work.
Government Relation Team	Coordinate with local government on a matter of concerned in the emergency response plan to liaise with local officers in their affair for support Emergency Response Team. Coordinate emergency plan with the government authorities, local community.
Environment Team	▪ In case of emergency related to the environmental pollution such as the chemical spill, oil spill into the ambient, the environment team will support the technical advice to control and mitigate the pollution until return to the normal situation.
Department Heads	Call up of personnel into the safe location for protective life and property. Take immediate and appropriate action while Emergency Response Team is being mobilized. Keep in touch with the Emergency Commander

Action Group	Responsibility
	Control and supervise operators and contractors on the implementation of this procedure, with consultation with Safety Team as necessary. Provide and maintain emergency equipment of their responsible areas.
Other Staff and Employees	All other staff and employees will remain at their workstations or assembly point unless directed otherwise from Emergency Response Team. Each supervisor will ensure that all members of his work group are accounted for and keep in touch with each of their Department Head.

F.4 PROCEDURE

Emergency situation and injuries to person can occur at any time or place either on Project site or elsewhere. The most two common types of emergencies on site are fire and serious accident.

Figure F.1 Emergency Procedure for Fire

FIRE

RESCUE
- Rescue any person in immediate danger if safe to do so

ALARM
- Raise the alarm by shouting to raise attention to others
- If confident and safe to do so, commence fighting the fire

EVACUATE
- If not practical to fight the fire, move to safe area ensuring all other personnel are warned along the way

REPORT
- Advice the Emergency coordinator of the reasons for the alarm and location of fire.

take the following action:

If a hazard exists consider your own safety then if possible remove the hazard or the injured person.

Assess the patient by checking for Airway, Breathing, Pulse and obvious

Report directly to First Aid or Security Centers, when raising the alarm you must clearly give the following in formation;
- Your name and the detail of accident
- The location of the injured person(s)
- The number of persons injured
- The extent of the injuries, if known
- What known hazards are in the area

Make the injured person as comfortable as possible

Treat the obvious injuries

Reassure the injured person

F.5 COMMUNICATION WITH AUTHORITIES / PRESS AT SITE

In the event of an accident or incident, only senior staff is permitted to give factual information to the authorities for resource of liability exposure. The press must be avoiding politely, at all costs, with the terse comment that "the matter is under investigation and relevant information when available will be provided by our Head Office" Do not ever give your opinion or story.

First Aid Persons

Upon advice of medical emergency, make immediate assessment to response required and if necessary, advise security to summon ambulance or medical assistance, the qualified first aid attendant should also,

Provide treatment to the victim(s) to the best of his/her ability.

Ensure the safety of victims by ceasing any work activity in the area.

Protect the injured from further danger and weather.

Assist medical services personnel when they arrive.

General Administration Team

Upon advice of medical emergency, maintain contact with first aid personnel and summon ambulance if required.

Security Team

If ambulance or emergency services are attending the site, ensure clear access and personnel are located to direct vehicle closest to the scene.

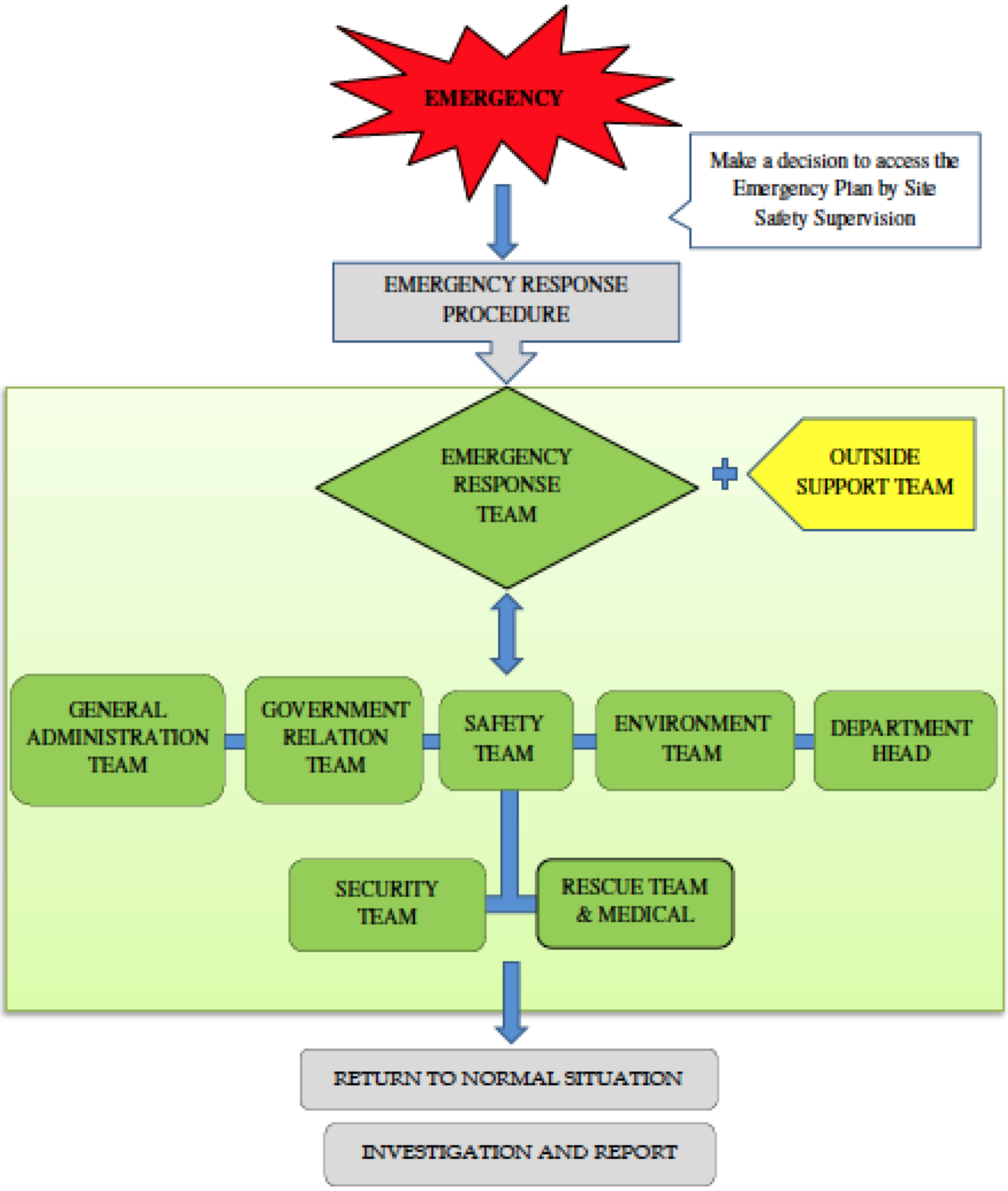
Prevent access to the site of unauthorized personnel (press, etc.).

Emergency Coordinator

The Emergency Coordinator shall assist emergency personnel at the scene as required through allocation of company resources.

The Emergency Coordinator shall ensure next-of-kin are properly notified as soon as possible and give whatever company support and assistance is necessary to assist them bundle the situation

The Emergency Coordinator shall ensure that senior management personnel are advised of the emergency as soon as practical after the event.



Note: Name of contact person and call number from Owner/Contractor to be determined.

F.5 INCIDENT AND ACCIDENT REPORT

Section A: Identification Data

Report No:	Date of Reported:	Reporter:	Sign:
Job Title:		Company Name:	

Section B: Violence Rate

Accident Violence: ☐ 01-Death ☐ 02-Serious Injury ☐ 03-Lost Time Injury ☐ 04-First Aid ☐ 05- Not Injury ☐ 06-Near Miss

Property Damage Cost: ☐ 1-2,000 USD ☐ 2,001-10,000 USD ☐ 10,001-50,000 ☐ > 50,001

Section C: Environmental Impact

Affected area	☐ Construction area	☐ Public area	
Receptor	☐ None	☐ Workers	☐ Community
Type of pollution	☐ Physical	☐ Chemical	☐ Biological
Toxicity	☐ Non-toxic	☐ Low - toxic	☐ High - toxic
Return to Normal	☐ 1 day	☐ 1 day to 1 week	☐ ≥ 1 week
Cumulative impact	☐ Non-cumulative	☐ Cumulative	

Section D: Injured/Illness Employee

1.Name:	Sex:	Date of Birth:			Age:	Regular Job Title:	Experience:	
	☐ Male ☐ Female	Month	Day	Year			In this job title Years Weeks	In this Project Years Weeks

Site:	Company:	Reference:	Phone No:	Social Security Number

Part of Body Injured or Affected:

☐ Head ☐ Hands ☐ Face ☐ Nose
☐ Eyes ☐ Legs ☐ Teeth ☐ Neck
☐ Trunk ☐ Toes ☐ Elbow ☐ Shoulder
☐ Back ☐ Ankle ☐ Wrist ☐ Foot
☐ Arms ☐ Thump ☐ Fingers ☐ Internal

Remark: ....

Nature of Injury or Illness:

☐ Laceration ☐ Amputation ☐ Puncture ☐ Fracture
☐ Strain & Sprain ☐ Burns ☐ Contusion ☐ Dry Heat Friction
☐ Hernia ☐ Foreign Body ☐ Chemical ☐ Contamination
☐ Skin (Occupationnel) ☐ Rash ☐ Irritation

Remark: ....

2.Name:	Sex:	Date of Birth:			Age:	Regular Job Title:	Experience:	
	☐ Male ☐ Female	Month	Day	Year			In this job title Years Weeks	In this Project Years Weeks

Site:	Company:	Reference:	Phone No:	Social Security Number

Part of Body Injured or Affected:

☐ Head ☐ Hands ☐ Face ☐ Nose
☐ Eyes ☐ Legs ☐ Teeth ☐ Neck
☐ Trunk ☐ Toes ☐ Elbow ☐ Shoulder
☐ Back ☐ Ankle ☐ Wrist ☐ Foot
☐ Arms ☐ Thump ☐ Fingers ☐ Internal

Remark: ....

Nature of Injury or Illness:

☐ Laceration ☐ Amputation ☐ Puncture ☐ Fracture
☐ Strain & Sprain ☐ Burns ☐ Contusion ☐ Dry Heat Friction
☐ Hernia ☐ Foreign Body ☐ Contamination ☐ Chemical
☐ Skin (Occupationnel) ☐ Rash ☐ Irritation

Remark: ....

Section E: Accidents/incident Details

Date Accident/Incident Occurred:	Time Accident/Incident Occurred:	Exact Location of the Accident / Incident:

Details of the actual Job Being done at the time:

Details of Accident/Incident/What actually happened?

Section F: Accident Cause (Basic cause mark X/Contributing cause, if any mark O)

UNSAFE CONDITIONS		UNSAFE ACTS	
1	☐ Inadequately Guarded	1	☐ Operating Without Authority / Training
2	☐ Unguarded	2	☐ Operating at Unsafe Speed
3	☐ Defective Tools, Equipment, or Substance	3	☐ Marking SHE Device Inoperative
4	☐ Unsafe Design or Construction	4	☐ Using Unsafe Equipment or Equipment Unsafely
5	☐ Hazardous Arrangement	5	☐ Unsafe Loading, Placing, Mixing
6	☐ Unsafe Illumination	6	☐ Taking Unsafe Position
7	☐ Unsafe Ventilation	7	☐ Working on Moving or Dangerous Equipment
8	☐ Unsafe Clothing	8	☐ Distraction, Teasing, Horse Play
9	☐ Insufficient Instruction	9	☐ Failure to use Personal Protective Devices
10	☐ Lack of system of work	10	☐ Lack of effective instruction or supervision

Why was the unsafe act committed? ____________ Why did the unsafe condition exist? ____________

Section G: Guide to Corrective Action (Base on the cause checked above, I am taking the following corrective action)

UNSAFE ACT	UNSAFE CONDITION	If Supervisor can't handle, then recommend to
☐ Stop the Behaviour	☐ Remove	☐ Site Engineer, or
☐ Study the job	☐ Guard	☐ Site Manager, or
☐ Instruct (tell-show-try-check)	☐ Warn	☐ Project Manager, or
☐ Follow Up	☐ Supervisory Training	☐ Safety Committee
☐ Enforce		

Detail below any immediate remedial actions that have been taken:

Detail below any corrective and preventative actions that could be taken to prevent future re-occurrence:	Responsible	Completion Date

Section H: Witness Statement			
Witness Name		**Interviewer Name**	
Section I: Reviewed & Recommend by			
Recommendation:			
Reviewed By:	Position:	Signature:	Date:

Remarks : If Accident or Incident happened with lost time injury and affected to the publicity must further report to Safety Department;
: First Aid Cases will not applicable to this form;
: The accident report shall submit to Safety Department within 3 days
: Attached the photograph or sketch the location of accident / incident;

Annexure F

Archaeological 'Chance Find' Procedure

Background

The purpose of this document is to address the possibility of archaeological deposits becoming exposed during ground altering activities within the project area and to provide protocols to follow in the case of a chance archaeological find to ensure that archaeological sites are documented and protected as required.

Archaeological sites are an important resource that is protected for their historical, cultural, scientific and educational value to the general public and local communities. Impacts to archaeological sites must be avoided or managed by development proponents. The objectives of this 'Archaeological Chance Find Procedure' are to promote preservation of archaeological data while minimizing disruption of construction scheduling/ It is recommended that due to the moderate to high archaeological potential of some areas within the project area, all on site personnel and contractors be informed of the Archaeological Chance Find Procedure and have access to a copy while on site.

Potential Impacts to Archaeological Sites

Developments that involve excavation, movement, or disturbance of soils have the potential to impact archaeological materials, if present. Activities such as road construction, land clearing, and excavation are all examples of activities that may adversely affect archaeological deposits.

Archaeological 'Chance Find' Procedure

If you believe that you may have encountered any archaeological materials, stop work in the area and follow the procedure below:

The following 'chance-find' principles will be implemented by the contractor throughout the construction works to account for any undiscovered items identified during construction works:

(i) Workers will be trained in the location of heritage zones within the construction area and in the identification of potential items of heritage significance.

(ii) Should any potential items be located, the site supervisor will be immediately contacted and work will be temporarily stopped in that area.

(iii) If the site supervisor determines that the item is of potential significance, an officer from the department of Archaeology (DoA) will be invited to inspect the site and work will be stopped until DoA has responded to this invitation.

(iv) Work will not re-commence in this location until agreement has been reached

between DoA and proponent as to any required mitigation measures, which may include excavation and recovery of the item.

(v) A precautionary approach will be adopted in the application of these procedures.

Detailed Procedural Steps

If the Director, department of Archaeology receives any information or otherwise has the knowledge of the discovery or existence of an antiquity of which there is no owner, he shall, after satisfying himself as to the correctness of the information or knowledge, take such steps with the approval of the Government, as he may consider necessary for the custody, preservation and protection of the antiquity.

Whoever discovers, or finds accidentally, any movable antiquity shall inform forth with the Directorate within seven days of its being discovered or found.

If, within seven days of his being informed, the Director decides to take over the antiquity for purposes of custody, preservation and protection, the person discovering or finding it shall hand it over to the Director or a person authorized by him in writing.

Where the Director decides to take over an antiquity, he may pay to the person by whom it is handed over to him such cash reward as may be decided in consultation with the Advisory Committee.

The Director or any officer authorized by him with police assistance may, after giving reasonable notice, enter into, inspect and examine any premises, place or area which or the sub-soil of which he may have reason to believe to be, or to contain an antiquity and may cause any site, building, object or any antiquity or the remains of any antiquity in such premises, place or area to be photographed, copied or reproduced by any process suitable for the purpose.

The owner or occupier of the premises, place or area shall afford all reasonable opportunity and assistance to the Director.

No photograph, copy of reproduction taken or made shall be sold or offered for sale except by or with the consent of the owner of the object of which the photograph, copy or the reproduction has been taken or made.

Where substantial damage is caused to any property as a result of the inspection, the Director shall pay to the owner thereof reasonable compensation for the damage in consultation with the Advisory Committee.

If the Director after conducting an inquiry, has reasonable grounds to believe that any land contains any antiquity, he may approach the Government to direct the Revenue Department to acquire such land or any part thereof and the Revenue Department shall thereupon acquire such land or part as for a public purpose.

Annexure G

Dust Management Plan

General

The purpose of this plan is to describe the measures that the project shall take to ensure that the risk of emissions from dust generated by site operations during construction are minimized and that best practice measures are implemented.

Dust emissions from construction can cause ill health effects to Contractor staff along with nuisance and annoyance to members of the local community. Dust will be controlled through:

Elimination

Reduction/Minimisation

Control

This dust management plan shall be implemented based on the measures already provided in the Environmental Management Plan (EMP) relating to controlling dust emissions.

Methodology

The following methodology will be undertaken for each project section:

Step 1 – Identify the dust generating activities

Construction activities that are likely to produce dust will be identified. The activities that will be taken into account are:

Haulage Routes, Vehicles and Asphalt/Concrete Batching Plant

Roads, surfaces and public highways

Static and mobile combustion plant emissions

Tarmac laying, bitumen surfacing and coating

Materials Handling, Storage, Spillage and Disposal

Storage of material

Stockpiles

Spillages

Storage of Waste

Site Preparation and Restoration after Completion

Earthworks, excavation and digging

Storage of spoil and topsoil

Demolition

Construction and Fabrication Processes

Step 2 – Identify Sensitive Receptors

Sensitive receptors have already been identified. The nature and location of the sensitive receptors will be taken into account when implementing control measures.

Step 3 – Implement Best Practice Measures to Control

Based on the nature of the activity producing the dust, the likelihood of dust being produced and the possible consequence of dust based on the sensitive receptors, the most effective control measure will be identified and implemented.

Step 4 – Monitor effectiveness of control

Construction Supervision Staff (CSC) will have the responsibility to ensure that dust control measures are being implemented and are effective.

Step 5 – Record and report result of monitoring

All inspections, audits and results of monitoring will be recorded and kept as part of the site filing system.

Method Statements and Risk Assessments

The Contractor’s Risk Assessments and Method Statements will be required to be approved by the CSC prior to commencing work and will be required to contain environmental aspects of the task, including dust control measures where required.

Where dust has been identified within the risk assessment as a significant issue, the method statement will be required to cover the following:

Methods and materials that will be used to ensure that dust generation is minimized.

The use of pre-fabricated materials where possible.

Optimum site layout:

Dust generating activities to be conducted away from sensitive receptors

Supply of water for damping down.

Good housekeeping and management

All employees will be briefed on the Risk Assessment and Method Statement before starting work.

Training

All Contractor staff will be required to attend training seminars as already mentioned in the EMP document. A site-specific induction will also be required before being allowed to work on site. These will include site-specific sensitive receptors and details regarding dust control measures to be taken.

Toolbox talks on air pollution and minimizing dust emissions will be provided on a regular basis to Contractor staff.

Identification of Dust Generating Sources and Control Methods

Haulage Routes, Vehicles and Asphalt/Concrete Batching Plant	
Dust Source	Dust Control Methods
Major haul roads and traffic routes	Haul roads will be dampened down via a mobile bowser, as required.
Public Roads	Road sweeper will be used to clean public roads as required.
Site traffic management	Site traffic will be restricted to constructed access roads as far as possible. Site speed limit will be set at 10 mph as this will minimize the production of dust.
Road Cleaning	A mechanical road sweeper will be readily available and used.
Handling, Storage, Stockpiling and Spillage of Dusty materials	
Material handling operations	The number of times a material will have to be handled will be kept to a minimum to prevent double handling and ensure dusty materials are not handled unnecessarily.
Transport of fine dusty materials and aggregates.	Closed tankers will be used or sheeted vehicles.
Vehicle loading/unloading materials on to vehicles and conveyors.	Dusty materials will be dampened down Drop heights will be kept to a minimum and enclosed where possible.
Storage of Materials	
Bulk cement, bentonite etc.	Bentonite will be delivered in tankers and stored in dedicated enclosed areas. Bulk cement will be transported through tractor trollies or trailers.
Fine dry materials	These will be protected from the weather and by storing in appropriate containers and indoors, where necessary.
Storage location	Material will be stored in dedicated lay-down areas.
Storage of Stockpiles	
Stockpile location	Stockpiles will be placed so as to minimize double handling and facilitate the site restoration.
Building stockpiles	Stockpiles, tips and mounds will not be stored at an angle greater than an angle of repose of the material.
Small and temporary stockpiles	Where possible, stockpiles will be placed under sheeting.

	Dusty material will be damped down. Wind barriers (protective fences) of a similar height to the stockpile will be erected, if required.
Large and long term stockpiles	Long-term stockpiles will be vegetated and stabilized as soon as possible. Stock plies will be dampened down until stabilized, where necessary. Wind barriers (protective fences) of a similar height to the stockpile will be erected, if required.
Waste Material from Construction	
Disposal method	A dedicated lay-down area will be available for waste. Waste will not be allowed to build up and will be disposed off at the designated locations as per EMP.
Site Preparation and Restoration	
Earthworks, excavation and digging	These activity areas will be kept damp where required and if possible, will be avoided during dry and windy periods.
Completed earthworks	Surfaces will be stabilized by re-vegetation as soon as possible, where applicable.
Construction and Fabrication Process	
Crushing of material for reuse, transportation and disposal	Authorization will be obtained from PMU and ADB before using any mobile plant on site for activities such as crushing and screening. Any crushing or screening activities will be located away from sensitive receptors.
Cutting, grinding, drilling, sawing, trimming, planning, sanding	These activities will be avoided wherever possible. Equipment and techniques that minimize dust will be implemented. Water will be used to minimize dust.
Cutting roadways, pavements, blocks	Water sprinkling to be used.
Angle grinders and disk cutters	Best practice measures will be used such as dust extraction.

Monitoring Arrangements

Monitoring will be conducted at sensitive receptor locations in the project area as provided in the EMP. Furthermore, at locations where PM levels are exceeding applicable guidelines, additional stringent measures will be implemented at the respective location(s) in the project area to ensure dust levels are controlled as far as possible.

ANNEXURE H

Site Specific EMP (SSEMP) Guide & Template for Guidance to Contractor

Guide for Development of SSEMP

Step 1: Define Boundaries

Step 2: Identify Sensitive Receptors

Step 3: Specify construction activities

Step 4: Conduct Risk Assessment

Step 5: Assign Environment Management measures

Step 6: Prepare Site Plans

Step 7: Prepare Environment Work Plans (if required)

Step 8: Monitoring

Step 1: The project area needs to be clearly defined.

Step 2: The mapping of sensitive receptors has already been conducted and needs to be presented clearly in a map.

Step 3: The tentative construction activities to be conducted are as follows:

Site Surveying and Vegetation (Trees and plants) Clearance

Establishment of Work Camp, Batching and Asphalt plant and access roads

Dismantling of Asphalt and existing structures including Utilities

Preparation of ground for Asphalting

Asphalting

Landscaping

Step 4: The Risk Assessment matrix template is provided in the table below.

Risk is assessed as the likelihood that the activity will have an effect on the environment as well as the consequence of the effect occurring. It is often described like this:

Risk = Likelihood × Consequence

Likelihood Scale

Likelihood	Definition	Scale
Certain	Will certainly occur during the activity at a frequency greater than every week if preventative measures are not applied	5
Likely	Will occur more than once or twice during the activity but less than weekly if preventative measures are not applied	3
Unlikely	May occur once or twice during the activity if preventative measures are not applied	2
Rare	Unlikely to occur during the project	1

Consequence Scale

Consequence	Definition	Score
Catastrophic	The action will cause unprecedented damage or impacts on the environment or surrounding community e.g. extreme loss of soil and water resources and quality from stormwater runoff extreme pollution of soil and water resources including major contamination from hazardous materials widespread effects on ecosystems with deaths of fauna/flora widespread community impacts resulting in illness, injury or inconvenience loss or destruction of archaeological or historical sites Occurrence will almost certainly result in the work being halted and a significant fine.	5
Major	The action will cause major adverse damage on the environment or surrounding communities e.g. major loss of soil and water resources and quality from stormwater runoff major pollution of soil and water resources including contamination from hazardous materials significant effects on ecosystems with isolated deaths of non-vulnerable flora and fauna significant annoyance or nuisance to communities major damage to or movement required to archaeological or historical sites	3

Consequence	Definition	Score
	Occurrence may result in work being halted and a fine	
Moderate	No or minimal adverse environmental or social impacts e.g. no measurable or noticeable changes in stormwater quality. Water quality remains within tolerable limits little noticeable effect on ecosystems no or isolated community complaints no or unlikely damage to archaeological or historical sites no likelihood of being fined	2
Minor	No or minimal adverse environmental or social impacts e.g. no measurable or noticeable changes in stormwater quality. Water quality remains within tolerable limits little noticeable effect on ecosystems no or isolated community complaints no or unlikely damage to archaeological or historical sites no likelihood of being fined	1

Risk Score Table

	Consequence				
		Catastrophic	Major	Moderate	Minor
Likelihood	Certain	25	15	10	5
	Likely	15	9	6	3
	Unlikely	10	6	4	2
	Rare	5	3	2	1

Risk: Significant: 15-25

Medium: 6-10

Low 1-5

Any Medium to Significant risk requires an environmental management measure to manage the potential environmental risk. Judgement will be required concerning the application of an environmental management measure to mitigate low risk situations.

The higher the risk the more intensive the required mitigation measure will need to be; e.g. where site sedimentation is deemed to be low risk, then silt fences may be needed but as the risk increases, then sediment traps may be required. The selection of the appropriate mitigation measure will require judgment based on the level of risk and the specific site parameters.

Step 5: The Environmental Management measuresare to be extracted from the IEE study for the project and should be added in the last column of the table below.

No.	Construction Activity	Hazards to Consider	Likelihood That the site or sensitive receptors will be affected?	Consequence of the site or sensitive receptors being affected?	Risk Score (consequence x likelihood)	Environmental Management Measures
i	Site Surveying & vegetation clearance	Damage to vegetation beyond project footprint				These can be taken from the EMP provided in the IEE report (If Risk Score is 6 or more)
		Erosion of exposed areas and sediment				
		Loss of topsoil				
		Dust generation				
		Noise				
ii	Establishment of Work Camp, Batching plant etc.	Soil deposited onto roads from tires				
		Stockpile erosion				
		Noise & Vibration				
		Traffic congestion				
		Fuel spills				

No.	Construction Activity	Hazards to Consider	Likelihood That the site or sensitive receptors will be affected?	Consequence of the site or sensitive receptors being affected?	Risk Score (consequence x likelihood)	Environmental Management Measures
iii	Dismantling of Asphalt and existing structures including Utilities	Noise and vibration				
		Dust generation				
		Community safety				
		Worker safety				
		Traffic Congestion				
iv	Preparation of Sub-Base	Noise and vibration				
		Dust generation				
		Traffic Congestion				
v	Asphalting	Noise and vibration				
		Dust generation				

No.	Construction Activity	Hazards to Consider	**Likelihood** **That the site or sensitive receptors will be affected?**	**Consequence** **of the site or sensitive receptors being affected?**	**Risk Score** **(consequence x likelihood)**	Environmental Management Measures
		Traffic Congestion				
		Community safety				
		Labor safety (PPEs)				
vi	Landscaping	Dust generation				
		Sediment runoff				
		Failure of vegetation to take root				
vii	Implementation of COVID-19 SOPs	Worker Health Risk				These can be taken from the EMP provided in the IEE report
		Public Health Risk				

Step 6: The Site plans are a critical part of the SSEMP and will need to be prepared, otherwise the ADB will consider the document as incomplete.

The site plan will need to provide the following:

Indication of North and scale

Existing and planned supporting infrastructure (e.g. access roads, water supplies and electricity supplies)

Location of planned work

Contours

Drainage systems

Locations of sensitive receptors

Step 7 (if required)[20]: The completed SSEMP provides details of all the environmental management requirements for all stages of the construction process. For individual work teams who are responsible for only a small part of the overall construction works it can be confusing as to what is required for their particular work component. For example, the work team responsible for stripping soil for the construction areas are not going to be interested in the requirements for pouring concrete for footings and foundations. However, it is essential that the soil stripping team knows exactly what to clear and what to leave and where to put stockpiles of soil for later use.

In situations where different work activities are required at different times or at different locations, environmental work plans can be prepared. These are similar to the work method statements that are often produced for major construction projects.

Step 8: A detailed monitoring plan will be providedalong with frequency and responsibilities to ensure all key environmental parameters are monitored to ensure compliance with both national and ADB requirements.

Template for SSEMP

Introduction

Project Overview

Scope of SSEMP

Objectives of SSEMP

Map of Sensitive Receptors

Construction Activities

Activities

Risk Assessment

[20]ADB, Safeguards Unit for Central & West Asia Department, *Environmental Management for Construction Handbook.*

Risk Assessment Matrix & Mitigation Measures

Site Plan(s)

Environmental Monitoring Plan

Instrumental Monitoring of Environmental Parameters by Contractor as per EMP

In-house monitoring

Third Party environmental monitoring

Visual monitoring of Environmental Parameters by Contractor as per EMP

Responsibilities

Organizational Responsibilities and Communication

Responsibility of EA

Responsibility of Construction Supervision Consultant (CSC)

Responsibility of Contractor

Responsibility of EPA

ANNEXURE I

Traffic Management Plan

K.1 Need for Plan

The construction of the water treatment plant and Mingora Greater Water Supply Scheme will take over 24 months and in this period, huge vehicular movement carrying large amount of material and machinery is expected. This will definitely interrupt the local traffic and is therefore important to manage the traffic to avoid the nuisance to local residents in terms of noise, dust, congestion and inconvenience.

K.2 The plan

The Objective of Traffic Management Plan (TMP) is to define the requirements that should be implemented to mitigate any potential negative risks to the environment, workers or the community resulting from construction traffic.

The TMP will advise and inform site Contractors and external suppliers of equipment and materials of access and entry points along with other key information such tipping areas and wash-out areas. It is intended to compliment and work alongside relevant ESMMP. The TMP will be classed as “live” and therefore be subjected to updates as required.

Contractor, at the time of the execution of the project will prepare a comprehensive TMP in coordination with local traffic police department, PMU, emergency services and local administrative department. The PMU and CSC will review and approve contractors TMP. The contractor’s TMP shall include following mitigation measures during its preparation:

Undertake a road conditions assessment prior to and following the peak construction period, to assess any damage to road infrastructure that can be attributed to Project construction.

Repair damage as appropriate or enter into a voluntary agreement with the relevant roads authority to reimburse the cost of any repairs required to the public road network as a result of the Project.

Spoil dumpsites located close to Project site to minimise journey distance and limit movements to site access roads.

Concrete mixing plant located at Project site limiting traffic movements associated with concrete delivery to site access roads

Construction of worker accommodation on site to reduce light vehicle movements relating to travel to/ from the site

Provision of bus/minibus services for personnel living in nearby settlements

Movements of construction workers will be planned to avoid the busiest roads and times of day when traffic is at its greatest.

Schedule deliveries and road movements to avoid peak periods

Road maintenance fund to leave a useful asset for communities after the construction phase.

Driver training for HGV drivers and refresher course every six months for Project drivers

Speed restrictions for project traffic travelling through communities (to be agreed with Traffic Manangement Authority)

Run a safety campaign to improve the people’s knowledge of the traffic hazard on their roads, public information and other activities to address the issues.

Run a pedestrian awareness programme

Temporary signage

The traffic management plan is provided below.

K.3 Other Recommendations

It is important to manage public access routes during construction because it can cause delay to local traffic and create a safety hazard both on and offsite. People working and living near the project site would be annoyed by the emissions, noise and visual intrusion of queuing vehicles. Some important factors involved in access routes and site traffic are as follows:

K.3.1 Public Access Routes

The use of public road for site access may be restricted in terms of:

Vehicle size, width and type of load

Time limits

Parking

Pedestrian conflicts

Contractor should have consultation with the local police or local authority to address these issues and to effectively manage them before the beginning of the construction.

K.3.2 Site Workers Traffic

Site personnel should not be permitted to park vehicles near the site boundary; this will lead to disruption in material deliveries. Designated parking area with appropriate parking space will be needed for this purpose; any plain area near construction site can be used for this purpose.

K.3.3 Site Rules

Access to and from the site must be only via the specified entrance.

On leaving the site, vehicles must be directed to follow the directions given.

Drivers must adhere to the site speed limits.

All material deliveries to site must keep allocated time limits.

No material or rubbish should be left in the loading-unloading area.

Develop a map for alternate routes showing material delivery services.

Assign designated personnel on site to receive deliveries and to direct the vehicles.

Monitor vehicle movement to reduce the likelihood of queuing or causing congestion in and around the area.

Project vehicles should have a unanimous badge or logo on windscreen displaying that they belong to the proposed project.

K.4 Contractor's Obligation

The traffic management plan of the Contractor should be safe enough and widening of access roads and construction of the detours must be completed before start of project construction activities so that heavy vehicular transportation for construction activities do not hinder the normal course of traffic lanes. While widening the access roads, the safe movement of the vehicles, people, animals and wildlife must be ensured. It will be sole responsibility of Contractor. The roads widening should be designed on the basis of the traffic survey, summarized and estimated site traffic. Contractor must ensure that road closures are carried out by a competent person. The Contractor obligation must include the display of traffic signs according to the need to divert the traffic volume and to guide the road users in advance. The traffic sign, traffic light should be placed from any diverting route or road marking.

The Contractor should consider the environmental and social impacts of the traffic during construction. It will be sole responsibility of the Contractor to implement a plan which produces minimum nuisance to the local people and to the environment. Safety of the people should be given due importance. It will be under Contractor obligation to notify the traffic management plan and its later changes to CSC, PMU, emergency services and Traffic Police, and also publish weekly programme in local newspapers.

ANNEXURE J
NEQS Guidelines

Parameter	Unit	Standards (maximum allowable limit)
Temperature increase	^{o}C	<3
pH value (acidity / basicity)	pH	6-9
5-day biochemical oxygen demand (BOD) AT 20 ^{O}C	mg/l	80
Chemical oxygen demand (COD)	mg/l	150
Total dissolved solids	mg/l	200
Total dissolved solids	mg/l	3,500
Grease and oil	mg/l	10
Phenolic compounds (as phenol)	mg/l	0.1
Chloride (as Cl)	mg/l	1.0
Fluoride (as F)	mg/l	10
Sulfate (SO_4)	mg/l	600
Ammonia (NH_3)	mg/l	40
Cadmium	mg/l	0.1
Chromium (trivalent and hexavalent)	mg/l	1.0
Copper	mg/l	1.0
Lead	mg/l	0.5
Mercury	mg/l	0.01
Selenium	mg/l	0.5
Nickel	mg/l	1.0
Silver	mg/l	1.0
Total toxic metals	mg/l	2.0
Zinc	mg/l	5
Arsenic	mg/l	1.0
Barium	mg/l	1.5
Iron	mg/l	8.0
Manganese	mg/l	1.5
Boron	mg/l	6.0
Chlorine	mg/l	1.0

Notes:

1. The standard assumes that dilution of 1:10 on discharge is available. That is, for each cubic meter of treated effluent, the recipient water body should have 10 m^3 of water for dilution of this effluent.

2. Toxic metals include cadmium, chromium, copper, lead, mercury, selenium, nickel and silver. The effluent should meet the individual standards for these metals as well as the standard for total toxic metal concentration.

Source: Government of Pakistan (2000) (SRO 549(I)/2000).

Pollutants	Time-Weighted Average	Concentration in Ambient Air		Method of Measurement
		Effective from 1st July 2010	Effective from 1st January 2013	
Sulfur Dioxide (SO_2)	Annual Average *	80 µg/m3	80 µg/m3	Ultraviolet Fluorescence
	24 hours**	120 µg/m3	120 µg/m3	
Oxides of Nitrogen as (NO)	Annual Average*	40 µg/m3	40 µg/m3	Gas Phase Chemiluminescence
	24 hours**	80 µg/m3	80 µg/m3	
Ozone (O_3)	1 hour	180 µg/m3	130 µg/m3	Non dispersive UV absorption
Suspended Particulate Matter (SPM)	Annual Average*	400 µg/m3	360 µg/m3	High Volume Sampling, (Average flow rate not less than 1.1 m3/minute).
	1 hour	180 µg/m3	130 µg/m3	
Respirable Particulate Matter. PM_{10}	Annual Average*	200 µg/m3	120 µg/m3	β Ray absorption
	24 hours**	250 µg/m3	150 µg/m3	
Respirable Particulate Matter. $PM_{2.5}$	Annual Average*	25 µg/m3	15 µg/m3	β Ray absorption
	24 hours**	40 µg/m3	35 µg/m3	
	1 hour	25 µg/m3	15 µg/m3	
Lead (Pb)	Annual Average*	1.5 µg/m3	1.0 µg/m3	ASS Method after sampling using EPM 2000 or equivalent Filter paper
	24 hours**	2.0 µg/m3	1.5 µg/m3	
Carbon Monoxide (CO)	8 hours**	5 µg/m3	5 µg/m3	Non dispersive Infra-Red (NDIR)
	1 hour	10 µg/m3	10 µg/m3	

* Annual arithmetic mean of minimum 104 measurements in a year taken twice a week 24 hourly at uniform interval.

24 hourly / 8 hourly values should be met 98% of the in a year. 20% of the time, it may exceed but not on two consecutive days.

Source: Government of Pakistan (2010) (SRO 1062 (I)/ 2010).

National Environmental Quality Standards for Noise[1]

S/No.	Category of Area/Zone	Limit in dB(A) Leq	
		Day Time	Night Time
1	Residential area (A)	55	45
2	Commercial area (B)	65	55
3	Industrial area (C)	75	65
4	Silence zone (D)	50	45

1: Effective from 1st July, 2012.

Note: 1. Day time hours: 6 am to 10 pm

2. Night time hours: 10 pm to 6 am

3. Silence zone: Zones that are declared as such by the competent authority. An area comprising not less than 100 meters around hospitals, educational institutions and courts.

4. Mixed categories of areas may be declared as one of the four above mentioned categories by the competent authority.

National Environmental Quality Standards for Motor Vehicle Exhaust and Noise

(A) For In-use Vehicles

Sr. No.	Parameter	Standard (Maximum permissible Limit)	Measuring Method	Applicability
1	Smoke	40% or 2 on the Ringlemann Scale during engine acceleration mode	To be compared with Ringlemann Chart at a distance 6 or more.	Immediate effect
2	Carbon Monoxide	6%	Under idling conditions: Non-dispersive infrared detection through gas analyzer.	
3	Noise	85 db (A).	Sound meter at 7.5 meters from the source.	

(B) For New Vehicles

(i) Emission Standards for Diesel Vehicles

(a) For Passenger Cars and Light Commercial Vehicles (g/Km)

Type of Vehicle	Category/Class	Tiers	CO	HC+ NOX	PM	Measuring Method	Applicability
Passenger Cars	M 1: with reference mass (RW) upto 2500 kg. Cars with RW over 2500 kg to meets NI category standards.	Pak-II IDI	1.00	0.70	0.08	NEDC (ECE 15+ EUDCL)	All imported and local manufactured diesel vehicles with effect from 01-07-2012
		Pak-II DI	1.00	0.90	0.10		
Light Commercial Vehicles	NI-I (RW<1250 kg)	Pak-II IDI	1.00	0.70	0.08		
		Pak-II DI	1.00	0.90	0.10		
	NI-I (1250 kg< RW< 1700 kg0	Pak-II IDI	1.25	1.00	0.12		
		Pak-II DI	1.25	1.30	0.14		
	NI-III (RW>1700 kg)	Pak-II IDI	1.50	1.20	0.17		
		Pak-II DI	1.50	1.60	0.20		

Parameter	Standard **(maximum permissible limit**	Measuring **Method**
Noise	85 db (A)	Sound meter at 7.5 meters from the source.

(ii) Emission Standards for Petrol Vehicles (g/km)

Type of Vehicle	Category/Class	Tiers	CO	HC+ NOX	Measuring Method	Applicability
Passenger	M 1: with reference mass (RW) upto 2500 kg. Cars with RW over 2500 kg to meets NI category standards.	Pak-II	2.20	0.50	NEDC (ECE 15+ EUDCL)	All imported and new models* locally manufactured petrol vehicles with effect from 1st July, 2009**
Light Commercial Vehicles	NI-I (RW<1250 kg)	Pak-II	2.20	0.50		
	NI-I (1250 kg> RW< 1700 kg0	Pak-II	4.00	0.65		
	NI-III (RW>1700 kg)	Pak-II	5.00	0.80		
Motor Rickshaws and motor Cycles	2.4 strokes < 150 cc	Pak-II	5.50	1.50	ECER 40	
	2.4 strokes < 150 cc	Pak-II	5.50	1.30		

Parameter	Standard (maximum permissible limit	Measuring Method
Noise	85 db (A)	Sound meter at 7.5 meters from the source.

Explantations:

DI: Direct Injection
IDI: Indirect Injection
EUDCL: Extra Urban Driving Cycle
NEDC: New Urban Driving Cycle
M: Vehicles designed and constructed for the carriage of passengers and comprising no more than eight seats in addition to the driver's seat.
N: Motor vehicles with at least four wheels designed and constructed for the carriages of goods.
* New model means both model and engine type change
** The existing models of petrol driven vehicles locally manufactured will immediately switch ever to Pak-II emission standards but not later than 30th June, 2012.

Source: Government of Pakistan (2009) (SRO 72 (KE)/ 2009).

National Standards for Drinking Water Quality

Properties/Parameters	Standard Values for Pakistan
Bacterial	
All water intended for drinking (E.Coli or Thermo tolerant Coliform bacteria)	Must not be detectable in any 100 ml samples
Treated water entering the distribution system (E.Coli or thermo tolerant coliform and total coliform bacteria)	Must not be detectable in any 100 ml samples
Treated water in the distribution system (E.Coli or thermo tolerant coliform and total coliform bacteria)	Must not be detectable in any 100 ml samples In case of large supplies, where sufficient samples are examined, must not be present in 95% of the samples taken throughout any 12-month period.
Physical	
Color	$\leq$ 15 TCU
Taste	Non objectionable/ Accept able
Odor	Non objectionable/Accept able
Turbidity	< 5 NTU
Total hardness as $CaCO_3$	< 500 mg/l
TDS	< 1000
pH	6.5-8.5
Chemical	
Essential Inorganic	*mg/Litre*
Aluminum (Al)	$\leq$ 0.005(P)
Antimony	$\leq$ 0.05(P)
Arsenic (As)	$\leq$ 0.05(P)
Barium (Ba)	0.7
Boron (B)	0.3
Cadmium (Cd)	0.01
Chloride (Cl)	<250
Chromium (Cr)	$\leq$ 0.05
Copper (Cu)	2
Toxic Inorganic	**Mg/Litre**
Cyanide (Cn)	$\leq$ 0.05
Fluoride (F)*	$\leq$ 1.5
Lead (Pb)	$\leq$ 0.05
Manganese (Mn)	$\leq$ 0.5
Mercury (Hg)	$\leq$ 0.001
Nickel (Ni)	$\leq$ 0.02
Nitrate (NO_3)*	$\leq$ 50
Nitrate (NO_2)*	$\leq$ 3 (P)
Selenium (Se)	0.01 (P)
Residual chlorine	0.2-0.5 at consumer end; 0.5-1.5 at source
Zinc (Zn)	5.0
Organic	
Pesticides mg/l	PSQCA No. 4639-2004, Page No. 4 Table No. 3 Serial No. 20-58 may be consulted.**
Phenolic compound (as phenols) mg/l	WHO standards: $\leq$ 0.002
Polynuclear Aromatic hydrocarbon (as PAH) g/L	WHO standards: $\leq$ 0.01v (by GC/MS method)
Radioactive	
Alpha Emitters bq/L or pCi	0.1
Beta Emitters	1

* Indicates priority health related inorganic constituents which need regular monitoring.

** PSQCA: Pakistan Standards Quality Control Authority.

Source: Government of Pakistan (2010) (SRO 1063(I)/2010).

ANNEXURE K

WHO Guidance on Laboratory Biosafety

Laboratory biosafety guidance related to coronavirus disease 2019 (COVID-19)

Interim guidance
12 February 2020

World Health Organization

1. Introduction

The purpose of this document is to provide interim guidance on laboratory biosafety related to the testing of clinical specimens of patients that meet the case definition of the novel pathogen identified in Wuhan, China, that is, 2019 novel coronavirus (2019-nCoV), now known as the virus responsible for coronavirus disease 2019 (COVID-19).

As our understanding of COVID-19 is limited but rapidly growing, the World Health Organization (WHO) continues to monitor developments and will revise these recommendations as necessary.

Highlights of COVID-19 laboratory biosafety

- All procedures must be performed based on risk assessment and only by personnel with demonstrated capability, in strict observance of any relevant protocols at all times.
- Initial processing (before inactivation) of all specimens should take place in a validated biological safety cabinet (BSC) or primary containment device.
- Non-propagative diagnostic laboratory work (for example, sequencing, nucleic acid amplification test [NAAT]) should be conducted at a facility using procedures equivalent to Biosafety Level 2 (BSL-2)
- Propagative work (for example, virus culture, isolation or neutralization assays) should be conducted at a containment laboratory with inward directional airflow (BSL-3).
- Appropriate disinfectants with proven activity against enveloped viruses should be used (for example, hypochlorite [bleach], alcohol, hydrogen peroxide, quaternary ammonium compounds and phenolic compounds).
- Patient specimens from suspected or confirmed cases should be transported as UN3373, "Biological Substance Category B". Viral cultures or isolates should be transported as Category A, UN2814, "infectious substance, affecting humans".

2. Laboratory biosafety

It is essential to ensure that health laboratories adhere to appropriate biosafety practices. Any testing for the presence of the virus responsible for COVID-19 or of clinical specimens from patients meeting the suspected case definition *(1)* should be performed in appropriately equipped laboratories, by staff trained in the relevant technical and safety procedures. National guidelines on the laboratory biosafety should be followed in all circumstances. For general information on laboratory biosafety guidelines, see the WHO *Laboratory biosafety manual*, 3rd edition *(2)* in the interim before the 4th edition is released.

Key points

- Each laboratory should conduct a local (that is, institutional) risk assessment to ensure it is competent to safely perform the intended testing with appropriate risk control measures in place.
- When handling and processing specimens, including blood for serological testing, laboratory practices and procedures that are basic to good microbiological practices and procedures (GMPP) should be followed.
- The handling and processing of specimens from cases with suspected or confirmed COVID-19 infection that are intended for additional laboratory tests, such as haematology or blood gas analysis, should follow local guidelines for processing potentially infectious material.
- Non-propagative diagnostic laboratory work, including sequencing and NAAT, on clinical specimens from patients who are suspected or confirmed to be infected with COVID-19, should be conducted adopting the practices and procedures of "core requirements",[1] as detailed in **Annex 1**, and an appropriate selection of "heightened control measures",[2] as informed by the local risk assessment. In the interim, BSL-2 in the WHO *Laboratory biosafety manual*, 3rd edition *(2)* remains appropriate until the 4th edition replaces it.
- Handling of material with high concentrations of live virus (such as when performing virus propagation, virus isolation or neutralization assays) or large volumes of infectious materials should be performed **only by**

[1] **Core requirements:** A set of minimum requirements defined in the 4th edition of the WHO *Laboratory biosafety manual* to describe a combination of risk control measures that are both the foundation for, and an integral part of, laboratory biosafety. These measures reflect international standards and best practice in biosafety that are necessary to work safely with biological agents, even where the associated risks are minimal.

[2] **Heightened control measures:** A set of risk control measures that may need to be applied in a laboratory facility because the outcome of a risk assessment indicates that the biological agents being handled and/or the activities to be performed with them are associated with a relatively high risk that cannot be acceptable solely with the core requirements.

properly trained and competent personnel in laboratories capable of meeting additional essential containment requirements and practices, that is, BSL-3.

- Initial processing (before inactivation) of all specimens, including those for sequencing and NAAT, should take place in an appropriately maintained and validated BSC or primary containment device.
- Appropriate disinfectants with proven activity against enveloped viruses should be used for the recommended contact time, at the correct dilution and within the expiry date after the working solution is prepared.
- All technical procedures should be performed in a way that minimizes the generation of aerosols and droplets.
- Appropriate personal protective equipment (PPE), as determined by a detailed risk assessment, should be worn by all laboratory personnel handling these specimens.
- Patient specimens from suspected or confirmed cases should be transported as UN3373, "Biological Substance Category B". Viral cultures or isolates should be transported as Category A UN2814, "infectious substance, affecting humans" *(3)*.

3. Recommendations addressing minimal/essential working conditions associated with specific manipulations in laboratory settings

The additional recommendations provided in this section address the minimal/essential working conditions associated with specific manipulations in laboratory settings.

a. Risk assessment

Risk assessment is a systematic process of gathering information and evaluating the likelihood and consequences of exposure to or release of workplace hazard(s) and determining the appropriate risk control measures to reduce the risk to an acceptable level. It is important to note that hazards alone do not pose a risk to humans or animals. Consideration therefore must also be given to the types of equipment used and the procedure(s) that will be performed with the biological agent.

It is highly recommended to start with performing a local risk assessment for each process step, that is, from sample collection, sample reception, clinical testing, polymerase chain reaction (PCR) to virus isolation (only when and where applicable). Certain hazards will then be considered for each process step, such as aerosol exposure during sample processing; eye splash during sample processing; infectious culture material spill; and leaking sample (in the case of sample reception), with an assessed grade of risk. For each identified risk, appropriate risk control measures, including but not limited to the following recommendations, should be selected and implemented, in order to mitigate the residual risks to an acceptable level.

A risk assessment template is provided in **Annex 2;** this is intended to serve as an example and to facilitate the process.

b. Routine laboratory procedures, including non-propagative diagnostic work and PCR analysis

Non-culture-based diagnostic laboratory work, and PCR analysis on clinical specimens from patients who are suspected or confirmed to be infected with the virus responsible for COVID-19, should be conducted adopting practices and procedures described for conventional clinical and microbiology laboratories as described in the "core requirements" (see **Annex 1**).

However, all manipulations of potentially infectious materials, including those that may cause splashes, droplets or aerosols of infectious materials (for example, loading and unloading of sealed centrifuge cups, grinding, blending, vigorous shaking or mixing, sonic disruption, opening of containers of infectious materials whose internal pressure may be different from the ambient pressure), should be performed in appropriately maintained and validated BSCs or primary containment devices, by personnel with demonstrated capability.

Examples of routine laboratory procedures include:

• diagnostic testing of serum; blood (including haematology and clinical chemistry); respiratory specimens such as nasopharyngeal and oropharyngeal swabs, sputum and/or endotracheal aspirate or bronchoalveolar lavage; stool; or other specimens;

• routine examination of mycotic and bacterial cultures developed from respiratory tract specimens. When handling and processing specimens, "core requirements" (see **Annex 1**), including GMPP, should be followed at all times, including but not limited to those under the following subheadings. More details are explained and demonstrated in the WHO Biosafety video series *(4)*.

c. Use of appropriate disinfectants

• While little is known about this novel virus, the comparable genetic characteristics between the virus responsible for COVID-19 and MERS-CoV suggest that the COVID-19 virus may be susceptible to disinfectants with proven activity against enveloped viruses, including sodium hypochlorite (bleach; for example, 1000 parts per million [ppm] (0.1%) for general surface disinfection and 10 000 ppm (1%) for disinfection of blood spills);

62–71% ethanol; 0.5% hydrogen peroxide; quaternary ammonium compounds; and phenolic compounds, if used according to the manufacturer's recommendations. Other biocidal agents such as 0.05–0.2% benzalkonium chloride or 0.02% chlorhexidine digluconate can be less effective.

• Particular attention should be paid not only to the selection of the disinfectant but also the contact time (for example, 10 minutes), dilution (that is, concentration of the active ingredient) and expiry date after the working solution is prepared.

• Human coronaviruses in general are known to persist on inanimate surfaces such as metal, glass or plastic for up to 9 days *(5)*.

d. Viral isolation

Unless a country decides otherwise, considering the newly acquired knowledge and effective preventive measures described above, viral isolation on clinical specimens from patients who are suspected or confirmed to be infected with the virus responsible for COVID-19 should be performed only in laboratories capable of meeting the following additional containment criteria:

• a controlled ventilation system maintains inward directional airflow into the laboratory room;

• exhaust air from the laboratory room is not recirculated to other areas within the building. Air must be HEPA (high-efficiency particulate air) filtered, if reconditioned and recirculated within the laboratory. When exhaust air from the laboratory is discharged to the outdoors, it must be dispersed away from occupied buildings and air intakes. This air should be discharged through HEPA filters;

• a dedicated hand-wash sink is available in the laboratory;

• all manipulations of infectious or potentially infectious materials must be performed in appropriately maintained and validated BSCs;

• laboratory workers should wear protective equipment, including disposable gloves; solid-front or wrap-around gowns, scrub suits, or coveralls with sleeves that fully cover the forearms; head coverings; shoe covers or dedicated shoes; and eye protection (goggles or face shield). Risk assessment should inform the use of respiratory protection (fit-tested particulate respirator, for example, EU FFP2, US 6 NIOSH-certified N95 or equivalent, or higher protection);

• centrifugation of specimens should be performed using sealed centrifuge rotors or sample cups. These rotors or cups should be loaded and unloaded in a BSC.

e. Additional risks associated with virus isolation studies

Certain experimental procedures may carry additional risks of virus mutations with possible increased pathogenicity and/or transmissibility, or viruses with altered antigenicity or drug susceptibility. Specific risk assessments should be conducted, and specific risk-reduction measures adopted, before any of the following procedures are conducted:

• coinfection of cell cultures with different coronaviruses, or any procedures that may result in a coinfection;

• culture of viruses in the presence of antiviral drugs;

• deliberate genetic modification of viruses.

f. Work with animals infected with the virus responsible for COVID-19

The following activities require an animal facility – BSL-3 facilities and work practices, as detailed in the WHO ***Laboratory biosafety manual***, 3rd edition *(2)*:

• inoculation of animals for potential recovery of the agent from specimens of the virus responsible for COVID-19;

• any protocol involving animal inoculation for confirmation and/or characterization of putative agents of the COVID-19 virus.

g. Referral of specimens to laboratories with appropriate containment measures in place

Laboratories that are not able to meet the above biosafety recommendations should consider transferring specimens to national, regional or international referral laboratories with COVID-19-detection capacity that can meet the biosafety requirements.

4. Packaging and shipment

All materials transported within and between laboratories should be placed in a secondary container, to minimize the potential for breakage or a spill. An example includes transfer of materials from the BSC to an incubator and vice versa. Specimens leaving the BSC should be surface decontaminated. Detailed guidance is provided in the WHO Biosafety video series *(4)*, in particular *Good microbiological practices and procedures (GMPP) 7: transport*.

Transport of specimens within national borders should comply with applicable national regulations. Cross-boundary transport of specimens of the virus responsible for COVID-19 should follow the United Nations model regulations, *Technical instructions for the safe transport of* *dangerous goods by air (Doc 9284)* of the International Civil Aviation Organization *(6)*, for airlifted transport, and any other applicable regulations depending on the mode of transport being used. More information may be found in the WHO *Guidance on regulations for the transport of infectious substances 2019-2020* (applicable as from 1 January 2019) *(3)*. A summary on transport of infectious substances can also be found in Tool box 4 of the WHO handbook, *Managing epidemics: key facts about deadly diseases* *(7)*.

Patient specimens from suspected or confirmed cases should be transported as UN3373, "Biological Substance Category B", when they are transported for diagnostic or investigational purposes. Viral cultures or isolates should be transported as Category A UN2814, "infectious substance, affecting humans" *(3)*. All specimens being transported (whether UN3373 or UN2814) should have appropriate packaging, labelling and documentation, as described in the documents mentioned earlier.

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ANNEXURE L

WHO/GoP advice on Use of Masks for the COVID-19 Virus

masks away from those in health care who need them most, especially when masks are in short supply.

Persons with symptoms should:

- wear a medical mask, self-isolate, and seek medical advice as soon as they start to feel unwell. Symptoms can include fever, fatigue, cough, sore throat, and difficulty breathing. It is important to note that early symptoms for some people infected with COVID-19 may be very mild;
- follow instructions on how to put on, take off, and dispose of medical masks;
- follow all additional preventive measures, in particular, hand hygiene and maintaining physical distance from other persons.

All persons should:

- avoid groups of people and enclosed, crowded spaces;
- maintain physical distance of at least 1 m from other persons, in particular from those with respiratory symptoms (e.g., coughing, sneezing);
- perform hand hygiene frequently, using an alcohol-based hand rub if hands are not visibly dirty or soap and water when hands are visibly dirty;
- cover their nose and mouth with a bent elbow or paper tissue when coughing or sneezing, dispose of the tissue immediately after use, and perform hand hygiene;
- refrain from touching their mouth, nose, and eyes.

In some countries masks are worn in accordance with local customs or in accordance with advice by national authorities in the context of COVID-19. In these situations, best practices should be followed about how to wear, remove, and dispose of them, and for hand hygiene after removal.

Advice to decision makers on the use of masks for healthy people in community settings

As described above, the wide use of masks by healthy people in the community setting is not supported by current evidence and carries uncertainties and critical risks. WHO offers the following advice to decision makers so they apply a risk-based approach.

Decisions makers should consider the following:

1. **Purpose** of mask use: the rationale and reason for mask use should be clear– whether it is to be used for source control (used by infected persons) or prevention of COVID-19 (used by healthy persons)
2. Risk of **exposure** to the COVID-19 virus in the local context:
   - The population: current epidemiology about how widely the virus is circulating (e.g., clusters of cases versus community transmission), as well as local surveillance and testing capacity (e.g., contact tracing and follow up, ability to carry out testing).
   - The individual: working in close contact with public (e.g., community health worker, cashier)
3. **Vulnerability** of the person/population to develop severe disease or be at higher risk of death, e.g. people with comorbidities, such as cardiovascular disease or diabetes mellitus, and older people
4. **Setting** in which the population lives in terms of population density, the ability to carry out physical distancing (e.g. on a crowded bus), and risk of rapid spread (e.g. closed settings, slums, camps/camp-like settings).
5. **Feasibility**: availability and costs of the mask, and tolerability by individuals
6. **Type** of mask: medical mask versus nonmedical mask (see below)

In addition to these factors, potential advantages of the use of mask by healthy people in the community setting include reducing potential exposure risk from infected person during the "pre-symptomatic" period and stigmatization of individuals wearing mask for source control.

However, the following potential risks should be carefully taken into account in any decision-making process:

- self-contamination that can occur by touching and reusing contaminated mask
- depending on type of mask used, potential breathing difficulties
- false sense of security, leading to potentially less adherence to other preventive measures such as physical distancing and hand hygiene
- diversion of mask supplies and consequent shortage of mask for health care workers
- diversion of resources from effective public health measures, such as hand hygiene

Whatever approach is taken, it is important to develop a strong communication strategy to explain to the population the circumstances, criteria, and reasons for decisions. The population should receive clear instructions on what masks to wear, when and how (see mask management section), and on the importance of continuing to strictly follow all other IPC measures (e.g., hand hygiene, physical distancing, and others).

Type of Mask

WHO stresses that it is critical that medical masks and respirators be prioritized for health care workers.

The use of masks made of other materials (e.g., cotton fabric), also known as nonmedical masks, in the community setting has not been well evaluated. There is no current evidence to make a recommendation for or against their use in this setting.

WHO is collaborating with research and development partners to better understand the effectiveness and efficiency of nonmedical masks. WHO is also strongly encouraging countries that issue recommendations for the use of masks in healthy people in the community to conduct research on this critical topic. WHO will update its guidance when new evidence becomes available.

In the interim, decision makers may be moving ahead with advising the use of nonmedical masks. Where this is the case, the following features related to nonmedical masks should be taken into consideration:

- Numbers of layers of fabric/tissue
- Breathability of material used
- Water repellence/hydrophobic qualities
- Shape of mask
- Fit of mask

Home care

For COVID-19 patients with mild illness, hospitalization may not be required. All patients cared for outside hospital (i.e. at home or non-traditional settings) should be instructed to follow local/regional public health protocols for home isolation and return to designated COVID-19 hospital if they develop any worsening of illness.[7]

Home care may also be considered when inpatient care is unavailable or unsafe (e.g. capacity is limited, and resources are unable to meet the demand for health care services). Specific IPC guidance for home care should be followed.[3]

Persons with suspected COVID-19 or mild symptoms should:

- Self-isolate if isolation in a medical facility is not indicated or not possible
- Perform hand hygiene frequently, using an alcohol-based hand rub if hands are not visibly dirty or soap and water when hands are visibly dirty;
- Keep a distance of at least 1 m from other people;
- Wear a medical mask as much as possible; the mask should be changed at least once daily. Persons who cannot tolerate a medical mask should rigorously apply respiratory hygiene (i.e. cover mouth and nose with a disposable paper tissue when coughing or sneezing and dispose of it immediately after use or use a bent elbow procedure and then perform hand hygiene.)
- Avoid contaminating surfaces with saliva, phlegm, or respiratory secretions.
- Improve airflow and ventilation in their living space by opening windows and doors as much as possible.

Caregivers or those sharing living space with persons suspected of COVID-19 or with mild symptoms should:

- Perform hand hygiene frequently, using an alcohol-based hand rub if hands are not visibly dirty or soap and water when hands are visibly dirty;
- Keep a distance of at least 1 meter from the affected person when possible;
- Wear a medical mask when in the same room as the affected person;
- Dispose of any material contaminated with respiratory secretions (disposable tissues) immediately after use and then perform hand hygiene.
- Improve airflow and ventilation in the living space by opening windows as much as possible.

Health care settings

WHO provides guidance for the use of PPE, including masks, by health care workers in the guidance document: Rational use of PPE in the context of COVID-19.[24] Here we provide advice for people visiting a health care setting:

Symptomatic people visiting a health care setting should:

- Wear a medical mask while waiting in triage or other areas and during transportation within the facility;
- Not wear a medical mask when isolated in a single room, but cover their mouth and nose when coughing or sneezing with disposable paper tissues. Tissues must be disposed of appropriately, and hand hygiene should be performed immediately afterwards.

Health care workers should:

- Wear a medical mask when entering a room where patients with suspected or confirmed COVID-19 are admitted.
- Use a particulate respirator at least as protective as a US National Institute for Occupational Safety and Health-certified N95, European Union standard FFP2, or equivalent, when performing or working in settings where aerosol-generating procedures, such as tracheal intubation, non-invasive ventilation, tracheotomy, cardiopulmonary resuscitation, manual ventilation before intubation, and bronchoscopy are performed.
- Full infection prevention and control guidance for health care workers is provided here.

One study that evaluated the use of cloth masks in a health care facility found that health care workers using cotton cloth masks were at increased risk of infection compared with those who wore medical masks.[25] Therefore, cotton cloth masks are not considered appropriate for health care workers. As for other PPE items, if production of cloth masks for use in health care settings is proposed locally in situations of shortage or stock out, a local authority should assess the proposed PPE according to specific minimum standards and technical specifications.

Mask management

For any type of mask, appropriate use and disposal are essential to ensure that they are effective and to avoid any increase in transmission.

The following information on the correct use of masks is derived from practices in health care settings:

- Place the mask carefully, ensuring it covers the mouth and nose, and tie it securely to minimize any gaps between the face and the mask.
- Avoid touching the mask while wearing it.
- Remove the mask using the appropriate technique: do not touch the front of the mask but untie it from behind.
- After removal or whenever a used mask is inadvertently touched, clean hands using an alcohol-based hand rub or soap and water if hands are visibly dirty.
- Replace masks as soon as they become damp with a new clean, dry mask.
- Do not re-use single-use masks.
- Discard single-use masks after each use and dispose of them immediately upon removal.

WHO continues to monitor the situation closely for any changes that may affect this interim guidance. Should any factors change, WHO will issue a further update. Otherwise, this interim guidance document will expire 2 years after the date of publication.

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Government of Pakistan
Ministry of National Health Services, Regulations & Coordination

Date: 11 April 2020
Document Code: 11-01
Version: 01

Guidelines
Health & Safety of Building & Construction Workers during COVID-19 Outbreak

Objective
To provide guidelines for the workers involved in building and construction work during the current epidemic of COVID-19.

Rationale

Construction processes are dynamic with significantly varying number of workers on a construction project site from day to day. The workers coming from diverse environments and working closely together increases the risk of exposure to COVID 19.

Building construction involves earth work, procurement of materials and supplies and their storage, construction work done by masons, blacksmiths, electricians, carpenters, plumbers, painters, supervisors, managers and security personnel. These guidelines provide the safety measure to be implemented at the construction site having a dusty environment, continuous flow of different materials and make-shift type of arrangements for storage, food and sanitation calls for implementation of safety precautions at the very basic level of personal hygiene only.

Advice for Site Managers:
Without prejudice to the following, all possible and prescribed actions shall be taken at the project site, as should facilitate the health of all life present at the site.

- Every construction project shall make proper arrangements for uninterrupted building services including but not restricted to, electricity, fuel, water supply, water disposal and sanitation, communication links, washrooms with hand hygiene and shower facility and with proper and adequate supply of soaps and disinfectants.
- Workers should not use biometric attendance machines or crowd during attendance, entry or exit to the premises of the construction site
- Ensure the availability of the thermal gun at the entry and exit of the construction site and no worker should be allowed without getting his/her temperature checked.
- Site manager must maintain a register of all contact details with NID number and addresses of all present at the site in case a follow up or tracing and tracking of contacts is required at a later stage.
- Develop the employee roaster to decrease the number of people on the site very day. Split the shifts of the workers in morning and evening with limit of each shift to 8 working hours.

- Every worker must change into standard working attire at the time of commencement of duty and change back to their regular dress after taking shower when their duty hours end.
- In addition to all other internationally recognized safety precaution for construction workers and other staff, every individual must be provided with a face mask. It must be ensured that everyone during his or her presence at the site continues to wear the mask. Face mask shall be replaced as and when soiled or otherwise removed. Outer surface of face mask must not be touched with hands.
- Non-essential work trainings must be postponed avoiding gathering of people.
- Ensure the physical distance by creating more than one route of entry and exit to the site.
- Instruct the workers to inform the construction manager (or authorities) if
    - They develop any symptoms of cough, flu or fever.
    - They have been exposed to someone suspected or confirmed with COVID 19.
    - They have met someone who has a travel history of COVID 19 endemic country
    - They have travelled in last couple of days or plan to travel soon
- All incidences of appearance of the symptoms of COVID-19 shall be immediately documented and maintained at the site and information regarding which shall be immediately communicated through e-mail or else, to the designated health facility, and the sick worker shall be transported to the health facility for further advice and action. The site manager must establish a link with a nearby healthcare facility with arrangements for quick transportation of workers in case of an emergency.
- Persuade the workers to inform the authorities for their safety and of other if they observe any signs and symptoms in a colleague
- Do not allow any worker at the construction site who has the symptoms
- Display the awareness banners about hand hygiene and physical distancing, where you can, around the work site.
- Everyone on the construction site must observe sneezing and coughing etiquettes.
- Workers shall be requested and required to wash their hands as frequently as practicable and shall also be advised not to touch their face with their hands during work.
- Workers must maintain no less than two arm lengths between them before, during after work at all the times. They shall not make physical contact and shall be required to maintain separate personal gears and assets which must be clearly labelled and stored without intermix.
- Only sanitize-able dinning surfaces shall be used, which must be cleaned before each service. Food must be heated to a temperature to no less than 70° C before consumption and shall preferably be served in disposable utensils. If reusable utensils are used, these must be washed with soap and water immediately after use and stored at a safe place.
- The lunch breaks and stretch breaks of the workers must be staggered to avoid the clustering of workers. Workers must not sit at less than 2 meters distance while having meals and while any other activity requiring interpersonal communications.
- In the wake of current restrictions on transportations site mangers will ensure safe transport arrangements for worker which should not be crowded and should have social distancing in place during the entire process from pickups till drops at destination

- In case of workers sleeping in at the site of construction, a safe distance of 2 meters must be ensured in the sleeping rooms
- A supply of safe drinking water must be made available at the project site and maintained.

Advice for Construction Workers:

- All possible and prescribed measures shall be taken to ensure your and others health
- Enter your contact details in the register maintained at the site, in case a follow up or tracing and tracking of contacts is required at a later stage.
- Follow hygiene practices at washrooms and shower facility with proper and adequate use of soaps and disinfectants.
- Every worker must change into standard working attire at the time of commencement of duty and change back to their regular dress after taking shower when their duty hours end.
- In addition to all other internationally recognized safety precaution for construction workers and other staff, every individual must use face mask. Face mask shall be replaced as and when soiled or otherwise removed. Outer surface of face mask must not be touched with hands.
- Workers should wash their hands as frequently as practicable and shall not to touch their face with their hands during work.
- Everyone on the construction site must observe sneezing and coughing etiquettes.
- Workers must maintain no less than two arm lengths between them before, during after work at all the times. They shall not make physical contact and shall be required to maintain separate personal gears and assets which must be clearly labelled and stored without intermix.
- Sick worker should immediately inform the site manager and must get medical advice from nearby health centre.
- Only sanitize able dinning surfaces shall be used. Food must be heated to a temperature to no less than 70° C before consumption and shall preferably be in disposable utensils. If reusable utensils are used, these must be washed with soap and water immediately after use and stored at a safe place.
- Do not sit at less than 2 meters distance while having meals and while any other activity requiring interpersonal communications.
- Do not use biometric attendance machines or crowd during attendance, entry or exit to the premises of the construction site.
- Use safe transport arrangements which should not be crowded and should have social distancing in place during the entire process from pickups till drops at destination.
- In case sleeping in at the site of construction, a safe distance of 2 meters must be ensured in the sleeping rooms.

Deliveries or Other Contractors Visiting the Site

- Non-essential visits to the construction sites should be cancelled or postponed.

Government of Pakistan
Ministry of National Health Services, Regulations & Coordination

- Delivery workers or other contractors who need to visit the construction site must go through temperature check before entering and should be given clear instructions for precautions to be taken while on site.
- Designate the workers, with protective gears or at least gloved and mask, to attend to the deliveries and contractors.
- Make alcohol-based hand sanitizer (at least 70%) available for the workers handling deliveries.
- Instruct the visiting truck drivers to remain in their vehicles and whenever possible make use of contactless methods, such as mobile phones, to communicate with your workers.

Note: The above recommendations are being regularly reviewed by the Ministry of National Health Services, Regulations & Coordination and will be updated based on the international & national recommendations and best practices.

The Ministry acknowledges the contribution of Irfan Mirza, Syeda Shehirbano Akhtar and HSA/ HPSIU/ NIH team to compile these guidelines.

For more information, please contact:

HSA/ HPSIU/ NIH, PM National Health Complex, Islamabad

http://covid.gov.pk/

http://nhsrc.gov.pk/ https://www.facebook.com/NHSRCOfficial
http://www.hsa.edu.pk/ https://twitter.com/nhsrcofficial
https://www.nih.org.pk/ https://www.youtube.com/channel/UCdYuzeSP4Ug1f__ZZKI

ANNEXURE M

Solid Waste Management Framework

Framework for Solid Waste Management

1. INTRODUCTION

Framework Solid Waste Management Plan for the development of Mingora WTP and associated distribution network is provided. Construction contractors may use this framework as guiding document for preparation of site specific solid waste management plan. The purpose of this Framework Solid Waste Management Plan is to ensure that wastes arising from the proposed construction works at Mingora WTP are managed, reused, recovered or disposed of by a method that ensures the provisions of the KP EPA Act, 2014 and Pakistan Environmental Protection, 1997 and ADB SPS, 2009. It also ensures that the optimum levels of waste reduction, re-use and recycling are achieved.

Waste management priorities for project are based on following waste management hierarchy.

- Prevent material wastage
- Minimize the quantity of waste
- Reuse of site materials
- Recycling of waste
- Energy recovery
- Disposal

2. WASTE MANAGEMENT AT SWAT WTP and SUPPLY NETWORK

2.1 National Level

Waste management of the project will be carried as per national rules including:

- Solid Waste Management Policy, 2000
- Requirements of KP EPA, 2014
- Draft Guidelines on Solid Waste Management, 2005.
- Section 11 of PEPA, 1997 prohibits discharge of waste in amount that violates the NEQS.
- Draft Hazardous Substances rule of 1999
- Section 132 of Cantonment Act, 1942
- Provision Contains in the Local Government Ordinance, 2001

2.2 Regional Level

- Asian Development Bank (ADB) SPS, 2009
- IFC guidelines for Solid Waste Management
- Best practices of waste management on construction sites

3. DESCRIPTION OF THE PROJECT

The proposed WTP will be developed at Mingora City. Administration wise proposed WTP located in UC Khawazakhel tehsil and District Swat Khyber Pakhtunkhwa Province.The proposed WTP will be developed. WTP site can be accessed from main Mandyan road.

The proposed project Mingora water treatment plant (WTP) and gravity water supply scheme (GWSS)" aims to fulfill water supply requirements of Mingora city for the projected planning horizon population, from a surface water source, via a gravity-based transmission and distribution system. The proposed project will include drawing water from intake at Swat river and after necessary treatment it will be supplied to Mingora city. The water from intakes will be supplied under gravity to the proposed water treatment plant.

3.1 Details of the wastes to be produced

During construction/civil works potential sources of waste will include spoils generated during excavation, concrete and construction waste, domestic wastes (solid & wastewater), fuel or oil leakages or spills, onsite effluents from vehicle wash & cleaning, and cement spills. It is the responsibility of all personnel on site including Contractors, Sub-Contractors and their Employees to ensure compliance with this Waste Management Plan.

3.2 Main Waste Categories

Contractors are required to develop inventory of main waste categories that will be generated during construction phase of the project. Anticipated main waste categories include construction debris, concrete waste, scrap wood, bricks, concrete, asphalt, plumping fixtures, piping, insulation (asbestos and non-asbestos), metal scraps, oil, electrical wiring and components, chemicals, paints, solvents.

3.3 Anticipated Hazardous Waste Arising

Fuels stored on site that will be used during the construction phase are classed as hazardous. There will be fuel stored on site for machinery and construction vehicles. All fuel tanks and draw off points will be bunded. If the fuel is correctly contained and bunded, it is not expected that there will be any fuel wastage at the site. Other sources of hazardous waste include used paints, used oil/lubricants, electrical waste and chemicals. Project contractors are required to develop SOPs for handling, storage and disposal of hazardous waste arising from the project.

4. ESTIMATED WASTE GENERATION

4.1 Construction Waste Generation

Project contractors are required to develop and maintain waste inventory clearly showing the type, amount and location of waste generated from different activities at the site. Waste record keeping is key to successful implementation of waste management plan.

4.2 Proposed Waste Management Options

Waste will be segregated on site. Contractor will ensure that sufficient number of waste drums are placed at site with appropriate color coding. All recyclable waste will be handed over to recycling contractor. The appointed waste contractor will collect and transfer the recyclable wastes as receptacles are filled. The non-recyclable waste will be transferred by an authorized waste collector to an appropriate facility. Project contractors will identify both recycling and non-recycling contractor working in the project area. Contractors through bidding documents will be bound to hire such waste contractors for efficient waste management at project sites. A successful Waste Management Plan is largely dependent on how readily it can be integrated in to normal site operations by the person responsible. It is recognized that the plan should not be obstructive to site operations and the construction program by placing the responsibility of construction waste management with the Manager, all reuse, recycling, wastage and necessary disposal can be monitored as close to the source as possible. An Environmental Representative from each Works Sub-Contractor will also be nominated responsible for all waste management in their own operations. In this way, it is possible to identify where the greatest material wastage occurs, with a view to implementing better management.

The site Construction Manager will be designated as the Responsible Person and have overall responsibility for the implementation of the on-site Waste Management Plan. The Responsible Person will be assigned the authority to instruct all site personnel to comply with the specific provisions of the plan. At the operational level, a nominated Environmental Representative from each sub-contractor company on the site shall be assigned the direct responsibility to ensure that the discrete operations stated in this framework for solid waste management are performed on an on-going basis.

4.3 Tracking and documentation procedures for off-site waste

The site construction Manager will maintain a copy of all waste collection permits. If waste (soil & stone) is being accepted on-site, a waste docket must be issued to the collector. If the waste is being transported to another site, a copy of the waste permit for that site must be provided to the manager. Record of waste collection docket, a receipt from the final destination of the material will be kept as part of the on-site waste management records. All information will be entered in a waste management system to be maintained on-site.

4.4 Disposal Waste

Contractors are required to develop SOP for disposal of recyclable, non-recyclable and hazardous waste generated at site. Surplus excavated soil will be disposed off at designated sites. Food waste will be disposed at food waste pit which will be fenced. Recycling waste will be handed over to recycling waste contractor. Hazardous waste will be disposed through incineration facility available in close proximity of the project area. Workers on the site will be encouraged to recycle as much municipal waste as possible i.e. cardboard, plastic, metals and glass. Prior to removal, the municipal waste will be examined to determine if recyclable materials have been placed in other containers. If this is the case, effort will be made to determine the cause of the waste not being segregated correctly.

5. ESTIMATED COST OF WASTE MANAGEMENT

Contractors are required to estimate and budget cost for waste management through BOQ items. Such waste management cost should include cost of waste drums, cost of waste handling crew, cost of waste transportation, cost of EPA approved waste contractor services and associated incineration costs if any. By reusing materials on site, there will be reduction in transport and disposal costs for a waste contractor taking the material away.

6. TRAINING PROVISIONS FOR WASTE MANAGER AND SITE CREW

A waste manager will be appointed or designated by construction contractors to ensure commitment, operational efficiency and accountability during the project execution.

6.1 Site Manager Training and Responsibility

The waste manager will be given responsibility and authority to select a waste team if required i.e. members of the site crew that will aid him in the organization, operation and recording the waste management system implemented on-site. The waste manager will have overall responsibility to oversee record and provide feedback to the CSC on everyday waste management at the site. Authority will be given to the waste manager to delegate responsibility to sub-contractors where necessary and to co-ordinate with suppliers, service providers and sub-contractors to prioritize waste prevention and salvage. The waste manager will be trained in how to set up and maintain a record keeping system, how to perform an audit and how to establish targets for waste management on-site. He will also be trained in the best method for segregation and storage of recyclable materials, have information on the materials that can be reused on-site and know how to implement this Framework for Solid Waste Management.

6.2 Site Crew Waste Management Training

Training of the site crew is the responsibility of the waste manager and as such, a waste training program should be organized. A basic awareness course will be held for all crew to outline the construction waste management plan and to detail the segregation of waste at source. This may be incorporated with other training needs (e.g. general site induction, safety training etc.). This basic course will describe the materials to be segregated, the storage methods and the location of the waste storage areas. A subsection on hazardous wastes will be incorporated and the particular dangers of each hazardous waste will be explained.

7. RECORD KEEPING

Records will be kept for each waste material which leaves the site, either for reuse on another site, recovery, recycling or disposal. A system will be put in place to record the construction waste arising on-site. The waste manager or delegate will record the following:

- Waste taken off-site for reuse
- Waste taken off-site for recovery
- Waste taken off-site for recycling
- Waste taken off-site for disposal
- Waste (soil & stone) accepted on-site for recovery

For each movement of waste off-site, a signed waste collection docket will be obtained by the waste manager (or delegate) from the contractor. This will be carried out for each material type. This system will also be linked with the delivery records. A signed waste acceptance docket will be issued for each movement of waste on-site.

8. OUTLINE WASTE AUDIT PROCEDURE

Contractors are required to develop SOP for waste auditing at the construction sites. Such SOP should reflect frequency and types of waste audits, audit criteria and way forward to close non-compliances.

8.1 Responsibility for Waste Audit

The appointed waste manager will be responsible for conducting a waste audit at the site during project execution.

8.2 Review of Records and Identification of Corrective Actions

A review of all the records for the waste generated and transported off-site, as well as waste accepted, should be undertaken. If waste movements are not accounted for, the reasons for this should be established in order to see if and why the record keeping system has not been maintained. Each material type will be examined in order to see where the largest percentage waste generation is occurring. The waste management methods for each material type will be reviewed in order to highlight how the targets can be achieved. Waste management costs will also be reviewed. Upon completion of the construction phase a final report will be prepared summarizing the outcomes of waste management processes adopted and the total recycling/reuse/recovery figures for the development.

9. CONSULTATION WITH RELEVANT BODIES

9.1 Local Authority

Project contractors are required to maintain close coordination with PMU, WSSC Swat and KP EPA to ensure that all available waste reduction, re-use and recycling opportunities are identified and utilized.

9.2 EPA Approved Waste Contractors

Companies that specialize waste management will be contacted to determine their suitability for engagement. If used, each company will be audited in order to ensure that relevant and up-to-date waste collection permits and/or license are held. In addition, information regarding individual materials will be obtained including the feasibility of recycling each material, the costs of recycling/reclamation and the means by which the wastes will be collected and transported off-site, and the recycling/reclamation process each material will undergo off-site.

ANNEXURE N
MSDS of
Alum
&
Sodium Hypochlorite

Material Safety Data Sheet - MSDS

Dry Alum

MARSULEX

Section 1. Chemical Product and Company Identification

Trade name	: Dry Alum		
Material uses	: Alum is used as a coagulating agent in municipal and industrial water and wastewater treatment and as an additive in papermaking.	**Headquarters**	: Marsulex Inc. 111 Gordon Baker Road Suite 300 North York, ON M2H 3R1 (416) 496-9655 www.marsulex.com
Validation date	: **11/15/2007**		
In case of emergency	: Canada : CANUTEC 1-613-996-6666 US : CHEMTREC: 1-800-424-9300		

Section 2. Hazards identification

Physical state and Appearance : Solid. (Granules or powder.)

This material is classified hazardous under OSHA regulations in the United States and the WHMIS Controlled Product Regulation in Canada.

Emergency overview : WARNING!
CAUSES EYE AND SKIN IRRITATION.
MAY CAUSE ALLERGIC SKIN REACTION.
Avoid contact with eyes, skin and clothing. Wash thoroughly after handling.

Routes of entry : Dermal contact. Eye contact. Inhalation. Ingestion.

Potential acute health effects

Eyes : The dust becomes acidic following contact with moisture in the eye and may result in moderate to severe irritation to eyes.

Skin : The dust becomes acidic following contact with moisture on the skin and mild to moderate irritation can occur. Aluminum is very poorly absorbed through the skin and toxic effects would not be expected following short-term skin contact. Prolonged and repeated exposure to dilute solutions may cause irritation, redness, pain and drying and cracking of the skin.

Inhalation : Dusts of aluminum sulfate hydrate probably cause irritation of the nose, throat and respiratory tract based on pH. The dust becomes acidic following contact with moisture in the air or tissues of the respiratory tract.

Ingestion : May cause irritation of the lining of the stomach. Ingestion is not a typical route of occupational exposure.

Potential chronic health effects : CARCINOGENIC EFFECTS: Not classified or listed by IARC, NTP, OSHA, EU and ACGIH.
MUTAGENIC EFFECTS: Not available.
TERATOGENIC EFFECTS: Not available.

Medical conditions aggravated by over-exposure : Skin irritation may be aggravated in individuals with existing skin lesions. Breathing of dust may aggravate acute or chronic asthma and chronic pulmonary disease such as emphysema and bronchitis.

Over-exposure signs/symptoms : Prolonged or repeated contact with dust may cause redness, dryness and itching of the skin (dermatitis).

See Section 11 for Toxicological Data.

Continued on next page

Section 3. Composition/information on ingredients

Name	CAS #	% by weight
Aluminum Sulfate Hydrate	16828-12-9	99

See Section 8 for Exposure Limits.
See Section 11 for Toxicological Data.

Section 4. First Aid Measures

Eye contact : Immediately flush eyes with lukewarm, gently running water for a minimum of 5 minutes or until the chemical is removed. Hold eyelids open during flushing. If irritation persists, repeat flushing. Obtain medical attention IMMEDIATELY. Do not transport victim until the recommended flushing period is completed unless flushing can be continued during transport.

Skin contact : Flush skin with lukewarm running water for a minimum of 5 minutes or until the chemical is removed. Start flushing while removing contaminated clothing. If irritation persists, repeat flushing and obtain medical attention. Do not transport victim unless the recommended flushing period is completed or flushing can be continued during transport.
Discard heavily contaminated clothing and shoes in a manner, which limits further exposure. Otherwise, wash clothing separately before reuse.

Inhalation : Move victim to fresh air. If irritation persists, obtain medical attention immediately. Give artificial respiration ONLY if breathing has stopped. Give Cardiopulmonary Resuscitation (CPR) if there is no breathing AND no pulse. Obtain medical attention IMMEDIATELY.

Ingestion : If irritation or discomfort occur, obtain medical advice immediately.

Notes to physician : Not available.

Section 5. Fire Fighting Measures

Flammability of the product : Non-flammable.

Auto-ignition temperature : Not applicable.

Flash points : Not applicable.

Flammable limits : Not applicable.

Products of combustion : Forms aluminum oxide, sulfur dioxide and/or sulfur trioxide at temperatures reported above 650 °C (1200°F).

Fire hazards in the presence of various substances : Not applicable.

Explosion hazards in the presence of various substances : Dry alum will dissolve in water to form sulfuric acid which reacts with some metals, especially when dilute, to give flammable, potentially explosive hydrogen gas. Hydrogen gas can accumulate to explosive concentrations inside confined spaces. Follow appropriate NFPA codes.

Fire-fighting media and instructions : Use appropriate extinguisher for surrounding material.

Protective clothing (fire) : The decomposition products are corrosive and hazardous to health. Wear a NIOSH/MSHA approved self-contained breathing apparatus and full protective clothing if vapors or mists are present. For fighting fires in close proximity to spill or vapors, use acid-resistant personal protective equipment. Evacuate residents who are downwind of fire. Prevent unauthorized entry to fire area. Dike area to contain runoff and prevent contamination of water sources. Neutralize runoff with lime, soda ash or other suitable neutralizing agents (see Deactivating Chemicals, Section 6). Cool containers that are exposed to flame with streams of water until fire is out. Take care not to get water inside container.

Section 6. Accidental Release Measures

Small spill and leak : Shovel into clean, dry, labelled containers and cover. Flush area with water. Do not get water inside containers or on spilled material.

Large spill and leak : Prevent solids from mixing with water or entering sewers or waterways. Shovel into clean, dry, labelled containers and cover. If liquid is present, dike with inert material (sand, earth, etc.). Consider in situ neutralization and disposal. Ensure adequate decontamination of tools and equipment following clean up. Comply with Federal, Provincial/State and local regulations on reporting releases.
Deactivating Chemicals: Lime, limestone, soda ash, sodium bicarbonate, dilute sodium hydroxide, dilute aqua ammonia.

Continued on next page

Section 7. Handling and Storage

Handling : Dry Alum is an irritating solid. Avoid generating dusts. Do not breathe dusts. Do not ingest. Do not get in eyes, on skin or on clothing. Use proper tools when opening containers. Keep containers closed when not in use. Empty containers may contain hazardous residues. When there is a large-scale use, do not use in areas equipped with sprinkler systems. Post "DO NOT USE WATER" signs. Good housekeeping is important to prevent accumulations of dust. Dry sweeping is not recommended.

Storage : Keep container tightly closed. Keep container in a cool, dry, well-ventilated area. Store away from incompatible materials such as strong bases. Post warning signs.

Section 8. Exposure Controls, Personal Protection

Engineering controls : Use process enclosures, local exhaust ventilation or other engineering controls to keep worker exposure to airborne contaminants below any recommended or statutory limits. If user operations generate dust, fumes or mist, use ventilation to keep exposure to airborne contaminants below the exposure limit.The most effective measures are the total enclosure of processes and the mechanization of handling procedures to prevent all personal contact. Use a corrosion resistant ventilation system separate from other exhaust ventilation systems.

Personal protection

Eyes : Splash goggles.

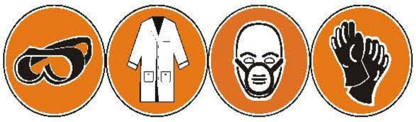
Body : Lab coat or coveralls.

Respiratory : NIOSH/MSHA approved dust mask, for dust concentrations of up to 10 mg/m^3. Air-purifying respirator equipped with acid gas/fume, dust, mist cartridges for concentrations up to 20 mg/m^3. An air-supplied respirator if concentrations are higher or unknown.

Hands : Gloves: Neoprene, PVC, vinyl or rubber.

Feet : Appropriate industrial footware.

Protective clothing (pictograms) :



Personal protection in case of a large spill : Splash goggles. Full suit. Dust respirator. Boots. Gloves. Self-contained breathing apparatus (SCBA) should be used to avoid inhalation of the product. Suggested protective clothing might not be adequate. Consult a specialist before handling this product.

Exposure limits

Product name	Exposure limits
Aluminum Sulfate Hydrate	**ACGIH TLV (United States).** TWA: 2 mg/m^3 8 hour(s). Form: as Aluminium (soluble salts) **OSHA PEL (United States).** TWA: 2 mg/m^3 8 hour(s). Form: as Aluminium (soluble salts)

Consult local authorities for acceptable exposure limits.

Section 9. Physical and Chemical Properties

Physical state and Appearance : Solid. (Granules or powder.)

Color : White.

Odor : Odorless.

Molecular weight : 594.4 g/mole

Molecular formula : $Al_2(SO_4)_3.14\ H_2O$

pH : > 2.9 @ 5%.

Boiling/condensation point : Not available.

Melting/freezing point : 86°C (186.8°F)

Specific gravity : Not available.

Vapor pressure : Not available.

Vapor density : Not available.

Odor threshold : Not available.

Evaporation rate : Not available.

Continued on next page

LogK_{ow}	:	Not available.
Solubility	:	Solubility in water at 20°C equivalent to approximately 8 wt-% Al_2O_3.

Section 10. Stability and Reactivity

Stability and reactivity	:	The product is stable.
Incompatibility with various substances	:	Strong bases such as sodium hydroxide. Reaction may be violent.
Hazardous decomposition products	:	Sulfuric acid vapors may be released upon heating and sulfur dioxide and sulfur trioxide may be released upon decomposition.
Hazardous polymerization	:	Will not occur.

Section 11. Toxicological Information

Toxicity data

Ingredient name	Test	Result	Route	Species
Aluminum Sulfate Hydrate	LD50	>9000 mg/kg	Oral	Rat
	LD50	>9000 mg/kg	Oral	Mouse

Chronic effects on humans	:	See Section 2.
Other toxic effects on humans	:	Very hazardous by the following route of exposure: of eye contact (irritant). Hazardous by the following route of exposure: of skin contact (irritant). Slightly hazardous by the following route of exposure: of inhalation (lung irritant).

Section 12. Ecological Information

Ecotoxicity data

Ingredient name	Species	Period	Result
Aluminum Sulfate Hydrate	Goldfish (LC50)	72 hour(s)	100 mg/l

Products of degradation	:	Decomposition products may include the following materials: carbon and sulfur oxides (CO_2, CO, SO_3 & SO_4). Toxicity is primarily associated with acidic pH. Acidic soil conditions can develop with the material present leading to release of some trace metals.
Toxicity of the products of biodegradation	:	The products of biodegradation are more toxic than the original product.

Section 13. Disposal Considerations

Waste information	:	Waste must be disposed of in accordance with federal, state and local environmental control regulations.

Consult your local or regional authorities.

Section 14. Transport Information

Canada (TDG)	:	Not regulated.
United States (DOT)	:	RQ, UN3077, ENVIRONMENTALLY HAZARDOUS SUBSTANCES, SOLID, N.O.S. (Aluminum sulfate), 9, PG III.
ERG	:	171

Section 15. Regulatory Information

WHMIS (Canada) : Class D-2B: Material causing other toxic effects (Toxic).

Canada inventory: All components are listed or exempted.

CEPA Toxic substances: This material is not listed.
Canadian ARET: This material is not listed.
Canadian NPRI: This material is not listed.
Alberta Designated Substances: This material is not listed.
Ontario Designated Substances: This material is not listed.
Quebec Designated Substances: This material is not listed.

Continued on next page

Dry Alum	*Page: 5/5*

This product has been classified in accordance with the hazard criteria of the CPR and the MSDS contains all the information required by the CPR.

HCS Classification : Irritating material

U.S. Federal Regulations : **United States inventory (TSCA 8b):** All components are listed or exempted.
SARA 302/304/311/312 extremely hazardous substances: No products were found.
SARA 302/304 emergency planning and notification: No products were found.
SARA 302/304/311/312 hazardous chemicals: No products were found.
SARA 311/312 MSDS distribution - chemical inventory - hazard identification: No products were found.

State Regulations : **Connecticut Carcinogen Reporting**: This material is not listed.
Connecticut Hazardous Material Survey: This material is not listed.
Florida substances: This material is not listed.
Illinois Chemical Safety Act: This material is not listed.
Illinois Toxic Substances Disclosure to Employee Act: This material is not listed.
Louisiana Reporting: This material is not listed.
Louisiana Spill: This material is not listed.
Massachusetts Spill: This material is not listed.
Massachusetts Substances: This material is not listed.
Michigan Critical Material: This material is not listed.
Minnesota Hazardous Substances: This material is not listed.
New Jersey Hazardous Substances: This material is not listed.
New Jersey Spill: This material is not listed.
New Jersey Toxic Catastrophe Prevention Act: This material is not listed.
New York Acutely Hazardous Substances: This material is not listed.
New York Toxic Chemical Release Reporting: This material is not listed.
Pennsylvania RTK Hazardous Substances: This material is not listed.
Rhode Island Hazardous Substances: This material is not listed.

California Prop. 65

No products were found.

Section 16. Other Information

Hazardous Material Information System (U.S.A.)

Health	2
Fire hazard	0
Physical Hazard	0
Personal protection	E

National Fire Protection Association (U.S.A.)

References : - 29CFR Part1910.1200 OSHA MSDS Requirements. - 49CFR Table List of Hazardous Materials, UN#, Proper Shipping Names, PG. ANSI Z400.1, MSDS Standard, 2004. - Canada Gazette Part II, Vol. 122, No. 2. Registration SOR/88-64, 31 December 1987. Hazardous Products Act "Ingredient Disclosure List" - Canadian Transport of Dangerous Goods, Regulations and Schedules, Clear Language version 2005. - Manufacturer's Material Safety Data Sheet.

Responsible name : **Atrion Regulatory Services, Inc.**
Date of issue : **11/15/2007**
Date of previous issue : **09/30/2006**
Version : **3**

<u>**Notice to reader**</u>

To the best of our knowledge, the information contained herein is accurate. However, neither the above named supplier nor any of its subsidiaries assumes any liability whatsoever for the accuracy or completeness of the information contained herein. Final determination of suitability of any material is the sole responsibility of the user. All materials may present unknown hazards and should be used with caution. Although certain hazards are described herein, we cannot guarantee that these are the only hazards that exist.

Revision Date 29/10/2012
Revision 5
Supersedes date October 2012

ICL INDUSTRIAL CHEMICALS LTD

SAFETY DATA SHEET
Sodium hypochlorite solution

SECTION 1: IDENTIFICATION OF THE SUBSTANCE/MIXTURE AND OF THE COMPANY/UNDERTAKING

1.1. Product identifier

Product name	Sodium hypochlorite solution
Synonyms, Trade Names	Commonly called bleach solution
REACH Registration number	01-2119488154-34
CAS-No.	7681-52-9
EC No.	231-668-3

1.2. Relevant identified uses of the substance or mixture and uses advised against

Identified uses Treatment of drinking water, has received approval by the European Committee for Standardisation. Washing and cleaning products Pulp and paper manufacturing Cleaning agent. Treatment of waste water. Finishing agent (textiles) Manufacture of substances. Disinfectant.

1.3. Details of the supplier of the safety data sheet

Supplier

Industrial Chemicals Limited
Hogg Lane
Grays
Essex
RM17 5DU
United Kingdom
T:+44 (0)1375 389000
F:+44 (0)1375 389110
sds@icgl.co.uk

1.4. Emergency telephone number

+44 (0)1865 407333 (24-hour)

SECTION 2: HAZARDS IDENTIFICATION

2.1. Classification of the substance or mixture

Classification (EC 1272/2008)

	Physical and Chemical Hazards	Met. Corr. 1 - H290
	Human health	EUH031;Skin Corr. 1B - H314
	Environment	Aquatic Acute 1 - H400;Aquatic Chronic 2 - H411
Classification (1999/45/EEC)	C;R34. N;R50. R31.	

The Full Text for all R-Phrases and Hazard Statements are Displayed in Section 16.

Human health

Vapours may irritate the respiratory system and cause coughing, asthmatic breathing and breathlessness. Corrosive to skin and eyes.

Environment

The product contains a substance which is very toxic to aquatic organisms.

Physical and Chemical Hazards

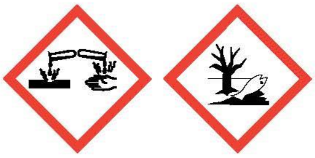
Contact with acids liberates toxic chlorine gas Product may be corrosive to some metals

2.2. Label elements

EC No.	231-668-3
Contains	SODIUM HYDROXIDE
	Sodium hypochlorite

Label In Accordance With (EC) No. 1272/2008

Sodium hypochlorite solution



Signal Word	Danger	
Hazard Statements		
	H290	May be corrosive to metals.
	H314	Causes severe skin burns and eye damage.
	H400	Very toxic to aquatic life.
	H411	Toxic to aquatic life with long lasting effects.
Precautionary Statements		
	P273	Avoid release to the environment.
	P280	Wear protective gloves/protective clothing/eye protection/face protection.
	P303+361+353	IF ON SKIN (or hair): Remove/Take off immediately all contaminated clothing. Rinse skin with water/shower.
	P304+340	IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing.
	P305+351+338	IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
	P310	Immediately call a POISON CENTER or doctor/physician.
	P403+235	Store in a well-ventilated place. Keep cool.
Supplementary Precautionary Statements		
	P260	Do not breathe vapour/spray.
	P264	Wash contaminated skin thoroughly after handling.
	P301+330+331	IF SWALLOWED: Rinse mouth. Do NOT induce vomiting.
	P363	Wash contaminated clothing before reuse.
	P390	Absorb spillage to prevent material damage.
	P391	Collect spillage.
	P405	Store locked up.
	P406	Store in corrosive resistant/… container with a resistant inner liner.
	P501	Dispose of contents/container in accordance with national regulations.
Supplemental label information		
	EUH031	Contact with acids liberates toxic gas.

2.3. Other hazards

SECTION 3: COMPOSITION/INFORMATION ON INGREDIENTS

3.2. Mixtures

SODIUM HYDROXIDE		**0.1 - 1.0%**
CAS-No.: 1310-73-2	**EC No.: 215-185-5**	
Classification (EC 1272/2008) Skin Corr. 1A - H314	Classification (67/548/EEC) C;R35	

Sodium hypochlorite		**5-20%**
CAS-No.: 7681-52-9	**EC No.: 231-668-3**	
Classification (EC 1272/2008) Met. Corr. 1 - H290 EUH031 Skin Corr. 1B - H314 Aquatic Acute 1 - H400 Aquatic Chronic 2 - H411	Classification (67/548/EEC) C;R34. N;R50. R31.	

Sodium hypochlorite solution

The Full Text for all R-Phrases and Hazard Statements are Displayed in Section 16.

REACH Registration number	01-2119488154-34
CAS-No.	7681-52-9
EC No.	231-668-3
Gross Formula	NaOCl + NaCl

SECTION 4: FIRST AID MEASURES

4.1. Description of first aid measures

General information

Get medical attention immediately!

Inhalation

Move the exposed person to fresh air at once. For breathing difficulties oxygen may be necessary.

Ingestion

Do not induce vomiting. If confined to the mouth, rinse mouth thoroughly and ensure water is not swallowed. If swallowed, drink plenty of water. If substance has been swallowed, give water to drink immediately

Skin contact

Remove contaminated clothes and rinse skin thoroughly with water.

Eye contact

Immediately flush with plenty of water for up to 15 minutes. Remove any contact lenses and open eyes wide apart.

4.2. Most important symptoms and effects, both acute and delayed

4.3. Indication of any immediate medical attention and special treatment needed

SECTION 5: FIREFIGHTING MEASURES

5.1. Extinguishing media

Extinguishing media

Use fire-extinguishing media appropriate for surrounding materials.

5.2. Special hazards arising from the substance or mixture

Hazardous combustion products

Thermal decomposition will evolve Chlorine. Contact with heavy metals, their compounds and alloys the product decomposes with evolution of oxygen.

5.3. Advice for firefighters

Protective equipment for fire-fighters

Self contained breathing apparatus and full protective clothing must be worn in case of fire.

SECTION 6: ACCIDENTAL RELEASE MEASURES

6.1. Personal precautions, protective equipment and emergency procedures

Wear protective clothing as described in Section 8 of this safety data sheet.

6.2. Environmental precautions

Do not discharge into drains, water courses or onto the ground.

6.3. Methods and material for containment and cleaning up

Flush away small spillages with plenty of water. Large Spillages: Absorb with sand or other inert absorbent. Pick up with vacuum or absorbent solid, store in closed container for disposal.

6.4. Reference to other sections

SECTION 7: HANDLING AND STORAGE

7.1. Precautions for safe handling

Avoid contact with eyes. Handle with care as an alkaline material. Wear appropriate protective clothing. Avoid inhalation of vapours and spray mists. Do not mix with acids, or other cleaning fluids (espicially ammonia).

7.2. Conditions for safe storage, including any incompatibilities

Unsuitable containers: metals. Store in vented vessels of rubber lined mild steel or HDPE. Uncontolled pressure build up may occur in closed systems (vessels, pipes etc.) so all containers must have a venting device. Sludge may build up in tanks over time, due to salt deposition. Keep away from acids, ammonia solutions, amines and methanol. Keep away from from heat and direct sunlight.

Sodium hypochlorite solution

7.3. Specific end use(s)

SECTION 8: EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1. Control parameters

Name	STD	TWA - 8 Hrs		STEL - 15 Min		Notes
SODIUM HYDROXIDE	WEL				2 mg/m3	

WEL = Workplace Exposure Limit.

Ingredient Comments

Chlorine vapour STEL 15min 0.5 ppm, 1.5 mg/m3

DNEL

Industry	Inhalation.	Long Term	1.55	mg/m3
Industry	Inhalation.	Short Term	3.1	mg/m3
Consumer	Inhalation.	Long Term	1.55	mg/m3
Consumer	Inhalation.	Short Term	3.1	mg/m3
Consumer	Oral	Long Term	Systemic Effects	0.26 mg/kg/day

8.2. Exposure controls

Protective equipment



Process conditions

Provide eyewash station.

Engineering measures

Provide adequate general and local exhaust ventilation.

Respiratory equipment

For respirator use cartridge type P3 SL

Hand protection

Wear protective gloves. Rubber or plastic.

Eye protection

Goggles/face shield are recommended.

Other Protection

Plastic apron, sleeves, boots - if handling large quantities, full body suit.

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

9.1. Information on basic physical and chemical properties

Appearance	Liquid
Colour	Green yellow
Odour	Irritating. Chlorine.
Solubility	Completely soluble in water
Initial boiling point and boiling range	110 Decomposes with heat
Melting point (°C)	-17°C
Relative density	1.26 20
pH-Value, Conc. Solution	> 13

9.2. Other information

SECTION 10: STABILITY AND REACTIVITY

10.1. Reactivity

Violent reaction with: Acids.

Sodium hypochlorite solution

10.2. Chemical stability

Avoid Contact with acids.

10.3. Possibility of hazardous reactions

Contact with acids liberates toxic chlorine gas. Reacts with amines and ammonia to form explosive compounds, and can react violently with methanol.

10.4. Conditions to avoid

Store in a cool dry place away from direct sunlight.

10.5. Incompatible materials

Materials To Avoid

Contact with acids liberates toxic chlorine gas. Decomposition with evolution of oxygen is accelerated by heat and light, and also by contact with metals, particularly copper, nickel, iron and monel.

10.6. Hazardous decomposition products

Thermal decomposition will evolve toxic vapours.

SECTION 11: TOXICOLOGICAL INFORMATION

11.1. Information on toxicological effects

Toxic Dose 1 - LD 50

>1200 mg/kg (oral rat)

Acute toxicity:

Acute Toxicity (Dermal LD50)

> 2000 mg/kg Rat

Skin Corrosion/Irritation:

Corrosive

Respiratory or skin sensitisation:

Not Sensitising.

Germ cell mutagenicity:

This substance has no evidence of mutagenic properties.

Carcinogenicity:

This substance has no evidence of carcinogenic properties.

Inhalation

Mist/droplets are corrosive to the respiratory tract, and will cause a burning sensation in the throat, coughing and breathing difficulties.

Ingestion

If ingested will cause severe damage to gastrointestinal tract.

Skin contact

Causes burns. Prolonged or repeated contact may cause dermatitis

Eye contact

Risk of serious damage to eyes. Risk of corneal damage.

SECTION 12: ECOLOGICAL INFORMATION

12.1. Toxicity

LC 50, 96 Hrs, Fish mg/l	0.01-0.1
mg/l active chlorine	
EC 50, 48 Hrs, Daphnia, mg/l	0.01-0.1
IC 50, 72 Hrs, Algae, mg/l	Technically unfeasible

Sodium hypochlorite solution

Acute Toxicity - Microorganisms

LOEC 0.375 mg/l Activated sludge

12.2. Persistence and degradability

Degradability

The product quickly decomposes in water or soil

12.3. Bioaccumulative potential

Bioaccumulative potential

Will not bio-accumulate.

12.4. Mobility in soil

Mobility:

The product is soluble in water.

12.5. Results of PBT and vPvB assessment

This product does not contain any PBT or vPvB substances.

12.6. Other adverse effects

SECTION 13: DISPOSAL CONSIDERATIONS

13.1. Waste treatment methods

Dispose of waste and residues in accordance with local authority requirements. Do not allow runoff to sewer, waterway or ground. Collect in marked containers and deliver to approved depot. Contaminated area should be washed with large amounts of water

SECTION 14: TRANSPORT INFORMATION

14.1. UN number

UN No. (ADR/RID/ADN)	1791
UN No. (IMDG)	1791
UN No. (ICAO)	1791

14.2. UN proper shipping name

Proper Shipping Name	HYPOCHLORITE SOLUTION
Proper Shipping Name	HYPOCHLORITE SOLUTION

14.3. Transport hazard class(es)

ADR/RID/ADN Class	8
ADR/RID/ADN Class	Class 8: Corrosive substances.
ADR Label No.	8
IMDG Class	8
ICAO Class/Division	8

Transport Labels

14.4. Packing group

ADR/RID/ADN Packing group	II
IMDG Packing group	II

Sodium hypochlorite solution

ICAO Packing group II

14.5. Environmental hazards

Environmentally Hazardous Substance/Marine Pollutant

14.6. Special precautions for user

EMS	F-A, S-B
Emergency Action Code	2X
Hazard No. (ADR)	80
Tunnel Restriction Code	(E)

14.7. Transport in bulk according to Annex II of MARPOL73/78 and the IBC Code

SECTION 15: REGULATORY INFORMATION

15.1. Safety, health and environmental regulations/legislation specific for the substance or mixture

EU Legislation

This product has been approved as a chemical used for the treatment of drinking water, under the appropriate BS EN Standard (see Sales Specification), and so it is also approved by the British Drinking Water Inspectorate. Regulation (EC) No 1907/2006 of the European Parliament and the Council of 18 December 2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH). Directive 98/8/EC of the European Parliament and of the Council of 16 February 1998 concerning the placing of biocidal products on the market.

Water hazard classification

WGK 2

15.2. Chemical Safety Assessment

A chemical safety assessment has been carried out.

SECTION 16: OTHER INFORMATION

Revision Comments

Corrections to concentrations in Sections 3, and transport information and Section14.

Issued By	Chief Chemist
Revision Date	29/10/2012
Revision	5
Supersedes date	October 2012

Risk Phrases In Full

R31	Contact with acids liberates toxic gas.
R34	Causes burns.
R35	Causes severe burns.
R50	Very toxic to aquatic organisms.

Hazard Statements In Full

EUH031	Contact with acids liberates toxic gas.
H290	May be corrosive to metals.
H314	Causes severe skin burns and eye damage.
H400	Very toxic to aquatic life.
H411	Toxic to aquatic life with long lasting effects.

Disclaimer

This information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process. Such information is, to the best of the company's knowledge and belief, accurate and reliable as of the date indicated. However, no warranty guarantee or representation is made to its accuracy, reliability or completeness. It is the user's responsibility to satisfy himself as to the suitability of such information for his own particular use.