# Initial Environmental Examination

Project Number: 50136-002
November 2021

# Pakistan: Khyber Pakhtunkhwa Cities Improvement Project

Extension of JICA Water Treatment Plant and Gravity Water Supply Scheme (Abbottabad)

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

## CURRENCY EQUIVALENTS

| | |
|---|---|
| As of 18th November, 2021 | Currency Unit – Pak Rupees (Pak Rs.) |
| Pak Rs 1.00 = $ 0.0057 | US$1.00 = Pak Rs. 175 |

## CONVERSIONS

1 meter = 3.28 feet

1 hectare = 2.47 acre

# Acronyms

| | |
|---|---|
| **ADA** | Abbottabad Development Authority |
| **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 |
| **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 |
| **WSSCA** | Water and Sanitation Services Company Abbottabad |

# 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 this reaction 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 water use is typically expressed as a ratio, or peaking factor, dividing the peak water use 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, 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 | 17-04-21 | First Draft of IEE report |
| 1 | 2 | 26-07-21 | Final Draft of IEE report |
| 3 | 3 | 18-11-21 | Updated Draft of IEE report |

# Table of Contents

# Annexures

# List of Figures

# List of Tables

# 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 Pakhtunkhwa 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 LGERDD. 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 "extension of JICA Gravity Water Supply Scheme" Abbottabad city has two main components:

- **Component 1**: Increase total available potable water production at the existing JICA Water Treatment Plant from the current 200 l/s to 500 l/s by adding an additional 300 l/s from two new surface water sources

- **Component 2:** Increase the distribution system capacity of JICA gravity scheme inside Abbottabad city

7. The proposed project "extension of JICA water treatment plant (WTP) and gravity water supply scheme (GWSS)" aims to fulfill water supply requirements of Abbottabad 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 Phalkot and Jandal Bari streams. The water from intakes will be supplied under gravity to the proposed water treatment plant.

8. Environmental audit of existing facilities including Phalkot structure, existing JICA water treartment plant, transmission main, overhead reservoirs and distribution network was carried out. Audit result shows that exisitng facilities does not pose any significant impact on environment. Operation of intake structure and transmission mains and distribution network have negligible impact on environment. At existing WTP site sludge from sedimentation tanks and wash water from sand filter cleaning is the waste which is being disposed off into nearby drain. There is need to increase cleaning frequency of overhead reservoirs, to increase purging frequency of distribution network. Water quality analysis lab should be within WTP as currently samples are being sent to WASA lab. There is need to increase sampling points and frequency of surface water quality monitoring at various components of the system.

9. Water source sustainability assessment of Phalkot and Jandal Bari streams 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.

10. The flow measurement for Jandar Bari Intake was 920 lit/sec while for Phalkot it was 450 lit/sec. Raw water Intake flow for proposed Jandar Bari stream is 200l/s while from Phalkot 100 l/s. Therefore, downstream water availability shall not be compromised and enough water would be flowing downstream in Dor River to maintain ecological flows. Moreover, the sources have enough water availability for uninterrupted water supply of WTP.

11. To treat the surface water and bringing the water quality parameters within National Environmental Quality Standards (NEQS), a conventional water treatment plant is proposed for Abbottabad City at choona hill. Supply mains shall transmit treated water to storage reservoirs and connected to water distribution network inside the city to supply water from storage reservoirs to end users with a water metering system.

12. The proposed water treatment plant is located at Choona Hill adjacent to existing JICA funded water treatment plant while the intake for raw water located at Phalkot and Jandal Bari streams.

13. The Union Councils (Ucs) under the jurisdiction of WSSC Abbottabad for the proposed water supply network are as follow

- UC-1 - Urban City

- UC-2 - Kehal

- UC-3 – Nawansher
- UC-4 - Malikpura

14. A map showing the location of intake sours, transmission main and location of WTP and UCs is provided in **Figure ES-1**. Map showing the location of WTP is also marked in **Figure ES-2**. Summary of project components is provided in Table **ES-1** and **ES-2**.

## Project Need

15. The existing JICA water treatment plant was built in 2015 through Japanese government (JICA) funding at Choona hill in Abbottabad. The maximum design capacity of existing JICA water treatment plant is 190,203 Gallons/hour (200 l/s) while its average production is around 95,102 GPH (100 l/s), due to seasonal variation at the available surface water sources. The current water shares from this existing JICA water treatment plant for four (4) UCs under WSSC Abbottabad jurisdiction is approximately 64% while the remaining 36% is allocated for the area under Public Health Engineering Department (PHED) jurisdiction. PHED is currently the operating agency of the existing JICA water treatment plant however after project execution WSSC Abbotabad will be the operating agency of new treatment plant and GWSS.

16. At present, there are two main sources of water supply in Abbottabad. The major source is ground water source based on tube wells while the second source is the existing surface water-based water treatment plant (JICA). At present, 14 out of 19 tube wells are operational while the remaining 5 tube wells are non-operational.The approximate discharge of the existing and operational 14 tube wells is 1,120,000 gallons per day and average water supply from existing JICA water treatment plant is approx. 1,460,766 gallons per day, which gives a total supply of 2,580,766 gallons per day. At present, there is net shortfall of 2,669,234 gallons per day in Abbottabad.

17. Apart from the supply received from the existing JICA gravity scheme, Abbottabad city is being served through a ground water-based system i.e. tube wells. The declining water table at existing 14 tube wells and higher levels of turbidity at the existing JICA water plant has necessitated identification of new sources of surface water to be tapped to satisfy the water demands of current and projected population of the Abbottabad city.

## Project Benefits

18. The main benefits of this project include the following

- Extension of the existing JICA water treatment plant thereby eliminating the need to rely on tube wells in mostly all the areas currently served by WSSC Abbottabad;
- Extension of the JICA water treatment plant will result in a water supply system that has lower operational costs by reducing or eliminating pumping costs in the system;
- Extension of the JICA water treatment plant 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 extension of JICA water treatment plant and gravity water supply scheme. Based on the initial findings, it was ascertained that certain adverse environmental impacts are not expected of significance that detailed assessment is required therefore IEE has been conducted for the proposed "extension of JICA WTP and GWSS, and thus the subject project is considered environmentally "B" category as per ADB SPS, 2009.

21. Further regulatory requirements of Khyber Pakhtunkhwa Environment Protection Agency (KPEPA) shall be complied by KP LGERDD as per IEE/EIA Regulation 2000 as notified by the Pakistan Environment Protection Agency vide S.R.O. 339 (1)/2001 during the project approval and execution stage.

## Scope and Objectives of the IEE

22. The scope of IEE will include environmental impact assessment of project activities including design, construction and operation of raw water intake structure, transmission main from intake to the water treatment plant, proposed water treatment plant (WTP), Treated water supply mains from WTP to Abbottabad City, construction of receiving water storage reservoirs, water distribution Network and water meters. Following are the objectives of the IEE;

- 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 proposed extension of JICA Gravity Water Supply Scheme pre-construction/design, construction, operation phases, on the physical, biological and socioeconomic environment of the project area;
- To propose mitigation measures that would help KP LGERDD and WSSCA 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 would assist KP LGERDD and WSSCA in the effective implementation of the recommendations of the IEE

## Study Methodology

23. 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.

24. 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. Field visits to the project area were undertaken and key receptors and stakeholders within the project

area has been identified and consulted.Integrated biodiversity assessment (IBAT) screening results of project area has been used to ascertain the key biodiversity species of the area and impacts on such species. IBAT screening results of nearby proposed landfill site to be constructed under KPCIP, located at distance of about 2.5 Km, were used for this purpose.

25. Detailed ambient air quality and noise monitoring was conducted around proposed location of WTP in project area. Apart from exceedance in $PM_{10}$ at various locations, all other pollutants are within the applicable 'most stringent' standards/guidelines. Increased $PM_{10}$ in air is due to unpaved roads within the vicinity, fields, and increased residential fires for cooking purpose due to unavailability of gas supply within nearby villages.The ambient noise levels are found to be generally within the applicable stringent standards/guidelines during the day and night time. Furthermore, the ground water quality was also monitored and it was found to be within the applicable NEQS limits.

26. Surface water quality was monitored to assess raw water quality of both Phalkot and Jandar Bari 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 Phalkot intake indicates the presence of turbidity, Suspended solids and coliforms.

27. The significance of impacts from the proposed project were then assessed and for those impacts requiring mitigation, suitable measures in project design, construction and operation phase were proposed to avoid/reduce impacts to within acceptable limits as per local and international applicable regulations. A detailed environmental management and monitoring plan has been developed to ensure compliance to the proposed measures during the project development.

## Baseline Condition of Project location

### Physical Environment

28. Topography wise the proposed WTP located on a fairly flat land on the top of choona hill adjacent to existing JICA WTP while the topography of intake points is hilly with steep slope hills.

29. There are two perennial streams Darkhan Katha Nullah & Dor River flowing very close to WTP site. Darkhan Katha Nullah which carries mainly waste water from Abbottabad city flowing at around 800 meter on the northern eastern side of proposed location. On the eastern side Dor River is flowing at around 2.5 km, originates from Dounga Gali range and terminates at Terbela Lake near Haripur.

30. Detailed Catchment studies of Phalkot and Jandar Bari streams has been conducted to assess water source sustainability 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.

31. The proposed intake sources Phalkot and Jander Bari are tributaries of Dor River. The flow measurement for Jandar Bari Intake was 920 lit/sec while for Phalkot it was 450 lit/sec. Raw water Intake flow for proposed Jandar Bari stream is 200l/s while from Phalkot 100 l/s. Therefore, downstream water availability shall not be compromised

and enough water would be flowing downstream in Dor River to maintain ecological flows. Moreover, the sources have enough water availability for uninterrupted water supply for WTP. Further at present there is no other use observed downstream during EDCM survey from both intake structures from Phalkot and Jandar Bari streams for agriculture, industrial and any other urban use.

32. The project area (Abbottabad) 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).

33. 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.

34. Raw water characterization study was carried to assess raw water quality of both Phalkot and Jandar Bari 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 Phalkot intake indicates the presence of turbidity, Suspended solids and coliforms. The turbidity values are above 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. However results at Phalkot from sample taken after two hours rain indicate higher values up to 90 NTU. TSS values are higher during monsoon due to rainwater intrusion which carries suspended solids of catchment area.

35. The presence of total coliform, fecal coliform, and E-Coli has also been reported above the permissible limits. The test results of water samples at Jandar Bari also indicate the presence of Turbidity, fecal coliform and E-Coli above permissible limit. With respect to microbial contamination sampls of Phalkot shows higher values than Jandar Bari stream. Higher values indicate that there may be animal waste/excreta entering into the stream. During EDCM detailes survey no upstream drains were located Project desing 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.

### Ecological Environment

36. Site is falling outside of restricted zone/wildlife/forest protected areas. However, there are two nearest protected areas which are the Ayubia National Park and the Qalandarabad game reserve. The Closest is Ayubia National Park located at approximately 15 Kms from proposed WTP area.

37. Integrated Biodiversity Assessment Tool (IBAT) screening was carried out for other KPCIP sub-project which is Dhamtore landfill site located at a distance of 2 Km from WTP site to identify the biodiversity features and species that are located within the following buffers: 1 km, 5 km and 10 km. Result of IBAT screening shows that there were no protected and/or key biodiversity areas found within 10 km buffer from the WTP site. There are 29 threatened species that are potentially found within 50 km from

area of interest, which include 18 avian species, 06 mammalian, 04 Actinopterygii and 01 Magnoliopsida. As the impacts associated with WTP are localized therefore, no impacts on biodervsity is envisaged.

38. The proposed WTP is located on barren land with 31 pine trees trees. The proposed WTP location is adjacent to existing JICA WTP and only 3.25 Acers of land will be utilized for construction of WTP. Therefore, no threat to biological environment is envisaged. The route of transmission main and supply network is within TMA RoW of existing roads. No excessive tree cuttings have been proposed only 15 trees need to be clear for the construction of WTP. An estimated 1,300 plant varieties are found in Abbottabad district. Commonly found trees are Acacia Modesta, Acacia nilotica and Morus alba. In addition, the area is home to 18 mammal species, seven of which are endangered: the common leopard, common red fox, Himalayan palm civet, jungle cat, Murree vole, musk deer and woolly flying squirrel. As project activities are planned in settled urban areas instead of natural habitat of flora and fauna therefore no significant impact on ecologcical environment is anticipated.

## Socio-economic Environment

39. The project is located in Abbottabad city, situated in the south east of Khyber Pakhtunkhwa Province. The proposed water treatment plant is located at Choona Hill adjacent to existing JICA funded while the intake for raw water located at Phalkot and Jandal Bari streams. The proposed water supply network shall be developed in UCs-Urban City, Kehal, Nawansher and Malikpura.

40. The WTP site is accessible from murree road via choona village road. No public/private water supply wells encountered during field visit. No archaeological and cultural site was observed in close proximity of WTP site and RoW of distribution networks.

41. 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. At the western side, Choona village is located at around 1km from WTP location while on the north-eastern side Takia camp village is located which is around 800 meters from proposed WTP location. Other surveyed settlements include owner Khel, Digi Muhalla, Band-ko UC, Old Seena laboratory chowk, District Compound, Mohalla Sikander Khel and Mohalla Jalal Baba and district colony.

42. The proposed project involves the upgradation of the existing water treatment plant and reservoir on 3.25 acres of land. The land for proposed WTP and reservoir is already under possession of Public Health Engineering Department (PHED) since 2011 which will be now handed over to WSSC Abbotabad. Replacement/laying of water supply pipeline in approximately 190 km of city area with right-of-way owned by TMA. About 16 nos surface water tanks will be constructed for which private land will be acquired (the exact area is yet unknown), PMU KPCIP is in the process of negotiation with landowners, once conclude social safeguard team will re-access the LAR impacts.

## Public Consultation Process

43. As part of environmental and social assessment, detailed consultations were carried with primary and secondary stakeholders and also with institutional stakeholders. Meetings with village notables and focus group discussions (FGDs) with the communities, including women in the project area were carried out. The public consultation process was carried out by the KPCIP-EDCM team in May, 2020. 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.

44. Total 8 FGDs were conducted. Total 82 men and women participated in these 8 FGDs out of 82 participants 44 (53%) are women. Information on positive and negative impacts associated with construction and operation phase of the project were discussed. Mitigation measures related to cater for negative impacts were also briefed during these discussed consultations.

45. Findings of consultation shows that existing water supply is not sufficient to cater the needs of nearby localities in terms of water demand. Treated water had tapeworm or biological contamination, broken lids of existing water storage reservoirs and mixing of flooded rainwater with water supply network. Project should provide permanent solution of such issues. Road infrastructure should be developed and maintained for easy access and basic health facilities should be provided.

46. Consultation plan for construction and operation phase of extension of JICA water supply scheme Abbottabad 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/WSSCA offices and necessary changes in operational modalities will be introduced in the system in light of the response provided by the consultants

## Analysis of Alternatives

47. If ‘no project’ option is triggered, it will result in loss of all positive impacts that project will pose on Abbottabad city; such as improved and sustainable potable water availability to citizens of Abbottabad 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 of Abbottabad.

48. 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

49. The Abbottabad Water Treatment Plant project is an extension to the existing JICA-funded treatment plant already in operation. This project aims to increase the supply of water to the city from 200 l/s to 500 l/s by establishing additional treatment facilities at the same site where land has been previously allocated for the same purpose. The site suitability and operations of the existing plant and the availability of land at the site meant that identifying additional alternative sites for the project would not be necessary.

50. The analysis for site alternatives was carried out for surface water intakes. Initially four locations for surface water intake was selected. Out of these locations two sites are further considered for detailed evaluation. Water from two different sources will be tapped to get the required flow of 300 l/s. The first intake structure at Phalkot has been

constructed by PHED having capacity of 100 l/s and the same will be used for this priority project by designing and constructing the additional transmission main. However, for the second source i.e. Jandar Bari, an intake structure will be designed for a capacity of 200 l/s. at Jandar-Bari (Dor River). Both locations are selected after detail hydraulic analysis. Water will be conveyed to JICA water treatment plant under gravity. An existing transmission main (300mm Dia) from Phalkot source has already been laid for about 6 kms. The proposed transmission main of approximately 11 km will be a continuation of the existing pipeline from the Murree Road onwards the Phalkot. Jandar Bari transmission mains will be new line, which is proposed to be laid as dual pipelines in a single trench arrangement.

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

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

52. Conventional water treatment comprises coagulation, flocculation and clarification followed by filtration and disinfection while Membrane filtration, microfiltration and ultra-filtration are 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.

53. Conventional Water Treatment Plant (CWTP) is simpler and environmental friendly as compared to complex Membrane Water Filtration Systems (MWFS). Energy requirements for CWTP is lower as compared to (MWFS) 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 MWFS acid/alkaline chemicals are required for treating fouled membranes. Wastewater 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 requiring careful supervision.

### Potential Major Impacts

54. The impact screening matrices for the pre-construction/design, construction and operation phases of the proposed extension of JICA WTP and GWSS are provided as **Tables ES.3, ES.4** and **ES.4**.

55. **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 treatment plant and storage tanks
- Improper designing of water treatment plant and distribution networks including transmission main

56. **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 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

57. **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

### Key Mitigation Measures

58. 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 Dor River. Detailed hydrological analysis has been conducted for both intake source and is designed to sufficiently fulfill water requirement for next 30 years. One trench dual transmission main is planned to avoid changes in landscape, moreover the route of transmission main will be adjacent to murree road. Location of WTP is adjacent to existing JICA WTP located at choona hill. 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.

59. 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 on a land with minimum vegetation only few trees need to clear while developing WTP. Transmission main shall be layed to avoid tree cutting with minimum vegetation clearance. 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.

60. 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 proposed landfill site at Dhamtor located at a distance of 2.5 km from the site. Landfill site will be developed under KPCIP to be fiananced by ADB, AIIB and GoKP.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

61. For the effective implementation and management of mitigation measures, an Environmental Management Plan (EMP) has been prepared and given in section 7 of 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.

62. The Environmental Management Plan (EMP) for Abbotabad 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

63. 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.

64. 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.

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

66. EMP implementation would be responsibility of all project stakeholders including PMU, WSSCA, Project Construction contractors, O&M contractor and other suppliers involoved 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 impement 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), WSSA will hire qualified environmental specialist during operation phase of the project who will be responsible for EMP implementation and reporting by WSSCA and its O&M contractors during operation. Monthly environmental compliance report will be prepared by WSSCA and circulated to concerned authorities.

### Climate Risk and Vulnerability Assessment of the extension of JICA gravity water supply scheme Abbottabad

67. Climate change can impact different aspects of the project activities due to projected increased temperatures and intense floods from heavy rainfalls at the catchment of Phalkot and Jander Bari, intake locations and water treatment plant location and associated distribution network. Project design has incorporated necessary climate change mitigations to avoid impacts on Jica gravity water supply.

68. Other environmental considerations of the proposed project include likelihood of groundwater depletion in the catchment of Dor river due to water intake from Dor river tributaries.

### Climate Change Adaptation Measures for Water Treatment Plant and Distribution Networks

69. 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) 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.

70. The flow measurement for Jandar Bari Intake was 920 lit/sec while for Phalkot it was 450 lit/sec. Raw water Intake flow for proposed Jandar Bari stream is 200l/s while from Phalkot 100 l/s. Therefore, downstream water availability will not have compromised and enough water would be flowing downstream in Dor River to maintain ecological flows.

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

72. 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

73. Based on the scoping exercise of the site and based on discussions with the public sector agencies, no other infrastructure works are planned with in the area of influence (AOI) of WTP project area during construction phase. However, Solid waste management facility (SWMF) is proposed in Abbottabad which is around 2.5 km from proposed WTP. Further, there is separate access road for SWMF other than access road of WTP therefore traffic congestion from both projects is not expected. Also transmission mains are not closed to SWMF therefore no impacts related to air emissions, water contamination are envisaged, hence no cumulative impacts are anticipated.

## Indirect and Induced Impacts

74. Potential impacts arising from each phase of the proposed extension of JICA WTP and GWSS 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.

75. Thus, negative indirect and induced impacts from the proposed project activities are not expected.

## Institutional Arrangements

76. 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 implementation of the proposed mitigation measures and monitor the implementation progress in the field. During operation phase responsibility of EMP implementation lies with WSSCA 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

77. The extension of JICA Gravity water supply system in Abbottabad is of high significance considering the urgent need for improving sustainable water supply system of Abbottabad city.

78. An action plan with clear roles and responsibilities of stakeholders is provided in the IEE report. The PMU, Contractors, WSSCA and the Construction Supervision Consultant are the major stakeholders responsible for the action plan. The action plan must be implemented prior to commencement of construction work. In order to execute successful operation of WTP and Supply networks, institutional review and capacity building (IRCB) component is included in the project design to enhance services delivery of WSSCA.

79. The majority of the environmental impacts are associated with the design and operation phase of the project as they are envisaged to be long-term. These include improper selection of intake source, reduced ecological flows, improper location of water treatment plant, improper designing of water treatment plant and distribution networks including transmission main and generation of solid waste, sludge and waste water during operation phase. Major impact during construction phase would be related traffic congestion and community health and safety issues during laying of water supply system in populated areas.

80. Mitigation measures will be assured by a program of environmental monitoring conducted during construction and operation 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 implementation of mitigation measures during construction 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 need to be retained by the Consultant to supervise the implementation process. The EMP includes measures to minimize project impacts due to traffic, noise, air pollution and waste generation etc.

82. 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.

83. 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 labour standards;

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: Details of raw water Intake sources and utilities

| | | **Location** | **Intake structure and flow** | **Topography** | **Proposed Alignment/route of Transmission Main** | **Length of Transmission Main** | **Dia of Transmission Main and Capacity** |
|---|---|---|---|---|---|---|---|
| **Raw Water Intake** | **Phalkot** | The intake point in Phalkot stream is located about 6.2 km from the main Abbottabad-Nathaigali road | The intake structure at Phalkot has already been constructed by PHED having capacity of 100 l/s and the same will be used for the project | Topography of the area is hilly with steep slope hills | The route of pipeline from the source to Murree road is along the Dheeri and Bara-hotar road | 17 km<br>Portion of the Phalkot transmission main has already been built (6 kms) | 300 mm 12 inches<br>100l/s |
| | **Jander Bari** | The intake point is located at the downstream of first bridge at Daur River on Girangali road. | At Jander Bari intake structure shall be constructed for a capacity of 200 l/s. | Topography of the area is hilly with steep slope hills | The tentative route of pipeline from the source to Murree road is partially along the River bank and partially along the Bara-hotar and Girangali road | 17 Km | 600 mm , 24 inches<br>300l/s |

## Table ES-2: Details of Water Treatment Plant and Components

| | Location | Topography | Capacity | Components | Nearest Receptors |
|---|---|---|---|---|---|
| **Water treatment Plant** | Located adjacent to JICA water treatment plant (Choona Hill) | The proposed project site is a rocky patch on top of the Choona hill | 300l/s<br>25,930m$^3$/day | Distribution Chamber;<br>Plain Sedimentation Tank;<br>Flash Mixer;<br>Flocculation Chamber;<br>Clarifier;<br>Rapid Sand Filters;<br>Chlorine Contact Tank<br>Treated Water Tank (Clearwell);<br>Sludge Holding Tank.<br>Chemical Building;<br>Chlorination Building | The nearest residential places near the proposed water treatment plant are Choona village, ukhraila village, Sultan Nagar. These areas consist of small residential colonies with poor road access |

### Table ES-3: 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 |

🟥 Critical Risk Level
🟧 Medium Risk Level
🟩 Positive Impacts
🟨 Significant Risk Level
🟦 Low Risk Level

## Table ES-4: 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 |
| 13 | Vegetation and Wildlife Loss | Unlikely | Moderate | Low | No residual Impact |
| 14 | Historical/Archaeological Sites | Unlikely | Moderate | Low | No residual Impact |

| 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) |
|---|---|---|---|---|---|
| 15 | Construction of Administration Building and Other Infrastructure | Likely | Moderate | Medium | Short term |
| 16 | Site Restorations | Likely | Moderate | Medium | Short term |

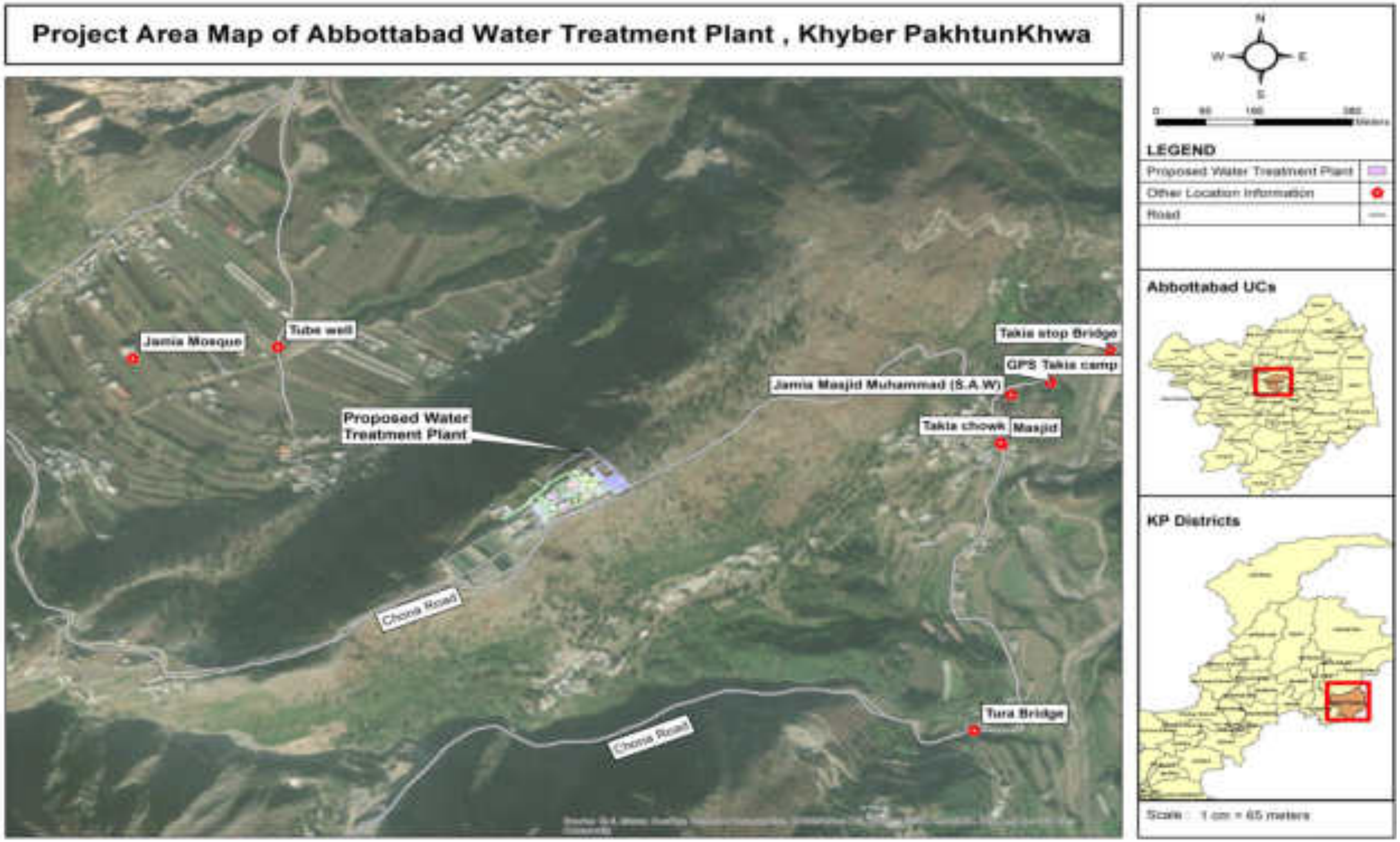

🟥 Critical Risk Level
🟧 Medium Risk Level
🟩 Positive Impacts
🟨 Significant Risk Level
🟦 Low Risk Level

**Table ES-5: Screening of Possible Impacts during Operation Phase**

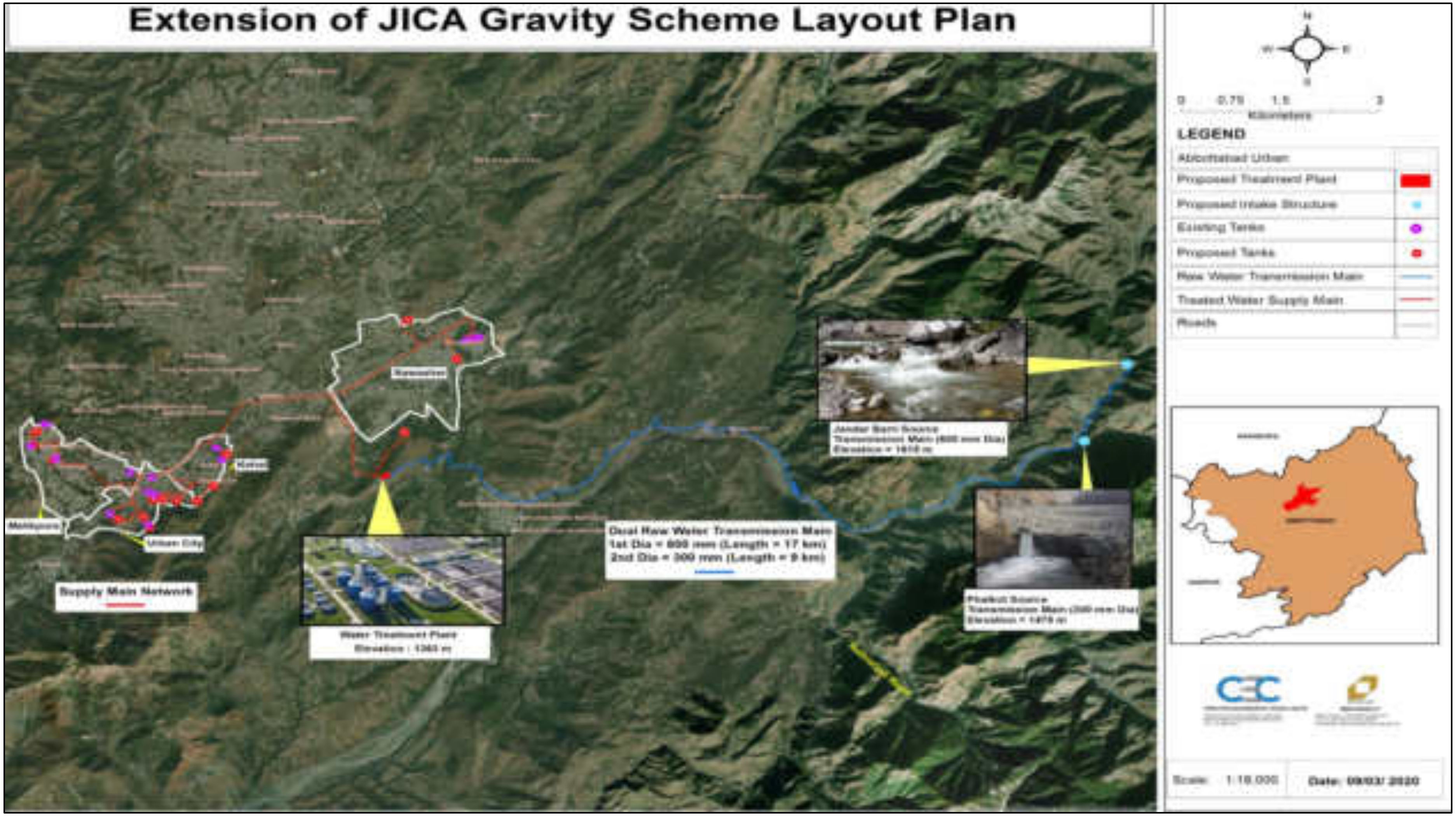
| S/No. | Potential Issues | Likelihood (Certain, Likely, Unlikely, Rare) | Consequence (Catastrophic, Major, Moderate, Minor) | Risk Level (Significant, Medium, Low) | Residual Impact (Short term, Long term) |
|---|---|---|---|---|---|
| 1 | Reduced downstream water availability | Likely | Major | Medium | 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
🟧 Medium Risk Level
🟩 Positive Impacts
🟨 Significant Risk Level
🟦 Low Risk Level

Figure ES-1: Location Map of Abbottabad Water Treatment Plant and GWSS



**Fgure ES-2: Layout Plan of Abbottabad 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 Pakhtunkhwa Cities Improvement Project (KPCIP) is be being processed through the Project Readiness Finance (PRF) modality by Asian Development Bank (ADB) under Grant 6016-PAK, being executed by KP LGERDD. 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 Improvement of water supply systems for Abbottabad "extension of JICA Gravity Water Supply Scheme" city has two main components:

- **Component 1**: Increase total available potable water production at the existing JICA Water Treatment Plant from the current 200 l/s to 500 l/s by adding an additional 300 l/s from two new surface water sources

- **Component 2:** Increase the distribution system capacity of JICA gravity scheme inside Abbottabad city

7. The proposed project "extension of JICA water treatment plant (WTP) and gravity water supply scheme (GWSS)" aims to fulfill water supply requirements of Abbottabad 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 Phalkot and Jandal Bari streams. The water from intakes shall be transported to the proposed water treatment plant.

8. 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 Abbottabad 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.

9. The project will pose positive impacts on Abbottabad city; such as improved and sustainable potable water availability to citizens of Abbottabad for next thirty years, the project will reduce abstraction of ground water from tubewells and water bores omitting chances of ground water depletion. Cleanest potable water will reduce water borne disease and ultimately reduced pressure on health care system.

10. The existing JICA water treatment plant was built in 2015 through Japanese government (JICA) funding at Choona hill top in Abbottabad. The maximum design capacity of existing JICA water treatment plant is 190,203 Gallons/hour (200 l/s) while its average production is around 95,102 GPH (100 l/s), due to seasonal variation at the available surface water sources. The current water shares from this existing JICA water treatment plant for four (4) UCs under WSSC Abbottabad jurisdiction is approximately 64% while the remaining 36% is allocated for the area under Public Health Engineering Department (PHED) jurisdiction. PHED is currently the operating agency of the existing JICA water treatment plant.

11. Apart from the supply received from the existing JICA gravity scheme, Abbottabad city is also served through a ground water-based system i.e. tube wells. The declining water table at existing tube wells and higher levels of turbidity at the existing JICA water plant has necessitated identification of new sources of surface water to be tapped into in order to satisfy the water demands of current and projected population of the Abbottabad city.

12. The main benefits of this project include the following

    - Extension of the existing JICA water treatment plant thereby eliminating the need to rely on tube wells in mostly all the areas currently served by WSSC Abbottabad;

    - Extension of the JICA water treatment plant will result in a water supply system that has lower operational costs by reducing or eliminating pumping costs in the system;

- Extension of the JICA water treatment plant will be a surface water source-based supply which is more sustainable and reliable than the current pumping-based tube well source of supply;

13. 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.

14. This Initial Environmental Examination (IEE) document focuses solely on the scope of works of the extension of JICA Gravity 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, KP Local Government, Elections and Rural Development Department (LGERDD) and ADB using the Environmental Management Plan (EMP).

## 1.2 Project Location

15. The project is located in Abbottabad city, situated in the south east of Khyber Pakhtunkhwa Province. The proposed water treatment plant is located at Choona Hill adjacent to existing JICA funded while the intake for raw water located at Phalkot and Jandal Bari streams.

16. The UCs for the proposed water supply network are as follow:

- UC-1 - Urban City
- UC-2 - Kehal
- UC-3 – Nawansher
- UC-4 - Malikpura

17. Geo-coordinates of proposed WTP and Intake structures are provided below;

| Name of Proposed Structure | Latitiude | Longitutude |
|---|---|---|
| JICA WTP | 34.142285 | 73.253974 |
| Jander Bari Intake Strcuture | 34.145607 | 73.370328 |
| Phalkot Intake Structure | 34.158454 | 73.377993 |

18. A map showing the location of intake source, transmission main and location of WTP and UCs under the jurisdiction of WSSC Abbottabad are shown in **Figure 1-1**. Map showing the location of WTP is also marked in **Figure 1-2**.

## 1.3 Objective of IEE

- 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 proposed extension of JICA Gravity 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 WSSCA 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 WSSCA in the effective implementation of the recommendations of the IEE.

## 1.4 Environmental Category of Project

19. According to ADB's Safeguard Policy Statement (SPS) 2009, a Rapid Environmental Assessment (REA) Checklist was prepared for the proposed extension of JICA water treatment plant and gravity water supply scheme (**Annexure A**). Based on the initial findings, it was ascertained that certain adverse environmental impacts are not expected of significance that detailed assessment is required therefore IEE has been conducted for the proposed "extension of JICA WTP and GWSS, and thus the subject project is considered environmentally "B" category as per ADB SPS, 2009.

20. Further regulatory requirements of Khyber Pakhtunkhwa Environment Protection Agency (KPEPA) shall be complied by KP LGERDD as per IEE/EIA Regulation 2000 as notified by the Pakistan Environment Protection Agency vide[1] S.R.O. 339 (1)/2001 during the project approval and execution stage.

## 1.5 Methodology of IEE Study

21. The various steps undertaken in the preparation of the IEE are summarized below:

### 1.5.1 Understanding of the Proposed Operation

22. 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.

### 1.5.2 Review of Legislation and Guidelines

23. National legislation, international agreements, environmental guidelines both of KP Environment Protection Authority (KP-EPA), and ADB, and best industry practices has been reviewed to set environmental standards that KP LGREDD as the executing Agency will adhere during implementation of the project.

### 1.5.3 Secondary Data Collection

- Available published and unpublished information pertaining to the background environment has been obtained and reviewed. All data sources have been

---

[1] https://www.informea.org/en/legislation/pakistan-environmental-protection-agency-review-iee-and-eia-regulations-2000

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.

### 1.5.4 Field Data Collection (Baseline Survey)

24. 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) was completed. The key receptors and stakeholders within the project area were identified.

25. 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 and social impact assessment carried out by social safeguard team. Climate risk and vulnerability assessment findings are discussed.

26. Primary data collection in two kilometer 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.

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

### 1.5.5 Public Consultation

28. 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, 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.

### 1.5.6 Impact Identification and Assessment

29. Potential impacts arising from each phase of the proposed project 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.

### 1.5.7 Recommendations for Mitigation Measures

30. 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.

### 1.5.8 Development of Environmental Management Plan (EMP)

31. An Environmental Management Plan (EMP) has been developed for effective implementation of the recommended mitigation measures. The EMP has included 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.

## 1.6 Proponent of Project

32. The LGERDD, GoKP is the Executing Agency (EA) for the proposed extension of JICA Gravity Water Supply Scheme Abbottabad while the project will be implemented through Water and Sanitation Services Company (WSSC), Abbottabad with the support of Project Management Unit (PMU). 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 (PMU) 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 |

## 1.7 Structure of the Report

33. 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

## 1.8 IEE Team

34. 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

## 1.9 Further Additions & Updating of IEE Study

35. This version of the report will be further updated once the detailed design is completed and any other details of the proposed extension of JICA WTP & GWSS 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: Location Map of Abbottabad WTP and GWSS

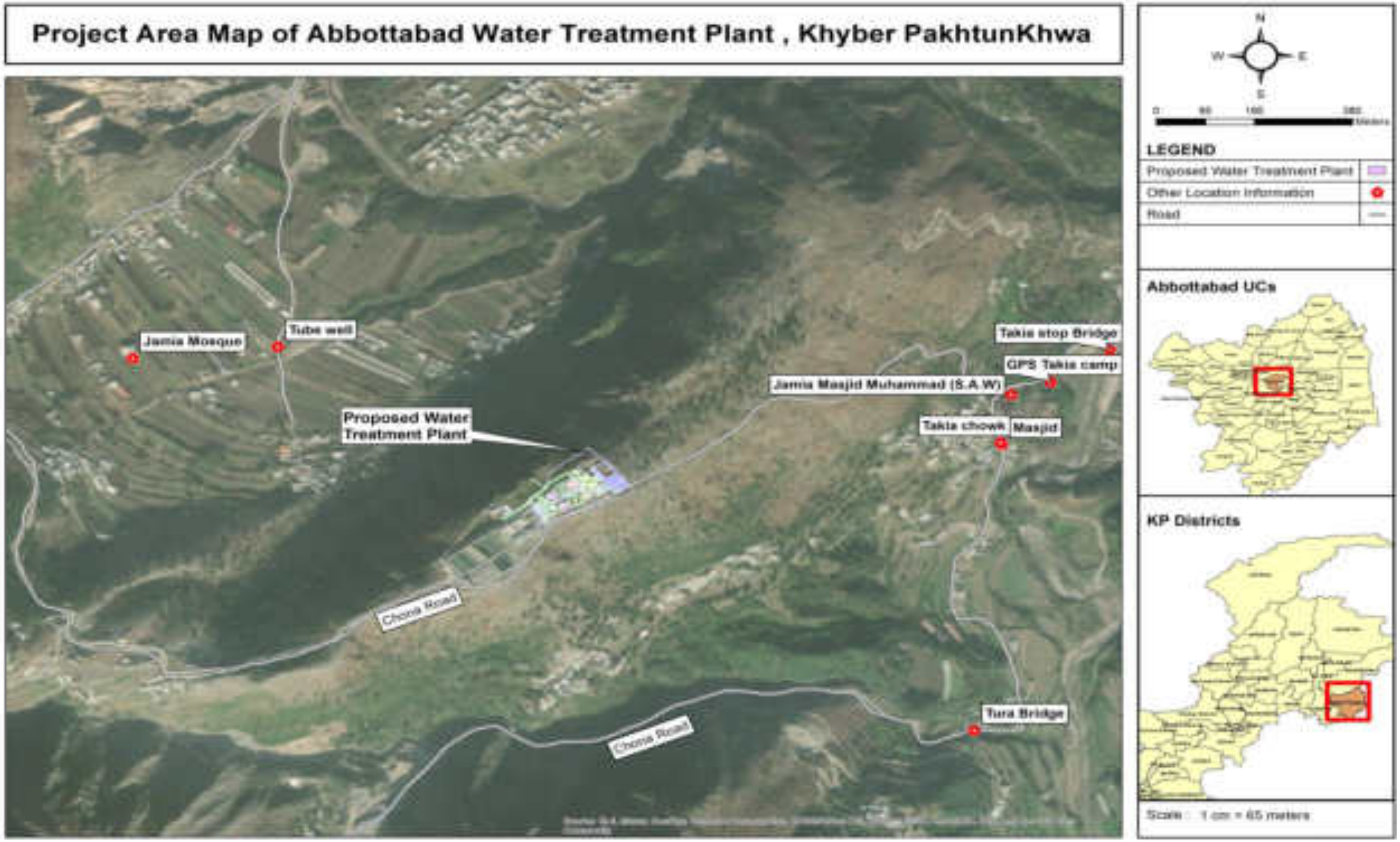
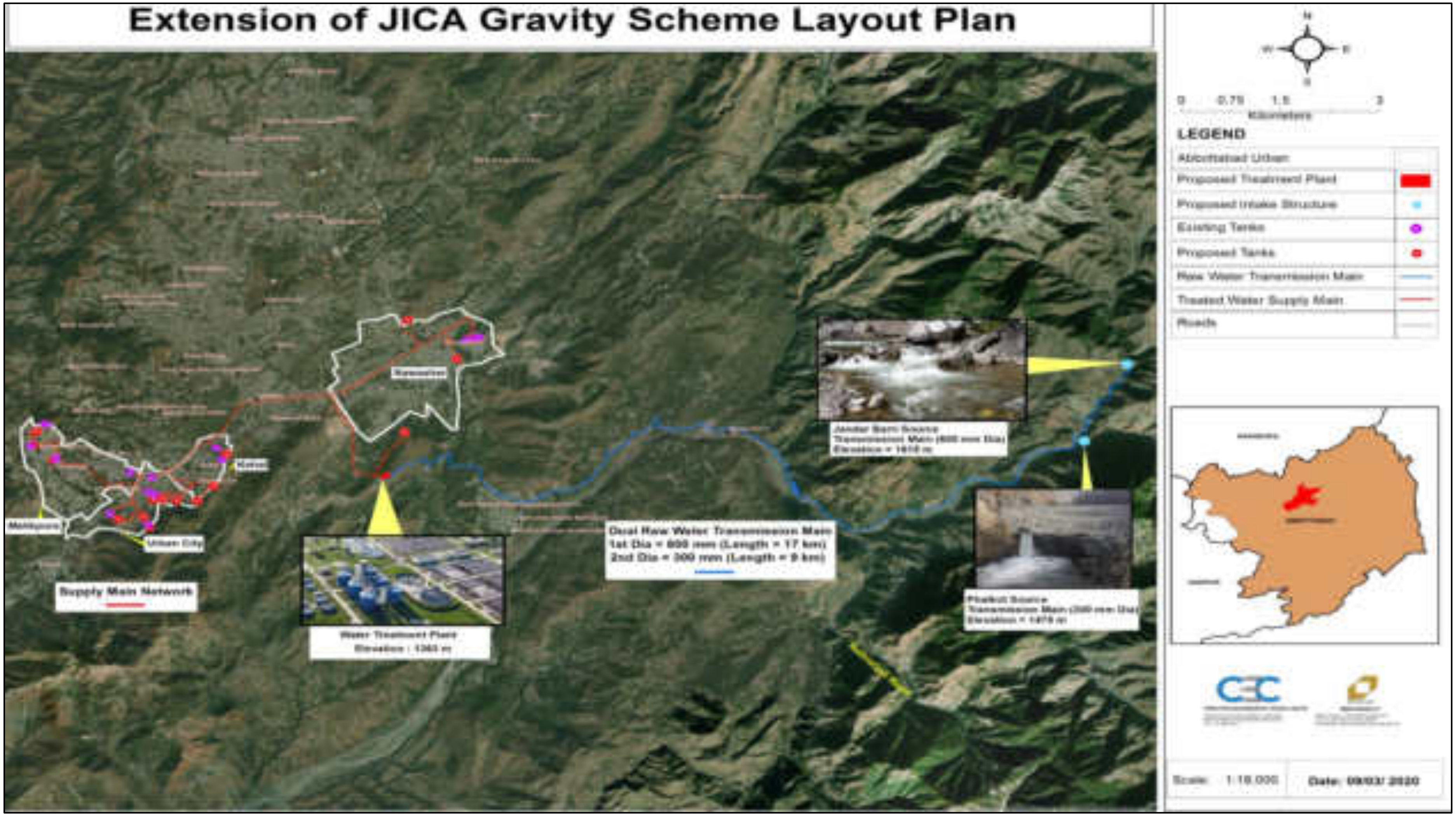


Figure 1-2: Layout Map of Abbottabad WTP and GWSS



# 2 Policy and Legal Framework

## 2.1 General

36. This section provides an overview of the policy framework and national legislation that applies to the proposed extension of JICA Water Treatment Plant & Gravity Water Supply Scheme for Abbottabad city, Pakistan. 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

37. 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 project development are ground water depletion, provision of sustainable potable water to citizens while conserving biodiversity.

38. Prior to the adoption of the 18th 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 18th 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

39. 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

40. In accordance with provincial regulatory requirements, an IEE/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.

## 2.5 Guidelines for Environmental Assessment, Pakistan EPA

41. 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

42. 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.

43. NEQS are attached as **Annexure K**.

## 2.7 Other Environment Related Legislations

44. 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 with in the area of influence of project activities i.e. WTP and water supply scheme. |
| **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 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 |

| Legislation/Guideline | Description |
|---|---|
| | 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 G**. |
| **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** | |
| **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 critical habitat of endangered species of plant life or animal life in the vicinity of the proposed water treatment plant. |
| **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. |

| Legislation/Guideline | Description |
|---|---|
| **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)**<br>**(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**<br>**(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)**<br>**(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**<br>**(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

45. The Pak-EPA formulated regulations in 2000 for ‘Review of IEE and EIA’ which categories 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.

46. 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.

47. 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.

48. The proposed project (Extension of JICA Water Treatment Plant & Gravity Water Supply Scheme Abbottabad) has been categorized as Schedule II (G) and requires an EIA.

49. The LGERDD, 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.

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

51. The LGERDD will submit the IEE/EIA Report on a prescribed application along with the processing fee to KP EPA. After submission of the environmental assessment report, a forty-five (45) day period for review will be provided. The assessment will be completed within a period of one hundred and twenty (120) days from receipt of the complete documents, and earlier than this wherever practicable.

## 2.9 ADB's Safeguard Policy Statement (SPS), 2009

52. 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.

53. 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:

54. **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.

55. **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. The project "extension of JICA gravity water scheme" falls in **Category B**. ADB requirements as stated in ADB SPS (2009) are that the IEE should at least include:

- A screening process for project should be conducted as early as possible, to determine the appropriate extent and type of environmental assessment and/or audit required so

that appropriate studies are undertaken commensurate with the significance of the Projects' potential environmental and social impacts and risks;

- Studying baseline information, which includes biodiversity, air quality, and noise and water quality. Required baseline surveys for each parameter that is present in the environmental conditions;
- An assessment of all the environment impacts in the project area;
- Mitigation measures, an environmental management plan including the use of appropriate mitigation technologies, an environmental monitoring plan with monitoring indicators, and institutional arrangements and responsibilities (including cost estimates and training);
- Examination of EA's implementation capacity in relation to Environmental safeguards needs and an institution review. A capacity development program to cover all of the marked capacity gaps.

56. ADB SPS 2009 also guide that the borrower/client will assess the significance of project impacts and risks on biodiversity and natural resources as an integral part of the environmental assessment process

57. **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.

58. **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

59. 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

60. The objectives of the Accountability Mechanism are 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

61. 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.

62. 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.

63. 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 |

| No. | Policy principle | Summary |
|---|---|---|
| | | and discharges. Avoid the use of hazardous materials subject to international bans or phase outs. |
| 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. |

## 2.13 IFC Environmental, Health, and Safety Guidelines for Water and Sanitation[2]

64. 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.

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

66. 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

---

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

- Water Distribution
    - Water system leaks and loss of pressure
    - Water discharges

## 2.14 Comparison of International and Local Environmental Legislations

67. 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.

68. 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.

69. The **Table 2.3** 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.

70. A comparison of applicable local and international guidelines for ambient air quality has been provided in **Table 2.4** 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.

71. Similar to the standards for air quality, the comparison of noise standards provided in **Table 2.5** 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 water quality of development project.

72. Comparison of International and Local Water Quality Standards has been provided in **Table 2.6**. Standard for Bacterial contamination are same for both NEQS and IFC/WHO standard while physical parameters are different. NEQS for odor, turbidity, hardness and pH are more stringent while IFC/WHO standards are stringent in metallic contaminations i.e. Arsenic, Barium, Boron, Cadmium and Zinc.

73. 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 2.3: 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 2.4: 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.<br>1 hr. | 0.5 ppm<br>75 ppb | 24 hr.<br>10 min | 20 up/m$^3$<br>500 up/m$^3$ | Annual Mean<br>24 hrs. | 80 up/m$^3$<br>120 up/m$^3$ |
| CO | 8 hrs.<br>1 hr. | 9 ppm (11 mg/m$^3$)<br>35 ppm (43 mg/m$^3$) | - | - | 8 hrs.<br>1 hr. | 5 mg/m$^3$<br>10 mg/m$^3$ |
| NO$_2$ | Annual Mean<br>1 hr. | 100 up/m$^3$ (53 ppb)<br>100 ppb | 1 yr.<br>1 hr. | 40 up/m$^3$<br>200 up/m$^3$ | Annual Mean<br>24 hrs. | 40 up/m$^3$<br>80 up/m$^3$ |
| O$_3$ | 8 hrs. | 0.07ppm (148 up/m$^3$) | 8 hrs. | 100 up/m$^3$ | 1 hr. | 130 up/m$^3$ |
| TSP | - | - | - | - | Annual Mean<br>24 hrs. | 360 up/m$^3$<br>500 up/m$^3$ |
| PM$_{10}$ | 24 hrs. | 150 up/m$^3$ | 1 yr.<br>24 hr. | 20 up/m$^3$<br>50 up/m$^3$ | Annual Mean<br>24 hrs. | 120 up/m$^3$<br>150 up/m$^3$ |
| PM$_{2.5}$ | Annual Mean<br>24 hrs. | 15 up/m$^3$<br>35 up/m$^3$ | 1 yr.<br>24 hr. | 10 up/m$^3$<br>25 up/m$^3$ | Annual Average<br>24 hrs.<br>1 hr. | 15 up/m$^3$<br>35 up/m$^3$<br>15 up/m$^3$ |

*: 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 air shed is significantly degraded and the pollutant levels are already exceeding the ambient pollutant concentrations provided in the table above, it shall be ensured that the project activities cause as small an increase in pollution levels as feasible, and amounts to a fraction of the applicable short term and annual average air quality guidelines or standards as established in the project specific environmental assessment.

**Table 2.5: Comparison of International and Local Noise Standards**

| Category of Area/Zone | Limit in dB(A) Lea | | | |
|---|---|---|---|---|
| | 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 2.6: 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 |
| **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.

# 3 Project Description

## 3.1 Project Introduction

74. The proposed Improvement of water supply systems for Abbottabad “extension of JICA Gravity Water Supply Scheme” city has two main components:

- **Component 1**: Increase total available potable water production at the existing JICA Water Treatment Plant from the current 200 l/s to 500 l/s by adding an additional 300 l/s from two new surface water sources
- **Component 2:** Increase the distribution system capacity of JICA gravity scheme inside Abbottabad city

75. The proposed project aims to fulfill water supply requirements of Abbottabad 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 Phalkot and Jandal Bari streams. The water from intakes shall be transported to the proposed water treatment plant.

76. 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 Abbottabad 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.

77. The proposed water treatment plant is located at Choona Hill adjacent to existing JICA funded water treatment plant while the intake for raw water located at Phalkot and Jandal Bari streams.

78. The UCs under the jurisdiction of WSSC Abbottabad for the proposed water supply network are as follow

- UC-1 - Urban City
- UC-2 - Kehal
- UC-3 – Nawansher
- UC-4 - Malikpura

79. A map showing the location of intake sources, Transmission main and location of WTP and UCs are shown in **Figure 1-1**. Map showing the location of WTP is also marked in **Figure 1-2**.

### 3.1.1 Project Need

80. The existing JICA water treatment plant was built in 2015 through Japanese government (JICA) funding at Choona hill top in Abbottabad. The maximum design capacity of existing JICA water treatment plant is 190,203 Gallons/hour (200 l/s) while its average production is around 95,102 GPH (100 l/s), due to seasonal variation at the available surface water sources. The current water shares from this existing JICA water treatment plant for four (4) UCs under WSSC Abbottabad jurisdiction is approximately 64% while the remaining 36% is allocated for the area under Public

Health Engineering Department (PHED) jurisdiction. PHED is currently the operating agency of the existing JICA water treatment plant however after project execution WSSC Abbotabad will act as operator of the facility.

81. Apart from the supply received from the existing JICA gravity scheme, Abbottabad city is also served through a ground water-based system i.e. tube wells. The declining water table at existing tube wells and higher levels of turbidity at the existing JICA water plant has necessitated identification of new sources of surface water to be tapped into in order to satisfy the water demands of current and projected population of the Abbottabad city.

### 3.1.2 Project Benefits

82. The main benefits of this project include the following

- Extension of the existing JICA water treatment plant thereby eliminating the need to rely on tube wells in mostly all the areas currently served by WSSC Abbottabad;
- Extension of the JICA water treatment plant will result in a water supply system that has lower operational costs by reducing or eliminating pumping costs in the system;
- Extension of the JICA water treatment plant will be a surface water source-based supply which is more sustainable and reliable than the current pumping-based tube well source of supply;

83. 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 of Water Supply Network

84. 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

85. 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 Planning Horizon

86. The extension of JICA 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. Details of the two scenarios are given which indicates that the total water production from all the water sources can cater for up to 25-30 years of projected water demands of Abbottabad city under the jurisdiction of WSSC Abbottabad.

87. Design criteria established for the proposed water supply distribution system and transmission main is summarized below in

88.

89. **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 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 |
| 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 WaterCAD |
| 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>11.25o at high pressure |
| 12 | Pipe roughness coefficient | 110 (Hazen William's Co-efficient) |
| 13 | Pipe bedding | 100mm sand bedding for plain/hilly areas |

### 3.2.3 Existing Water Distribution System

90. Currently, there are two main sources of water supply in Abbottabad. The major source is ground water source based on tube wells while the second source is the existing surface water-based water treatment plant (JICA). The approximate discharge of the existing and operational 14 tube wells is 1,120,000 gallons per day and average water supply from existing JICA water treatment plant is approx. 1,460,766 gallons per day, which gives a total supply of 2,580,766 gallons per day. At present, there is net shortfall of 2,669,234 gallons per day in Abbottabad.

91. The mode of operation for water supply is intermittent in Abbottabad city. The average pumping hours of the tube wells vary from 9 to 22 hours depending on the area served and availability of power.

### 3.2.4 Population estimate and Water Demand computations

92. The current population of the four UCs of Abbottabad under jurisdiction of WSSC Abbottabad is approximately 150,000, based on the Census 2017 data. UC-wise population data for the four (4) UCs under jurisdiction of WSSC Abbottabad is given below in Error! Reference source not found. including assumptions as shared by the W SSC Abbottabad. Current population for UCs under jurisdiction of WSSC Abbottabad

**Table 3.2: Current population for UCs under jurisdiction of WSSC Abbottabad**

| Union Council | Population |
|---|---|
| Urban City | 24,331 |
| Kehal | 25,761 |
| Nawansher | 32,028 |
| Malikpura | 26,643 |
| Additional Areas* | 17,938 |
| Additional Demand** | 23,299 |
| **Total** | **150,000** |

*According to WSSCA, some additional areas i.e. Qasba Abbottabad, Nawasher Shumali, and Nawasher Janubi are also under WSSCA jurisdiction and should be included in the total population count.

** WSSCA informed that 23,299 additional persons also needs to be included in order to cater water demand of approximately 200 Masjids, 20 schools, 100 public taps, shops, hotels and government offices.

93. The projected population for the next 10, 20, and 30 years for Abbottabad city comprising of these 4 UCs is estimated in below **Table** 3.3 by considering a 3% growth rate.

**Table 3.3: Population projection for UCs under jurisdiction of WSSC Abbottabad**

| Current Estimated Population (2017 Census) | Projected Population @3% growth ($P_t = P_0(1+r)^t$) | | |
|---|---|---|---|
| | 10 Years | 20 Years | 30 Years |
| 150,000 | 201,587 | 270,917 | 364,089 |

94. Based on the population provided above in **Table** 3.3, the average daily demands for Abbottabad city, under WSSC Abbottabad, is calculated by considering 35 gallons per day per capita consumption rate. **Table 3.4** below indicates that Abbottabad city is having approx. 5.25 MGD demand as per current population while the projected demand for 10 years is 7 MGD. The projected demands for 20 years and 30 years population is 9.48 MGD and 12.74 MGD respectively. These projected demands will be checked against the enhanced capacity proposed as a result of the extension of gravity water supply scheme with a new proposed water treatment plant.

**Table 3.4: Projected demand for UCs under jurisdiction of WSSC Abbottabad**

| Planning Horizon | Population | Current Water Demand (based on 35 gpcd) | |
|---|---|---|---|
| | | GPD | MGD |
| **Current** | 150,000 | 5,250,000 | 5.25 |
| **Projected (5 Years)** | 173,891 | 6,086,185 | 6.09 |
| **Projected (10 Years)** | 201,587 | 7,055,545 | 7.06 |
| **Projected (15 Years)** | 233,695 | 8,179,325 | 8.18 |
| **Projected (20 Years)** | 270,917 | 9,482,095 | 9.48 |
| **Projected (25 Years)** | 314,067 | 10,992,345 | 10.99 |
| **Projected (30 Years)** | 364,089 | 12,743,115 | 12.74 |

95. Currently, there are two sources of water supply production in Abbottabad including the existing surface water treatment plant and ground water tube wells.

96. **Existing JICA WTP:** The existing JICA surface water treatment plant was built in 2015 through Japanese government funding which is referred to in this report as the JICA water treatment plant. The maximum design capacity of JICA water treatment plant is 4,56,4000 Gallons/day (200 l/s) while reportedly its average production is around 2,282,000 Gallons/day (100 l/s). The water shares from JICA water treatment plant for four (4) UCs under WSSC Abbottabad jurisdiction is approximately 64% while the remaining 36% is allocated for the area under PHED jurisdiction.

97. **Tube Wells Based Supply**: There are 19 number of existing tube wells under jurisdiction of WSSC Abbottabad. At present, 14 out of 19 tube wells are operational while the remaining 5 tube wells are non-operational.

98. **New (Extension) WTP**: The new surface water treatment plant proposed under the KPCIP project with a maximum capacity of 300 l/s will increase the total water production. While the maximum capacity of the new plant will be 300 l/s, the average production in early phase of the project is estimated to be at 200 l/s.

99. Two different scenarios were analyzed to check the total water production from different water sources, both existing and proposed, against the projected water demands. Under the first scenario, the average water production was calculated by considering that the available water sources are not operating at full capacity. The existing JICA water source is considered as running at average rate of 100 l/s under this scenario as reported by WSSC. Similarly proposed new water scheme is considered as running at average rate of 200 l/s as compared to the full operating capacity of 300 l/s. The existing operating tube wells are also considered as contributing to the average water production. The total water production for this scenario is given below in **Table 3.5**.

**Table 3.5: Total Water Production based on Average Production Scenario (Surface /Ground water sources)**

| Water Production from Tube wells (GPD) | Average Water Production from Existing JICA Plant running @ average rate of 100 l/s and assuming 64% WSSCA Share (GPD) | Water Production from Proposed JICA Extension Plant @ average rate of 200 l/s capacity (GPD) | Total Water Supply (Production Capacity) (GPD) |
|---|---|---|---|
| 1,120,000 | 1,460,766 | 4,56,4000 | 7,144,766<br>(7.14 MGD) |

100. A graph for scenario 1 has been prepared that shows the comparison of average water production against the projected demands, please see below in **Figure 3-1**. The graph indicates that the average water production from all the sources will cater for next 10 years of projected demands.

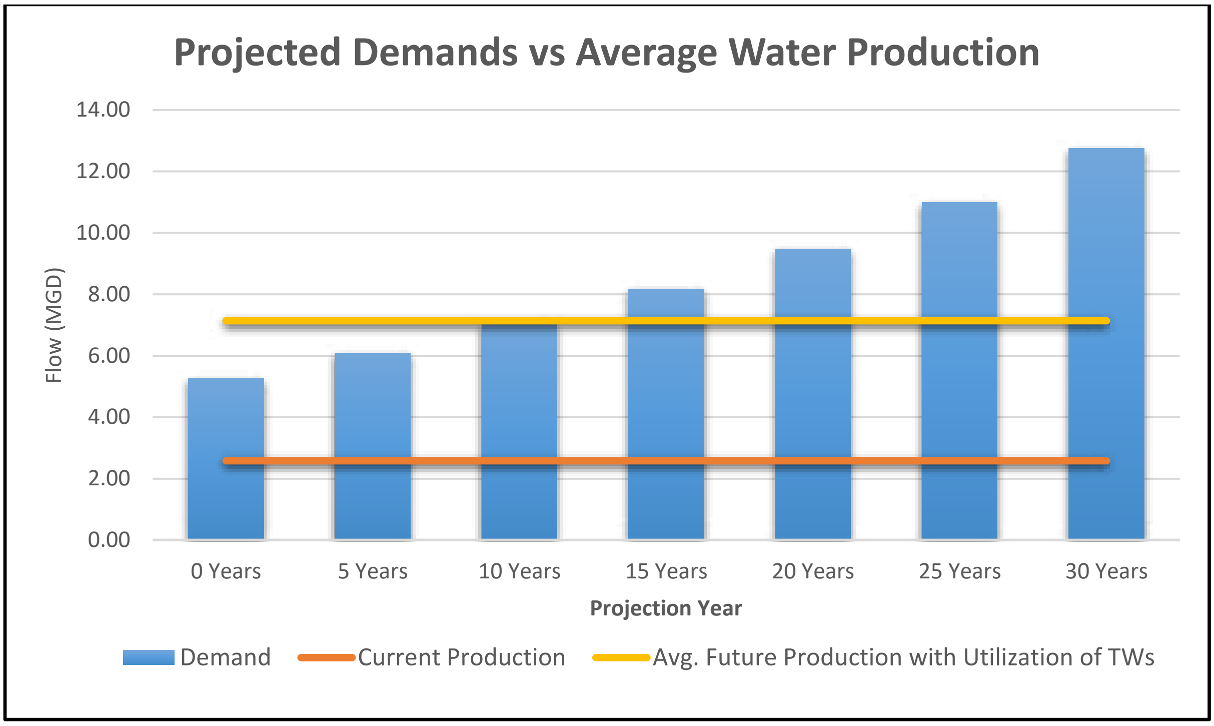


**Figure 3-1: Project demands vs average water production in Abbottabad**

101. Under the scenario 2, the total water production based on maximum operating capacity of the water sources, with and without tube wells, was calculated as presented in **Table 3.7** below.

**Table 3.6: Total Water Production based on Maximum Production Scenario (Surface /Ground water sources)**

| Water Production from Tube wells (GPD) | Water Production from Existing JICA Plant running @ 200 l/s Peak capacity & 64% WSSCA Share (GPD) | Water Production from Proposed JICA Extension Plant @ 300 l/s Peak capacity (GPD) | Total Water Supply without Utilization of TWs(GPD) | Total Water Supply with Utilization of TWs(GPD) |
|---|---|---|---|---|
| 1,120,000 | 2,920,960 | 6,846,000 | 9,766,960 | 10,886,960 |

102. A graph showing the comparison of maximum water production against the projected demands is shown in **Error! Reference source not found..** The graph indicates that t he maximum water production from surface sources operating at full capacity, can cater to the projected demands of next 20 years without utilization of tube wells and 25 years with utilization of tube wells.

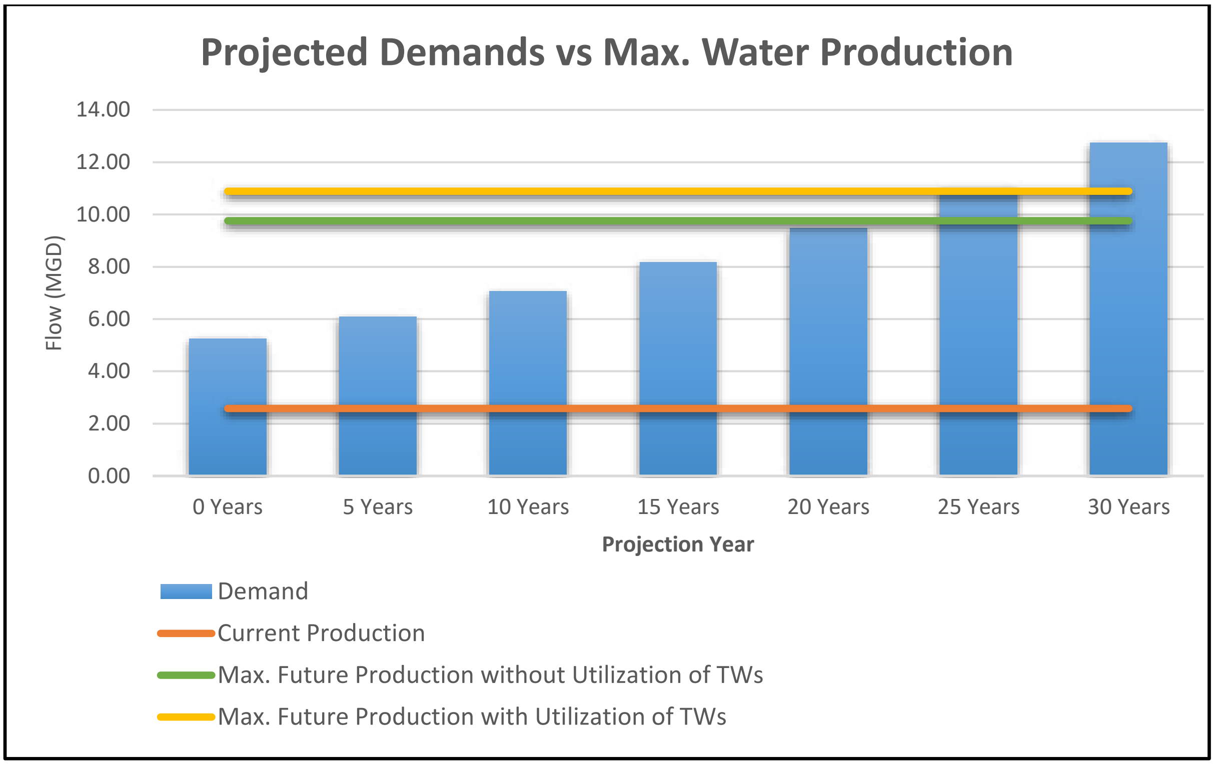


**Figure 3-2: Project demands vs maximum water production in Abbottabad**

103. There are total 33 no. of existing and proposed water storage reservoirs in the city. Details of the existing and proposed water storage reservoirs are provided in below sections. Catchment area for each water storage reservoir was marked and number of plots were counted for each catchment. Accordingly, the population for each water storage reservoir catchment was calculated keeping in view the criteria of 7 persons per house. Allowance for future projected population was also considered by considering growth projection factors. The details of water storage reservoirs, catchment marking, and future growth projection are presented below **Table 3.7**.

**Table 3.7: 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 | Jail New Water Tank | 1,820 | 12,739 | 445,868 | 668,802 | 1,337,603 |
| 2 | Aram Bagh | 920 | 6,440 | 225,403 | 338,104 | 676,208 |
| 3 | Kotera Tank | 1,506 | 10,544 | 369,027 | 553,541 | 1,107,082 |
| 4 | Proposed Tank 2 | 956 | 6,692 | 234,212 | 351,318 | 702,636 |
| 5 | Proposed Tank 3 | 2,209 | 15,463 | 541,210 | 811,816 | 1,623,631 |
| 6 | Proposed Tank 4 | 1,840 | 12,880 | 450,805 | 676,207 | 1,352,414 |
| 7 | Proposed Tank 10 | 1,005 | 7,035 | 246,220 | 369,331 | 738,661 |
| 8 | Proposed Tank 11 | 68 | 476 | 16,659 | 24,989 | 49,977 |
| 9 | PS Ward 12 | 313 | 2,191 | 76,685 | 115,028 | 230,056 |
| 10 | Chari Water Tank | 1,219 | 8,533 | 298,660 | 447,991 | 895,981 |
| 11 | Jail Old Water Tank | 2,187 | 15,310 | 535,835 | 803,753 | 1,607,505 |

| Sr. No | Tank Names | Served Houses | Served Population | Avg. daily demand (US gpd) | Max. daily demand (US gpd) | Max. Peak Hour Demand (US gpd) |
|---|---|---|---|---|---|---|
| 12 | Proposed Tank 14 | 2,156 | 15,092 | 528,209 | 792,314 | 1,584,627 |
| 13 | Proposed Tank 15 | 1,409 | 9,863 | 345,192 | 517,788 | 1,035,575 |
| 14 | Muslim Town | 1,112 | 7,784 | 272,424 | 408,637 | 817,273 |
| 15 | Proposed Tank 5 | 641 | 4,487 | 157,045 | 235,568 | 471,135 |
| 16 | Proposed Tank 6 | 820 | 5,740 | 200,900 | 301,350 | 602,700 |
| 17 | Proposed Tank 13 | 354 | 2,478 | 86,730 | 130,095 | 260,190 |
| 18 | Jinnah Tank | 1,747 | 12,232 | 428,137 | 642,206 | 1,284,412 |
| 19 | Main Bazar | 1,181 | 8,269 | 289,406 | 434,109 | 868,218 |
| 20 | Proposed Tank 8 | 1,832 | 12,824 | 448,840 | 673,260 | 1,346,519 |
| 21 | Proposed Tank 12 | 1,872 | 13,104 | 458,641 | 687,961 | 1,375,922 |
| 22 | Shimla New | 636 | 4,452 | 155,820 | 233,730 | 467,460 |
| 23 | Shimla Old | 828 | 5,796 | 202,860 | 304,290 | 608,580 |
| 24 | Ward 10 | 496 | 3,472 | 121,520 | 182,280 | 364,560 |
| 25 | Ward 11 | 482 | 3,377 | 118,212 | 177,319 | 354,637 |
| 26 | Dhudyal Tank | 196 | 1,372 | 48,020 | 72,030 | 144,060 |
| 27 | JICA Tank | 956 | 6,692 | 234,220 | 351,330 | 702,660 |
| 28 | Maira Chungi | 440 | 3,080 | 107,800 | 161,700 | 323,400 |
| 29 | Committee Chowk | 807 | 5,649 | 197,715 | 296,573 | 593,145 |
| 30 | Proposed Tank 1 | 2,629 | 18,403 | 644,105 | 966,158 | 1,932,316 |
| 31 | Proposed Tank 7 | 2,033 | 14,231 | 498,084 | 747,127 | 1,494,253 |
| 32 | Proposed Tank 9 | 2,527 | 17,690 | 619,166 | 928,750 | 1,857,499 |
| 33 | Proposed Tank 16 | 733 | 5,131 | 179,585 | 269,378 | 538,755 |
| **Total** | | | **279,521** | **9,783,215** | **14,674,833** | **29,349,650** |

### 3.2.5 Design of Proposed Water Supply System Components

104. A snapshot of information on the proposed project component with its function and location within the system is provided in **Table 3.8.**

**Table 3.8: Snap short of Information on the proposed project components**

| Infrastructure | Function | Description | Location |
|---|---|---|---|
| Water intake facilities | To extract surface water | Water extraction is proposed from Jandar Bari and Phalkot streams. | Jandar Bari and Phalkot |
| Tube Wells | To extract ground water | Exisitng Tubewells: 19 out of which 14 are operational | Within Abbotabad Union Councils |
| Raw water main | To supply surface water to WTP | Separate pipe of 24” and 12” for supply mains | From Jandar Bari and Phalkot to WTP at |

| Infrastructure | Function | Description | Location |
|---|---|---|---|
| | | Construction of the Pump Room (3M x4Mx 2.5 M Hight) diameter and 17 Km length from each intake location that are designed to operate under gravity. | Coona Hill |
| Water Treatment Plant | To treat extracted surface water from intake structures | Two process trains have been proposed each having treated water capacity of 12,965 m3/day (150l/sec). Each train will consist of separate plain sedimentation tank, flash mixer, flocculation basin, clarifier. Both trains will have a combine filtration unit. Average production of WTP would be 7.14 MGD while maximum production will be 10.8 MGD. | Choona Hill, Abbotabad |
| Clear water well and pump houses | To supply treated water to transmission system | The treated water will be stored in treated water tank (Clearwell) having six (6) hours storage. Two treated water tanks will be provided (each for one train). Each tank will have dimensions of 25.5m x 25.5m x 5m.<br>Construction of the 05 Pump Room (3M x4Mx 2.5 M Height). | Within WTP, Choona Hill Abbotabad |
| Transmission system | To supply water form clear well to water storage reserviors | The treated water supply main from the proposed water treatment plant branches out into multiple smaller pipelines to 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. | Wihtin Abbotabad city |
| Clear water reservoirs | To store water for further supply to end user | As per the data collected from WSSC Abbottabad, there are 17 number of major existing water storage reservoirs in Abbottabad city under the jurisdiction of WSSC Abbottabad. Each of the existing water storage reservoir will be supplied treated water via a dedicated supply main. Beside the 17 number of existing water reservoirs, new surface water | Wihtin Abbotabad city |

| Infrastructure | Function | Description | Location |
|---|---|---|---|
| | | storage reservoirs/tanks were proposed so that the entire system can provide a minimum storage equivalent to demand of one-day covering the entire population of Abbottabad City. | |
| Distribution network | To distribute water from storage reservoirs to end user | Districbution network is proposed in four union councils i.e. Urban city, Kehal, Nawansher and Malikpura. | Within Abbotabad City |
| Bulk Water Meters | To monitor the water use by consumer | Water meters will be installed at each house connection to monitor water use and to bill the service by WSSC abbotabad | Within Abbotabad City |

105. Extension of JICA Gravity 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 Abbottabad City;
- Receiving Water Storage reservoirs;
- Water Distribution Network and water meters

106. Project schematic layout showing all the major components (excluding distribution network) of Extension of JICA Gravity Scheme is presented in **Figure 1-1** while the details of the proposed raw water Intake structure are presented in section 3.3.

## 3.3 Raw Water Intake Design & Hydrology

107. 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 Abbottabad City.

### 3.3.1 Intake Locations

108. After having a series of consultative sessions with WSSC Abbottabad and Public Health Engineering Department (PHED), four locations for intake/ source water were initially identified as potential sources for this surface water extension project. However, after visiting the locations and further discussions, two of the four intake locations will be considered for this project keeping in mind the quantity and quality of available water and related social issues. One of the selected source is located at Phalkot and the other at Jandar Bari.

109. The first intake structure at Phalkot has already been constructed by PHED having capacity of 100 l/s and the same will be used for this priority project by designing and constructing the additional transmission main. However, for the second source i.e. Jandar Bari, an intake structure will be designed and constructed for a capacity of 200 l/s. Location of the Intake has been fixed, by 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

110. The two intakes are located at eastern side of Abbottabad city as shown in **Figure 1.1.**

### 3.3.2 Phalkot source

111. Village Phalkot is located towards east of district headquarter Abbottabad on a link road, which branches out of the Abbottabad – Nathiagali road near Harnoi in a hilly area. A portion of the road is paved. The intake point in Phalkot stream is located about 6.2 km from the main Abbottabad-Nathaigali road. Topography of the area is hilly with steep slope hills. The route of pipeline from the source to Murree road is along the Dheeri and Bara-hotar road.

112. Phalkot source was first identified by PHED in 2015 after complete survey in the catchment area of Daur River. A private engineering firm, Associates in Development (AID), was contracted at that time to design the intake structure and its transmission components. The intake was designed to supplement the raw water source to the existing JICA water treatment plant and to overcome the shortfall in the current supply during winters and low flow period. Initial plan was to lay a dedicated pipeline up to the existing WTP from this source but due to high cost and unavailability of sufficient funds at that time, it was decided to connect it with the existing raw water transmission main. Currently, the civil works for intake structure along with a 6 km raw water transmission main (300 mm diameter) has been already completed. The scope of work related to this intake structure under this extension project is to design and construct the remaining unconstructed pipeline from the existing intake structure up to the newly proposed treatment plant.

113. The flow of the stream measured on June 2, 2015 by AID Consultants was 280 l/s. It was reported by the locals that this flow reduces by about 40% in the dry months of November to January, i.e. it reduces to approx. 170 liters per second during dry months.

### 3.3.3 Jandar-Bari source

114. Jandar-bari is located on Girangali road approx. 3 km towards north of the Phalkot intake. A portion of the road is paved while the remaining is under construction. The intake point is located at the downstream of first bridge at Daur River on Girangali road. Topography of the area is hilly with steep slope hills. The tentative route of pipeline from the source to Murree road is partially along the River bank and partially along the Bara-hotar and Girangali road. Jandar-bari is a newly identified source by WSSC Abbottabad and PHED.

115. There are no previous studies or records of any flow measurement available on Jandar Bari source. During the initial site visits in January 2020, it was observed that the flow at Jandar-Bari source is more than 300l/s. However, proper flow measurement at the site will be conducted during the next 6-12 months to come up with more accurate flow at the source.

### 3.3.4 Flow measurement at source

116. As described above, both the water sources are located on natural streams while the flow at both the proposed intake locations is a perennial flow which is mainly contributed by the natural springs and snow melting in the catchment area of the natural streams. Runoff also contributes to the flow of the streams during rains. The flow at the source can be measured at the intake location by using some flow measurement tools like current meter by properly defining a cross section of the streams at the measurement location. EDCM has recently started taking the flow measurement at the intake locations. It is planned to take flow measurement at the intake location twice a month for a period of one year, to check the stream flows during all the seasons and get confirmation about water availability for the new water treatment plant.

117. For this purpose, a team of professionals was mobilized to the site, to take the first round of flow measurement on 04th May 2020. Flow measurement at the Jandar Bari intake site was completed on the same day, using the flow current meter, while the Phalkot cannot be done due to some social issues. The flow recorded at Jandar Bari Intake was around 850 l/s in the first measurement while the flow measurement process will continue for a year. The pictures taken during the first round of flow measurement is given below in **Figure 3-3.**

**Figure 3-3: Flow measurement at Jander bari and Phalkot source**

118. A second reading was taken at both the sources on May 21, 2020 using a different flow measurement method which is a conductivity method/salt injection method.

119. The purpose of different flow measurement method is to check for the reliability of the first flow reading. Based on the method, the flow measurement for Jandar Bari Intake was 920 lit/sec while for Phalkot it was 450 lit/sec. A table has been developed to note down all the flow measurement reading, please refer below to **Table 3-9.**

**Table 3.9: Flow Measuremnt at the Intakes**

**Table 3.9: Flow measurements at the intakes**

| **Sr. No** | **Date of measurement** | **Measured flow (lit/sec)** | **Sr. No** | **Date of measurement** | **Measured flow (lit/sec)** |
|---|---|---|---|---|---|
| **1.** | **Jandar Bari Intake** | | **2.** | **Phalkot Intake** | |
| 1 | 04-May-20 | 850 | | | |
| 2 | 21-May-20 | 920 | 1 | 21-May-20 | 450 |
| 3 | 26-Jun-20 | 490 | | | |
| 4 | 15-Jul-20 | 280 | | | |
| 5 | 28-Jul-20 | 208 | | | |
| 6 | 18-Aug-20 | 1415 | 2 | 18-Aug-20 | 305 |

120. In addition to flow measurements at the sites, EDCM design team also carried out hydrological analysis of the flow contributed by the rainfall that occurs in the contributing upstream watershed and to check the runoff of the stream during rainfall periods. Abbottabad receives ample rainfall throughout the year and the runoff flow of the streams will be an added flow that becomes part of the base flow that is present in the streams throughout the year. This is in addition to the perennial flows at the streams as contributed by natural springs and/or snow melts.

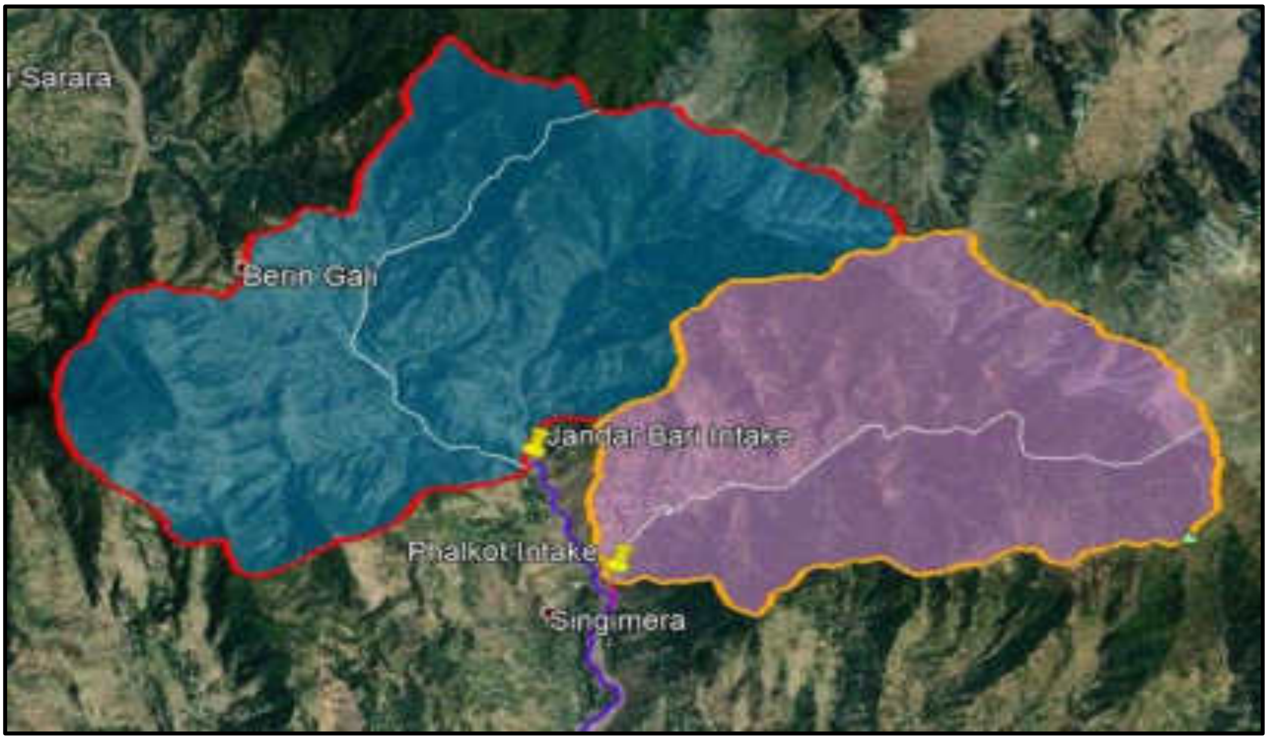
### 3.3.5 Catchment Areas of Intake sources

121. The catchment boundaries of both the natural streams were marked with the help of watershed delineation tool in ArcGIS. A 12.5m Digital Elevation Model (DEM) data was used to run the watershed analysis. The catchment areas of the two water sources are shown **Table 3-10** in while the watershed map is presented in **Figure 3-4.**

**Table 3.10: Details of Catchment Basins**

| Sr. No. | Watershed | Contributing Drainage areas | |
|---|---|---|---|
| | | (Acres) | (Sq. Km) |
| 1 | Jandar Bari | 5,874 | 23.8 |
| 2 | Phalkot | 4,206 | 17 |

**Figure 3-4: Demarcation of catchment area of Jander Bari and Phalkot source**



122. Detailed Catchment studies of Phalkot and Jandal Bari streams 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.

123. The flow measurement for Jandar Bari Intake was 920 lit/sec while for Phalkot it was 450 lit/sec. Raw water Intake flow for proposed Jandar Bari stream is 200l/s while from Phalkot 100 l/s. Therefore, downstream water availability shall not be compromised and enough water would be flowing downstream in Dor River to maintain ecological flows. Moreover, the sources have enough water availability for uninterrupted water supply of WTP.

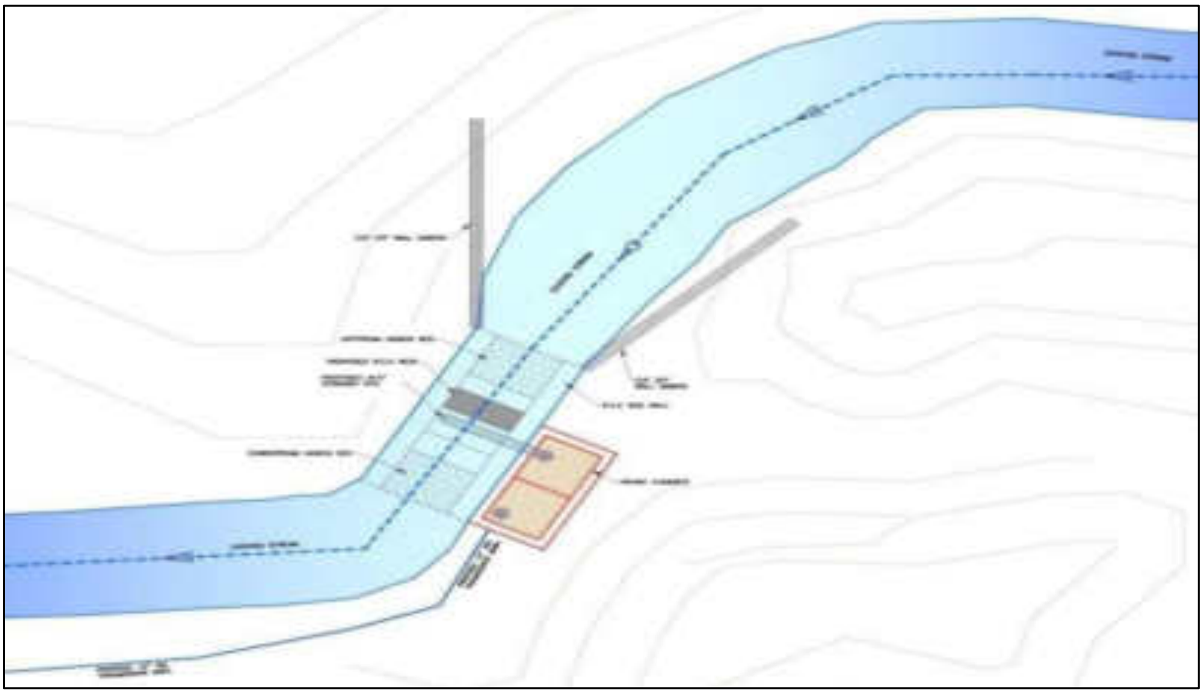
### 3.3.6 Intake Structure Design

124. As described above, two different sources will be tapped to get the required flow of 300 l/s. The proposed intake structure will mainly follow the same configuration as the existing intake structures constructed for the existing JICA water supply scheme that includes:

- A weir structure;
- Cut off walls;
- Intake chamber; and
- Bar Screen/ strainers

125. The **Figure 3-6** below shows the general arrangements of the proposed intake structure. However, the detailed configuration of the various components of the intake structure will be finalized during the detailed design stage after completing detailed site and hydrological investigations.

Figure 3-5: Arrangements for the proposed Intake structure



## 3.4 Raw Water Transmission Mains

126. The untreated water from the two sources will be supplied via transmission mains from the proposed Intake structures to the proposed new water treatment plant at Choona hill top. There will be a separate pipe from each intake location that are designed to operate under gravity.

### *Transmission Main for Jandar Barri Source*

127. One of the surface source is the Jandar Barri source which will contribute major portion of raw water flow for the proposed water supply scheme. Hydraulic model based on WaterCad software was simulated for the proposed transmission main using the elevations obtained from the topographic survey. Main characteristics of the proposed transmission main are provided below:

- Nominal Diameter = 600 mm (24 inches)
- Length of transmission main = Approximately 17 kms.
- Pipe material = Mild Steel (To be laid underground)
- Pipe Roughness = 110 (Hazen William Coefficient)
- Flow = 6.85 MGD (300 liters/sec)
- Velocity = 1.1 m/s
- Head loss Gradient = 2.289 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.

128. **Proposed Route**: The route of Jandar Barri transmission main will run initially inside the stream bed or flood plain for approximately 2 kilometers. This stretch will be enforced via concrete encasement for better flood protection. The proposed pipeline then follows the Bada-Hotar road till it reaches the Murree Road. From this point onward, the proposed pipeline runs parallel to Murree Road, and follows the same corridor on which existing transmission mains for the existing water treatment plant has been constructed. The route of the proposed transmission mains is shown in **Figure 1-1** while further details are provided in the detailed design drawings.

***Transmission Main for Phalkot Source***

129. The second source for extension of JICA water supply scheme is the Phalkot source. There is an already constructed intake structure at this source executed by PHED, but the structure has never been operationalized. The maximum design capacity of the source is 124 l/s, while its average capacity is rated at 100 l/s for the proposed water supply scheme. The Phalkot transmission main will be connected to both existing and proposed JICA Treatment Plant so that it can offer the flexibility to serve both the existing and new plants in case of water shortage. An existing transmission main (300mm Dia) from Phalkot source has already been laid for about 6 kms. The proposed transmission main of approximately 11 km will be a continuation of the existing and previously built pipeline from the Murree Road onwards. Hydraulic characteristics of Phalkot transmission main was also checked by simulations of a WaterCAD-based hydraulic model. The model reflected both the existing and proposed pipeline route for hydraulic analysis. The elevation data used to run the model was obtained from the topographic survey. Main characteristics of the proposed transmission main are provided below:

- Nominal Diameter = 300 mm (12 inches)
- Length of transmission main = Approximately 17 kms (Both existing and proposed)
- Pipe material = Mild Steel (To be laid underground)
- Pipe Roughness = 110 (Hazen William Coefficient)
- Flow = 2.83 MGD (124 liters/sec)
- Velocity = 1.75 m/s
- Head loss Gradient = 9.1 m/km
- External Coating = Bitumen
- Internal Coating = cement mortar lining / liquid-applied epoxy
- Proposed valves: Different types of valves are proposed along the alignment of the transmission main including isolation valves, air valves, washout valves, etc.

130. ***Proposed Route**:* Portion of the Phalkot transmission main has already been built (6 kms). For the first 2 kilometers, it runs along the stream bed and then it runs along the

Bada-Hotar road till it reaches Murree Road. From this point onward, a new transmission main is proposed as part of this project. From Murree Road onward, both the Phalkot and Jandar Barri transmission mains are proposed to be laid as dual pipelines in a single trench arrangement. The proposed transmission mains run parallel to the Murree Road, and follows the alignment of the existing transmission main for the existing treatment plant. After reaching the proposed treatment plant location at Choona hill, it bifurcates into two branches, one is connected with the existing plant and other with the proposed new plant. The route of the proposed transmission mains is shown in **Figure 1-1** while further details are provided in the detailed design drawings.

### 3.4.1 Water Treatment Plant

131. The details of the proposed water treatment plant are presented in section 3.5.

### 3.4.2 Treated Water Supply Mains

132. The treated water from the proposed water treatment plant will be transported via a network of supply mains to all the water storage reservoir located within the project area. The alignment of proposed supply mains starts from Choona hill and goes partially through fields and Choona road to reach Murree road. From this point onwards, it branches into two major supply mains; one supply main goes towards Nawanshahr and other towards Malikpura, Urban city and Kehal. These two primary mains further divide into numerous supply mains to serve existing and newly proposed storage reservoirs/tanks.

133. The hydraulic model, using WaterCad software, was simulated for flows and pressures in 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.

134. Based on the results of the hydraulic model, the diameters of the proposed supply mains vary from 600mm 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 **Error! Reference source not found.**.

### 3.4.3 Receiving Water Storage Reservoirs

135. The treated water supply main from the proposed water treatment plant branches out into multiple smaller pipelines to 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.

136. As per the data collected from WSSC Abbottabad, there are 17 number of major existing water storage reservoirs in Abbottabad city under the jurisdiction of WSSC Abbottabad. The details of the existing water storage reservoirs including the capacity and location are provided below in the **Table 3.11.**

**Table 3.11: Details of Existing Water Reservoirs**

| Sr. No | Existing Receiving Tanks | Capacity (US Gallons) | Northing | Easting |
|---|---|---|---|---|
| 1 | Aram Bagh | 120,000 | 73.22800 | 34.14940 |
| 2 | Chari Tank | 240,000 | 73.19760 | 34.15080 |
| 3 | Dhudiyal Tank | 60,000 | 73.26990 | 34.16640 |
| 4 | Gujar Bandi | 60,000 | 73.27140 | 34.16680 |
| 5 | Jail Tank Old | 240,000 | 73.20170 | 34.14860 |
| 6 | Jain Tank New | 120,000 | 73.20160 | 34.14840 |
| 7 | JICA Tank | 96,000 | 73.27200 | 34.16670 |
| 8 | Jinnah Tank | 120,000 | 73.21370 | 34.14570 |
| 9 | Kotera Tank | 120,000 | 73.22880 | 34.14740 |
| 10 | Main Bazaar | 120,000 | 73.21720 | 34.14480 |
| 11 | Muslim Town | 60,000 | 73.20069 | 34.13880 |
| 12 | Shimla New | 60,000 | 73.20024 | 34.15450 |
| 13 | Shimla Old | 36,000 | 73.20040 | 34.15440 |
| 14 | Ward 10 | 60,000 | 73.21620 | 34.13670 |
| 15 | Ward 11 | 36,000 | 73.21640 | 34.14230 |
| 16 | Ward 12 | 120,000 | 73.21760 | 34.14180 |
| 17 | Committee Chowk OHR | 60,000 | 73.26540 | 34.16599 |

137. 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 1325 MSL will get uninterrupted water supply via a gravity system. While the remaining reservoirs, located at slightly higher elevation than 1325 MSL, will be fed through a pumping system. In order to minimize the operational cost of pumping system, energization through different clean energy options of those pump houses are proposed. The pumps will have capacity to run both on clean energy based sources 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 3-12.**

**Table 3.12: Details of water storage reservoir served via Pumps Energized through Clean Energy Sources**

| S. No. | Water storage reservoir | S. No. | Water storage reservoir |
|---|---|---|---|
| 1 | Proposed Tank 15 | 2 | Shimla Old |
| 3 | Proposed Tank 8 | 4 | Proposed Tank 13 |

| S. No. | Water storage reservoir | S. No. | Water storage reservoir |
|---|---|---|---|
| 5 | Shimla New | 6 | Proposed Tank 10 |
| 7 | Ward 10 | | |

138. Beside the 17 number of existing water reservoirs, new surface water storage reservoirs/tanks were proposed so that the entire system can provide a minimum storage equivalent to demand of one-day covering the entire population of Abbottabad City. The location for the proposed water reservoirs were selected in close coordination with WSSC Abbottabad. 16 new surface water reservoirs are being proposed to supply treated water to customers and increase daily storage capacity of the distribution system in the city. 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 are given below in **Table 3.13** and **Figure 3-6**. These locations were finalized with the approval of WSSC Abbottabad after several meetings.

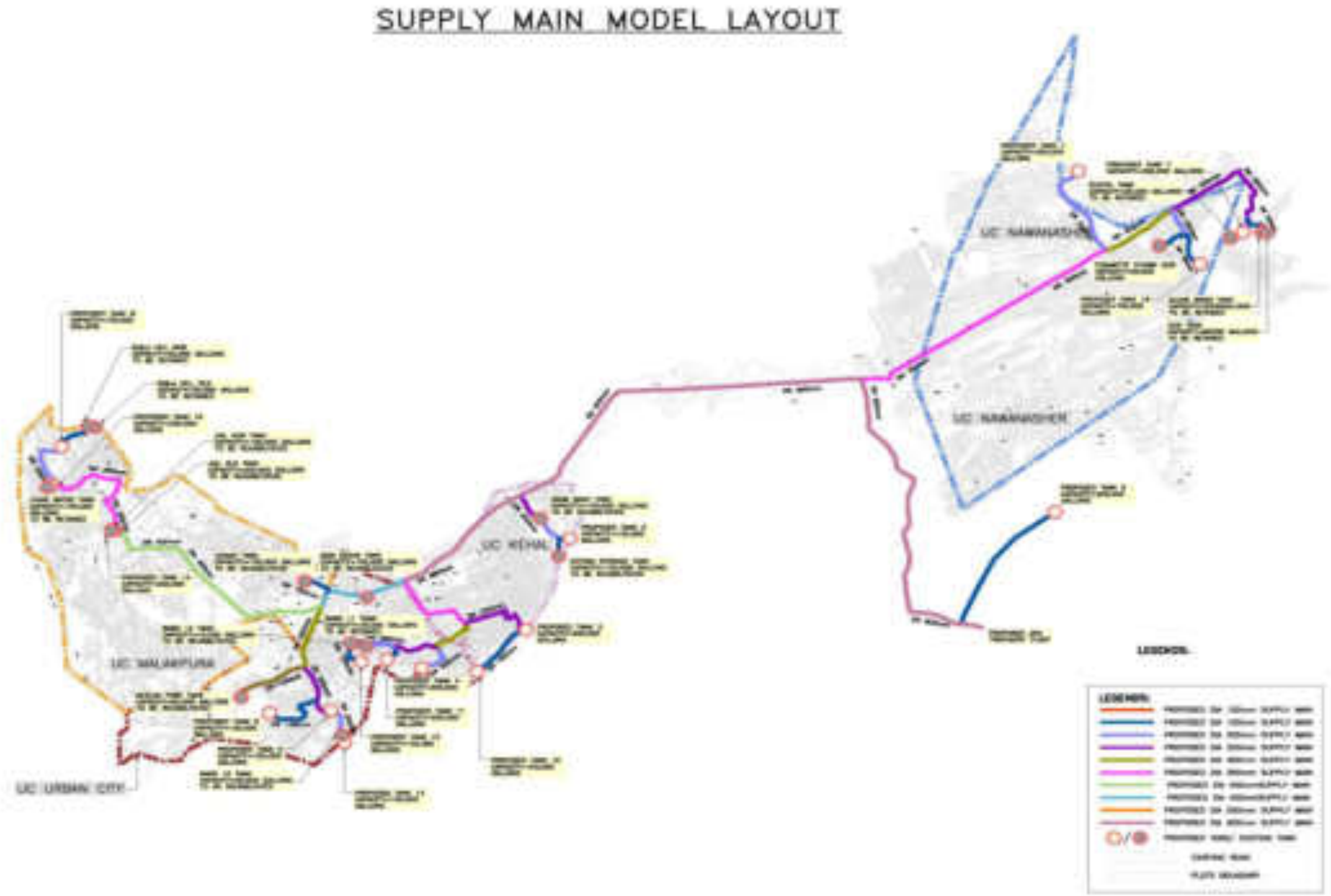
**Table 3.13: Details of Proposed Surface tanks**

| Proposed Tanks | Proposed Capacity (US Gallons) | Northing | Easting |
|---|---|---|---|
| Proposed Tank 1 | 200,000 | 73.260498 | 34.1702003 |
| Proposed Tank 2 | 100,000 | 73.229599 | 34.1483994 |
| Proposed Tank 3 | 200,000 | 73.2273026 | 34.1430016 |
| Proposed Tank 4 | 300,000 | 73.2210007 | 34.1407013 |
| Proposed Tank 5 | 150,000 | 73.2154999 | 34.1381989 |
| Proposed Tank 6 | 100,000 | 73.212797 | 34.137510 |
| Proposed Tank 7 | 300,000 | 73.2706985 | 34.1666985 |
| Proposed Tank 8 | 100,000 | 73.1987 | 34.1531982 |
| Proposed Tank 9 | 200,000 | 73.2591019 | 34.1502991 |
| Proposed Tank 10 | 100,000 | 73.2244034 | 34.1404991 |
| Proposed Tank 11 | 100,000 | 73.2189026 | 34.1411018 |
| Proposed Tank 12 | 100,000 | 73.2173004 | 34.1409988 |
| Proposed Tank 13 | 100,000 | 73.2164001 | 34.1362991 |
| Proposed Tank 14 | 200,000 | 73.2012024 | 34.1483994 |
| Proposed Tank 15 | 200,000 | 73.1980972 | 34.151001 |
| Proposed Tank 16 | 100,000 | 73.2682037 | 34.1632996 |

139. Currently, the total storage capacity of the existing water supply system is approx. 1,600,000 GPD. With the addition of the proposed new water storage reservoirs the overall storage capacity of the proposed water supply system will be 4,100,000 GPD. At the connection to the water storage reservoir, a complete assembly of flow control valve has been proposed. Each assembly contains, flow control valve, flow meter, pressure transmitter and dedicated valve chamber. This arrangement will help to perform water balance calculations for each tank and regulate flows and pressures in the system

.

**Figure 3-6: Water Supply Main Model Layout**



## 3.5 Proposed Water Treatment Plant

140. 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 4.1.6 of IEE report) and the quality of water to be achieved through treatment. The 3D model of proposed WTP is shown as **Figure 3-7**.

### 3.5.1 Detailed Design Basis

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

### 3.5.2 Location of Water Treatment Plant

142. The water treatment plant is located in Abbottabad adjacent to existing JICA funded plant. The choona road provides an easy access to Murree Road from proposed WTP site. Layout of Jica Funded Water Treatment Plant and Adjacent location for proposed Water Treatment Plant has been shown in **Figure 3-8.**

### 3.5.3 Capacity of Water Treatment Plant

143. As mentioned in preceding section the water treatment plant units are designed for a daily flow of 25,930 $m^3$/day (300l/sec).

### 3.5.4 Water Treatment Processes

144. 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.

145. 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.

### 3.5.5 Process Train

146. Two process trains have been proposed each having treated water capacity of 12,965 $m^3$/day (150l/sec). Each train will consist of separate plain sedimentation tank, flash mixer, flocculation basin, clarifier. Both trains will have a combine filtration unit. The water in the two trains will be fed from a structure known as distribution chamber. The process flow chart is already shown in **Figure 3-9.** Layout plan for the proposed water treatment plant has been shown in **Figure 3-10**. Process flow of proposed water treatment plan is shown in **Figure 3-11** while the hydraulic profile is shown in **Figure 3-12.**

Figure 3-7: 3D model of proposed Water Treatment Plant

## 3.6 Water Treatment Plant Components

147. 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 (Clearwell);
- Sludge Holding Tank.
- Chemical Building;
- Chlorination Building;

148. The description of each aforesaid component with its design and basis of design is presented in forthcoming paragraphs.

### 3.6.1 Distribution Chamber

149. 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 and temperature sensors and turbidity meter for the measurement of pH, temperature and turbidity respectively. The flow from the chamber will be controlled through motorized penstock gates.

### 3.6.2 Plain Sedimentation Tanks (PST)

150. 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.

151. Considering overflow rate of 200 m/d, two plain sedimentation tanks each of 9 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 flash mixer. The design criteria and the unit dimensions are provided in the **Table 3-14.**

**Table 3.14: Plain Sedimentation tank Design**

| Description | Unit | Value |
|---|---|---|
| **ADOPTED DESIGN CRITERIA** | | |
| Overflow Rate | m/d | 200 |
| Water Depth (D) | m | 4 |

| **Description** | **Unit** | **Value** |
|---|---|---|
| **DESIGN** | | |
| Q (design) | $m^3/d$ | 25,930 |
| Number of Tanks | Nos. | 2 |
| Flow in each Tank | $m^3/d$ | 12,965 |
| Geometry of Tank | | Circular |
| Volume of each Tank | $m^3$ | 259 |
| Surface Area of each Tank (As) | $m^2$ | 65 |
| Internal tank Diameter | m | 9 |
| Water Depth | m | 4 |
| Bottom Slope | | 1:12 |
| Detention Time | min | 29 |

### 3.6.3 Flash Mixers

152. The small suspended particles (generally clay particles) cannot be removed 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.

153. Considering detention time of 60 seconds, two flash mixers (one for each train) has been proposed. Each flash mixer will have 1.85 m width and 1.85 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 3-15**.

**Table 3.15: Design criteria and the unit dimensions of Flash Mixer**

| **Description** | **Unit** | **Value** |
|---|---|---|
| **ADOPTED DESIGNCRITERIA** | | |
| Detention Time | sec | 60 |
| **DESIGN** | | |
| Type of Coagulant | - | Alum |
| Type of Mixing Device | - | Turbine & Propeller Mixer |
| Q (design) | $m^3/min$ | 18 |
| Number of Tanks | Nos. | 2 |

| Description | Unit | Value |
|---|---|---|
| Flow in each Tank | $m^3$/min | 9 |
| Volume of each Tank | $m^3$ | 9.58 |
| Dimension of Tank | - | Square |
| Length x Width (As) | $m^2$ | 1.85 x 1.85 |
| Water Depth | m | 2.8 |

### 3.6.4 Flocculation Chamber

154. 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 two in number (for each train), and the size of each tank will be 11 m x 5.43 m. Each flocculation tank will be further divided into two compartments having dimension of 5.8m x 5.8m. The agitation will be imparted through paddle mixers, known as flocculators. The velocity gradient will be 30/s. The design criteria and the unit dimensions are provided in the **Table-3-16.**

**Table 3.16: Flocculation Chamber Design**

| Description | Unit | Value |
|---|---|---|
| **ADOPTED DESIGN CRITERIA** | | |
| Detention Time | min | 20 |
| **DESIGN** | | |
| Type of Flocculants aid | - | Polyelectrolyte |

### 3.6.5 Clarifiers

155. 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.

156. Two clarifiers are proposed (one for each train). The internal area of both clarifiers with surface loading of 38 m/d will be 341 $m^2$ having an internal diameter of 21 m. About 2.5 hr. detention time will be provided to the flocculated water. 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 by effluent pipe.

157. 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 3-17.**

**Table 3.17: Design of Clarifier**

| Description | Unit | Value |
|---|---|---|
| **ADOPTED DESIGN CRITERIA** | | |
| Surface Loading Rate | m/d | 38 |
| Water Depth (D) | m | 4 |
| **DESIGN OF CLARIFIER** | | |
| Q (design) | $m^3/d$ | 25,930 |
| Number of Tanks | Nos. | 2 |
| Geometry of Tank | | Circular |
| Flow in each Tank | $m^3/d$ | 12,965 |
| Volume of each Tank | $m^3$ | 1365 |
| Surface Area of each Tank (As) | $m^2$ | 341 |
| Internal Tank Diameter | m | 21 |
| Bottom Slope | | 1:12 |
| Detention Time | hr. | 2.5 |

### 3.6.6 Rapid Gravity Filters

158. The clarified water from both trains will transfer to a common 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. The total filtration area required, at filtration rate of 130 $m^3$/m2/day and flow of 25,930 $m^3$/d, is 199$m^2$. There will be 4 filter beds each having dimension of 9m x 6m. 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.

159. Due to accumulating of suspended solids in the pores of sand, the head loss increases. Consequently, the filtration rate will decrease from the design filtration rate. At that stage, the filter media is washed by reversing the flow in filter bed. The reverse flow will be applied with the filtered water; in conjunction with compressed air.

160. Three vertical turbine backwash water pumps (two working and one standby) each having capacity of 1079 $m^3$/hr. will be installed for all filter beds in filter complex unit. These pumps will be installed in the wash water pump house constructed at the delivery ends of filtered pipes. The pumps will draw water from filtered water effluent channel. Two air compressors (one working and one standby) with air flow rate of 2700 $m^3$/hr. will also be installed in the same pump house for filter air scouring.

161. The combined weir has been located at one side of filter beds. At downstream of weir an effluent covered channel has been provided. From this effluent channel, filtered water will be discharged into a chlorine contact tank.

162. The design criteria and the unit dimensions are provided in the **Table 3-18.**

### Table 3.18: Rapid Sand Filter Design

| Description | Unit | Value |
|---|---|---|
| **ADOPTED DESIGN CRITERIA** | | |
| Filtration Rate | $m^3/m^2/d$ | 130 |
| Backwash Rate | m / hr. | 40 |
| Air Scour Rate | / hr. | 50 |
| **DESIGN** | | |
| Q (design) | $m^3/d$ | 25,930 |
| Number of Filtration Plants | Nos. | 1.0 |
| Total Filtration Area | $m^2$ | 199 |
| **a) Filter beds** | | |
| Number of beds in each plant | No. | 4 |
| Area of one Filter Unit (L xW) | $m^2$ | 9 x 6 |
| Maximum filtration rate during one filter Backwash | $m^3/m^2/d$ | 160.1 |
| **b) Filter Media** | | |
| **Silica Sand** | | |
| Uniformity Coefficient | - | 1.4 |
| Shape factor | - | 0.75 |
| Porosity | - | 0.4 |
| Effective size | mm | 0.6 |
| Bed Depth | mm | 750 |
| **Gravel** | | |
| Uniformity Coefficient | - | 1.8 |
| Shape factor | - | 0.73 |
| Porosity | - | 0.5 |
| Bed Depth | mm | 450 |
| **c) Backwashing** | | |
| Backwash flow | $m^3/h$ | 2159 |
| Number of backwash Pump | No. | 2 + 1(standby) |
| Discharge of each pump | $m^3/h$ | 1079 |
| Head of each pump | m | 12 |
| Type of Pump | - | Vertical Turbine |

| | | |
|---|---|---|
| Number of Air Blower | No. | 1 + 1(standby) |
| Air flow of Each Blower | $m^3/h$ | 2700 |
| Pressure of blower | bar | 1 |

### 3.6.7 Chlorine Contact Tank

163. 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.

164. 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 25.5m.

165. The disinfected water will then overflow to treated water storage tank (Clearwell) through weir wall. The design criteria and the unit dimensions are provided in the **Table 3.19.**

**Table 3.19: Design of Chlorine Contact Tank**

| Description | Unit | Value |
|---|---|---|
| **ADOPTED DESIGN CRITERIA** | | |
| Contact Time | min | 30 |
| **DESIGN** | | |
| Q (design) | $m^3/min$ | 18 |
| Number of Tank | Nos. | 2 |
| Flow in each Tank | $m^3/min$ | 9 |
| Volume of each Tank | $m^3$ | 270 |
| Depth of each Tank | m | 4.3 |
| Width of each Tank | m | 1 |
| Number of Parallel Channel | Nos. | 2 |
| Required Length of each Channel | m | 25 |
| Provided Length of each Channel | m | 25.5 |

### 3.6.8 Treated Water Tank (Clearwell)

166. The treated water will be stored in treated water tank (Clearwell) having six (6) hours storage. Two treated water tanks will be provided (each for one train). Each tank will have dimensions of 25.5m x 25.5m x 5m.

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

168. The design criteria and the unit dimensions are provided in the **Table 3-20**.

**Table 3.20: Treated Water Tank Design**

| Description | Unit | Value |
|---|---|---|
| Q (design) | $m^3$/hr. | 1,080 |
| Storage Time | hrs. | 6 |
| Number of Tank | Nos. | 2 |
| Geometry of Tank | | Square |
| Flow in each Tank | $m^3$/hr. | 540 |
| Volume of each Tank | $m^3$ | 3,241 |
| Depth of each Tank | m | 5 |
| Area of each Tank (L x W) | $m^2$ | 25.5 x 25.5 |

### 3.6.9 Sludge Holding Tank

169. The sludge from Plain Sedimentation tank and clarifier of both trains will be transfer and collected into sludge holding tank. Transfer of sludge will be carried out by sludge pumps. Circular tank having internal diameter of 12m 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 3-21.**

**Table 3.21: Sludge Holding Tank Design**

| Description | Unit | Value |
|---|---|---|
| Q (design) | m3/d | 25,930 |
| Number of Tanks | Nos. | 1 |
| Geometry of Tank | | Circular |
| Volume of Tank | $m^3$ | 522 |
| Depth | m | 5 |
| Surface Area of each Tank (As) | $m^2$ | 104 |
| Internal Diameter of Tank | m | 12 |

### 3.6.10 Chlorination Building

170. 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.

### 3.6.11 Chemical Building

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

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

### 3.6.12 Mechanical Equipment

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

- Penstock gates
- Sludge pumps
- Sludge Scrapers for Primary and Secondary Settling Tanks
- Backwash Pumps
- Air Blowers
- Sludge Scraper for sludge holding tank
- Cranes
- Flow Meters and valves

**Figure 3-8: Jica Funded Water Treatment Plant and Adjacent location for proposed Water Treatment Plant**

**Figure 3-9: Process flow of Proposed Water Treatment Plant**

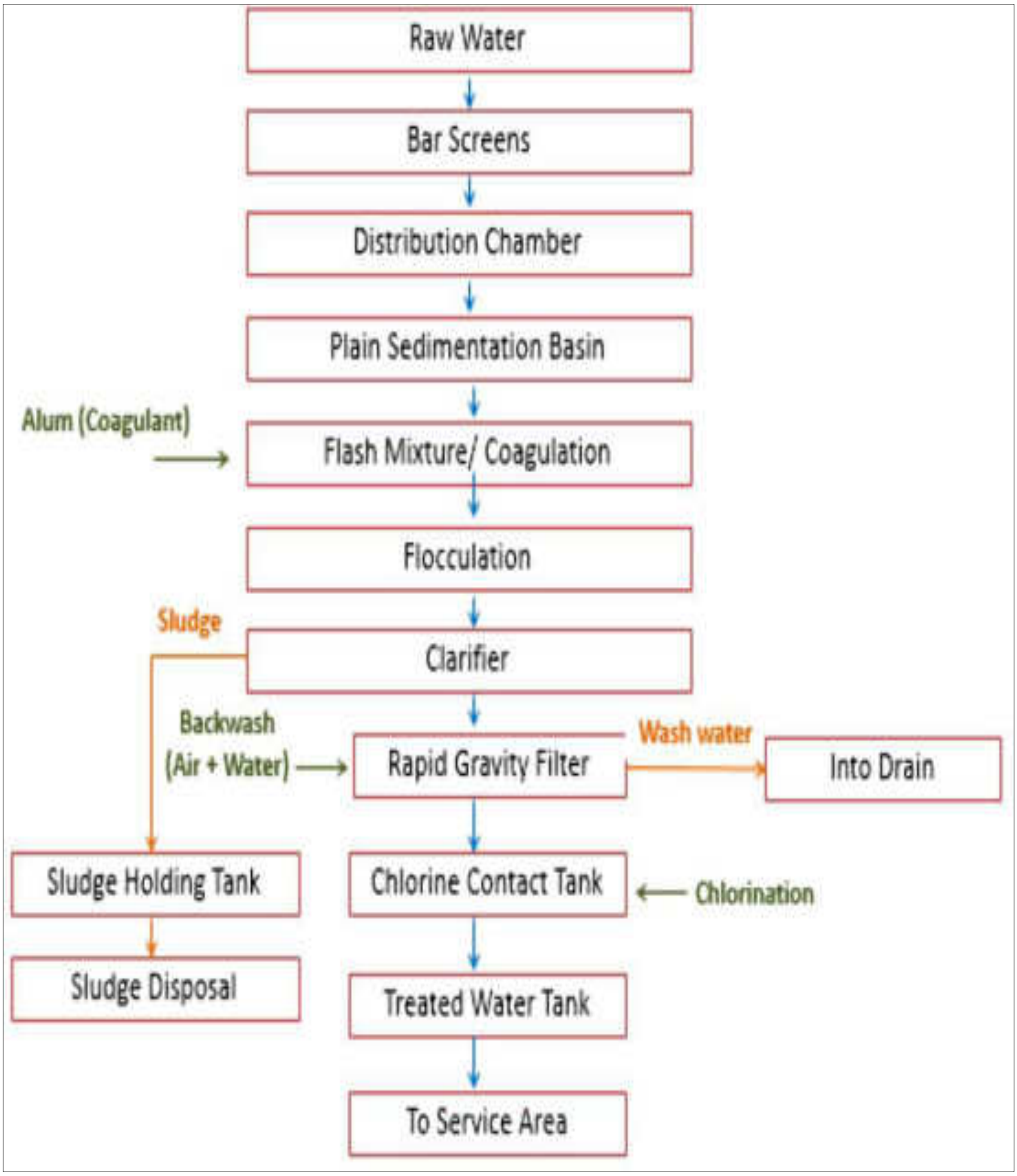


Figure 3-10: Layout plan of proposed water treatment plant

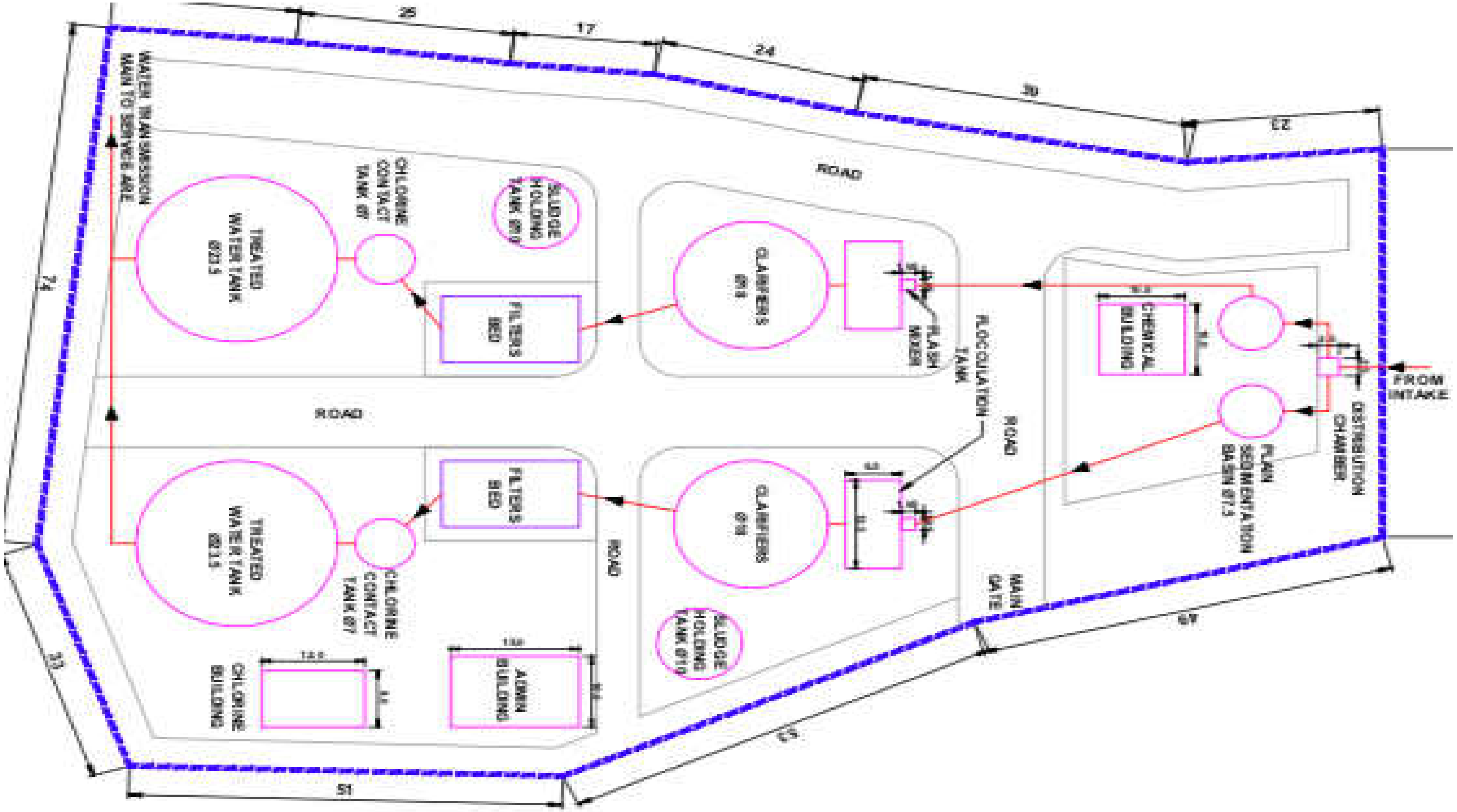


Figure 3-11: Process flow of Proposed Water Treatment Plant

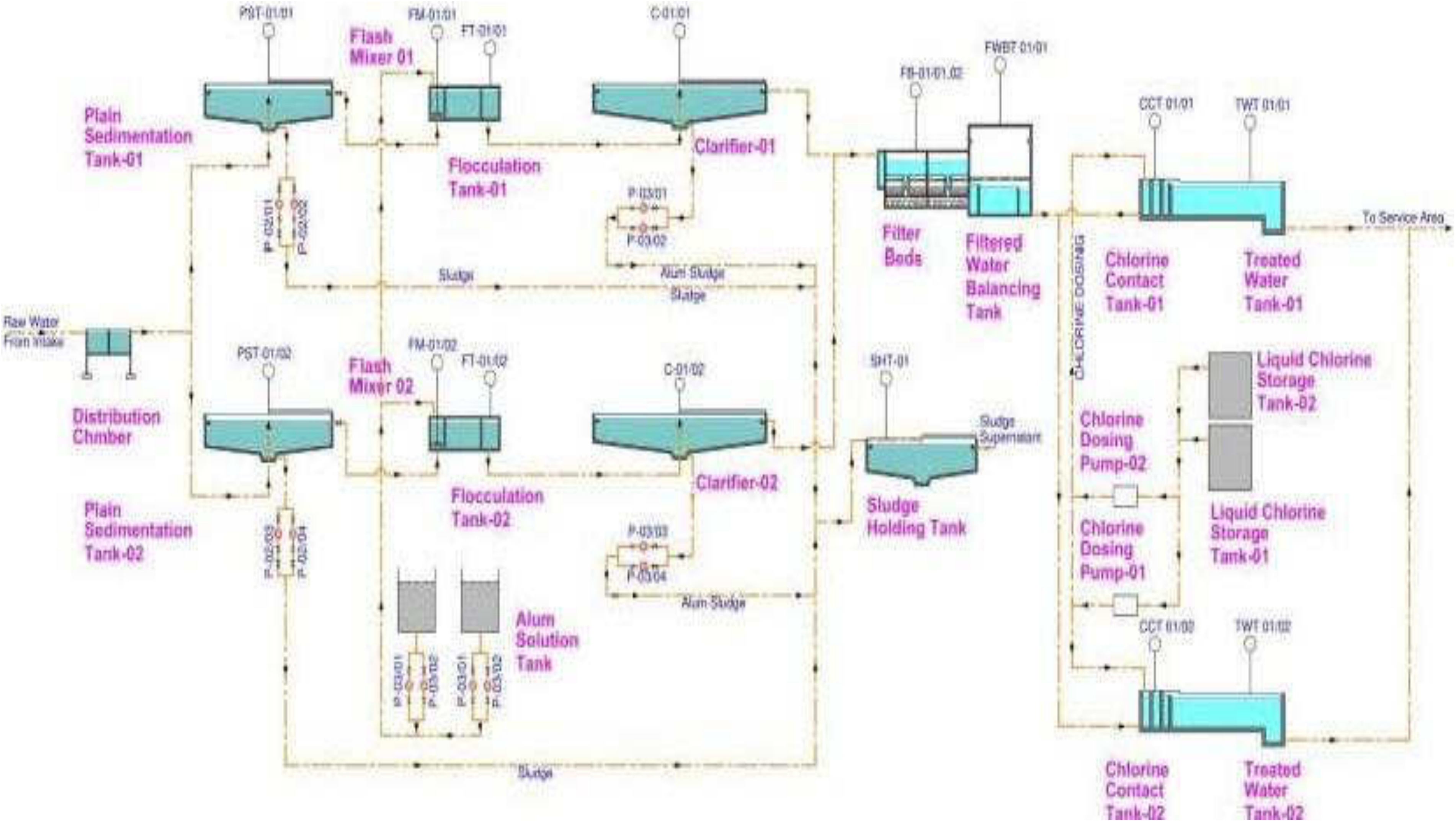
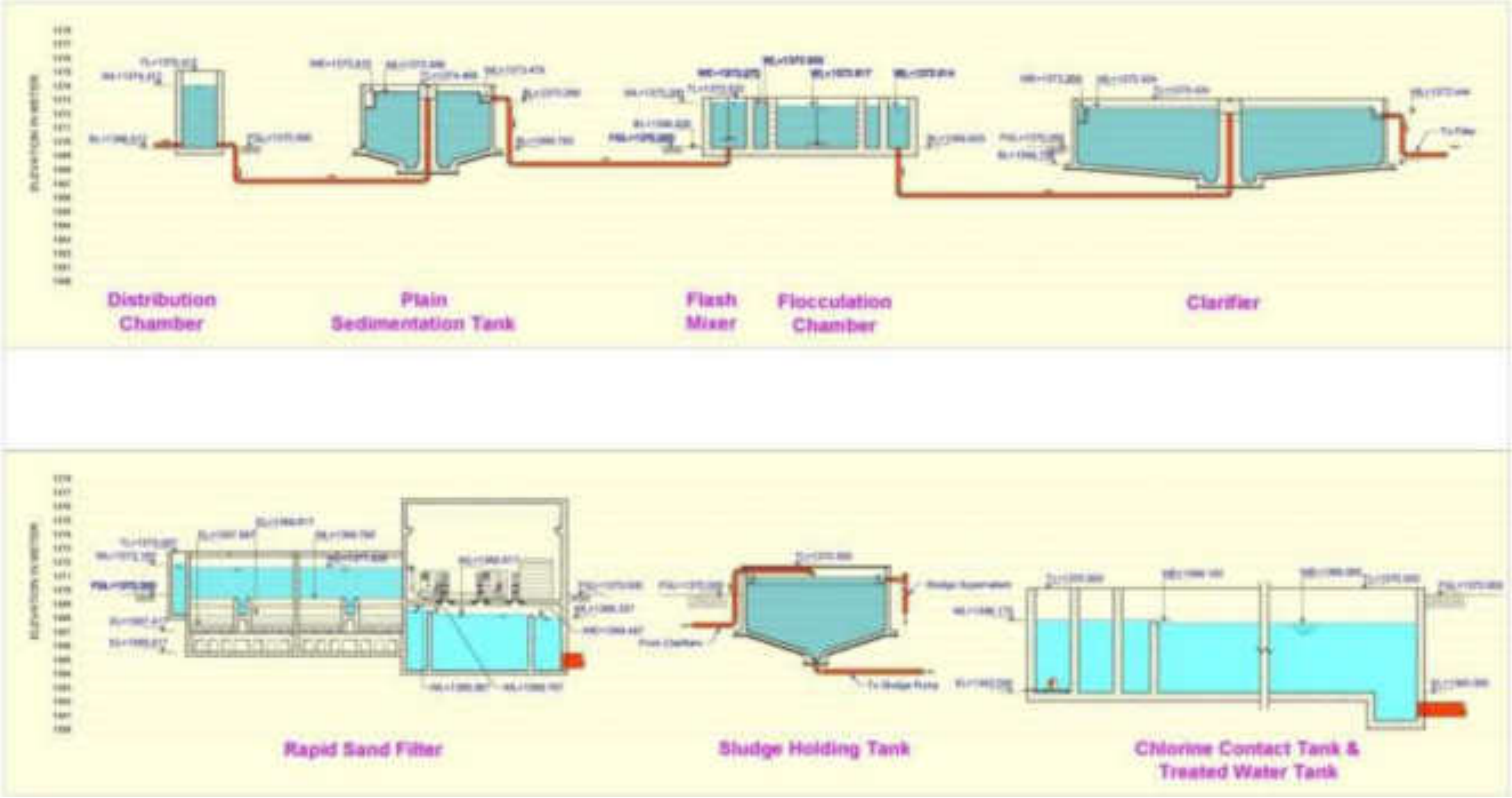


Figure 3-12: Hydraulic Profile of Proposed Water Treatment Plant



### 3.6.13 Administration Building

174. A two-story administration building has been proposed at plant site. It will consist of the following:

a) Office for O&M Staff

For O&M staff, an office has been proposed, comprising:

- (Separate room for plant manager,
- A room for the assistant Plant Managers/Assistant Directors,
- (Office for Accountant,
- A hall for support staff

b) Conference Room

175. Water treatment plant is an important installation and is of specific significance for the civil administration. Presentations, regarding plant operations are often given to the administrators and professionals relating to this area of engineering. For this purpose, a conference room has been proposed for 40 participants.

c) Control Room

176. A control room has been proposed, to be used for organizing the plant operation in such a manner that all treatment, information, important events and alarms are displayed, indicated and recorded at a centralized location in the control room. Central control room affectively controls the process and operational variables.

d) Laboratory

177. In order to monitor quality of water, a laboratory has been proposed, for the testing of:

- Temperature
- Appearance
- Residual Chlorine
- Turbidity
- pH
- Nitrate
- Total Hardness
- Calcium Hardness
- Magnesium Hardness
- Total Dissolved Solids
- Total Coliform Count
- Fecal Coliform Count
- Jar testing to check coagulant dose

178. For biological and chemical testing, following equipment are proposed to be provided:

i. Drying oven & sterilizers
ii. Ultrasonic washers
iii. Colony counter
iv. Double beam spectrophotometer

v. Turbidity meter
vi. pH meters
vii. Conductivity meter
viii. Refrigerator and medical freezer
ix. Centrifuges
x. Nitrogen digester and distillation apparatus
xi. Jar testers
xii. Furniture and glasswares
xiii. Microscopes

### 3.6.14 Workshop

179. The workshop for routine maintenance will be required. The workshop will be accessible through a sufficiently wide road. 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
vi. Insulation resistance tester.

### 3.6.15 Internal Roads

180. 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 6 m. Road network within WTP facility is shown in Figure 3-10.

### 3.6.16 External Electrification

181. Treatment plant area needs to be well illuminated, both for aesthetic as well as satisfactory performance of operation and maintenance activities specifically at night. For this purpose, lightening poles will be proposed at junction pints of internal roads and at least 60 m center to center Fluorescent/ incandescent fixtures have been proposed to be installed along the roads as they provide instant illumination when they are switched on.

### 3.6.17 Residual Management

182. 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:

183. 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

184. 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.

a) Settled Sludge

185. 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.

b) Wash Water

186. 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.

### 3.6.18 Residual Disposal

187. The residual disposal is carried out through:

a) Discharge through natural water ways;
b) Transportation to Landfill,
c) Beneficial reuse such as fertilizers.

### 3.6.19 Instrumentation and SCADA System

188. 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.

### 3.6.20 Construction Phase Details for WTP

#### *Construction Schedule*

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

#### *Construction phase activities*

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

- **Development of Construction and Labor Camps**

191. 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.

192. The construction of the proposed WTP and Gravity 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.

193. 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.

194. 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.

195. 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.

196. 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**

197. 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.

198. 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**

199. Major construction works are construction of intake structures, laying of transmission/supply/delivery mains of varying diameter from 100-600 mm 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.

200. Two process trains each having treated water capacity of 12,965 m3/day (150L/sec) will be constructed for WTP. Each train will consist of separate plain sedimentation tank, flash mixer, flocculation basin, clarifier. Both trains will have a combine filtration unit.

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

201. Following WTP components and building infrastructure will be constructed and installed at proposed site at Chona Hill, Abbottabad.

- Bar Screens;
- Distribution Chamber;
- Plain Sedimentation Tank;
- Flash Mixer;
- Flocculation Basin;
- Clarifiers;
- Filters;
- Treated Water Tank (Clearwell)
- 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*

202. 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.

203. The **Table 3.12** below outlines the approximate number of major machinery and vehicles that are envisaged to be required for the project construction works.

**Table 3.22: 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*

204. 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 3.13** below.

**Table 3.23: 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. |

| Sr.# | Raw Material | Source |
|---|---|---|
| 5 | Water | Ground water is available at depth of 170-190 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. |

### 3.6.21 Operation Phase Details for WTP

***Scope of Activities***

205. 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 jurisdication of WSSCA.

***Operation Equipment and Machinery***

206. 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***

207. It is expected that existing organizational capacity of WSSC Abbottabad 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 WSSCA.

208. 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 of Project

### 3.7.1 Climate Change Trends and Extremes in Abbottabad

209. Main climate change impacts in Abbottabad are highly associated with potential increase in rainfall and increase in temperature (both maximum and minimum temperatures). These potential changes will result in an increase in flooding (riverine, flash and urban flooding) and increase in heat waves (particularly in density populated UCs and industrialized areas). These will impact businesses, domestic homes, agriculture and exacerbate the challenges associated with urban and transport infrastructure development, energy consumption, energy supply and municipal services (like water supply, sanitation systems sewerage systems, drainage and community health. Climate change projections along with associated impacts and their likelihood are mentioned in **Table 3.21**. Summary of the main Climate Change trends and Projections observed in Abbottabad are mentioned in **Table 3.22**.

**Table 3.24: Climate events in Abbottabad and their impacts on the city**

| Climate Change Projection | Event | Impact | Likelihood |
|---|---|---|---|
| Extreme precipitation | Flash flooding<br>Urban flooding | Damage to houses, infrastructure.<br>Increased demands on drainage and storm water management system and sewer outflows<br>Road washouts and flooding | High |
| Heavy rain and temperature changes in the catchment of Salhad and Naray streams | Increased precipitation resulting in flooding in the streams | Higher cost of flood protection, maintenance and expansion of man-made erosion controls | Medium |
| Temperature rise | Increased snow melt, Increased precipitation/evaporation | Increased flooding<br>Increased water demand<br>Increased energy consumption<br>Decline in surface and ground water resources | High |

**Table 3.25: Summary of the main Climate Change Trends and Projections observed in Abbottabad**

| Climate Trend | Description | Current and/or future impacts |
|---|---|---|
| Precipitation increase | Based on CSIRO-CCAM RCM precipitation is expected to rise between 113.8mm/yr. to 329.5mm/yr. during 2011- | Flash floods may increase, which will adversely affect the ground water. Groundwater will continue to decline. |

| Climate Trend | Description | Current and/or future impacts |
|---|---|---|
| | 2100 compared to 1976-2005 period under both scenarios. | Runoff increase adversely effecting ground water.<br>Together with temperature rise, decrease in precipitation may result in more soil erosion and slope instability. |
| Temperature Increase | Maximum temperature is also expected to rise between 0.06°C to 6.2°C during 2011-2100 compared to 1976-2005. Similarly, minimum temperature is expected to rise between 1.2oC to 4.9oC during 2011-2100 compared to 1976-2005. | Increased demand for water and electricity, putting an additional pressure on the stretched supply of both.<br>Temperature rise will enhance evaporation and losses. It will also adversely impact structural design and urbanization.<br>Adverse changes to the ecosystem, local flora and fauna.<br>Frequent heat waves associated with health impacts. |

### 3.7.2 Climate Risk and Vulnerability Assessment of the extension of JICA gravity water supply scheme Abbottabad

210. 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 Phalkot and Jander bari and up to some extent to the structure of WTP and distribution networks due to intensive rains which may cause landslides and subsequently washout sections of water supply networks located in hilly areas.

211. Other climate considerations of the proposed project include likelihood of groundwater depletion in the catchment of Dor river due to water intake from Dor river tributaries.

### 3.7.3 Climate Change Adaptation Measures for Water Treatment Plant and Distribution Networks

212. 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. Time of concentration at intake points has been calculated after computing CN number that consider catchment characteristics including the soils; cover type, treatment, and hydrologic conditions/land use etc.

213. The flow measurement for Jandar Bari Intake was 920 lit/sec while for Phalkot it was 450 lit/sec. Raw water Intake flow for proposed Jandar Bari stream is 200l/s while from Phalkot 100 l/s. Therefore, downstream water availability shall not be compromised and enough water would be flowing downstream in Dor River to maintain ecological flows.

214. Intake structures has been designed to withstand flash flooding in event of intensive rain.

215. 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.

# 4 Description of Environment

216. This section examines the existing environmental conditions of the project area to provide a baseline against which the project impacts can be measured and monitored in future. This chapter also identifies sensitive flora, fauna and ecosystems in the project area.

217. The information provided in this section is both quantitative and qualitative and is based on primary and secondary data sources. While primary information was collected through field surveys conducted specifically for this study by PMU and EDCM consultant for IEE baseline survey in July, 2020. Secondary information is from desk studies related to the project area and the design study carried out for the extension of JICA WTP & GWSS Abbottabad.

218. The description of the environment is site-specific and includes the information of physical environment including topographic condition, geological setting, water quality (surface water and groundwater), ambient air quality, climate of the area, land use, description of ecological habitats, located in the overall environmental study area and socio-economic conditions of the area.

219. With due regard to baseline environmental conditions, the impact of project interventions is addressed and mitigation measures are proposed in the foregoing sections. The baseline information also assists in identifying specific issues to be monitored during project implementation as well as during the operational phase.

## 4.1 Physical Environment

### 4.1.1 Topography

220. The topography of the project area (Abbottabad is predominately sub mountainous, eroded by intervening flat valleys, which are fertile and partially irrigated by canals or by lifting groundwater through tube wells. Along the northern boundary of the district, a series of low lying hills form barrier to the Mangal tract in district Mansehra. To the south of these hills, Orash or Resh plains lie with an area of about six square kilometers. Another such tract is Dhan which is an elevated basin enclosed by Nara hills.

221. The proposed WTP site is a rocky patch on top of the Choona hill with average elevation of 1343m from AMSL The project site is currently an open area with few trees. While the intake structures located on stream bed with steep slope hills. The elevation of Jander bari intake location is 1615 m while Phalkot is 1475m from AMSL.

222. The intake structures are located in stream beds therefore; the topography of the intake structures area is hilly with steep slope hills on both sides.

### 4.1.2 Soils and Geotechnical Investigation of Proposed WTP location

223. The ground comprises of Stiff to Very Stiff to Hard Silty Clay with Gravels/Silty Clay/Poorly Graded Gravels with Silt/Limestone up to maximum investigated depth of 20m below EGL.

224. The soils classified as granular indicated fines (passing # 200 sieve) ranging from 3% to 25%. The fine content in the cohesive soils were indicated as 54% to 87%.

### *Geologic Setting*

225. The geologic formations of the Abbottabad range in age from Precambrian to Quaternary and include sedimentary, igneous, and metamorphic rocks and unconsolidated material.

### *Lithological Description*

226. The Hazara Formation in Abbottabad consists mainly of slate, phyllite,un-metamorphosed shale, and a few layers of limestone and graphite. Slate and phyllite are dark gray, dark green, or black on the fresh surface and rusty brown or dark green on the weathered surface. Slate units consisting of sill-sized material are somewhat lighter toned than those of clay-sized material, and in places they are crossbedded. Layers of thick-bedded fine to medium-grained graywacke sandstone are found locally, but sandstone is not common.

227. Limestone beds totaling as much as 500 feet in thickness and a sequence of calcareous phyllite and gypsum ranging from 100 to 400 feet in thickness are found in two separate zones that extend from Muzaffarabad to Kohala. These beds are gradient with the enclosing slate and phyllite and are an integral part of the Hazara Formation. In the Tarbela area, the Hazara Formation likewise contains a few layers of limestone as well as graphite, graphitic limestone, and calcareous shale.

### *Ground water*

228. No Ground water encountered during excavation of test pits upto 20 meters.

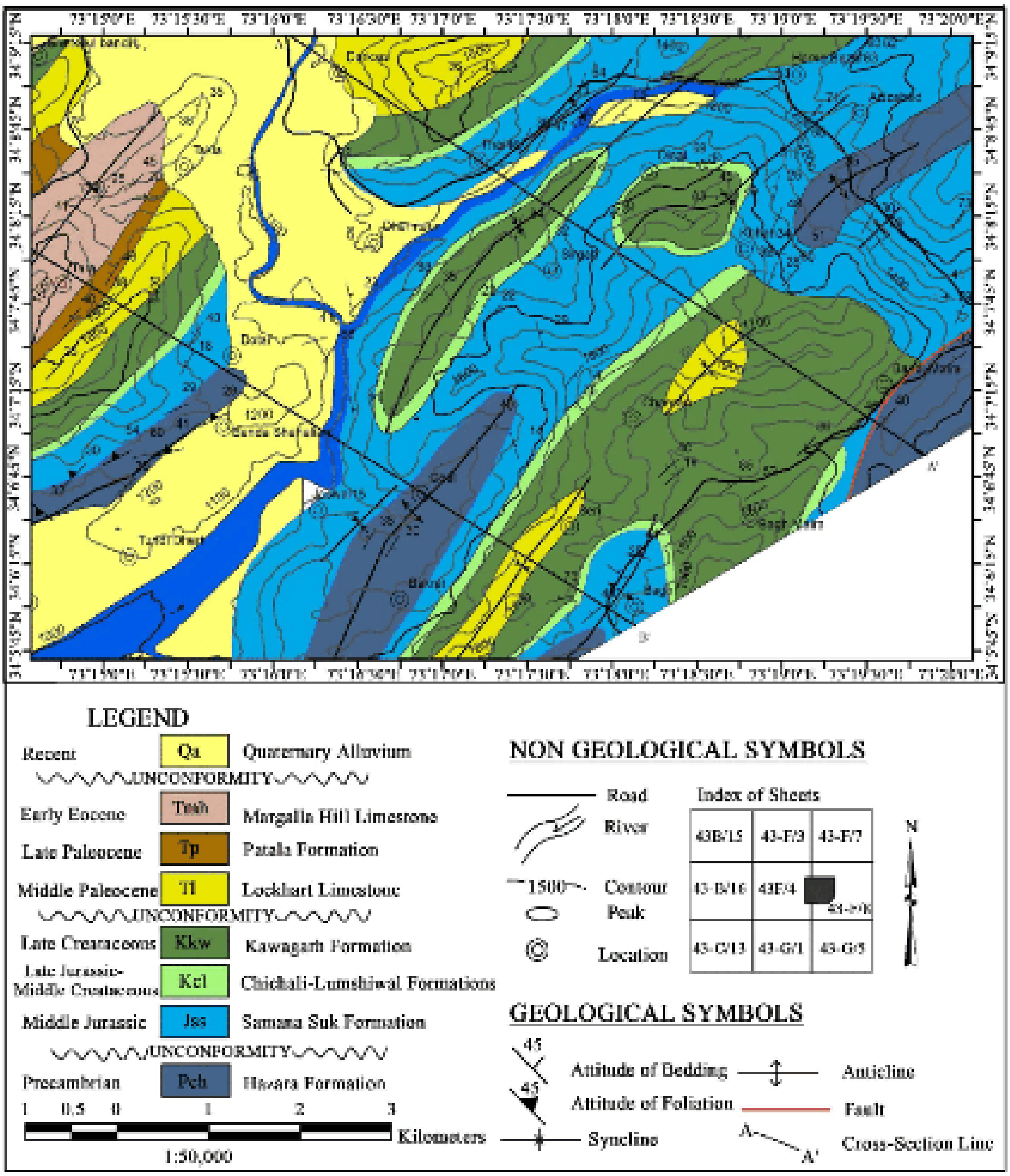
### *Reccomendations of Geotechnical Study*

- Cutting of this rock must be done without blasting
- Cutting must be conducted that the walls remain in slope not ls than 15 degrees with the vertical.

### 4.1.3 Seismicity

229. Seismic zoning map of Pakistan showing proposed project site area is presented as **Figure 4-2**, indicating zones according to the Building Code of Pakistan - 2007. The project site 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).

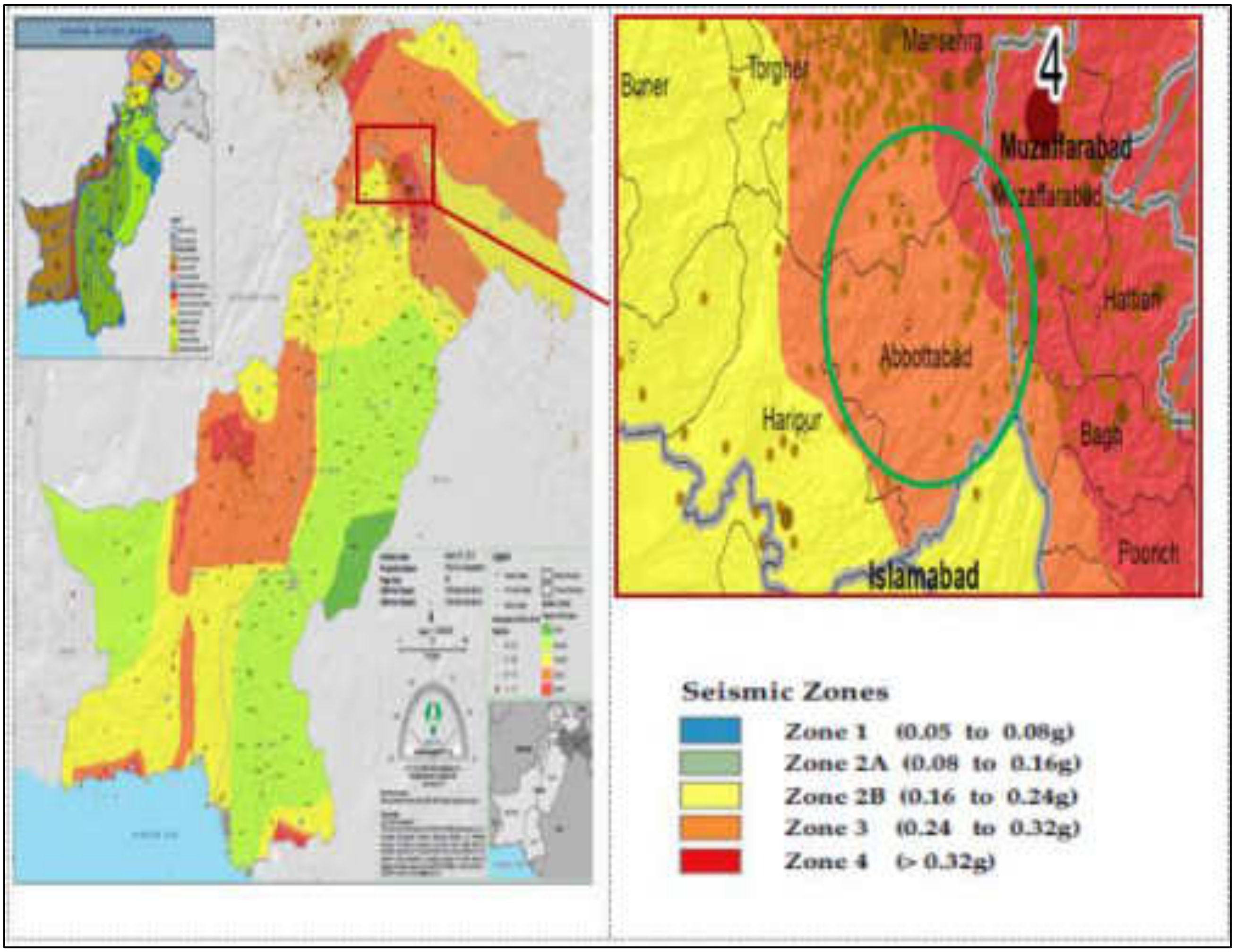
**Figure 4-1: Geology of Project Area**[3]



---

[3] https://www.google.com/search?q=Geology+of+Dhamtor+area&rlz=1C1GCEU_enPK927PK927&sxsrf=ALeKk01QlJM5JzNfytFbEzZHBKAjbspFgQ:1620723479126&source=lnms&tbm=isch&sa=X&ved=2ahUKEwip_oG6ocHwAhX1nVwKHZ_jAUMQ_AUoAXoECAEQAw&biw=1280&bih=580#imgrc=i9SKZ8F-QwOCzM

Figure 4-2: Seismic Zoning Map of Pakistan[4]



### 4.1.4 Climate

230. The Köppen Climate Classification subtype for this climate is "Cfa". (Humid Subtropical Climate). The climate is mild, and generally warm and temperate. Abbottabad is a city which receive significant rainfall as compared to other cities of Pakistan.

***Temperature***

231. Abbottabad has a humid subtropical climate, with mild to warm temperatures during the spring and autumn months, hot temperatures during June and July, and cool to mild temperatures during the winter. The temperature can rise as high as 38 °C (100 °F) during the mid-summer months and drop below −5 °C (23 °F) during the extreme cold waves. The average annual temperature in Abbottabad is 18.0 °C | 64.3 °F.

***Changes in Mean Temperature in Abbottabad***

---

[4] National Disaster Management Authority

232. Winter months (December to March) and August maximum temperature data show statistically significant rising trends during 1971-2015. The trends range between 0.03°C/month/yr. to 0.087°C/month/yr. (for February and March respectively). The data from PMD shows a rise in maximum temperature between 1.3°C to 3.8°C during the last 45 years. Annual maximum temperatures have risen at 0.018°C/year (with a total rise of 0.82 °C during 1971-2015). Minimum temperature shows a rise during February, March and August. Monthly rise in minimum temperature ranges between 0.52°C (for August) and 1.5°C (for March) during 1971-2015[5].

### *Rainfall*

233. The annual rainfall is 1262 mm | 49.7 inch. Winters, are comparatively severe, with heavy snowfall in the higher elevations causing the snowline to drop to around 1,650 m. Heavy rainfall occurs during the monsoon season stretching from July to September that frequently results flooding in lower lying parts of the city.

### *Changes in Mean Precipitation in Abbottabad*

234. Monthly precipitation data shows a statistically significant decline during January, March, April, May and July. January precipitation data shows maximum percentage decline (about 1.25% decline/month/yr.) with a total decline of about 68mm over a 57-year period. Annual precipitation in Abbottabad shows a declining trend. It is noteworthy that a total of about 577.6 mm decline occurred during 1957-2015 (59 years) at a rate of 9.78mm/yr. (about 0.6%/yr.)[6]

235. Climatic data of Abbottabad for the year 2019, and 2018 is given as **Table 4.2**, **Table 4.3** while **Figure: 4-3** showing 3 Year Temperature Variation of District Abbottabad and **Figure 4-4**: showing 3 Year Precipitation Variation at District Abbottabad. **Figure 4-5**: a), annual maximum temperature during 1971-2015 (b), annual minimum temperature during 1971-2015

### *Relative Humidity*

236. Abbottabad observe some very humid and moderately humid months. The least humid month is May (43.8% relative humidity), and the most humid month is August (74.1%)[7]. As compared to other cities of Pakistan the precipitation effectiveness index (P.E) level of Abbottabad is high as it falls in wet zone.[8] Historic Average Relative Humidity Levels for Abbottabad is given in **Table 4.4**.

### *Wind Rose*

---

[5] Pakistan Meteorological Data Balakot Climate Station (PMD)

[6] Monthly precipitation data of Balakot station has been acquired from Pakistan Meteorological Department (PMD) for a period 1957-2015 (59 years).Monthly maximum and minimum temperature data of Balakot station have also been acquired from PMD for the period 1971-2015 (45 years). Both these datasets have been used for baseline climate data analysis.

[7] https://championtraveler.com/dates/best-time-to-visit-abbottabad-pk/#:~:text=Humidity%20and%20Wind,month%20is%20August%20(74.1%25).

[8] http://www.pmd.gov.pk/rnd/rnd_files/vol6_issue11/5_Climatic%20Zonation%20of%20Pakistan%20through%20Precipitation.pdf

237. The wind rose for Abbottabad shows how many hours per year the wind blows from the indicated direction. The Wind Rose for Abbottabad City (provided as **Figure 4.6**) shows that the predominant wind direction is West-South-West and South-West.

### *Ambient Environment*

238. Abbottabad’s environment has suffered tremendously due to an ever-increasing population, unplanned growth and a poor regulatory framework. Air and noise pollution is a significant issue in several parts of the city, and the water quality, once considered to be exceptionally good, is also deteriorating at faster pace. However, as proposed WTP is located at a remote location therefore, results show reduce noise levels and pristine air quality. Works on distribution network will increase dust and particulate matter within the vicinity, however, distribution activity will be of short term and dust management plan shall be followed to reduce impact on ambient air. Details of Ambient noise and air quality of proposed WTP area has been summarized in later sections. Lab reports are attached as **Annexure D**.

**Table 4.1: Climatic Data of Abbottabad Year 2019**

| Month | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Year |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Average high °C** | 11.9 | 13.7 | 18.4 | 23.2 | 28.3 | 32.9 | 30 | 28.1 | 27.8 | 24.9 | 19.7 | 14.7 | 22.8 |
| **Daily mean °C** | 6.7 | 8.5 | 12.8 | 17.3 | 22 | 26.5 | 25 | 23.6 | 22.4 | 18.5 | 13.5 | 9.2 | 17.2 |
| **Average low °C** | 1.6 | 3.3 | 7.3 | 11.5 | 15.7 | 20.2 | 20.1 | 19.2 | 17 | 12.2 | 7.3 | 3.7 | 11.6 |
| **Average rainfall mm** | 76 | 103 | 122 | 98 | 68 | 75 | 251 | 243 | 97 | 42 | 28 | 47 | 1250 |

*Source Meteorological Data of District Abbottabad (Kakul).

**Table 4.2: Climatic Data of Abbottabad Year 2018**

| Month | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Year |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Average high °C** | 14.5 | 16.3 | 21 | 25.8 | 30.9 | 35.5 | 32.6 | 30.7 | 30.4 | 27.5 | 22.3 | 17.3 | 25.4 |
| **Daily mean °C** | 9.3 | 11.1 | 15.4 | 19.9 | 24.6 | 29.1 | 27.6 | 26.2 | 25 | 21.1 | 16.1 | 11.8 | 19.8 |
| **Average low °C** | 4.2 | 5.9 | 9.9 | 14.1 | 18.3 | 22.8 | 22.7 | 21.8 | 19.6 | 14.8 | 9.9 | 6.3 | 14.2 |
| **Average rainfall mm** | 79 | 106 | 125 | 101 | 71 | 78 | 254 | 246 | 100 | 45 | 31 | 50 | 1286 |

*Source Meteorological Data of District Abbottabad (kakul).

Figure 4-3: 3 Year Temperature Variation of District Abbottabad

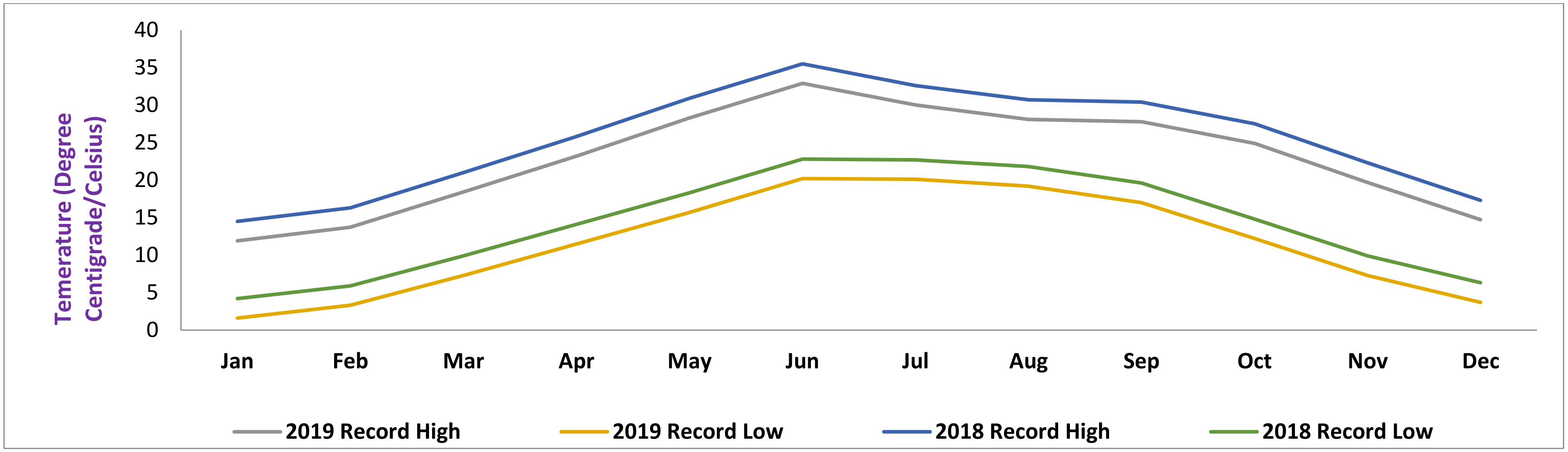


Figure 4-4: 3 Year Precipitation Variation at District Abbottabad

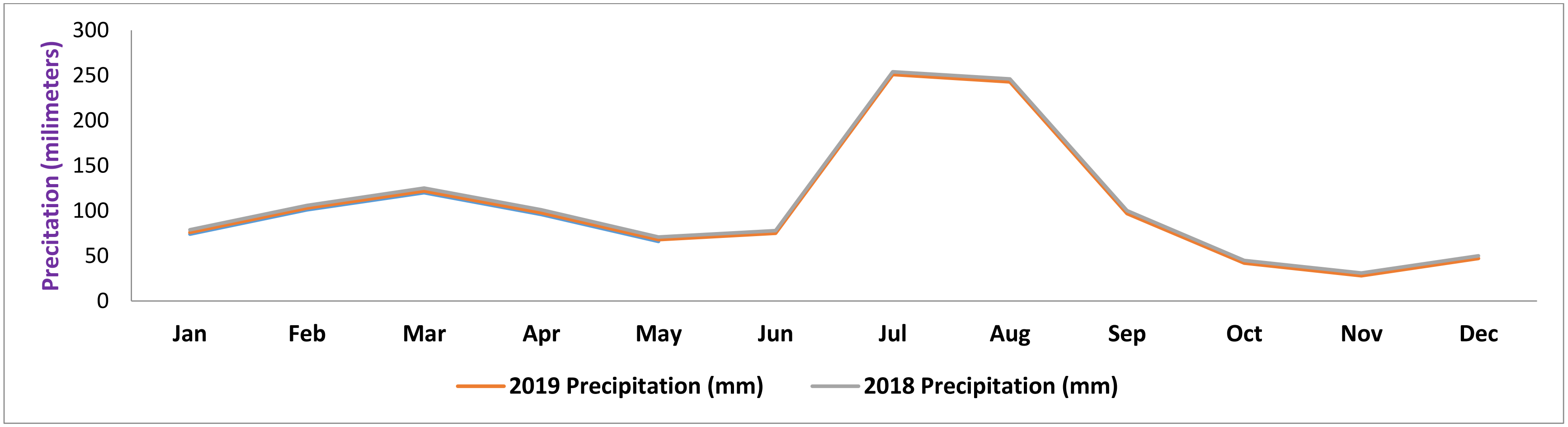
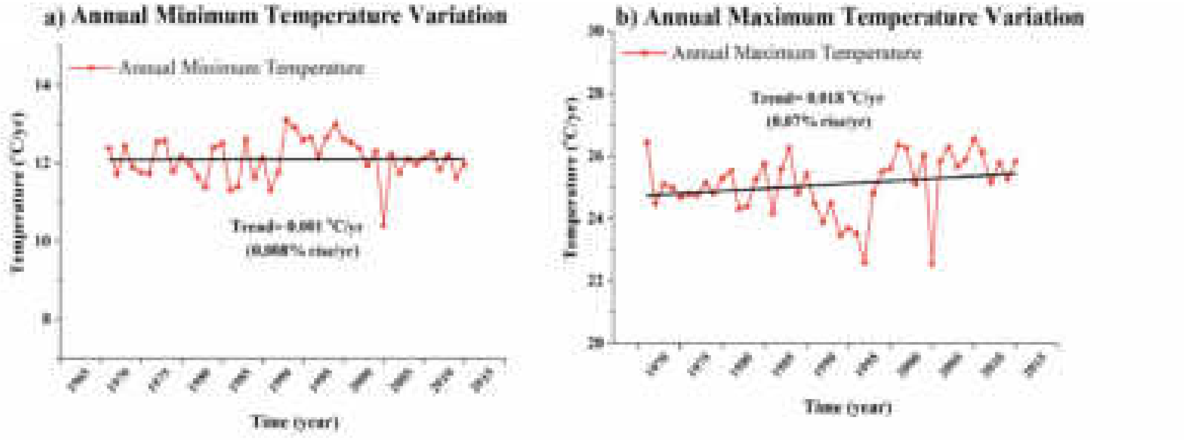


Figure 4-5: Annual maximum temperature during 1971-2015 (b), annual minimum temperature during 1971-2015

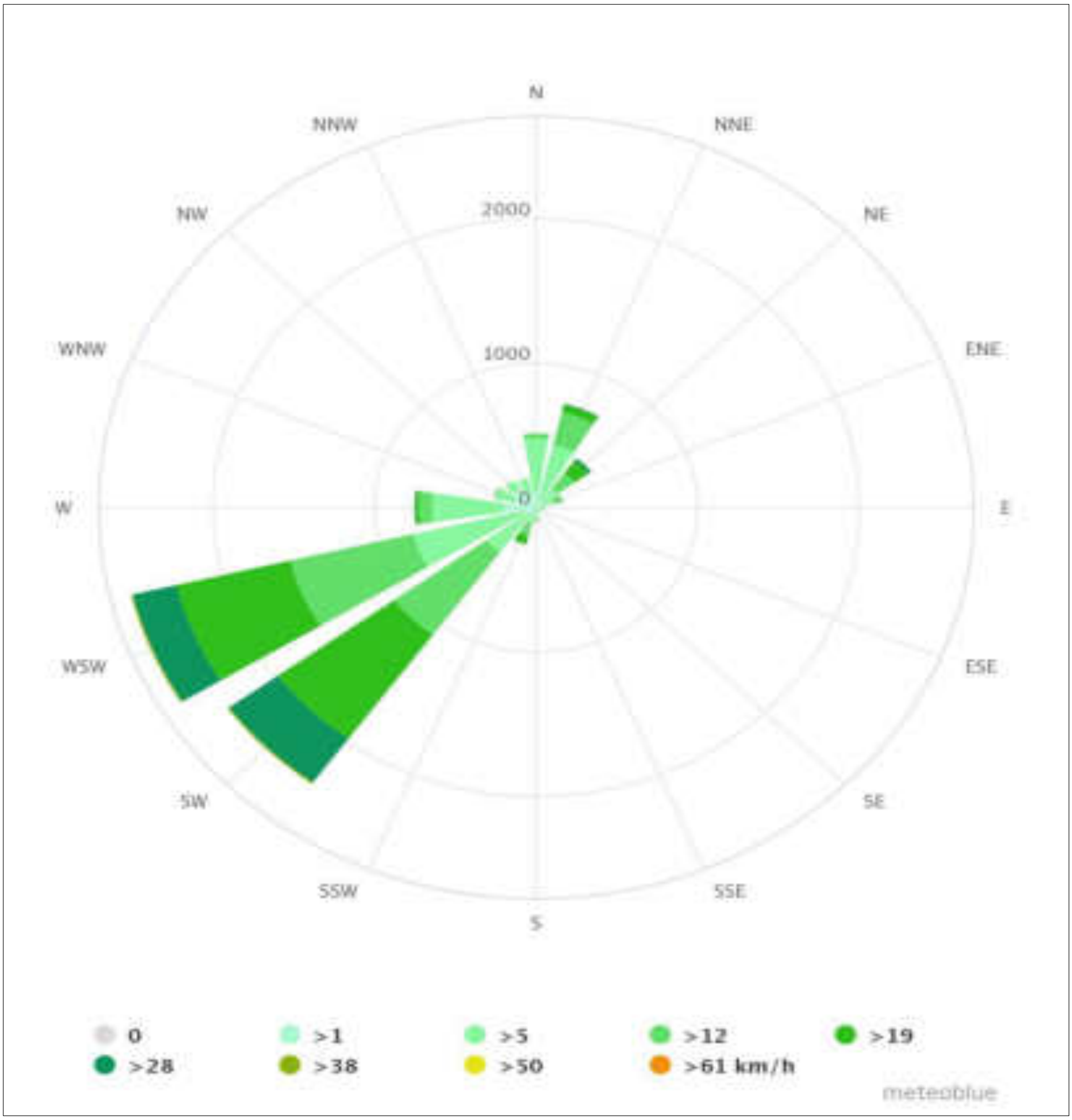


## Table 4.3: Historic Average Relative Humidity Levels for Abbottabad

| Month | Avg. Relative Humidity |
|---|---|
| January | 50.3% |
| February | 61.2% |
| March | 54.1% |
| April | 53.8% |
| May | 43.8% |
| June | 47.7% |
| July | 66.1% |
| August | 74.1% |
| September | 65.3% |
| October | 52.6% |
| November | 48.6% |
| December | 48.7% |

Source: https://championtraveler.com/

Figure 4-6: Wind rose for Abbottabad



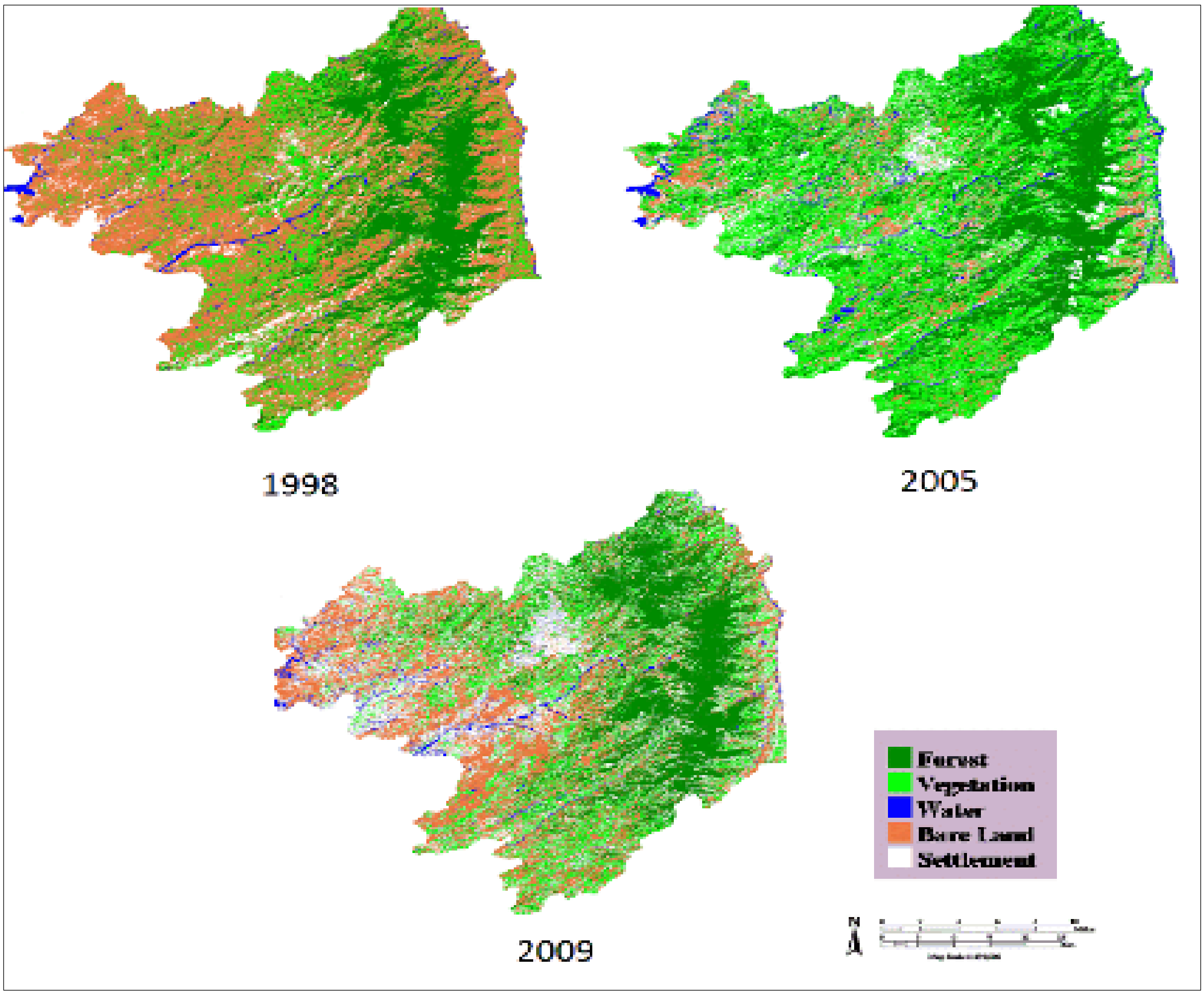
Source: meteoblue.com

### 4.1.5 Land Use

239. The district Abbottabad has gone through extensive land use changes in the last decade due to accelerated developmental and educational advancements, urbanization, and a major earthquake of 2005.

240. Auriba Raza, Ifthikhar A Raja, Shahid Raza, (2015) conducted a study on Land-Use Change Analysis of District Abbottabad Pakistan Taking Advantage of GIS and Remote Sensing[9]. Results of this study shows that Abbottabad has undergone a noticeable land-use change due to the different demographic, environmental and natural, and anthropogenic factors. Earthquake 2005 played a major role in land-use change. Results show that from 1998 to 2009 the vegetative land and bare land decreased while the areas of settlement, forest, and water area increased. The vegetative land decreased by 1.053%, bare land by 1.394%, settlement, forest and water area increased by 9.29%, 2.82%, and 0.33%, respectively. Major portion of vegetative land and bare land was converted into settlements.

**Figure 4-7: Land use pattern of district Abbottabad during 1998-2009**



241. As seen from **Figure 4-7** there has been a considerable change during 11 years period. Forest and settlement have increased in the area by 2.83% and 9.3%,

---

[9] https://www.researchgate.net/publication/267957472_LANDUSE_CHANGE_ANALYSIS_OF_DISTRICT_ABBOTTABAD_PAKISTAN_TAKING_ADVANTAGE_OF_GIS_AND_REMOTE_SENSING

respectively, whereas bare land has decreased significantly in area by 11.4%. Forest and vegetation in the area first increased in 2005 and then decreased in 2009. Increase in the forest and vegetation is due to the extensive Shajar Kari Mohim (plantation) in 1998 to improve the forest area. Decrease in the later years is attributed to the increase in the built up area and earthquake 2005 triggered landslide that eroded much of the green land with it and left large portion of the land barren.

242. Land use distribution map of 2 km radius around project location has been shown in **Figure 4-8**. The analysis of land use indicates that majority of the 42% of land is barren land. 23% of land is crop land while 27.6 is green patch. Only 6.2 % land is residential. There are scattered concentrations of residential properties of varying sizes, almost all of them at respectable distances away from the site perimeter. At the western side Choona village is located at around 1km from WTP location while on the north-estern side Takia camp village is located which is around 800 meters from proposed WTP location.

The proposed WTP site located on barren land with few trees. No settlements present within the proposed WTP area. The closest settlement area is existing JICA WTP near proposed WTP marked as red and showing in Figure 4-8.

**Figure 4-8: Land use distribution of map of 2 km radius around project location**

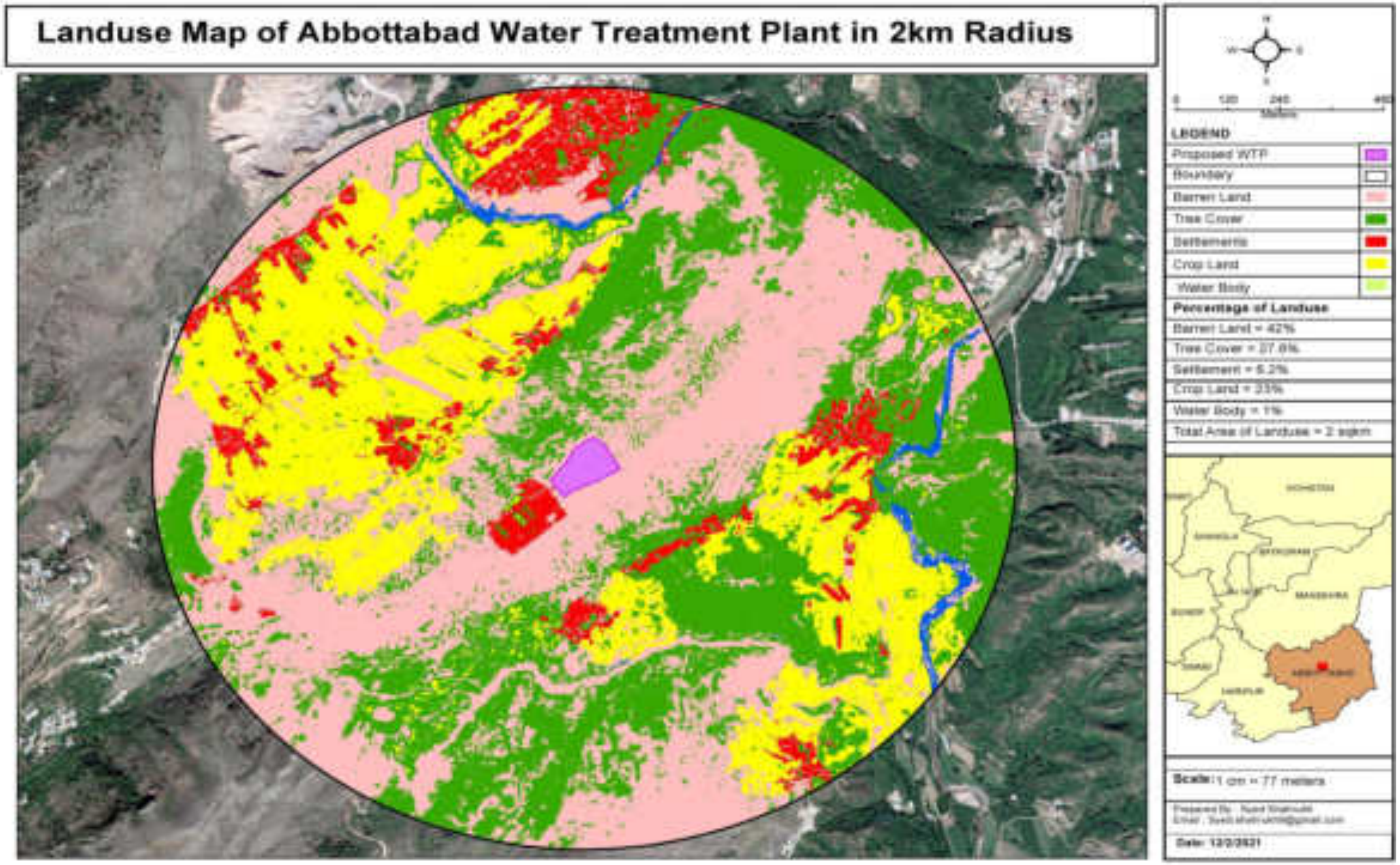
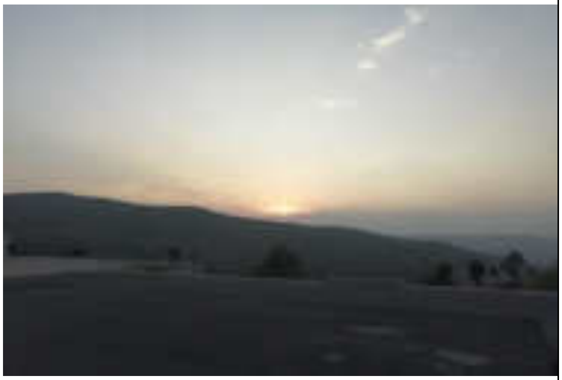


**Figure 4-9: Typical setting and existing land use of project site**

| | |
|---|---|
|  |  |
| Typical view of proposed JICA Water Treatment Plant extension, Abbottabad | Pictoral view of exisitng supply network |
|  |  |
| View of existing Administration building | Pictorial view of water storage ponds at existing JICA Water Treatment Plant |
|  |  |
| Masjid Muhallah Sarafa situated near the transmission main network, JICA WTP | Residential structures near proposed JICA WTP |

### 4.1.6 Surface water

243. The major surface water resources flowing in the vicinity of Abbottabad are Dor and Haro. The Dor River originates at the northern end of Daunga Gali range, flows through the plains of Haripur and joins the Sirin River near north of Gandger range eight (8)

kilometers above Tarbela eastern whereas Haro River emerges from the Khanpur Hills. These rivers are perennial sources of water and have sufficient water due to substantial rainfall in the project area throughout the year except during months of November to January (low flow season). The major nullahs / streams in Abbottabad are Rakh Bhallar, Tai Kas, Dotal Kas, Gadawa, etc. Hydroligical Map of Abbottabad is attached as **Figure 4.10**

244. As far as the project area is concerned, there are two perennial streams Darkhan Katha Nullah & Dor River flowing very close to WTP site. Darkhan Katha Nullah which carries mainly waste water from Abbottabad city flowing at around 300 meter on the northern eastern side of proposed location. On the eastern side of proposed location Dor River is flowing at around 2.5 km, originates from Dounga Gali range and terminates at Terbela Lake near Haripur.

245. The proposed intake sources Phalkot and Jander bari are tributaries of Dor river. The flow measurement for Jandar Bari Intake was 920 lit/sec while for Phalkot it was 450 lit/sec. Raw water Intake flow for proposed Jandar Bari stream is 200l/s while from Phalkot 100 l/s. Therefore, downstream water availability shall not be compromised and enough water would be flowing downstream in Dor River to maintain ecological flows. Moreover, the sources have enough water availability for uninterrupted water supply for WTP.

246. Raw water characterization study was carried out to assess raw water quality at both Phalkot and Jandar Bari 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. Results of surface water quality monitoring are provided in **Annexure D**.

247. The test results of raw water at Phalkot intake structure indicates the presence of turbidity, Suspended solids and coliforms. The turbidity values are above 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. However results at Phalkot from sample taken after two hours rain indicate higher values up to 90 NTU. TSS values are higher during monsoon due to rainwater intrusion which carries suspended solids of catchment area.

248. The presence of total coliform, fecal coliform, and E-Coli has also been reported above the permissible limits. The test results of water samples at Jandar Bari also indicate the presence of Turbidity, fecal coliform and E-Coli above permissible limit. With respect to microbial contamination, sampls of Phalkot intake structure shows higher values than Jandar Bari stream. Higher values indicate that there may be animal waste/excreta entering into the stream. During EDCM detailed design survey no upstream drains were observed entering the streams. Project design has incorporated the treatment of microbial contamination in WTP process 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.

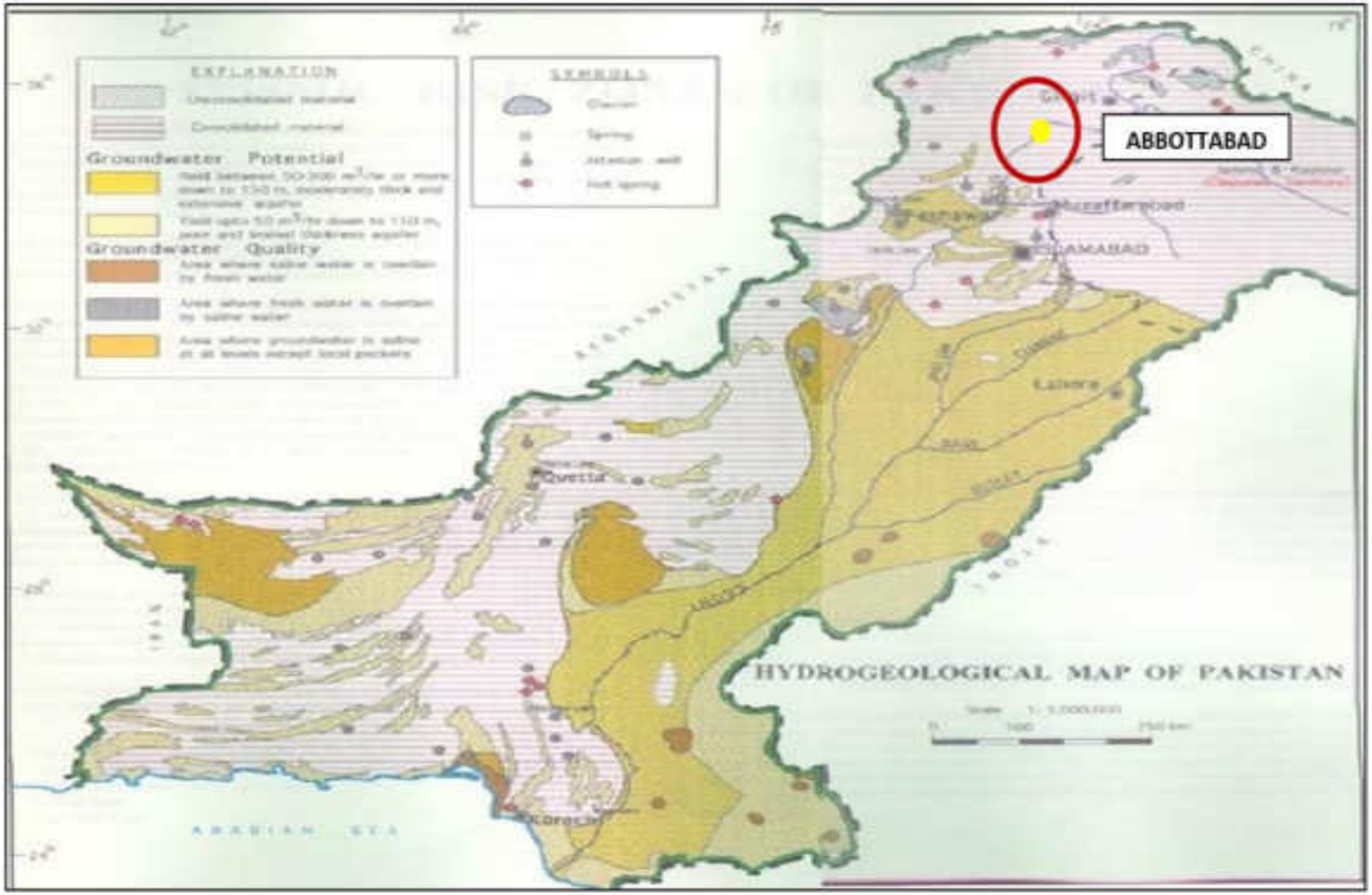
**Table 4.4: Raw Water Quality of Jandar Bari and Phalkot Streams in Monsoon**

| Parameters | Units | WHO | NEQS | Jandar Bari Stream<br>23 Sep, 2020 | Phalkot Stream<br>23 Sep, 2020 |
|---|---|---|---|---|---|
| Color | TCU | ≤ 15 | ≤ 15 | 17 | 21 |
| Turbidity | NTU | < 5 | < 5 | 21 | 24 |
| Total Suspended Solids (TSS) | mg/l | NGV | NGV | 23 | 36 |
| E-coli | Numbers/ 100 ml | Numbers/100 ml | Numbers/100 ml | 10 | 54 |
| Fecal Coliform | Numbers/ 100 ml | Numbers/100 ml | Numbers/100 ml | 21 | 32 |
| Total Coliform | Numbers/ 100 ml | Numbers/100 ml | Numbers/100 ml | 60 | 123 |

**Table 4.5: Raw Water Quality of Jandar Bari and Phalkot Streams in June, 2020**

| Parameters | Units | WHO | NEQS | Jandar Bari Stream | | Phalkot Stream | |
|---|---|---|---|---|---|---|---|
| | | | | Sample A | Sample B | Sample A | Sample B |
| Color | TCU | ≤ 15 | ≤ 15 | 8 | - | 31 | 28 |
| Turbidity | NTU | < 5 | < 5 | 10 | - | 91 | 39 |
| Total Suspended Solids (TSS) | mg/l | NGV | NGV | 6 | | 61 | 46 |

**Figure 4-10: Hydrological Map of Pakistan**



### 4.1.7 Groundwater

249. The boring of water wells to obtain ground water is a standard practice by the residents of Abbottabad for supply of water, which has led to a reduction in the water table of Abbottabad city over 200 feet over the past decade.

250. Geotechnical and topographical reports suggests that groundwater is not encountered in boreholes up to a depth of 20 m. Upon site observation, the first strata of subsoil water is found approximately 90 ft. (27 meters) and is around 200 ft. (60 meters) most of the year.

251. As part of IEE baseline, one ground water sample was collected from choona village and analyzed from EPA certified lab. The results of the tests are presented as **Annexure D,** which indicates that all parameters of the ground water samples taken are within the applicable NEQS.

252. No adverse impact on ground water has been envisaged due to proposed extension of JICA WTP and GWSS. However, positive impact has been forecasted after completion of project as continuous supply of potable water will reduce ground water abstraction in Abbootabad city and eventually reduce ground water depletion.

### 4.1.8 Noise

253. The receptor map showing the selected ambient noise monitoring locations are provided as **Figure 4-11** below with the comparison of the results also presented in **Table 4.6** below. While the results indicate the ambient noise levels being within the most stringent standards. Results of Ambient Noise Monitoring from EPA Approved laboratory has been attached as **Annexure D**.

254. There are no sensitive receptors with regards to noise levels within 250 meters from the proposed WTP location.

### 4.1.9 Air Quality

255. The receptor map showing the selected ambient air quality monitoring locations are provided as **Figure 4.11** below with the comparison of the results presented as **Table 4.7** below. Results of 24 hourly Ambient Air Quality Monitoring from EPA Approved laboratory has been attached as **Annexure D**. Ambient air quality has been carried out at WTP location. The Wind Rose for Abbottabad City (provided as **Figure 4.6**) shows that the predominant wind direction is West-South-West and South-West. No sensitive receptors are located in western direction, moreover WTP operations shall not produce any gasses or air emission which would damage ambient air quality of the area.

256. 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. Increased $PM_{10}$ in air is due to unpaved roads within the vicinity, fields, or increased residential fires due to unavailability of gas supply within nearby villages.

Figure 4-11: Sampling Locations for Environmental Monitoring

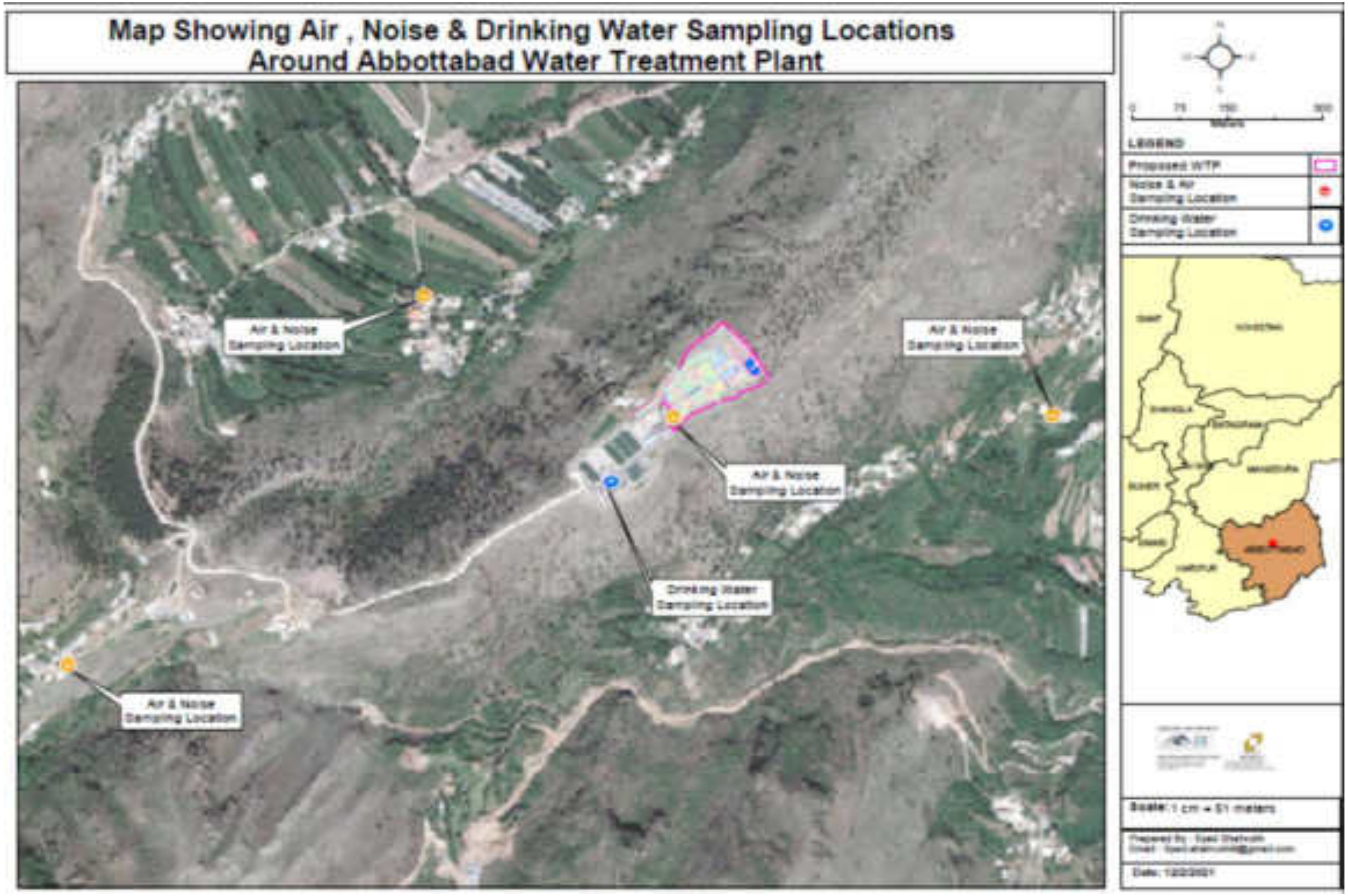


**Table 4.6: Ambient Noise Monitoring Results (Day and Night) in Project Area**

| Monitoring Location | Parameter | Noise Reading Results | Noise Guideline (Commercial Area) | Compliance Status for Commercial Areas |
|---|---|---|---|---|
| **Day Time Readings (09:30 AM)** | | | **Day time** | |
| West Side of WTP | dB(A) Lea | **48.15** | 65 | 🟩 |
| South West Side | | **44.85** | | 🟩 |
| East Side | | **43.85** | | 🟩 |
| Existing WTP site (Reading time 9:00 AM) | | **46.8** | | 🟩 |
| **Night Time Readings (09:30 PM)** | | | **Night time** | |
| West Side of WTP | dB(A) Lea | **45.55** | 55 | 🟩 |
| South West Side | | **42.25** | | 🟩 |
| East Side | | **46.45** | | 🟩 |
| Existing WTP site (Reading time 9:00 AM) | | **49.40** | | 🟩 |

🟥 **Exceedance from applicable guidelines**

🟩 **'Within' applicable guidelines**.

**Table 4.7: Comparison of ambient air quality results versus applicable Air Quality standards**

| Monitoring Location | Parameter | NO (up/m$^3$) | NO$_2$ (up/m$^3$) | CO (mg/m$^3$) | SO$_2$ (up/m$^3$) | PM$_{2.5}$ (up/m$^3$) | PM$_{10}$ (up/m$^3$) |
|---|---|---|---|---|---|---|---|
| **Applicable Guideline (up/m$^3$) for 24 hrs.** | **Average** | **-** | **80** | **05** | **20** | **25** | **50** |
| West Side of WTP | - | 10.61 | 13.41 | 0.72 | 12.16 | 18.75. | 83.38 |
| South West Side | - | 10.84 | 13.69 | 0.77 | 12.67 | 17.93 | 77.08 |
| East Side | - | 11.23 | 13.45 | 0.79 | 11.91 | 19.63 | 79.36 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Existing WTP site | - | 12.1 | 15.36 | 0.88 | 14.43 | 18.33 | 81.40 |

🟥 **Exceedance from applicable guidelines**
🟩 **'Within' applicable guidelines**

## 4.2 Ecological Environment

257. In order to identify ecological resources, ecological baseline survey was carried out by EDCM team. Detailed surveys were conducted for project scoping during July 2020. The proposed WTP located on bare land with some trees and used as pasture. Therefore, no threat to ecological Environment has been envisaged. No excessive tree cuttings have been proposed only 10-15 trees need to be clear for the construction of WTP.

### 4.2.1 Biological Environment

258. Three major habitat types have been identified in Abbottabad district:

- Subtropical broad-leaved zone, confined to sheltered ravines, which carries 40 species of trees, shrubs and woody climbers;
- Subtropical chir pine zone, where chir is the dominant vegetation but a sprinkling of other associated plant species is also found; and
- Moist temperate zone, covering 26% of the district, which is an important biotope for wildlife and supports coniferous forests with patches of broad-leaved species.

### 4.2.2 Protected areas/Critical Habitats

259. Two protected areas, the Ayubia National Park and the Qalandarabad game reserve, have been designated by KP wildlife department with in Abbottabad District. Both protected areas are far away from proposed WTP location. The closest is Ayubia National Park which is located at approximately 15 Kms from proposed WTP area.

260. Integrated Biodiversity Assessment Tool (IBAT) screening was carried out for other KPCIP sub-project which is Dhamtore landfill site located at a distance of 2 Km from WTP site to identify the biodiversity features and species that are located within the following buffers: 1 km, 5 km and 10 km. Result of IBAT screening shows that there were no protected and/or key biodiversity areas found within 10 km buffer from the WTP site. There are 29 threatened species that are potentially found within 50 km from area of interest, which include 18 avian species, 06 mammalian, 04 Actinopterygii and 01 Magnoliopsida. As the impacts associated with WTP are localized therefore, no impacts on biodervsity is envisaged.

### 4.2.3 Flora

261. There are some species such as trees, grasses and shrubs are found near the project area. Good quality fodder grasses are also found at the moist places, where the incidence of grazing is less. List of flora observed in project area are listed below in **Table 4.8**.

**Table 4.8: List of Flora observed in Project Area**[10]

| Scientific Name | | Common Name | IUCN Status |
|---|---|---|---|
| Tree | Acacia Modesta | Phulai | Data Deficient (DD) |
| | Acacia nilotica | Kikar | Least Concern (LC) |
| | Dodonaea Viscosa | Broad leaf hopbush | Least Concern (LC) |
| | Melia azedarach | Bakain | Least Concern (LC) |
| | Morus alba | Mulberry | Least Concern (LC) |
| | Lagerstroemia regina | Taman | Data Deficient (DD) |
| | Bambusa arundinacea | Bamboo | Data Deficient (DD) |
| | Zizyphus jujuba | Ber | Data Deficient (DD) |
| Shrub | Adhatoda Vesica | Bhaikar | Data Deficient (DD) |
| | Ricinus Communis | Arind | Data Deficient (DD) |
| | Calotropis procera | Ak | Data Deficient (DD) |
| Herb | Chenopodium botrys | Bathu | Data Deficient (DD) |
| | Gymnosporia royleana | Pataki | Data Deficient (DD) |
| Grass | Cynodon dactylon | Khabbal | Data Deficient (DD) |
| | Cymbopogan jawarnica | Khawi | Data Deficient (DD) |
| | Desmostachya bipinnata | Dab | Least Concern (LC) |
| | Saccharum munja | Kana | Data Deficient (DD) |
| | Dicanthium annulatum | Murka | Data Deficient (DD) |

### 4.2.4 Fauna

262. The project area, on account of nature of vegetation and topography, once rich in vegetation and wildlife has now reduced its potential due to over hunting, loss of proper habitat, conversion of forest land into bare land. Fauna of the tract consists of mammals, reptiles, amphibians and bird.

***Mammals***

263. Important mammal species found in the vicinity of the project area are mentioned below in the table with their respective IUCN status in the Red List.

---

[10] Data collected by EDCM eology team team during  field survey

**Table 4.9: List of Mammals observed in Project Area[11]**

| Scientific Name | | Common Name | IUCN Status |
|---|---|---|---|
| Mammals | Vulpes | Red Fox | Least Concern (LC) |
| | Canis Aureus | Golden Jackal | Least Concern (LC) |
| | Hystrix Indica | Indian Crested Porcupine | Least Concern (LC) |
| | Sus Scrofa | Wild Boar | Least Concern (LC) |
| | Funambulus pennanti | Squirrel | Least Concern (LC) |
| | Mus musculus | Mouse | Least Concern (LC) |

***Reptiles***

264. Reptiles reported in the project area and its vicinity are given in **Table 4.10**. Other varieties of snakes reported in the project area are Rat Eaters, Sang Choor and a snake locally called as Phissi.

**Table 4.10: List of Reptiles observed in Project Area**

| Sr.No. | Common Name | Scientific Name |
|---|---|---|
| 1 | Cobra | Najanaja |
| 2 | Indian Krait | Bungaruscaerueus |
| 3 | Spiny Tailed Lizard | Uromastixhardwickii |
| 4 | Fringed Toed Lizard | Acanthodactylus cantoris |
| 5 | Brown Turtle | Kachugasmithii |
| 6 | Indian Monitor | Varanusbengalensis |

***Amphibians***

265. Amphibians found in the project area are given in **Table 4.11.**

**Table 4.11: List of Amphibians observed in Project Area**

| Sr.No. | Common Name | Scientific Name |
|---|---|---|
| 1 | Frog | Ranatigrina |
| 2 | Common Toad | Bufobufo |

***Birds***

266. Avifauna of the project consists of small and medium sized birds of different colors, flying from one tree to the other or from crop to crop. Most common birds are House Sparrow, House Crow and Mynah. Birds like Cuckoo, Bulbul, Hoopoe, Parrots, Blue

---

[11] Source: EDCM Ecology Survey, July 2020

Birds, and Little Egrets etc. were frequently sighted. **Table 4.12** shows list of birds listed noticed or reported in the project area.

**Table 4.12: List of Birds observed in Project Area[12]**

| Sr.No. | Common Name | Scientific Name |
|---|---|---|
| 1 | House Sparrow | Passer domesticus |
| 2 | House Crow | Corvussplendons |
| 3 | Mynah | Acridotherisginginianus |
| 4 | Parrot | Psittaculakrameri |
| 5 | Pigeon | Columba livia |
| 6 | Koel | Eudynamysscolopacea |
| 7 | Red Vented Bulbul | Pycnontuscafer |
| 8 | Common Teal | Anascrecca |
| 9 | Little Egret | Egrettagarzetta |
| 10 | Ruddy Shedluck | Tadornaferruginea |
| 11 | Mallard | Anus plantyrhynchos |
| 12 | Hoopoe | Upupaepops |
| 13 | Indian Robin | Coraceusbengalensis |
| 14 | Grey Partridges | Francolinuspondicerianus |
| 15 | Black Partridges | Francolinusfrancolinus |
| 16 | Falcon | Falco perginus |
| 17 | Shikra | Accipeterbadius |
| 18 | Tillor | Houbara bustard |
| 19 | Eagle | Aquillarapax |
| 20 | JalKookri | Fulicaatra |
| 21 | Fakhta | Streotopelladecaocto |

### 4.2.5 Aquatic Life of the Projec region

267. Dor River is flowing in the eastern side of proposed location. Major species of fish found in Dor River is Indian carps, such as Rah (Labeorohita), Thela (Catlacatla), Mori (Cirrhinusmrigala) and Singhari (Aorichthysaor). However population of fisheries is countinoualsy decreasing due to increased water pollution and reduce environmental flows[13].

268. Both Jandar Bari and Phalkot streams falls into Dor river. Water colums in both streams and even in Dor river are much less. Both streams and Dor river has a shorter and more rapid course Due to low water cloumn and rapid flows from Jandar Bari and Phalkot streams, no significant aquatic ecology is sustaining. Few fish species are present in Dor river however in intake streams no significant aquatic ecology is present.

---

[12] EIA of Hasanabdal – Havelian Section of E-35 Project.

[13] EIA of Hasanabdal – Havelian Section of E-35 Project

### 4.2.6 Endangered Species of the Project Region

269. An estimated 1,300 plant varieties are found in Abbottabad district. In addition, the area is home to 18 mammal species, seven of which are endangered: the common leopard, common red fox, Himalayan palm civet, jungle cat, Murree vole, musk deer and woolly flying squirrel. Project area has been converted into bare land and it is no longer habitat of such species therefore no impact of project activities on endangered species is envisaged.

### 4.2.7 Tree Cutting

270. The proposed WTP located on bare land with few trees. The proposed WTP location is adjacent to existing JICA WTP and only 3.25 Acers of land shall be utilized for construction of WTP. Therefore, no threat to ecological environment has been envisaged. The route of transmission main and supply network is within TMA RoW of existing roads. No excessive tree cuttings have been proposed only 15 pine trees need to be removed for the construction of WTP.

## 4.3 Socio-economic Environment

271. 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.

272. To assess the socioeconomic conditions of the project area, consultations are being carried out with participants including male and female. Households (HH) has been studied during field survey based on individual interviews as well as focus group discussions/ public consultations. Consultation participant include project affected people and community residing along the route of WTP. 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 has been consulted.

273. Detailed surveys were conducted for project scoping during the month of May 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 study area or the project 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 corridor is to cover those areas that have a potential to be affected by the project activities.

274. The names of the major settlements falling within the close vicinity of project area are Malik pura, Degi Muhalla, Bandko, khal, choona village, Jalal baba. Photographs depicting socio-economic conditions in the project area are provided in **Figure 4-12.** Socio-economic map of the project area is presented as **Figure 4-13**.

### 4.3.1 Administrative Setup

275. The project is located in Abbottabad city, situated in the south east of Khyber Pakhtunkhwa Province. The proposed water treatment plant is located at Choona Hill adjacent to existing JICA funded while the intake for raw water located at Phalkot and

Jandal Bari streams. The proposed water supply network shall be developed in UC-Urban City, Kehal, Nawansher and Malikpura.

276. The decentralization of lower-tier governance, a process set in motion following the promulgation of the NWFP Local Government Ordinance 2001, has created new administrative structures in the province. At the district level, a three-tier local government system has been put in place, consisting of the following levels:

i. District government,
ii. Town municipal administration (TMA), and
iii. Union Council administration.

277. There are only two tehsils in the district Abbottabad i.e. Abbottabad tehsil and Haveliaan tehsil. District administration is headed by the Deputy Commissioner (DC), who is assisted by Assistant Commissioner (AC), Tehsil Mayor and 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.

### 4.3.2 Demography and Population

278. The population of Abbottabad district in 1998 was 881,000. The city's annual growth rate is estimated at 3.99% per year, and the population of Abbottabad district is 1,332,912 according to the 2017 census, Abbottabad is the 40th-largest city of Pakistan.

| Districts | Headquarters | Area (km²) | Population (2017) | Density (people/km²) |
|---|---|---|---|---|
| Abbottabad | Abbottabad | 1,967 | 1,332,912 | 680 |

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

### 4.3.3 Religion

279. Almost whole population of the project area is Muslim. Cultural festivals are mostly linked with traditional religious events. Only 1% minorities were identified during field visit.

### 4.3.4 Archaeological and Cultural Site

280. No archaeological and cultural site was observed in close proximity of Abbottabad WTP site and distribution network. However, if any archaeological antiquity discovered Archeological Chance Find procedure shall be adopted. Archeological Chance Find procedure has been attached as **Annexure G.**

### 4.3.5 Ethnicity in the Project Area

281. During Social Due Diligence (SDD) for extension of JICA WTP and GWSS 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 200. None of these castes may be considered as indigenous people (IP) based on ADB SPS definition.

### 4.3.6 Language and Dialects

282. The major language of the area is Hindko, which in the 1981 census was the mother tongue of 95% of households. The variety spoken in the city of Abbottabad has formed the basis of a literary language. It is very close to the Hindko varieties of Mansehra: the two share 86% of their basic vocabulary. In the project area of the district, the language is still known as Hindko but becomes more distinct and gradually transitions into the dialects of Pahari. Other languages are overall more common in urban areas: in the 1998 census, 2.3% of the population reported their language as Punjabi (rising to 10.8% in urban areas), while the share of Pashto was 2.2% (8.4% in urban areas) and that of Urdu – 1.1% (5.1% in urban areas).[14]

### 4.3.7 Dwellings

283. 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 most population is living in semi-pacca and pacca houses.

### 4.3.8 Economics of Abbottabad

284. Abbottabad is blessed with many natural resources. It is especially famous for the production of agricultural products, mining, tourism, industries of various products, and dependence on natural resources. All these produce play an important role in economic uplift of the people of Abbottabad[15]. Majority of the people of Abbottabad are directly or indirectly depends on agricultural, mining, tourism, Government/private jobs in educational/government institutions for their income**.**

### 4.3.9 Education Facilities in Project area

285. Abbottabad has a very encouraging literacy rate approximately 56% on an average. The city has a young demographic (ages 15–30) due to the large number of students who have come from across the country to study in its schools, for example PIPS, Army Burn Hall College, Army Public College Kakul and Abbottabad Public School.

286. The Abbottabad city has also wide variety of post-secondary institutions, such as Ayub Medical College, Frontier Medical College, COMSATS University of Science and Technology, and the University of Engineering & Technology Abbottabad Campus.

### 4.3.10 Social Amenities in the project area

287. During the field survey, the access/ availability of the social amenities/ basic infrastructure 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 Abbottabad city.

### 4.3.11 Major Source of Drinking Water

288. Currently, there are two main source of water supply in Abbottabad. The major source is ground water source based on tube wells while the second source is the existing surface water-based water treatment plant (JICA). The approximate discharge of the existing and operational 14 tube wells is 1,120,000 gallons per day and average water

---

[14] *1998 District census report of Abbottabad*. Census publication. Islamabad: Population Census Organization, Statistics Division, Government of Pakistan. 1999

[15] https://smeda.org/index.php?option=com_content&view=article&id=103:abbottabad&catid=47&Itemid=258

supply from existing JICA water treatment plant is approx. 1,460,766 gallons per day, which gives a total supply of 2,580,766 gallons per day. At present, there is net shortfall of 2,669,234 gallons per day in Abbottabad.

## 4.4 Findings of Social Due Diligence

289. 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.

290. 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 IR and IPs screening and categorization, the proposed sub-project falls in category C.

291. 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.

292. Details of findings of Due Diligence Work for Extension of JICA water treatment plant and water supply network has been summarized in **Table 4-13**

.

## Table 4.13: Due Diligence Work for Extension of JICA water treatment plant and water supply network

| S# | City | Project | IR/IP Category | Remarks |
|---|---|---|---|---|
| 1 | Abbottabad | New surface water treatment plan (WTP) and intake structure Chuna water | C | **Screening result:**<br>a) This activity involves upgradation of existing water supply scheme funded by JICA. Land measuring 9.75 acres owned by several landowners (exact number of landowners is unknown) land was acquired by PHED in 2011 through Section 17/4/6 (urgency procedure of Land Acquisition Act 1894 (LAA). The project is owned by PHED. The construction will be done in 3.25 acres of land.<br>b) A compensation amount of total PKR 36,6301.51 (for entire land 9.75 acres) was allocated however landowners refused to accept compensation due to low land price.<br>c) PMU KPCIP is in process of negotiations with the community with respect to compensations.<br>d) The subproject does not seem to have any impacts to any private structures whether residential, commercial or pubic. The water supply was constructed in 2015 by JICA in an area of 6.5 acres (from the total 9.75 acres) and needs upgradation in an area of 3.25 acres under KPCIP.<br>e) Landowners and general public in the project area do not recognize themselves as indigenous peoples as described in SPS 2009.<br>**IR/IP categorization:** The proposed extension work is categorized as IR/IP category C, a corrective action plan needs to be prepared in consultation with landowners to resolve the disputes and compensate all landowners before start of extension work. **Potential risks**: In view of land litigation and disputed compensation, this subproject has a potential risk of complaints to ADB if not resolved before its implementation under the proposed KPCIP project. |

| | | | | |
|---|---|---|---|---|
| 2 | Abbottabad | a) Rehabilitation and upgradation of water supply system connected to WTP<br>b) Rehabilitation or provision of water storage reservoirs<br>c) New distribution network and water metering system | C | **Screening result:**<br>a) Replacement of water supply pipeline in approximately 190 km of city area with right-of-way owned by TMA<br>b) LAR impacts are not envisaged as ROW is government owned but encroachment selected areas especially in urban/commercial areas and presence of hawkers and vendors cannot be ruled out. Some impacts to hawkers and vendors maybe expected during the excavation and pipeline laying activities that may result in loss of business incomes.<br>**IR/IP categorization**:<br>c) Conditional to adoption of design-construction related design measures guarantying no impacts to any structures encroaching in ROW and vendors and their businesses operating in ROW, the subproject may be categorized as C for both IR and IP at this stage. Those impacts are not assessed at this stage. However, a detailed due diligence or monitoring is required during the construction stage and in case of any impact, mitigation measures will be followed through the preparation and implementation of Resettlement Plan. The construction work will not be started in the particular section unless the Resettlement Plan is fully implemented and validated by an External Monitoring Consultant engaged with the approval of ADB.<br>d) The WSSC Abbottabad has shared the details for 16 no's of proposed surface tanks for which private land will be acquired (the exact area is yet unknown), they are in the process of negotiation with land owners, once conclude social safeguard team will re-access the LAR impacts. |

**Figure 4-12: Photographs depicting Socio-economic Conditions of the project area**

| | |
|---|---|
|  |  |
| Takiya Chowk near WTP | Tube well near proposed WTP |
|  |  |
| Jamia Masjid in close proximity of WTP | GPS Choona |
|  |  |
| Tube well within 500 m form WTP | BHU Nawasher |

| | |
|---|---|
|  |  |
| Govt. JICA Model School | Dor Tributory Bridge |

## 4.5 Sensitive Receptor Mapping

293. The proposed WTP site location with the nearest receptors i.e. residential settlements in the form of clusters and individual settlements are shown in **Figure 4.13**. Socio-ecominc map of the project area is provided as **Figure 4.14.** The respective distances of these sensitive receptors from the proposed site are provided in **Table 4.14** below.

294. 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. At the western side scattered settlements of Choona village is located at around 264 meters from WTP location while on the eastern and southern side few settlements of Takia camp village is located which is around 234 meters from proposed WTP location.

Figure 4-13: Closest Receptors from WTP

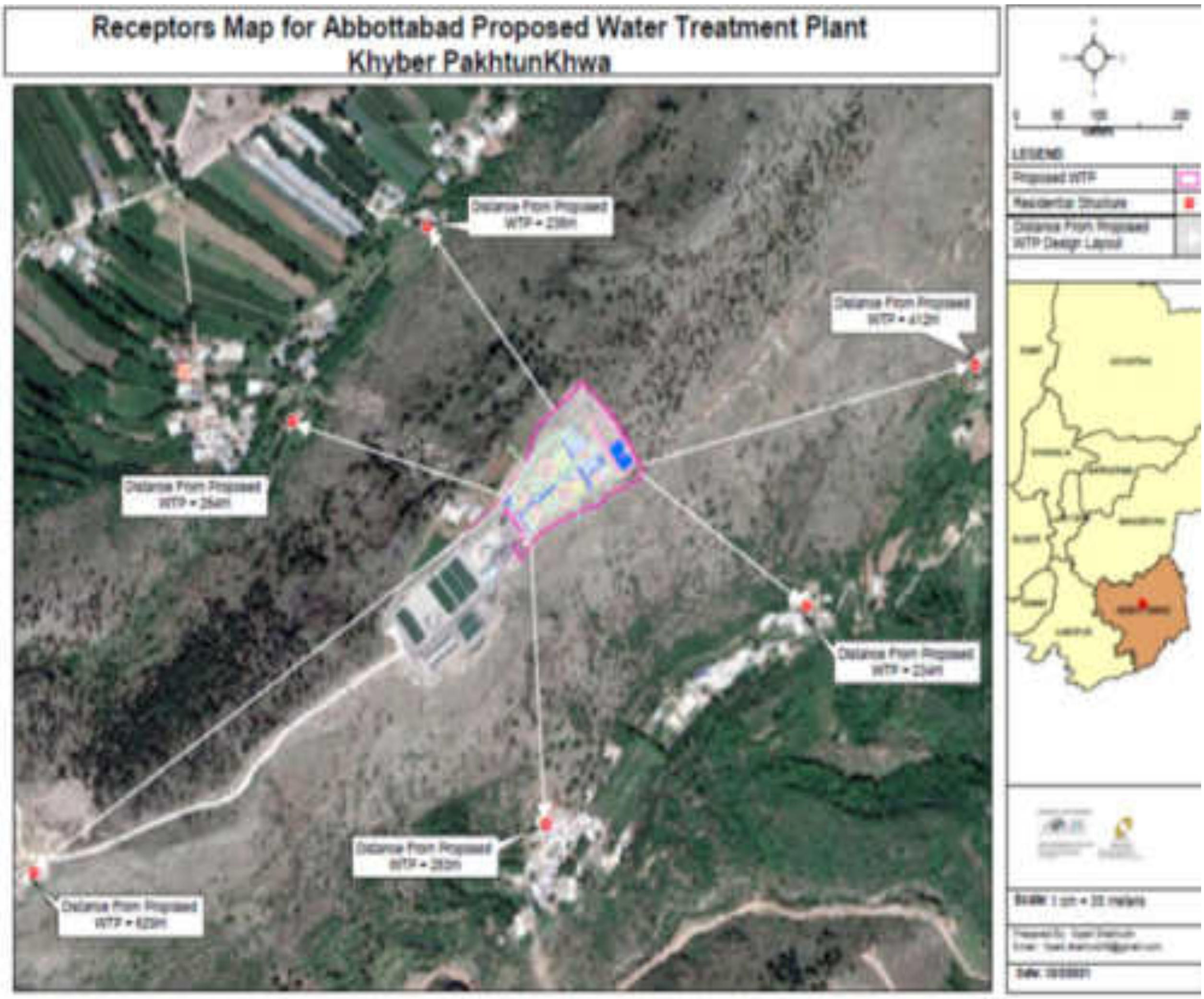
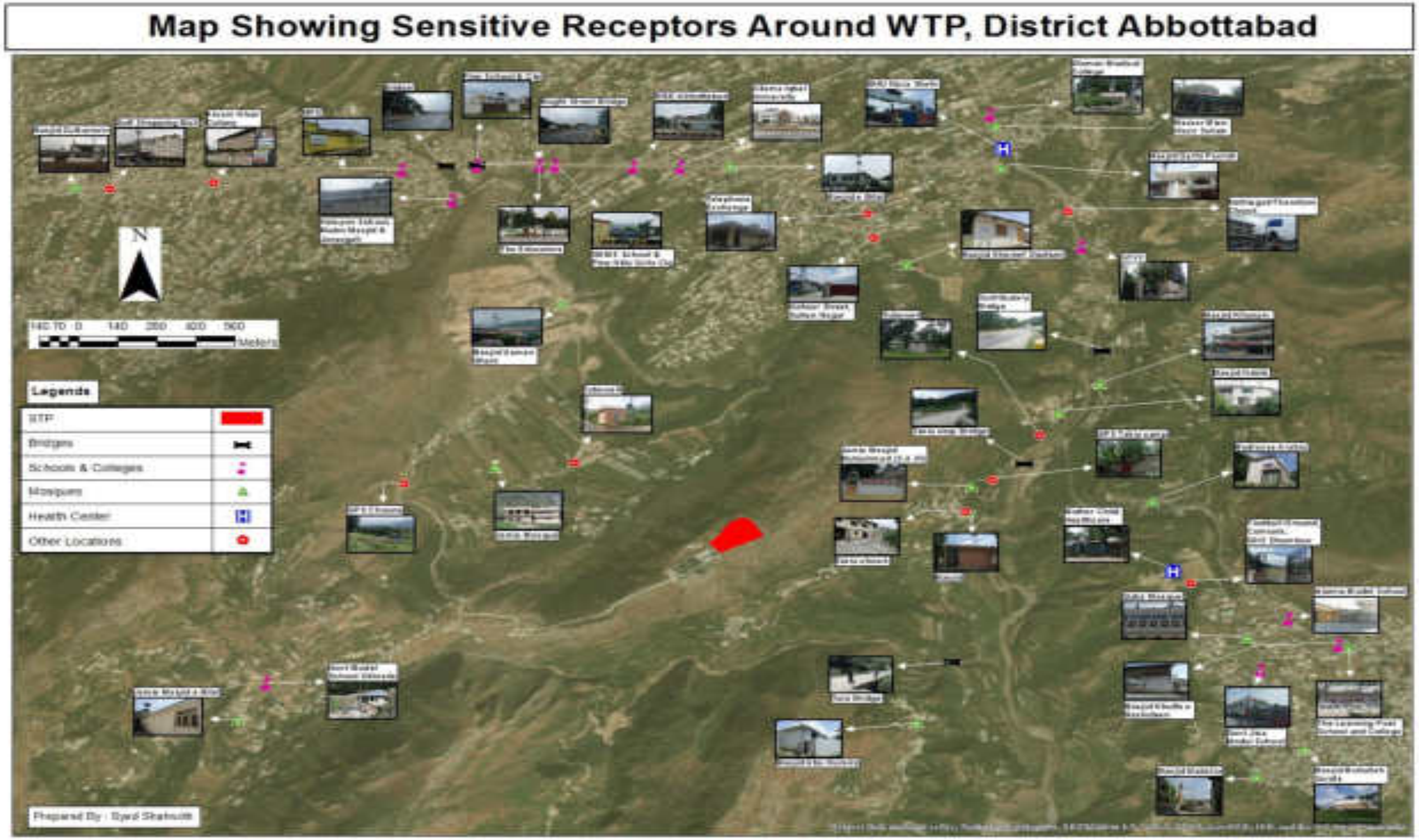


Figure 4-14: Socio-economic Map of Project Area



### Table 4.14: Nearest Receptors and Prominent Structures within radius of 2 km from the proposed WTP Site

| Sr No | Pictorial View | Site Coordinates | Distance from Site (meters) | Description |
|---|---|---|---|---|
| 1. |  | X: 73.23419<br>Y: 34.15708 | 2420 | Masjid Zulkarnain |
| 2. |  | X: 73.23530<br>Y:34.15706 | 2338 | Gulf Shopping Mall |
| 3. |  | X: 73.23865<br>Y:34.15729 | 2104 | Akram Khan Colony (GGHS & Perfect Schooling System) |
| 4. |  | X:73.24471<br>Y:34.15780 | 1791 | Rise Pakistan School |
| 5. |  | X: 73.24613<br>Y:34.15795 | 1723 | Bridge |
| 6. |  | X: 73.24713<br>Y:34.15798 | 1592 | Pine Hills Public School & College, The Grow Montessori School |
| 7. |  | X: 73.24713<br>Y:34.15798 | 1690 | Bridge on Mughal Street |
| 8. |  | X: 73.24916<br>Y:34.15798 | 1598 | The Educators |

| Sr No | Pictorial View | Site Coordinates | Distance from Site (meters) | Description |
|---|---|---|---|---|
| 9. |  | X: 73.24966<br>Y:34.15796 | 1622 | GEMS School & Pine Hills Girls College |
| 10. |  | X: 73.25216<br>Y:34.157911 | 1521 | BISE Abbottabad |
| 11. |  | X:73.25370<br>Y:34.15791 | 1495 | Allama Iqbal Open University, Abbottabad |
| 12. |  | X: 73.25530<br>Y:34.15792 | 1490 | Masjid Bilal |
| 13. |  | X: 73.26403<br>Y:34.15786 | 1686 | Masjid Garhi Panrah |
| 14. |  | X: 73.26617<br>Y:34.15618 | 1624 | Nathiagali/Thandiani Chowk & First Frontier NS Campus |
| 15. |  | X: 73.26659<br>Y:34.15483 | 1530 | Govt Technical Vocation Centre |
| 16. |  | X: 73.26729<br>Y:34.15080 | 1280 | Dor tributary Bridge |

| Sr No | Pictorial View | Site Coordinates | Distance from Site (meters) | Description |
|---|---|---|---|---|
| 17. |  | X: 73.26723<br>Y:34.14949 | 1205 | Masjid Khanam / Forks Knives Restaurant |
| 18. |  | X: 73.26588<br>Y:34.14838 | 1030 | Masjid Habib and residential neighborhood |
| 19. |  | X: 73.26525<br>Y:34.14753 | 925 | Tube well |
| 20. |  | X: 73.26408<br>Y:34.15858 | 1760 | BHU Nava Shehr |
| 21. |  | X: 73.26367<br>Y:34.15994 | 1890 | Women Medical College |
| 22. |  | X: 73.26385<br>Y:34.15945 | 1833 | Mazaar Mian Wazir Sahab |
| 23. |  | X: 73.24635<br>Y:34.15661 | 1595 | Halcyon School & Madni Masjid/Janazgah |
| 24. |  | X: 73.24986<br>Y:34.15257 | 1050 | Masjid Usman Ghani |

| Sr No | Pictorial View | Site Coordinates | Distance from Site (meters) | Description |
|---|---|---|---|---|
| 25. |  | X: 73.25027<br>Y:34.14650 | 520 | Tube well |
| 26. |  | X: 73.24774<br>Y:34.14627 | 690 | Jamia Mosque |
| 27. |  | X: 73.24477<br>Y:34.14567 | 930 | GPS Choona |
| 28. |  | X: 73.24034<br>Y: 34.13797 | 1410 | Govt Model School Ukhraila |
| 29. |  | X: 73.23943<br>Y:34.13653 | 1555 | Jamia Masjid Bilal |
| 30. |  | X: 73.25970<br>Y:34.15608 | 1345 | Telephone Exchange |
| 31. |  | X: 73.25991<br>Y:34.15514 | 1272 | Kohsar Street, Sultan Nagar |
| 32. |  | X: 73.26098<br>Y:34.15411 | 1180 | Masjid Sharif & Stadium |

| Sr No | Pictorial View | Site Coordinates | Distance from Site (meters) | Description |
|---|---|---|---|---|
| 33. |  | X: 73.26477<br>Y: 34.14644 | 825 | Takia stop Bridge |
| 34. |  | X: 73.26374<br>Y: 34.14580 | 735 | GPS Takia camp |
| 35. |  | X: 73.26305<br>Y: 34.14554 | 660 | Jamia Masjid Muhammad (S.A.W) |
| 36. |  | X: 73.26290<br>Y: 34.14453 | 625 | Masjid |
| 37. |  | X: 73.26287<br>Y: 34.14457 | 620 | Takia chowk |
| 38. |  | X: 73.26890<br>Y: 34.14496 | 1170 | Madrassar Arabia (Abdullah bin Abaas & Fatima Zahra) |
| 39. |  | X: 73.26241<br>Y: 34.13877 | 790 | Tura Bridge |
| 40. |  | X: 73.26130<br>Y: 34.13642 | 915 | Masjid Abu Huraira |

| Sr No | Pictorial View | Site Coordinates | Distance from Site (meters) | Description |
|---|---|---|---|---|
| 41. |  | X: 73.26027<br>Y: 34.12870 | 1680 | Masjid |
| 42. |  | X: 73.27011<br>Y: 34.14184 | 1280 | Football Ground, COMSATS, GHS Dhamtour |
| 43. |  | X: 73.26957<br>Y: 34.14228 | 1220 | Mother Child Healthcare |
| 44. |  | X: 73.27196<br>Y: 34.13970 | 1510 | Quba Mosque |
| 45. |  | X: 73.27237<br>Y: 34.13846 | 1590 | Govt Jica Model School |
| 46. |  | X: 73.27329<br>Y: 34.14045 | 1610 | Islamia Model School |
| 47. |  | X: 73.27489<br>Y: 34.13947 | 1780 | The Learning Post School and College |
| 48. |  | X: 73.27521<br>Y: 34.13932 | 1825 | Masjid Khulfa e Rashideen |

| Sr No | Pictorial View | Site Coordinates | Distance from Site (meters) | Description |
|---|---|---|---|---|
| 49. |  | X: 73.27227<br>Y: 34.13432 | 1813 | Masjid Badalza |
| 50. |  | X: 73.27381<br>Y: 34.13539 | 1856 | Masjid Muhallah Sarafa |

# 5 Analysis of Alternatives

## 5.1 Overview

295. Project alternatives are studied as a part of this IEE process. Alternatives analysis has been conducted in detail to foresee environmental, economic and social impact of each alternative. This chapter also provides an overview of the various commercially available technologies for the water treatment in an environmentally sound manner and are successfully running in developed countries in particular and recommend the most suitable set of options for Abbottabad city.

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

297. The development of the proposed water treatment and 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.

298. This process of analysis of the different alternatives for development/extension of the water treatment plant 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

299. If 'no project' option is triggered, it will result in loss of all positive impacts that project will pose on Abbottabad city; such as improved treated potable water availability to citizens of Abbottabad for next thirty years, the project will reduce abstraction of ground water from tube wells and water bores resulting in sustainable water use. Project will reduce water borne disease and ultimately reduced pressure on health care system of city.

300. 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

301. 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 Abbottabad 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.

302. Two key components of this particular analysis are:

a) Site Selection and

b) Technology Selection

303. 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

304. There are many different, often inter-related, criteria that go into the selection of an appropriate site for a water treatment plant. These may be based on any number of technical, environmental, geological-hydrogeological, operational, economic, social and political factors. The site analysis of the treatment plant in question will attempt to integrate the major factors into a few relevant categories that effectively describe the process and provide some justification to the selection.

***Environmental Sensitivity (Climate, Nature Conservation)***

- Pollution of ambient environment and ground water is one concern.
- Wind and rain are common climatic factors influencing site selection. For high rainfall areas, effective storm water diversion is essential to minimize interference with plant operations.
- Locations with higher potential for nature conservation or agriculture should not be considered, e.g., wetlands etc.

***Infrastructure***

- 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***

- Identified site should have enough capacity.
- Site topography and ground features should be conducive to plant operations.

***Land Acquisition, Cost***

- Each location has its monetary value, and certain due processes for its acquisition.
- Existing and possible future developments, residential etc., adjacent to the site should be considered.

***Social Acceptability***

- The location identified should be accepted socially.

### 5.4.1 Site alternatives

305. The Abbottabad Water Treatment Plant is an extension to the existing JICA-funded treatment plant already in operation. This project aims to increase the supply of water to the city from 200 liters per second to 500 liters per second by establishing additional treatment facilities at the same site where land had also been previously earmarked for this very purpose. Keeping in view the exsiting WTP site suitability, operations of the existing plant and the availability of land, analysis of no additional alternative sites were made.

306. The analysis for site alternatives was carried out for surface water intakes. Out of four possible locations, two sites have been selected. Two different sources will be tapped to get the required flow of 300 l/s. The first intake structure at Phalkot has already been constructed by PHED having capacity of 100 l/s and the same will be used for this priority project by designing and constructing the additional transmission main. However, for the second source i.e. Jandar Bari, an intake structure will be designed and constructed for a capacity of 200 l/s. at Jandar-Bari and Phalkot.

## 5.5 Technology Selection

307. 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 criteria are 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 odor 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.

### 5.5.1 Available Technologies for Treatment System

308. 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).

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

***Conventional Water Treatment***

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

311. 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 cation ($Al^{+3}$, 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 5-1: Typical process train for surface water treatment by conventional treatment**

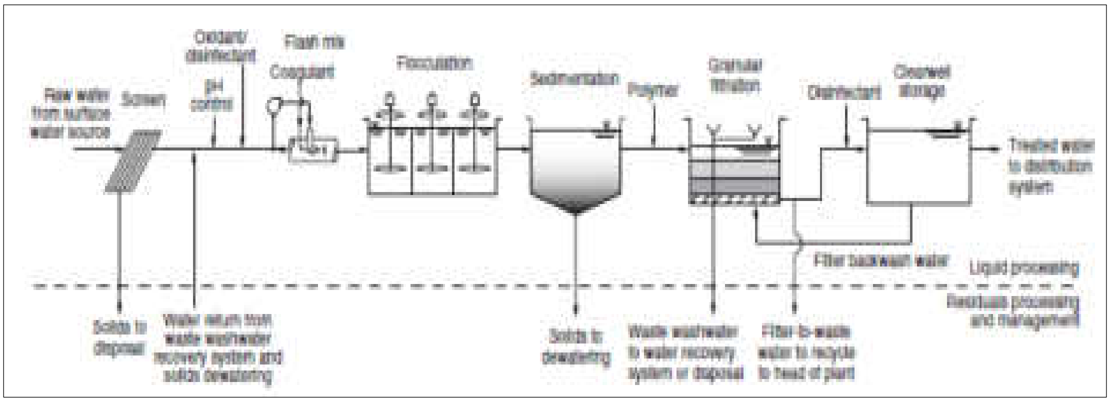


**Table 5.1: Merits and Demerits of conventional treatment**

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

### *Membrane Filtration*

312. 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 5-2: Typical process train for surface water treatment Membrane Filtration**

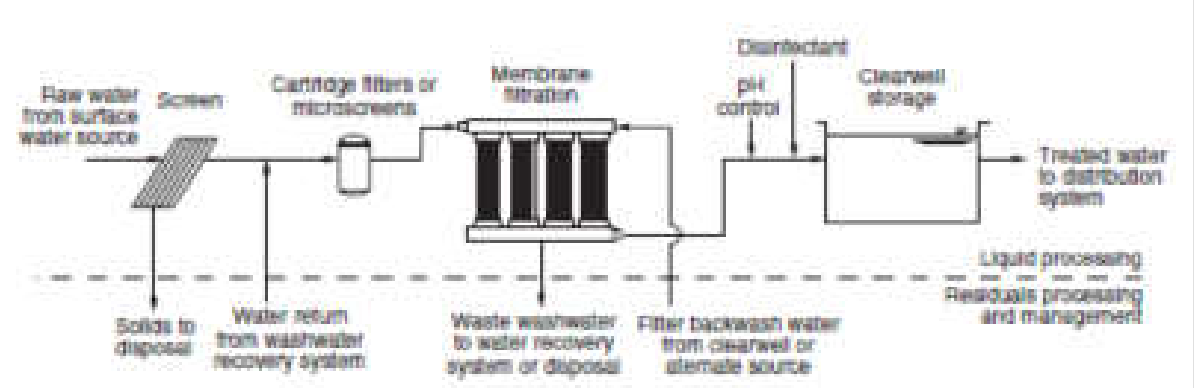


**Table 5.2: Merits and Demerits of Membrane Filtration**

| 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;<br>The membrane system can produce low turbidity water, generally less than 0.1 NTU;<br>There are no turbidity variations or particle break through, as long as there are no breaks in the membrane or seals; | 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;<br>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; |
| 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 | 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; |
| Since in the membrane system, coagulants are rarely used, its residuals are less | A lower temperature requires higher operating pressure to maintain same filtered water flow rate. Thus an understanding of the |

| Merits | Demerits |
|---|---|
| problematic than the residuals of Conventional Water Treatment. | automatic control system is necessary for the operators;<br>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;<br>The UF membrane system does not remove heavy metals, if present in raw water;<br>Pre-treatment with coagulation and settling will be required for the removal of high turbidity and total organic carbon; and<br>Its removal efficiency of Total Organic Carbon (TOC) without coagulation is very less. |

313. 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.

314. 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.

### 5.5.2 Available Technologies for Filtration

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

a) Slow sand filtration

b) Rapid gravity (sand) filtration.

316. 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 $m^3/m^2$/day. Further comparison of these two is given in the table below.

**Table 5.3: 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 |
|  | 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. |
| 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 |

317. The merits and demerits in the Table 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 supply bulk water to their residents. Based on the comparative analysis, rapid sand filters have been selected as the preferred technology for this project

## 5.6 Conclusion & Environment Perspective of Alternatives

318. 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 Filteration 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.

.

# 6 Potential Environmental Impacts and Mitigation Measures

319. Potential impacts arising from design, construction and operation phase of extension of JICA WTP and Gravity water supply scheme 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 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.

320. The impact assessment of proposed extension of JICA WTP and Gravity 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 extension of JICA water treatment plant and gravity water supply scheme to determine the scope of the IEE'.

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

## 6.1 Methodology for impact screening

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

323. 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** |  |  |  |
|---|---|---|---|---|---|
|  |  | 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

324. 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*

325. 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 |

🟥 Critical Risk Level

🟨 Significant Risk Level

🟧

🟦

Medium Risk Level

Low Risk Level

### 6.2.1 Improper selection of intake source and reduce ecological flows

***Impacts***

326. 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 have deprived 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.

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

328. Four locations for intake/ source water were initially identified as potential sources for this surface water extension project. However, after visiting the locations and further discussions, two of the four intake locations will be considered for this project keeping based on parameters like availability of water, quantity and quality of available water and related social issues. One of the selected source is located at Phalkot and the other at Jandar Bari.

329. 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.

330. The flow measurement for Jandar Bari Intake was 920 lit/sec while for Phalkot it was 450 lit/sec. Raw water Intake flow for proposed Jandar Bari stream is 200l/s while from Phalkot 100 l/s. Therefore, downstream water availability shall not be compromised and enough water will be flowing downstream in Dor River to maintain ecological flows. Moreover, the sources have enough water availability for uninterrupted water supply for WTP.

***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 both Phalkot and Jander Bari streams 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***

331. The possibility exists that in case the project is not designed in accordance with international standards and guidelines[16] for water and sanitation it could result in multiple potential impacts that could adversely affect the settlements of project area.

332. If water intake structures are not designed to minimize impacts on aquatic life e.g. higher intake velocity through intake screen may entrap aquatic life and fish

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

334. 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 Abbottabad city.

335. If Distribution mains and supply network is not designed properly it will increase chances of pipe bursting, leakages, reduce water delivery to particular residents resulting in social issues.

336. Treatment and disposal for sludge and waste water generated during operation of WTP may cause adverse impacts to settlements and ground water contamination.

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

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

***Mitigation Measures***

339. 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 WASA Lahore. Where required, international best practices were also considered in establishing the design criteria for the proposed water supply system and water treatment plant. Design criteria of proposed water supply system is summarized in Table 3.1.
- Limit maximum through-screen design intake velocity to limit entrance 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.
- Design water containment and diversion structures to allow unimpeded movement

---

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

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 capacity of 12,965 m3/day (150L/sec). 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.
- 1.2-meter cover has been 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 will be disposed of through implementation of EMP. WSSC Abbottabad will ensure that mechanism for residual management of sludge is in place at WTP site.
- 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*

340. 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.

341. The extension of JICA 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*

342. The following mitigation measures will be implemented:

- 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.

- 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
- Based on the hydraulic model of the proposed transmission main and supply mains, raw water from sources shall be conveyed under gravity.
- Water supply network design shall facilitate uninterrupted water supply through gravity system without technical constraints.
- Water storage reservoirs with elevation levels in the range of 1325 MSL will get uninterrupted water supply via a gravity system.
- While the remaining reservoirs, located at slightly higher elevation than 1325 MSL, will be fed through a pumping system. Only 7 water storage reservoir need pumping stations due to high elevation levels.

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

***Impacts***

343. 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***

344. 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.

345. 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.

346. 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***

347. Hauling of material can have significant impacts on the community, public safety, traffic congestion, air quality and lifespan of the Abbottabad city road ways.

### *Mitigation Measures*

348. The construction vehicles hauling materials along the Abbottabad 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*

349. 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.

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

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

### *Mitigation Measures*

352. PMU KPCIP shall review the contractor capacity with respect to safeguard management and contracts shall be awarded accordingly.

353. 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.

354. PMU KPCIP 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*

355. The duration of the construction activity for the extension of JICA WTP and GWSS 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*

356. 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.

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

358. 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*.**

359. 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. At the western side Choona village is located at around 1km from WTP location while on the north-eastern side Takia camp village is located which is around 800 meters from proposed WTP location. The distribution networks will be laid within TMA RoW which may create nuisance and disturbance. However, the activity shall be of short term, excavation of trenches, laying of pipeline and covering shall be done within 20-25 days of a certain section.

360. 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***

361. No mitigation measures are required.

### 6.2.9 Land Acquisition and Resettlement Impacts

***Impacts***

362. The proposed project involves the upgradation of the existing water treatment plant and reservoir on 3.25 acres of land. The land for proposed WTP and reservoir is already under possession of Public Health Engineering Department (PHED). Replacement/laying of water supply pipeline in approximately 190 km of city area with right-of-way owned by TMA. Sixteen (16) nos of proposed surface tanks for which private land will be acquired (the exact area is yet unknown), PMU is in the process of negotiation with land owners, once conclude social safeguard team will re-access the LAR impacts.

***Mitigation Measures***

363. The PMU KP LGERDD shall ensure the following:

- 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 acquiation for proposed16 surface tanks.
- PMU KPCIP 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*

364. Site is located outside of seismically active area as it falls in Zone 3. No fault lines or significantly fractured geologic structure is present that may allow unpredictable settlement/land sliding.

365. 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 KPCIP shall ensure the proposed infrastructure shall be designed keeping in view the seismic zone 3 building considerations.
- 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.
- Water supply network shall not be disrupted/impacted from urban flash flooding, potential seismic intervention and other climate hazards.
- On site waste storage 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.

### 6.2.11 Impacts due to Existing Utilities

#### *Impacts*

366. Proposed site of WTP is located within existing boundary of JICA WTP and there are no utilities expected to encounter during project works. The proposed WTP site is a rocky patch on top of the Choona hill with average elevation of 1343m from AMSL. The project site is currently an open area with few trees. While the intake structures located on stream bed with steep slope hills.

367. The route of transmission main and supply network is within TMA RoW along existing roads within Abbotabad city. TMA RoW along the roads are designated place for laying of water supply/transmission mains and sewerage convenyance networks therefore limited impact on exisiting utilities is expected.

#### *Mitigation Measures*

- The PMU KPCIP shall ensure the proposed infrastructure shall be designed keeping in view the minimum distrurbance to existing utilities.
- CSC will ensure that project contractors will perform condition assessments prior to excavation works for supply mains and networks and will inform CSC/WSSC Abbotabad about the presence of any exisiting utilities within RoW.

- In case if there is need of shifting of any utility, utility custodian department will be taken on board by WSSC Abbotabad for necessary approvals and informations.
- PMU KPCIP/WSSC Abbotabad will pay compensation to damage of utilities to utlity owners and will ensure that there will be no grieavances in this regard.

## 6.3 Construction Phase

### *Impact Screening Matrix*

368. 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 |

| 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) |
|---|---|---|---|---|---|
| 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 |
| 13 | Vegetation and Wildlife Loss | Unlikely | Moderate | Low | No residual Impact |
| 14 | Historical/Archaeological Sites | Unlikely | Moderate | Low | No residual Impact |
| 15 | Construction of Administeration 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***

369. If the proposed WTP, intake structures and water supply networks is not constructed in accordance with the finalized design and its corresponding design parameters, it could lead to a number of unanticipated impacts such as inadequate 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***

370. 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 KPCIP 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 water distribution networks and Transmission Mains

*Impacts*

371. Construction activity of water distribution network and transmission main will be conducted along the roads. 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 silty clays, poorly graded gravels with silt/limestone.

372. 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.

373. The pipeline 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.

374. Details of excavated soil from scarification of exisiting road pavement structures, excavation of earthen/rock material for extension of JICA 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 | 22155.73 | Disposal of the unsuitable material of Road pavement Structure at designated source |
| Excavation for water supply line | 280037.44 | Usable material will be used as backfill<br>Unsuitable material will disposed of at designated place |
| Back filling with suitable excated material | 140018.72 | Excavated material shall be utilized for back filling |
| Additional Material required for backfilling | 55830.61 | - |
| laying of local sand around water supply line | 74859.94 | Will be borrowed from local sources |

Source: EDCM Design Report, 2020

375. 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.

376. 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***

377. 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.

- 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 Abbotabad.
- 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 Impacts on surface water quality

***Impacts***

378. Construction activity of intake structure will be carried ou at run of stream. In order to construct designed intake structure, temorary diversion will be constructed to divert stream water. This diversion will facilitate the execution of civil works at Jandar Bari stream. Unattended stockpiling of excavated materials may interfere with drainage paths if not disposed off properly.

379. Poor solid waste management at intake construction site and waste dumping into streams by contractor staff may result in surface water quality degradation. The drainage of streams shall not be impeded by the works. The scale of the works does not warrant hydrological monitoring and any surface water quality depletion.

380. Soil erosion triggered by exposed soils on slopes is very unlikely to occur; therefore, no significant impact on surface water quality due to soild erosion is expected.

381. If labor camps are situated close to waterways, sanitary waste may cause surface water pollution. But the scattered nature of construction and short time may not require large scale labor camps. Construction of water distribution network and transmission main will be conducted along the roads therefore no impact on surface water quality is

envisaged.Construction works during rainy season particular during monsoon shall be avoided. Construction work during rainy season can trigger slip, fall hazards, solid waste management problems, poo quality construction works and interruptions in material supply.

***Mitigation Measures***

- PMU KPCIP will ensure that temporary diversion is provided before start of construction work at intake structure.
- PMU KPCIP will ensure that intake structure construction works shall be planned with a view that monsoon and winter rainfall season is avoided.
- CSC will expedite the construction works at intake structure of streams as much as possible to complete the taks with minimum time duration.
- Constrcution debris shall not be disposed off in Jandar bari stream.
- No stockpiling of materials will be carried out at location of intake structure.
- No labor camp will be constructed at intake location. No solid waste will be diposed off in the streams.
- CSC will maintain good housekeeping during construction works at Intake structures.
- No slopes/excavations at the location of intake structure shall be left unattended.
- After construction of intake sturcutre all constrction material left shall be picked up and site shall be restored to its original condition following best practices.

### 6.3.4 Degradation of Ambient Air Quality

***Impacts***

382. The proposed extension of WTP will not involve large scale earth works and transporting and dumping large quantities of dry material. However, laying of water supply networks will involve excavation up to 2 meters in depth and 1 meter in width for trenching. This will likely lead to an increase in SPM (Suspended Particulate Matter) in and around the construction zones.

383. 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.

384. 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.

385. 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.

386. 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.

387. 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 $PM_{10}$ emissions from every activity on the construction site separately. Typical and worst-case $PM_{10}$ emissions from construction sites have been estimated[17] as 0.27 mega gram per hectare per month of activity (Mg/ha-month) and 1.04 Mg/ha-month, respectively.

### *Mitigation Measures*

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

- 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 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

---

[17] 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>

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 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).

### *Fugitive Dust Control*

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

**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.<br>Areas that cannot be stabilized, such as wind driven dust, must have an application of water at least twice a day |
| Inactive Disturbed | Apply dust suppressants (clear vegetation only from areas where work is to commence, plant or mulch areas that will not receive traffic, construct artificial |

| Source | Control Measures |
|---|---|
| Surface Areas | 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<br>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. |

***Vehicular & Equipment Emissions***

390. 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.

### 6.3.5 Increased Traffic and Community Health and Safety

Accessability

### *Impacts*

391. The laying of water supply distribution network will involve the use of considerable machinery within Abbottabad city along with posing the risk of community members falling into trenches excavated for replacement/laying of pipelines for water supply. 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.

392. Moreover, traffic congestion is also envisaged due to construction activity within city and also along Murree road. Traffic diversion may result in severe congestion, pollution, and a high rate of accidents during peak hours. Lane blocking incidents cause major disruption to traffic flow. Peak hour congestion with low average speeds may be a source of public nuisance. As transmission and supply network will be constructed within TMA RoW along road side therefore no major road closure is expected during construction works. Traffic diversion are expected during construction of supply network which will be managed through implementation of traffic management plan.

393. Traffic congestion and mobility issues are not envisaged from WTP construction activity as existing road i.e. choona road will be utilized for mobilization of material and equipment to the WTP location. The choona road is connected with Murree road.

394. Traffic Management Plan has been attached as **Annexure J.**

### *Mitigation Measures*

395. The following mitigation measures will be implemented:

- A comprehensive traffic management plan (TMP) must be developed and implemented;
- 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 Abbottabad city during laying of pipeline must be restricted to specific routes containing least number of sensitive receptors and low traffic volumes.
- 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. Contrators shall identify suitable places for material stock piling and parking of machinery.
- 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.
- 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 KPCIP 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.

### 6.3.6 Occupational Health and Safety (OHS)

***Impacts***

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

397. The major OHS hazards expected during the proposed activities are as follows:[18]

***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 asphyxiant gases released or from oxygen deficiency, during maintenance and cleaning operations;
- Burns caused by hot parts of equipment, steam lines etc., by release of hot water

---

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

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***

***General***

398. 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.

399. 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 Organisation 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.

400. 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:[19]

### *Mitigation Measures for Physical Hazards*

### *Rotating and Moving Equipment*

401. 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*

402. 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, shall 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.

403. 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*

404. 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

---

[19] 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*

405. 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*

406. 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*

407. 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*

408. 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*

409. 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*

410. 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 F**.

***Corrosive, oxidizing, and reactive chemicals***

411. 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***

412. 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.

### 6.3.7 High Noise Levels

***Impacts***

413. The proposed extension of JICA WTP and GWSS will result in different construction equipment and machinery i.e. jack hammer, cutter, excavator and haul trucks etc.

being used which will generate high noise levels at the project site and in the project area.

414. 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.

415. 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

416. 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 proposed extension of JICA WTP and GWSS works include equipment, machinery, and transportation used for the construction activities. The equipment used for construction will be the major source of noise.

417. 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.

418. 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.

419. 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.

420. 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 at 15 m | Typical 'Quieted Equipment' Sound Level 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 (Jack Hammer/ potable jack hammer)** | 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

421. 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.

422. Nearest sensitive receptors with respect to noise are the settlements of UC Nawanshahr, Urban City, Kemal, and Malappuram 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. concreate, 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.

423. The mitigation measures listed below shall be implemented to minimize noise levels during the construction activity as far as possible.

### *Mitigation Measures*

424. 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.
- 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).
- 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.

### 6.3.8 Hazardous and Non-Hazardous Waste Management

***Impacts***

425. During construction/civil works potential sources of waste will include spoils generated during excavation of trenches, excavation waste for other civil works including WTP infrastructure, domestic wastes (solid & wastewater), fuel or oil leakages or spills, onsite effluents from vehicle wash & cleaning, and cement spills.

426. 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.

427. Domestic wastes generated during construction of Abbottabad WTP will include sewage, grey water (from kitchen, laundry, and showers), kitchen wastes, combustible wastes and recyclable wastes from contractor camps.

***Mitigation measures***

428. 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 wastecollectionl and an onsite hazardous waste storage facility i.e. designated area with secondary containment.

429. Licensed waste contractors will be engaged to dispose off all non-hazardous waste material that cannot be recycled or reused.

- 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 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.
- The structure of a Framework waste management plan has been prepared for the project and attached as **Annexure N** 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

### 6.3.9 Camp & Batching Plant Effluent

***Impacts***

430. The staff and labor camps for the construction of the proposed extension of WTP and GWSS 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.

431. 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 and construction waste.

***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.

### 6.3.10 Soil Contamination

***Impacts***

432. 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.

433. 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.

### 6.3.11 Employment Conflicts

***Impacts***

434. The proposed extension of JICA WTP and GWSS is not 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 during construction. 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.

435. 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 KPCIP 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.

### 6.3.12 Communicable diseases incl. COVID-19

***Impacts***

436. Communicable diseases such as COVID-19 and HIV may be introduced due to the immigration of workers associated with the project.

437. Ministry of National Health Services, Regulations and Coordination, GoP has issued guidelines in April, 2020 for Health & Safety of Building and Construction Workers during COVID-19 outbreak. These guidelines are prepared for the workers involved in building and construction work during the current epidemic of COVID-19. 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.

***Mitigation measures***

438. A communicable diseases prevention program will be prepared for construction workers or residents near the construction sites.

***COVID-19 specific measures WHO***

- 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)[20].

- 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 biosafety and use of masks are provided as **Annexure L** and **Annexure M.**

- 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

---

[20] https://covid.gov.pk/guideline

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).
- COVID 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).

439. WHO advice on Use of Masks for the COVID-19 Virus has been attached as **Annexure M**.

***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 sanitizable dining surfaces shall be used,
- 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 a well ventilated area.

- 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 in a well ventilated area.
- 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 sanitizable dining surfaces shall be used.
- 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 shall 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 in a well ventilated area.

**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.

### 6.3.13 Vegetation and Wildlife Loss

***Impacts***

440. The WTP site located in a rural environment in the outskirts of Abbottabad city with limited human settlements and activities. The WTP site is located on top of choona hill adjacent to existing JICA WTP. The land is under possession of PHED and contains few trees with limited vegetation cover and limited wildlife of any significance. Only 3.25 acers of land is required for the development of WTP. The water distribution network will use RoW of TMA and mostly along existing roads and streets therefore, no vegetation and wildlife loss is envisaged.

441. No impact on vegetation and wildlife is expected due to limited vegetation cover within project site. There are only few trees, some 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. Necessary plantation will be carried out, which will act as buffer zone from surrounding environment. Reasonable area has been 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.

### 6.3.14 Historical/Archaeological Sites

**_Impacts_**

442. No historical/archaeological sites have been identified in the project area or project site.

**_Mitigation measures_**

443. 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 G**.

### 6.3.15 Construction of Administeration Building and Other Infrastructure

**_Impacts_**

444. Abbotabd WTP will have 2-storey admin building, chemical budiling, chlorination building, workshop, labortary and internal roads to accommodate various operations of the facility.

445. 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.

446. Soil erosion is main impact during construction of building infrastrcuture 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.

447. 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.

448. 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 activiites. 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.

449. 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*

450. Following are the mitigation measures that will be employed to mange impacts from construction of building and associated infrastructure.

451. Water will be sprinkled regularly to suppress dust emissions. Off road travelling of vehicles will be prohibited.

452. 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.

453. 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.

454. 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.

455. Set protocols for proper and regular maintenance of construction machinery, vehicles and generators. Generators that will be used will be placed at suitable locations.

456. Contractor will not be allowed to store bulk quantities of fuel or hazardous material at site.

457. 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.

458. Equipment and machinery with loose vibratory parts will not be allowed to use. Used equipment and machinery will be in compliance to NEQS.

459. Waste bins will be provided at appropriate places to mange waste. Daily housekeeping of the construction area will be carried out.

460. Equipment and machinery with loose vibratory parts will not be allowed to be used. Anyequipment, vehicles and machinery available for use by the project will be NEQS compliant.

## 6.3.16 Site restorations

### *Impacts*

461. 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.

462. Unattended construction waste and excated 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 resortation protoclols 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.

## 6.4 *Operation* Phase

463. The potential impacts from operation of the WTP and GWSS are provided as **Table 6.6** below.

**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 | Reduced 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 |

| 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) |
|---|---|---|---|---|---|
| 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

### 6.4.1 Reduced downstream water availability

#### *Impacts*

464. 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. Both Phalkot and Jander bari are the tributaries of Dor river.

#### *Mitigation measures*

- 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.
- The flow measurement for Jandar Bari Intake was 920 lit/sec while for Phalkot it was 450 lit/sec. Raw water Intake flow for proposed Jandar Bari stream is 200l/s while from Phalkot 100 l/s. Therefore, downstream water availability shall not be compromised and enough water will be flowing downstream in Dor River to maintain ecological flows. Moreover, the sources have enough water availability for uninterrupted water supply of WTP.
- Catchment of both sources Jander bari and Phalkot lies in District Abbottabad.
- Water withdraw from streams shall be done without warranting reduced ecological flow. Water withdraw record shall be maintained.
- PMU KPCIP/WSSC Abbottabad 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***

465. 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.

466. 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

467. 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***

468. The residual disposal is carried out through:

a) Settled Sludge

469. 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 that will be developed under KPCIP.

b) Wash Water

470. 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***

471. 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.

472. 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***

473. 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 O.

474. 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.

475. Vapors of 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.

476. 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 emission is 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, 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

**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*

477. There are considerable risks associated with the operation of the proposed WTP from an occupational health and safety perspective, keeping in view the scope of work to be conducted on a daily basis. Storage and handling chemicals and the use of monorail/crane for lifting chemicals in chemical/chlorination house to be involved in the daily operations has substantial health and safety risk. A laboratory has also been proposed which required dealing with chemicals and shall pose health and safety risk to laboratory staff. Moreover, cutting, grinding and hot work shall be done in workshop which also has significant safety risk. 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 water treatment plant during its day-to-day

operations. Draft Occupational Health and Safety Plan has been attached as **Annexure E**.

***Mitigation Measures***

478. In order to ensure a safe and healthy working environment for the staff of the WTP and all its auxiliary facilities, the following measures have to be strictly enforced, implemented and monitored:

  - PMU KPCIP and WSSC Abbotabad 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 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 such as Alum and Sodium Hypochlorite 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 developed 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;
- 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;
- 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.

### 6.4.6 Generation of solid waste

***Impacts***

479. 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.

480. Detailed impact assessment and mitigation measures for sludge and wash water has been provided in section 6.4.2.

481. Sewage and grey water from Admin building, chemical building and workshops shall be drained into nearest municipal drain.

482. 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 Abbottabad or Peshawar.

483. Non recyclable waste such as demoliation waste, food waste, debris, non-hazardous chemicals shall be transported to landfill site for ultimate disposal.

484. 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***

485. 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.

486. Licensed waste contractors will be engaged to dispose off 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 N.**
- WSSC Abbottabad 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.

### 6.4.7 Improved drinking water availability

***Impacts***

487. The continued supply of treated quality water by proposed project will be an indispensable facility in Abbottabad. The proposed extension of JICA WTP and GWSS will facilitate the domestic as well as commercial water requirements of people living in Abbottabad. With the replacement of outlived/rusted pipeline water shortages and leakage/wastage issues shall also be resolved. Moreover, the proposed extension will provide Improved and sustainable potable water availability to citizens of Abbottabad 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 WSSCA.

488. 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

489. ***Mitigation measures***

- No measures required.

### 6.4.8 Improvements in Public Health

***Impacts***

490. 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

491. Based on the scoping exercise of the site and based on discussions with the public sector agencies responsible for development in the project area. No other infrastructure works are planned to be conducted in the WTP project area while these project works shall be conducted. However, Solid waste management facility (SWMF) has been proposed in Abbottabad which is around 2 km from proposed WTP. The access road for SWMF is different therefore traffic congestion due to activities are not envisaged. Moreover, the proposed WTP location is around 2km from SWMF and route of transmission mains is also not closed to SWMF as a result impacts like air emissions, water contamination is not envisaged. Thus, no cumulative impacts are expected.

## 6.6 Indirect and Induced Impacts

492. The potential impact of proposed Extension of WTP and GWSS 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 and associated demand. Impacts from the WTP 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.

493. Thus, negative indirect and induced impacts from the proposed water plant and supply network are not expected during operation phase. During construction phase indirect Impacts related to social nuisance are anticipated resulting from the delayed or halted construction works particular while working in congested areas. Such issues will be of short term and will be managed through effective coronation and GRM proposed for the project.

# 7 Environmental Management Plan & Institutional Requirements

## 7.1 Introduction

494. The IEE has identified potential impacts that are likely to arise during proposed extension of JICA WTP and GWSS 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.

495. The Environmental Management Plan (EMP) is developed to eliminate and/or mitigate the impacts envisaged at the design, construction and operation stages.

496. The detailed EMP provided in this document as **Table 7.1** ensures that extension of JICA WTP and GWSS Abbottabad 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)

497. 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 and operation on the environment and community.
- Ensure that the construction and operation 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

498. 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 ManagementMonitoring and Reporting

499. 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 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.

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

501. 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

502. 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.

503. 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.

504. 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

505. The environmental management plan will require involvement of the following organizations for its implementation during construction and operation phases of the project:

### 7.5.1 Role of PMU, KPCIP, LGE RDD

506. 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

507. The ADB will:

- Support the coordination and administration of the project;
- Provide guidance to PMU KPCIP and WSSCA 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)

508. 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 including staff from contractors

### 7.5.4 Role of KP EPA

509. The KP EPA will have the following responsibilities with regards to this project:

- Provides regulatory compliance works for the project.
- Reviews and approves environmental assessment report of WTP, 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

510. 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 (SSEMPs) as required. SSEMPs will be prepared by Contractor's Environment Specialist, site in charge, 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. Site Specific EMP (SSEMP) Guide & Template for Guidance to Contractor has been attached as **Annexure I**.
- 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 WSSCA

511. The WSSCA 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
- WSSCA will be responsible to ensure that contractors engaged during operation phase of WTP are executing activities in compliance to IEE/EMP.
- WSSCA will be required to have qualified Environmental Specialist designated for

WTP to ensure all mitigation measures are implemented in true letter and spirit.

- WSSCA will design and drive behavior change campaigns to increase public participation and cooperation. Public cooperation will be extended through incentives and penalties to the public.
- WSSCA will plan customer feedback surveys in order to ensure sustainable service delivery and to remove gaps in the system.

## 7.6 Monitoring Parameters

512. A monitoring plan for the pre-construction/design, construction and operation phases of the project, indicating environmental parameters, frequency and applicable standards is provided below as **Table 7.2, Table 7.3** and **Table 7.4** below.

513. 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.

514. During the construction period, the monitoring activities will focus on ensuring that any required environmental mitigation measures are implemented to address possible impacts.

515. 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.

516. 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 of WTP will be carried out by WSSC Abbotabad with support from PMU.

## 7.7 Environmental Training

### 7.7.1 Capacity Building and Training

517. 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.

518. The details of this capacity building and training program are presented in the **Table 7.5**

## 7.8 Environmental Staffing and Reporting Requirements

519. EMP implementation will be responsibility of all project stakeholders including PMU, WSSCA, Project Construction contractors, O&M contractor and other suppliers involoved in the project. Requirement of environemntal 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 impement 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), WSSA will hire qualified environmental specialist during operation phase of the project who will be responsible for EMP implementation and reporting by WSSCA and its O&M contractors during operation. Monthly environmental compliance report will be prepared by WSSCA and circulated to concerned authorities.

520. Organogram of PMU KPCIP within LGERDD and City implementation unit (CIU) within WSSCs is provided as **Figure 7-1 and 7-2.**

**Figure 7-1: Proposed Organogram of PMU KPCIP**

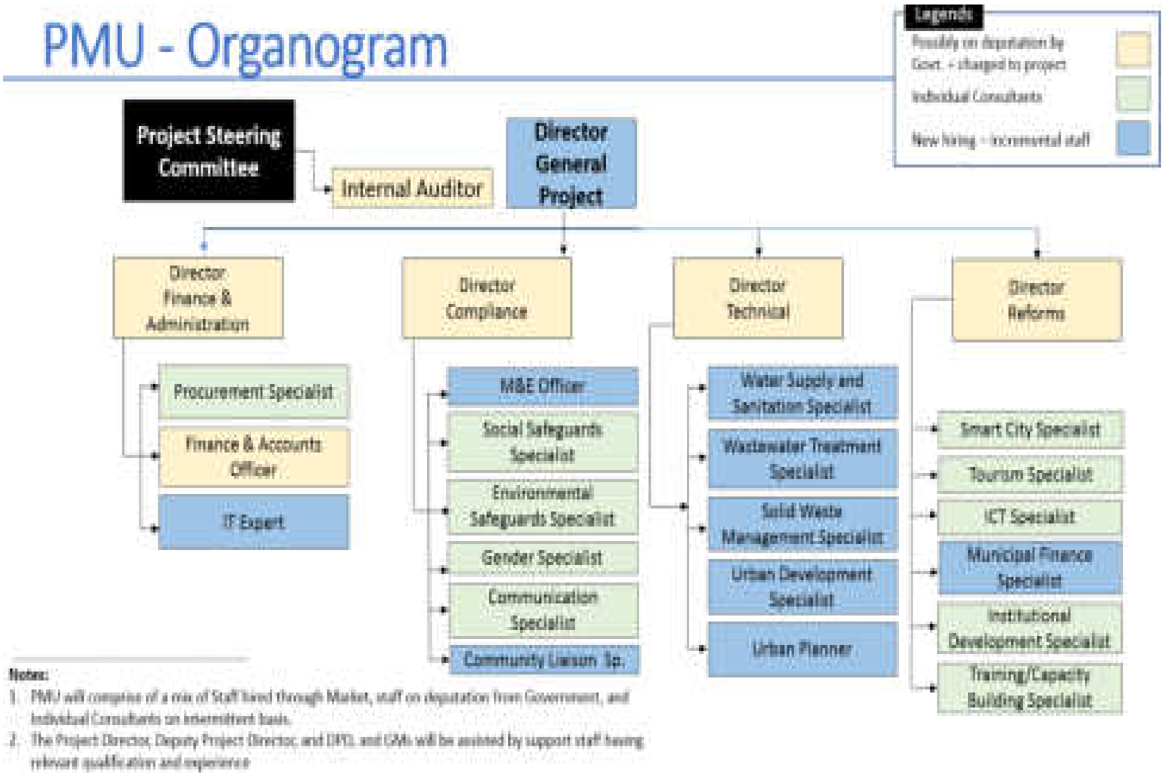
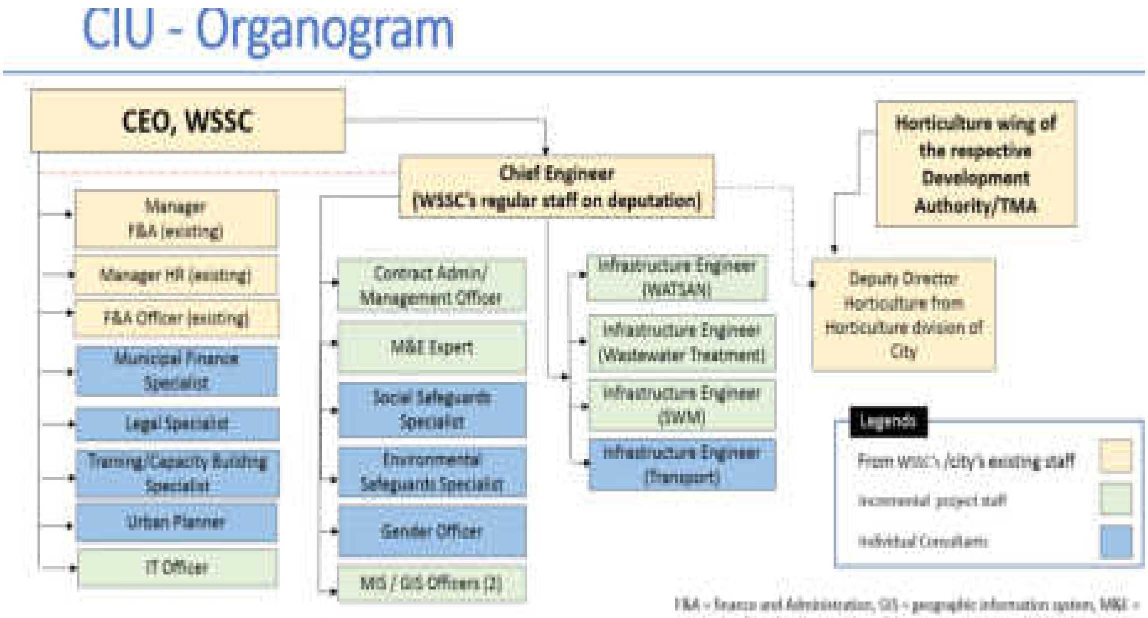


Figure 7-2: Proposed Organogram of CIU WSSC Abottabad



F&A = finance and Administration, GIS = geographic information system, M&E = monitoring & evaluation, SWM = solid waste management, WATSAN = water supply and sanitation, TMA = tehsil municipal authority, WSSC = water supply and sanitation company

* CIU will have these positions according to their respective subsector portfolio.

**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 reduced ecological flows | • Detailed Catchment studies shall be conducted as part of designing intake flow from sources.<br>• Runoff volume calculations shall be carried on periodic basis to ensure water supplies from intake structure<br>• Periodic flow measurement on both Phalkot and Jander Bari streams shall be carried out to ascertain the continuous water availability for the project.<br>• 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 entrapment of aquatic organisms<br>▪ Avoid construction of water intake structures in sensitive ecosystems | EDCM | PMU | BC: during detailed designing of the sub-project |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | transmission main | ▪ Intake structure shall be designed adequately to reduce sediment load and uninterrupted raw water supply to WTP<br>▪ Design water containment and diversion structures to allow unimpeded movement of fish and other aquatic organisms and to prevent adverse impacts on water quality<br>▪ 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 capacity of 12,965 m3/day (150L/sec). 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<br>▪ A SCADA system has been proposed to check compliance and monitoring of WTP components.<br>▪ 1.2-meter cover has been proposed from the top of pipe to reduce chances theft and pipe bursting due to traffic loads.<br>▪ 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 will be disposed off through implementation of EMP. WSSC Abbottabad will ensure that mechanism for residual management of sludge is in place at WTP site.<br>- 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.<br>- Location of the Intake shall be 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.<br>  - Suitability of the Intake structure type | PMU | - | BC: during detailed designing of the sub-project |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | ○ Geological and Topographic conditions<br>○ Technically most suitable site to supply water to consumers<br>○ Minimum Environmental Degradation<br>▪ Based on the hydraulic model of the proposed transmission main and supply mains, raw water from sources shall be conveyed under gravity.<br>▪ Water storage reservoirs with elevation levels in the range of 1325 MSL will get uninterrupted water supply via a gravity system.<br>▪ While the remaining reservoirs, located at slightly higher elevation than 1325 MSL, will be fed through a pumping system. Only 7 water storage reservoir need pumping stations due to high elevation levels. | | | |
| | 1.4 | Lack of integration of IEE/EMP requirements into Construction bid documents | ▪ 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. | EDCM | PMU | BC: during detailed designing of the sub-project |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | ▪ 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.<br>▪ Project contractors shall have qualified and experienced environmental staff to plan, arrange, implement, monitor and report IEE/EMP requirements | | | |
| | 1.5 | Material Haul Routes | ▪ The construction vehicles hauling materials along the Abbottabad 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 designing of the sub-project |
| | 1.6 | Inadequate Contractor's Environmental Safeguards Capacity | • PMU KPCIP shall review the contractor capacity with respect to safeguard management and contracts shall be awarded accordingly.<br>• 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. | PMU | - | BC: during detailed designing of the sub-project |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | • PMU KPCIP shall ensure the project contractors are selected on merit and necessary funds has been 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.<br>▪ Solid and liquid effluent waste disposal facilities shall also be designed to cater waste of administration/office building etc.<br>▪ 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 designing of the sub-project |
| | 1.8 | Land Acquisition and Resettlement Impacts | The PMU KP LGERDD shall ensure the following:<br>▪ Due payment to all land owners must be paid before mobilization of construction contractors.<br>▪ Social safeguard unit shall ensure that project affected people has been paid following | EDCM | PMU | |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | appropriate procedures and there are no grievances about land acquisition process.<br>▪ PMU KPCIP will expedite the process of land i for proposed 16 surface tanks.<br>▪ PMU KPCIP 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 KPCIP shall ensure the proposed infrastructure shall be designed keeping in view the seismic zone 3 building considerations.<br>▪ Surface water diversion shall be included in the design to protect intake structures from flash flooding.<br>▪ Extreme precipitation events analysis shall be performed for i.e. 100 years, to predict and manage impacts of flash flooding on intake structures.<br>▪ Water supply network shall not be disrupted/impacted from urban flash flooding, potential seismic intervention and other climate hazards.<br>▪ On site waste storage shall be kept to minimum during high precipitation events. | EDCM | PMU | BC: during detailed designing of the sub-project |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | ▪ 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 | | | |
| | 1.10 | Impacts due to existing utilities | ▪ The PMU KPCIP shall ensure the proposed infrastructure shall be designed keeping in view the minimum distrurbance to existing utilities.<br>▪ CSC will ensure that project contractors will perform condition assessments prior to excavation works for supply mains and networks and will inform CSC/WSSC Abbotabad about the presence of any exisiting utilities within RoW.<br>▪ In case if there is need of shifting of any utility, utility custodian department will be taken on board by WSSC Abbotabad for necessary approvals and informations.<br>▪ PMU KPCIP/WSSC Abbotabad will pay compensation to damage of utilities to utlity owners and will ensure that there will be no grieavances in this regard. | | | |
| **Construction Phase** | 2.1 | Construction of water treatment plant and other structures not in accordance with | ▪ Method statements must be prepared by the Contractor and approved by the Construction Supervision Consultant (CSC) prior to commencement of construction works.<br>▪ The CSC must closely monitor the construction works being conducted by the | Contractor | CSC, PMU | DC |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | finalized design | Contractor to ensure the finalized design is implemented in full and the WTP design is developed completely in compliance of the approved finalized designs.<br>▪ 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 GWSS.<br>▪ PMU KPCIP 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:<br>▪ 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.<br>▪ 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.<br>▪ Method Statement shall be in a Table format with appended site layout map and cover the following:<br>o Work description<br>o No. of workers (skilled & unskilled)<br>o Details of Plant, equipment & machinery, vehicles<br>o Work duration (total, and activity-wise, for example for pipe laying, from excavation to road resurfacing/testing)<br>o PPE (helmet, gloves, boots, etc.) details for each type of work<br>o Details of materials at each site (type & quantity)<br>o 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.)<br>o Construction waste/debris generated | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | (details & quantity)<br>o Detail the sequence of work process (step-by-step) including specific details of each work<br>o Contractor’s supervision & management arrangements for the work<br>o Emergency: Designate (i) responsible person on site, and (ii) first aider<br>o Typical site layout plan including pipe trenching, placement of material, excavated earth, barricading etc.<br>▪ The following shall be included in the site layout plan:<br>o Provide barricading/security personnel at the site to prevent entry/trespassing of pedestrian/vehicles into the work zone.<br>o Location of temporary stockpiles and provision of bunds<br>o Separation of stockpiles areas with workers/vehicle movement paths to avoid disturbing the stockpiled soil<br>o 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.<br>▪ PMU KPCIP will ensure the identification of disposal sites for unsuitable excavated material in consultation with CSC/WSSC Abbotabad.<br>▪ 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.<br>▪ Stock piling of excavated material at places that are congested will be avoided as these piles can create traffic issues and public nuisance.<br>▪ Already available quarry sites for additional backfill material will be utilized. Development of new quarry site will be discouraged.<br>▪ Record of borrow materials will be maintained including details of quarry site, agreement and necessary approvals from concerned government authorities | | | |
| | 2.3 | Degradation of | ▪ At the WTP and the immediately adjoining areas, water will be sprinkled every three | Contractor | CSC, PMU | DC |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | air quality due to construction works | hours and at a higher frequency if felt necessary, at all construction sites to suppress dust emissions.<br>▪ All heavy equipment and machinery shall be fitted in full compliance with the national and local regulations.<br>▪ Stockpiled soil and sand shall be slightly wetted before loading, particularly in windy conditions.<br>▪ Fuel-efficient and well-maintained haulage trucks shall be employed to minimize exhaust emissions.<br>▪ Vehicles transporting soil, sand and other construction materials shall be covered with tarpaulin.<br>▪ Limitations to speeds of such vehicles as felt necessary. Transport through densely populated area shall be avoided.<br>▪ Concrete plants to be controlled in line with statutory requirements and shall not be close to sensitive receptors.<br>▪ Stack height of generators will be at least 3 meters above the ground.<br>▪ Project traffic will maintain maximum speed limit of 20 km/hr. on all unsealed roads within project area.<br>▪ A minimum distance of 300 meters will be | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | ensured between batching plant(s) and the nearest community.<br>▪ 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.<br>▪ 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.<br>▪ 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.<br>▪ Developing and implementing work practices to minimize release of | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | contaminants into the work environment including:<br>o Direct piping of liquid and gaseous materials<br>o Minimized handling of dry powdered materials; Enclosed operations<br>o Local exhaust ventilation at emission/release points<br>o Vacuum transfer of dry material rather than mechanical or pneumatic conveyance<br>o Indoor secure storage, and sealed containers rather than loose storage<br>▪ Where ambient air contains several materials that have similar effects on the same body organs (additive effects).<br>It shall be ensured that the following measures are taken to control emissions from vehicles being used in the construction activity:<br>▪ 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.<br>▪ Regularly change the engine oil and use new engines/machinery/equipment having good efficiency and fuel burning characteristics.<br>▪ Controlled technology generator and batching plants will be used to avoid excessive emissions.<br>▪ Burning of wastes at any site will not be allowed.<br>▪ The stack height of generators will be at least 3 meters above the ground.<br>▪ Training of the technicians and operators of the construction machinery and drivers of the vehicles.<br>▪ All type of machinery and generator must comply with the NEQS. Vehicles, which are not in compliance with NEQS are not allowed to use.<br>▪ Periodic emission monitoring of vehicles, generator and batching plants is proposed.<br>▪ 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.<br>▪ 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;<br>▪ 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;<br>▪ Furthermore, the movement of heavy vehicles within Abbottabad city during laying of pipeline must be restricted to specific routes containing least number of sensitive receptors and low traffic volumes.<br>▪ 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.<br>▪ Local communities in the project area will be | Contractor | CSC, PMU | DC |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | briefed on traffic safety, especially women who are the main care providers to children.<br>▪ Temporary walkways shall be constructed on trenches for providing passage commuters.<br>▪ 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.<br>▪ Educate drivers on safe driving practices to minimize accidents and to prevent spill of hazardous substances and other construction materials during transport.<br>▪ Contractor must take proper safety measures (placing warning tapes around excavations) to avoid people, especially children, accidentally falling into excavations.<br>▪ All the working platforms must be cordon off with special care by well-trained skilled workers.<br>▪ 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.<br>▪ 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**<br>▪ 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.<br>▪ Monitoring will be required to ensure that the OHS plan based on contract specifications is followed.<br>▪ Cement feed hopper areas will be inspected daily to ensure compliance with the requirement of dust masks.<br>▪ 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.<br>▪ All drivers engaged by Contractors must hold a valid license for the vehicle they are operating.<br>▪ Work in confined space shall be executed with available safety standards. Adequate monitoring and equipment shall be available to detect deficient oxygen levels.<br>▪ The Contractor shall submit to the Engineer of CSC for approval an emergency evacuation plan and practice the procedure | Contractor | CSC, PMU | DC |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | annually.<br>▪ 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.<br>▪ Fire extinguishers shall be provided throughout camps and work sites. Fire extinguishers shall be inspected monthly and maintained as necessary.<br>▪ An adequate and reliable supply of safe drinking water shall be made available at readily accessible and suitable places including at all camps.<br>▪ 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 Organisation standards for drinking water.<br>▪ 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.<br>▪ 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.<br>▪ 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.<br>▪ All HSE protocols shall be implemented in true letter and spirit.<br>▪ Contractor must appoint an HSE resource to implement, monitor and report the HSE management plan to concerned authorities.<br>▪ Contractor must ensure the provision of first aid facility at construction site and camps through hiring medics and establishing a dispensary at the campsite.<br>▪ Reasonable number of first aid kits shall be available on construction sites and within contractor camps.<br>▪ 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:21<br>**Mitigation Measures for Physical Hazards**<br>▪ Rotating and Moving Equipment<br>▪ Designing machines to eliminate trap hazards and ensuring that extremities are kept out of harm's way under normal operating conditions.<br>▪ 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.<br>▪ 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.<br>▪ Designing and installing equipment, where feasible, to enable routine service, such as lubrication, without removal of the guarding devices or mechanisms.<br>**Vibration**<br>▪ Exposure to hand-arm vibration from | | | |

---

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

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | equipment such as hand and power tools, or whole-body vibrations from surfaces on which the worker stands or sits, shall 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.<br>**Electrical**<br>▪ Marking all energized electrical devices and lines with warning signs;<br>▪ 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;<br>▪ 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; ·<br>▪ Double insulating / grounding all electrical equipment used in environments that are, or may become, wet; using equipment with ground fault interrupter (GFI) protected circuits; ·<br>▪ Protecting power cords and extension cords against damage from traffic by shielding or suspending above traffic areas; ·<br>▪ Conducting detailed examination and | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | marking of all buried electrical wiring prior to any excavation work.<br>▪ Appropriate labeling of service rooms housing high voltage equipment (‘electrical hazard’) and where entry is controlled or prohibited; ·<br>**Eye Hazards**<br>▪ 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.<br>**Welding/Hot Work**<br>▪ 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. ·<br>▪ 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.<br>**Industrial Vehicle Driving and Site Traffic**<br>▪ Training and licensing industrial vehicle operators in the safe operation of specialized vehicles such as forklifts, including safe loading/unloading, load limits. ·<br>▪ Ensuring drivers undergo medical surveillance. ·<br>▪ Ensuring moving equipment with restricted rear visibility is outfitted with audible back-up alarms. ·<br>▪ 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. ·<br>▪ Restricting the circulation of delivery and private vehicles to defined routes and areas, giving preference to ‘one-way’ circulation, where appropriate.<br>▪ Ergonomics, Repetitive Motion, Manual | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | Handling<br>▪ Facility and workstation design with 5th to 95th percentile operational and maintenance workers in mind.<br>▪ 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.<br>▪ Selecting and designing tools that reduce force requirements and holding times and improve postures.<br>▪ Providing user adjustable workstations.<br>▪ Incorporating rest and stretch breaks into work processes and conducting job rotation. ·<br>▪ Implementing quality control and maintenance programs that reduce unnecessary forces and exertions. ·<br>▪ Taking into consideration additional special conditions such as left-handed persons.<br>▪ Working at Heights<br>▪ Installation of guardrails with mid-rails and toe boards at the edge of any fall hazard area. ·<br>▪ Proper use of ladders and scaffolds by trained employees. ·<br>▪ 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. ·<br>▪ Appropriate training in use, serviceability, and integrity of the necessary PPE. ·<br>▪ Inclusion of rescue and/or recovery plans, and equipment to respond to workers after an arrested fall.<br>**Fire and Explosions**<br>▪ Storing flammables away from ignition sources and oxidizing materials. Further, flammables storage area shall be:<br>▪ Remote from entry and exit points into camps<br>▪ Away from facility ventilation intakes or vents<br>▪ Have natural or passive floor and ceiling level ventilation and explosion venting<br>▪ Use spark-proof fixtures<br>▪ 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.<br>▪ 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).·<br>▪ Providing specific worker training in handling of flammable materials, and in fire prevention or suppression. | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | ▪ Corrosive, oxidizing, and reactive chemicals<br>▪ 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.<br>▪ 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.).<br>▪ 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.<br>**Mitigations for Biological Hazards**<br>▪ 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.<br>▪ 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.<br>▪ Excessive noise emitting equipment will not be allowed to operate and will be replaced.<br>▪ Blowing of horns will be prohibited on access roads to work sites.<br>▪ Manual excavation has been proposed for congested areas to reduce generation of noise.<br>▪ Limited use of jack hammer in populated areas.<br>▪ As a rule, the operation of heavy equipment | Contractor | CSC, PMU | DC |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | shall be conducted in daylight hours.<br>▪ Construction equipment, which generates excessive noise, shall be enclosed or fitted with effective silencing apparatus to minimize noise.<br>▪ Well-maintained haulage trucks will be used with speed controls.<br>▪ 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).<br>▪ 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.<br>▪ Periodic medical hearing checks shall be performed on workers exposed to high noise levels.<br>▪ Grievance redress mechanism will be established.<br>▪ All the equipment and machinery used during construction phase shall 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.<br>▪ 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.<br>▪ 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.<br>▪ Waste management training for all site staff to be included in Contractor’s training plan.<br>▪ 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.<br>▪ 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 | Contractor | CSC, PMU | DC |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | leaks and all such leaks will be plugged immediately.<br>▪ Designated vehicles/plant wash down and refueling points must be included in camp layout plan to be submitted for approval.<br>▪ Hazardous waste will be initially stored on site at designated area and then handed over to EPA certified contractor to final disposal.<br>▪ Record of waste generation and transfer shall be maintained by project contractors.<br>▪ Spill kits, including sand buckets (or other absorbent material) and shovels must be provided at each designated location.<br>▪ 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.<br>▪ It will be ensured that after restoration activities, the campsite is clean and that no refuse has been left behind.<br>▪ Clinical wastes will be temporarily stored onsite separately and will be handed over to approved waste contractor for final disposal.<br>▪ Training will be provided to personnel for identification, segregation and management of waste.<br>▪ The structure of a Framework waste | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | management plan has been prepared for the project and attached as Annexure N 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 | | | |
| | 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.<br>▪ A closed sewage treatment system including soak pits and septic tank will be constructed to treat the effluent from the construction/labor camps.<br>▪ Sewage treatment system will be installed at each respective labor camp based on the number of laborers residing at the respective camp.<br>▪ 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.<br>▪ 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.<br>▪ Ensure that the soak pits remain covered all | Contractor | CSC, PMU | DC |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | the time and measures are taken to prevent entry of rainwater into them.<br>▪ 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.<br>▪ 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.<br>▪ 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.<br>▪ Regular inspections will be carried out to detect leakages in construction vehicles and equipment and all vehicles will be washed in external commercial facilities.<br>▪ Fuels, lubricants and chemicals will be stored in covered bounded areas, underlain with | Contractor | CSC, PMU | DC |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | impervious lining. Appropriate arrangements, including shovels, plastic bags and absorbent 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.<br>▪ It will be ensured that maximum number of unskilled and semi-skilled jobs will be provided to the residents of the project area.<br>▪ 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 | **COVID-19 specific measures**<br>▪ All workers must perform complete sanitization at the site as per SOPs/guidelines issued by WHO.<br>▪ 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.<br>▪ 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 | Contractor | CSC, PMU | DC |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | 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.<br>▪ 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.<br>▪ 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.<br>▪ All workers will be strictly advised to wash their hands as frequently as practicable and not to touch their face during work.<br>▪ A supply of safe drinking water will be made available and maintained at the project site(s).<br>▪ COVID awareness sign boards must be installed at the clinic premises and at the work site(s).<br>▪ 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.<br>▪ Prohibition of entry for local community/any unauthorized persons at work sites.<br>▪ Proper hygiene practices in the toilets and washrooms will be implemented with proper and adequate use of soaps and disinfectant spray.<br>▪ Social distancing must be maintained during the pick-up and dropping off of workers from their residences to and from the work site(s).<br>**COVID-19 specific measures GOP**<br>**Advice for Site Managers:**<br>▪ 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.<br>▪ Workers shall not use biometric attendance machines or crowd during attendance, entry or exit to the premises of the construction site.<br>▪ 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.<br>▪ 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.<br>▪ 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.<br>▪ 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.<br>▪ Non-essential work trainings must be postponed avoiding gathering of people.<br>▪ Ensure the physical distance by creating more than one route of entry and exit to the | | | |

|  |  |  |  |  |  |  |
|---|---|---|---|---|---|---|
|  |  |  | site.<br>▪ Instruct the workers to inform the construction manager (or authorities) if<br>▪ They develop any symptoms of cough, flu or fever.<br>▪ They have been exposed to someone suspected or confirmed with COVID 19.<br>▪ 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.<br>▪ 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.<br>▪ Persuade the workers to inform the authorities for their safety and of other if they observe any signs and symptoms in a colleague.<br>▪ Do not allow any worker at the construction |  |  |  |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | site who has the symptoms<br>▪ Display the awareness banners about hand hygiene and physical distancing, where you can, around the work site.<br>▪ 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.<br>▪ 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.<br>▪ Only sanitizable dining surfaces shall be used, which must be cleaned before each service.<br>▪ 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.<br>▪ Adequate ventilation shall be provided in dining areas, resting places and sleeping | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | areas.<br>▪ 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.<br>▪ In case of workers sleeping in at the site of construction, a safe distance of 2 meters must be ensured in the sleeping rooms in a well ventilated area.<br>▪ A supply of safe drinking water must be made available at the project site and maintained.<br>**Advice for Construction Workers:**<br>▪ 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.<br>▪ Follow hygiene practices at washrooms and shower facility with proper and adequate use of soaps and disinfectants.<br>▪ 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.<br>▪ Workers shall wash their hands as frequently as practicable and shall not to touch their face with their hands during work.<br>▪ Everyone on the construction site must observe sneezing and coughing etiquettes.<br>▪ 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.<br>▪ Sick worker shall immediately inform the site manager and must get medical advice from nearby health Centre.<br>▪ Only sanitizable dining surfaces shall be used.<br>▪ 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.<br>▪ Use safe transport arrangements which shall not be crowded and shall have social distancing in place during the entire process from pickups till drops at destination.<br>▪ In case sleeping in at the site of construction, a safe distance of 2 meters must be ensured in the sleeping rooms in a well ventilated area.<br>▪ Deliveries or Other Contractors Visiting the Site:<br>▪ Non-essential visits to the construction sites shall be cancelled or postponed.<br>▪ 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.<br>▪ Designate the workers, with protective gears or at least gloved and mask, to attend to the deliveries and contractors.<br>▪ Make alcohol-based hand sanitizer (at least 70%) available for the workers handling deliveries.<br>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 | | | |
| | 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 allocated for plantation to improve landscape of the area.<br>▪ Off-road travel will be strictly prohibited and observance of this will be monitored during execution of the project. And<br>▪ Vehicles speed will be regulated and monitored to avoid excessive dust emissions.<br>▪ No hunting or killing of animals will be permitted.<br>▪ No cutting down of vegetation or using vegetation or trees as firewood will be permitted. | Contractor | CSC, PMU | DC |
| | 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 G**. | 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.<br>▪ 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.<br>▪ 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.<br>▪ 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.<br>▪ Set protocols for proper and regular maintenance of construction machinery, vehicles and generators. Generators that will be used will be placed at suitable locations.<br>▪ Contractor will not be allowed to store bulk quantities of fuel or hazardous material at site.<br>▪ 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 | Contractor | CSC, PMU | DC |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | be provided with hard impervious surface and secondary containment.<br>▪ Equipment and machinery with loose vibratory parts will not be allowed to use. Used equipment and machinery will be in compliance to NEQS.<br>▪ Waste bins will be provided at appropriate places to mange waste. Daily housekeeping of the construction area will be carried out.<br>▪ Equipment and machinery with loose vibratory parts will not be allowed to use. Used equipment/machinery/vehicle will be in compliance to NEQS. | | | |
| | 2.15 | Site restoration | ▪ Demobilization of all equipment and machinery;<br>▪ Disposal of any waste material remaining at the time of completion of the operation;<br>▪ Backfilling of all excavation followed by compactions;<br>▪ Dismantling and removal of fence or barriers surrounding the campsite area; and<br>▪ General restoration of the site area including landscaping and restoration of drainage where required. | Contractor | CSC, PMU | DC |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | ▪ 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.<br>▪ PMU KPCIP will ensure periodic monitoring of such restorations.<br>▪ Contractors will develop site resortation protoclols and will submit to CSC/PMU for review and approval.<br>▪ Construction site restoration protocols will be part of bidding documents and constructions contracts.<br>▪ 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.<br>▪ The flow measurement for Jandar Bari Intake was 920 lit/sec while for Phalkot it was 450 lit/sec. Details of flow measurement are | O&M Contractor/ WSSCA | WSSCA, PMU | DO |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | mention in Table 3:11. Raw water Intake flow for proposed Jandar Bari stream is 200l/s while from Phalkot 100 l/s. Therefore, downstream water availability shall not be compromised and enough water will be flowing downstream in Dor River to maintain ecological flows. Moreover, the sources have enough water availability for uninterrupted water supply for WTP<br>▪ Water withdraw from streams shall be done without warranting reduced ecological flow. Water withdraw record shall be maintained.<br>▪ PMU KPCIP/WSSC Abbottabad will ensure that water withdraw from the streams shall not disrupt the ecological flows.<br>▪ Periodic flow and catchment studies shall be carried during operation phase of the project | | | |
| | 3.2 | Generation of Sludge and wash water | ▪ The residual disposal is carried out through:<br>a)Settled Sludge<br>▪ 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 sludge holding tanks by pumpimg. The sludge from the holding tanks shall be transported into nearby landfill site.<br>b)Wash Water<br>▪ The wash water received from filter beds, | O&M Contractor/ WSSCA | WSSCA, PMU | DO |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | 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. | | | |
| | 3.3 | Water system leaks and water discharges during flushing | ▪ Ensure construction meets applicable standards and industry practices;<br>▪ Conduct regular inspection and maintenance;<br>▪ Implement a leak detection and repair program (including records of past leaks and unaccounted-for water to identify potential problem areas);<br>▪ 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.<br>▪ Discharge the flush water into a municipal sewerage system with adequate capacity;<br>▪ Discharge the flush water into a separate storm sewer system<br>▪ 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/ WSSCA | WSSCA, 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<br>▪ A chemical house has been provided to accommodate the solution tanks, Alum Bags | O&M Contractor/ WSSCA | WSSCA, PMU | DO |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | and other chemicals (if required). Monorail and overhead crane have been provided for handling of the chemicals.<br>▪ 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.<br>▪ Store sodium hypochlorite in cool, dry, and dark conditions for no more than one month, and use equipment constructed of corrosion-resistant materials<br>▪ Minimize the amount of chlorination chemicals stored on site while maintaining a sufficient inventory to cover intermittent disruptions in supply;<br>▪ 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<br>Accidental Release Measures (Alum)<br>▪ 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<br>▪ 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<br>Accidental Release Measures (Sodium Hypochlorite)<br>▪ Flush away small spillages with plenty of water.<br>▪ Large Spillages: Absorb with sand or other inert absorbent. Pick up with vacuum or absorbent solid, store in closed container for disposal | | | |
| | 3.5 | Occupational Health and Safety | ▪ PMU KPCIP and WSSC Abbotabad through CSC will ensure the implementation of SOPs issued by GoP and WHO related to COVID-19.<br>▪ Designation of an Environment, Health and Safety (EHS) officer dedicated to the site;<br>▪ 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 | O&M Contractor/ WSSCA | WSSCA, PMU | DO |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | undertaken;<br>▪ Strict use of Personal Protective Equipment (PPE) by all personnel (especially staff working in Laboratory/chemical building and workshop) must be ensured.<br>▪ 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;<br>▪ 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<br>▪ 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 WTP and its auxiliary facilities;<br>▪ 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;<br>▪ 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);<br>▪ Accidental fires must be addressed | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | immediately. Firefighting plan shall be developing and extinguishers shall be placed at appropriate location.<br>▪ Emergency plan (including fire management) must be developed and implemented;<br>▪ Availability of first-aid kits and vehicles that can be used to bring any injured employee to the nearest doctor in cases of accidents;<br>▪ Adequate ventilation shall be provided in dining areas, resting places and sleeping areas.<br>▪ Mandatory reporting of all accidents or incident of near misses of accidents and immediate adoption of corrective measures;<br>▪ 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;<br>▪ 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 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.<br>Licensed waste contractors will be engaged to dispose of all non-hazardous waste material that cannot be recycled or reused.<br>▪ 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.<br>▪ Waste management training for all WTP staff to be included in training plan.<br>▪ 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.<br>▪ 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.<br>▪ Designated drains for vehicles/plant wash | O&M Contractor/ WSSCA | WSSCA, PMU | DO |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | down shall be constructed and layout plan to be submitted for approval.<br>▪ Hazardous waste will be initially stored on site at designated area and then handed over to EPA certified contractor to final disposal.<br>▪ Record of waste generation and transfer shall be maintained by project contractors.<br>▪ Spill kits, including sand buckets (or other absorbent material) and shovels must be provided at each designated location.<br>▪ Clinical wastes will be temporarily stored onsite separately and will be handed over to approve waste contractor for final disposal.<br>▪ Training will be provided to personnel for identification, segregation and management of waste.<br>▪ The structure of a Framework waste management plan has been prepared for the project and attached as Annexure N 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<br>▪ WSSC Abbottabad 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 | | | |

| | |
|---|---|
| **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 –<br>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**<br>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 –<br>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**<br>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**<br>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** | 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 | Bi-annual basis on a typical working day | WSSC Abbotabad |
| **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 Abbotabad |
| **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 Abbotabad |

### Table 7.5: Capacity Development and Training Programme

| Provided by | Organized by | Contents | Target Audience | Venue | Duration |
|---|---|---|---|---|---|
| **Pre-construction Phase**<br>PMC offering specialized services in environmental management and monitoring | CSC & PMU | Short seminars and courses on:<br>Environmental Management Plan and Environmental Monitoring Plan<br>Group exercise and participatory workshop to measure effectiveness of program | Contractor staff | WSSC Office, Abbottabad | One day long training seminar including group exercise/workshop |
| **Construction Phase**<br>PMC offering specialized services in social management and monitoring | CSC & PMU | Short seminar on Environmental risks associated with construction phase.<br>Development of Environmental Performance Indicators<br>Occupational Health and Safety (OHS) issues<br>Group exercise and participatory workshop to measure effectiveness of program | Contractor staff | WSSC Office, Abbottabad | One day long training seminar including group exercise/workshop |
| **Operation Phase**<br>Water Treatment Plant Operator authorized representative or 3rd party trainer | WSSCA & PMU | Short seminars on Environmental risks associated with operation phase.<br>Development of Environmental Performance Indicators/<br>Occupational Health and Safety (OHS) issues | O&M contractor | Training Hall of WTP facility | One day long training seminar including group exercise/workshop |

| | | | | | |
|---|---|---|---|---|---|
| | | Group exercise and participatory workshop to measure effectiveness of program | | | |

## 7.9 Environmental Management Costs

522. 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.

523. 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 cost for capacity development and training programme for project contractors for the proposed extension of WTP and GWSS.

**Table 7.6: Annual Cost Estimates for 'Pre-Construction Phase' Environmental Monitoring**[22]

| Monitoring Component | Parameters | Quantity | Amount PKR | Details |
|---|---|---|---|---|
| Surface water Quailty | 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** | |

---

[22] For air quality monitoring: 'Passive samplers' such as test tubes can be used or 'Active samplers' with sorbent turbes can also be used.

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[23]

| 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[24]

| Monitoring Component | Parameters | Quantity | Amount PKR | Details |
|---|---|---|---|---|
| Surface Water Quality | NEQS/WHO | 12 (bi-annual only at 3 locations for 02 streams) | 360,000 | 12 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** | | | 24000 | 5% of monitoring cost |
| **Total (PKR)** | | | **504,000** | |

### Table 7.9: Estimated Costs for EMP Implementation

| Item | Sub-Item | Estimated Total Cost (PKR) |
|---|---|---|
| **Staff, audit and monitoring cost[1]** | 1 person for 24 months<br>(@ 100,000 per month) | **2,400,000** |

---

**[1]: To cover staff cost and expenses of Environmental Specialist for Contractor**

| | | |
|---|---|---|
| **Monitoring Activities** | Provided separately in Tables 7.7 and 7.8. | - |
| **Mitigation Measures** | As prescribed under EMP and EIA. | **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 control odor levels** | To plant vegetation all along the boundary of WTP | 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** |

**Table 7.10: Cost of Capacity Development and Training Programme for Project Contractor(s)**

| Provided by | Organized by | Contents | No. of training events | Duration | Cost (PKR) |
|---|---|---|---|---|---|
| **Pre-construction Phase**<br>Monitoring Consultants/Organizations offering specialized services in environmental management and monitoring | CSC & PMU | Short seminars and courses on:<br>Environmental Management Plan and Environmental Monitoring Plan | Two seminars for Contractor management staff and project staff | 1 day | 100,000/Training |
| **Construction Phase**<br>Monitoring Consultants/Organizations offering specialized services in environmental management and monitoring | CSC & PMU | Short seminars on Environmental risks associated with construction phase.<br>Development of Environmental Performance Indicators<br>Occupational Health and Safety (OHS) issues | Two seminars for Contractor management staff and project staff dealing in environment and social issues | 1 day | 100,000/Training |
| **Operation Phase**<br>Water Treatment Plant Operator authorized representative or 3rd party trainer | WSSC Abbotabad | Short seminars on Environmental risks associated with operation phase.<br>Development of Environmental Performance Indicators<br>Occupational Health and Safety (OHS) issues | Bi-annual seminars | 1-2 Day | 600,000/Year |
| **Total** | | | **800,000**<br>**(PKR 0.8 million)** | | |

# 8 Public Consultation and Information Disclosure

524. 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.

525. 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.

526. The public consultation process was carried out by the KPCIP-EDCM team from start in May, 2020. 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.

527. Total 8 FGDs was conducted. Total 82 men and women participated in these 8 FGDs out of 82 participants 44 (53%) are women. Information on positive and negative impacts associated with constructional and operational stage and proper mitigation of adverse impacts were shared at these consultations. Questionnaires for conducting FGDs and Surveys are attached as **Annexure B**.

528. Details on the public consultations conducted are provided as **Annexure C**.

## 8.1 Identification of Stakeholders

529. 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

530. 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 extension of JICA WTP and Gravity water supply scheme, Abbottabad. 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.

### 8.1.2 Secondary Stakeholders

531. The secondary stakeholders are typically 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 extension of JICA WTP and Gravity water supply scheme, Abbottabad. These also include 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. They include project proponent local through WSSC Abbottabad, other concerned departments that may have a

role during various phases of the project, regulatory agencies such as EPA, other relevant departments such as Forest and Wildlife, non-governmental organizations (NGOs), the broader interested communities including academia and journalists, and general public.

## 8.2 Consultation Process

532. As part of the present environmental and social assessment, detailed consultations were carried out through village meetings and 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 Abbottabad, etc. Details of this consultation process are described below;

## 8.3 Consultation with Project Affected Peoples

533. The consultation with project affected peoples was carried out during the various site visits. All data of group discussion, individual discussion and FGDs was recorded. Total 8 FGDs conducted on WTP and WS&DS. Total 82 men and women participated in these 8 FGDs out of 82 participants 43(52%) are women. Details of stakeholder consultations are mentioned in **Table 8.1** and pictures are attached as **Figure 8.1**.

### 8.3.1 Issues, Concerns and Findings of the Focal Group Discussion:

- The people living in the vicinity of the project area had some concerns related to the water supply system of the city. The existing water supply is not sufficient to cater the needs of nearby localities in terms of water demand.
- People told that water supply from current JICA Water Treatment Plant sometimes had tapeworm or biological contamination.
- Broken lids of water tanks allow dust and dirt to settle down in the existing water storage tanks around city and thus making the drinking water impure.
- There are no special arrangements for cleaning the drains, it gets flooded with rainwater. With this, the wastewater often mixes into clean water pipeline and this water is again harmful to health. This is an indication of drinking water being contaminated at some point.
- The improvement in roads infrastructure near choona hill will help in easy access to different basic life necessities
- Due to unavailability of basic health units/ hospitals, the nearby residents of the proposed WTP area had to travel long distance for different health treatment.

### 8.3.2 Responses and Proposed Solutions:

- Residents in the site’s vicinity were assured that the extension of JICA Water Treatment Plant is proposed for the soul purpose to provide enough water supply to the residents of the city so they can fulfil their water needs just enough.
- 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/rehabilated with new structures.

- The drain shall be cleaned and arrangements shall be made separately to avoid mixing of wastewater in the clean water source.

- Widening and improvement of existing road infrastructure will also be considered a part of this project along the proposed project route.

- 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.

- Educating about the technologies that go into water treatment plant which will alleviate water supply shortage efficiently.

- Locals will be preferred for jobs provision as this is both socially and economically favored and feasible.

- Water quality at outlet of JICA water treatment plant will be monitored and any leakages into the water supply network shall also be noticed.

**Table 8.1: Consultation with Project Affected Peoples**

| Sr. No. | Date | Location of Consultation | Total No. of Participants | Comments/Concerns | Consultant Response |
|---|---|---|---|---|---|
| i | 13/05/2020 | Malik Pura | 18<br>(13 male and 05 female) | Broken lids of water tanks allow dust and dirt to settle down in those tanks and thus making the drinking water impure.<br>There is no special arrangements for cleaning the drains, it gets flooded with rainwater. With this, the wastewater often mixes into clean water pipeline and this water is again harmful to health. | 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.<br>The drain shall be cleaned and arrangements shall be made separately to avoid mixing of wastewater in the clean water source. |
| ii | 13/05/2020 | Lower Khel | 05 (male) | Road network shall be improved and widened for efficient transportation | Widening and improvement of existing road infrastructure will also be considered a part of this project along the proposed project route. |
| iii | 13/05/2020 | Degi Muhalla | 16<br>(06 male and 10 female) | Due to unavailability of water pumps in many houses, burden on the existing water pumps has increased which in turn have caused damaging of those pumps and thus disconnecting the flow of water. | 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. |
| iv | 13/05/2020 | Band-ko UC | 06<br>(male) | The project was appreciated as the extension of existing water supply network will increase the availability of clean water to the residents. | Educating about the technologies that go into water treatment plant which will alleviate water supply shortage efficiently. |

| | | | | | |
|---|---|---|---|---|---|
| v | 13/05/2020 | Old Seena laboratory chowk | 08 (male) | The existing water supply is not sufficient to cater the needs of nearby localities in terms of water demand. | The extension of JICA Water Treatment Plant is proposed for the soul purpose to provide enough water supply to the residents of the city so they can fulfil their water needs just enough. |
| vi | 13/05/2020 | District Compound | 07 (female) | Job opportunities shall be provided for the locals and they shall be educated about the new technologies to be installed at extension of JICA Water Treatment Plant. | Locals will be preferred for jobs provision as this is both socially and economically favored and feasible. |
| vii | 13/05/2020 | Mohalla Sikander Khel and Mohalla Jalal Baba | 14 (female) | Over population has affected every city/village around the Globe, which is why the current supply of clean drinking water is not enough for the existing population of the area. | The extension of JICA Water Treatment Plant is proposed for the soul purpose to provide enough water supply to the residents of the city so they can fulfil their water needs just enough. |
| viii | 13/05/2020 | District Colony | 08 (female) | Due to unknown reasons, the water supply from current JICA Water Treatment Plant sometimes detect tapeworm. This is an indication of drinking water being contaminated at some point. | Water quality at outlet of JICA water treatment plant will be monitored and any leakages into the water supply network shall also be noticed |

**Figure 8-1: Photographs of Focus Group Discussions**

| | |
|---|---|
|  |  |
| EDCM Social Safeguard team in consultation with secondary stakeholders at Old Seena Laboratory Chowk | EDCM Social Safeguard team in consultation with secondary stakeholders at Lower Malikpura |
|  |  |
| EDCM Social Safeguard team in consultation with secondary stakeholders at Lower MalikPura | EDCM Social Safeguard team in consultation with secondary stakeholders at Degi Muhalla |
|  |  |
| EDCM Social Safeguard team in consultation with secondary stakeholders at District Colony | EDCM Social Safeguard team in consultation with secondary stakeholders at Jalal Baba |

| | |
|---|---|
|  |  |
| EDCM Social Safeguard team in consultation with secondary stakeholders at District Colony | EDCM Social Safeguard team in consultation with secondary stakeholders at Jalal Baba |

## 8.4 Consultation with Official Stakeholders:

534. As part of environmental assessment, detailed meetings were held with the institutional stakeholders in the form of one-to-one meetings i.e. with EPA, WSSC Abbottabad, PkHA, KP Irrigation department and District Administeration. Details of this consultation process are described below

535. Officials of the Khyber Pakhtunkhwa Environmental Protection Agency (KP-EPA) have been consulted and briefed on the salient features of the project. Deputy Director KP-EPA Mr. Waheed stated that proper mitigation plan shall be designed and then implemented in the construction and operation phase of the project activities. Details of consultation meetings with official stake holders are mentioned in **Table 8.2** and photographs are attached as **Figure 8.2**.

536. Although the engagement is in its initial stages, at some point prior to and during construction the KP-EPA, as well as other KP government departments are expected to be increasingly involved in the stakeholder consultation process.

### Table 8.2 Findings of Consultation with Government Stakeholder

| 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 shall be in compliance with the KPEPA 2014 and NEQS. Project proponent shall 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 shall 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 shall 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. |
| **8** | 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 8-2: Photographs of Consultations with Institutional Stakeholders**

| | |
|---|---|
|  |  |
| Consultation with TMO and DC Abbottabad | PMU & EDCM Environmental and Social Safeguards experts meeting WSSC-Abbottabad officials |
|  |  |
| Meeting with KP EPA | Consultation with Irrigation Department |

## 8.5 Consultation Plan for Construction and Operation Phase

537. Consultation plan for construction and operation phase of extension of JICA water supply scheme Abbottabad 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/WSSCA offices and necessary changes in operational modalities will be introduced in the system in light of the response provided by the consultants.

# 9 Grievance Redressal Mechanism

## 9.1 General

538. 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 proposed extension of JICA WTP and GWSS works.

539. 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.

540. 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.

541. The PMU KPCIP 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.

542. 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 PMU office, construction sites and other key public offices in the project area. Should the grievance remain unresolved, it will be escalated to the second tier.

543. **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), Abbottabad who will pass unresolved complaints upward to the Grievance Redress Committee (GRC). The GRC will be established by WSSC Abbottabad 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 KP EPA (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.

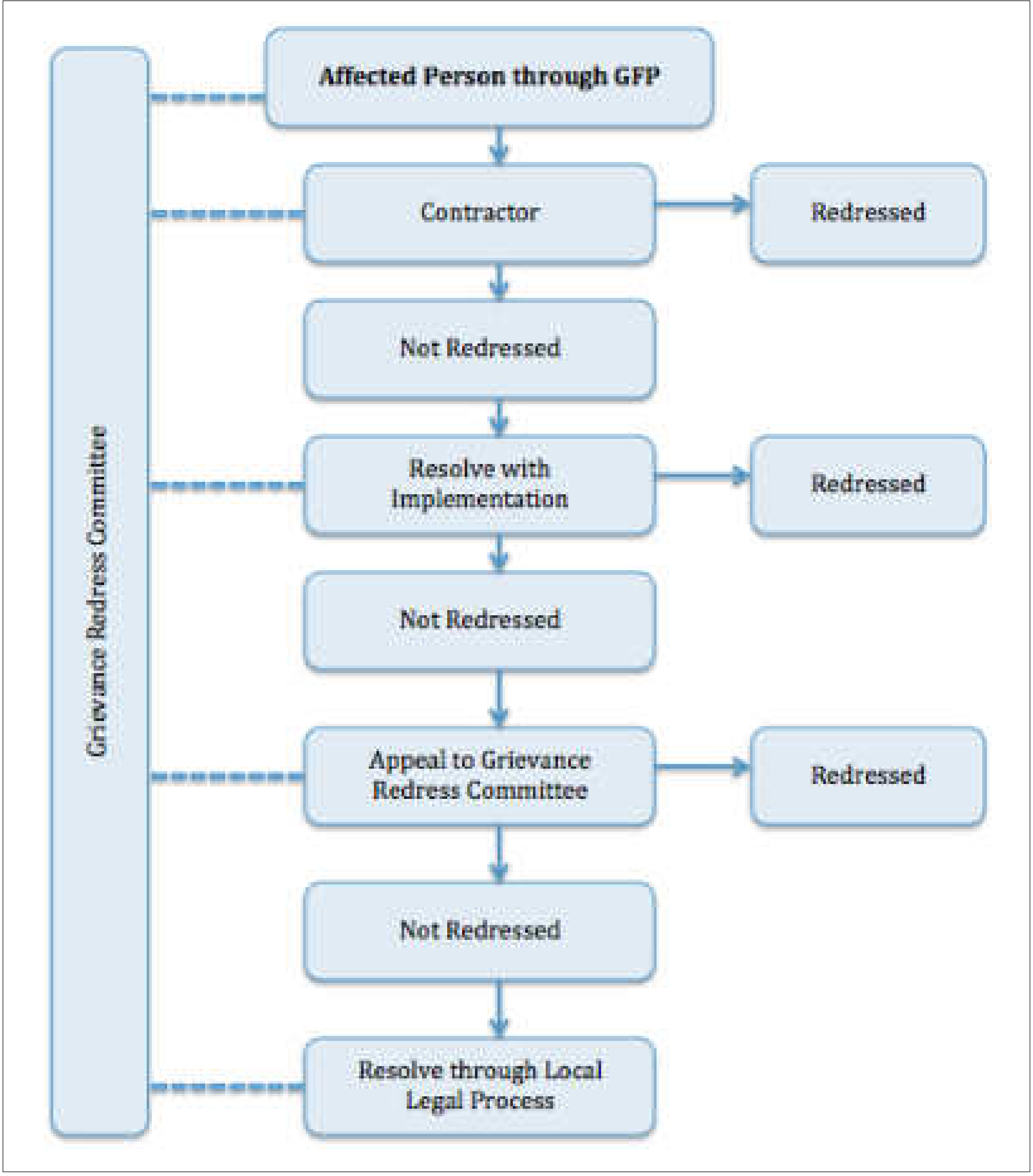
544. The functions of the local GRC are as follows: (i) resolve problems and provide support to affected persons arising from various environmental issues and including dust, noise, utilities, power and water supply, waste disposal, traffic interference and public safety as well as social issues and 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.

545. The WSSC Abbottabad 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.

546. **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 redressal through the district or sub-district committees as appropriate. The PMU or GRC will be kept informed by the district, municipal or national 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).

547. 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

548. The extension of JICA Gravity water supply system in Abbottabad is of high significance considering the urgent need for improving sustainable water supply system of Abbottabad city.

549. 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. Any environmental impacts associated with the project need to be properly mitigated, through the existing institutional arrangements described in this report.

550. The majority of the environmental impacts are associated with the design and operation phase of the project as they envisaged to be long-term, such as improper selection of intake source and reduce ecological flows, improper location of water treatment plant, improper designing of water treatment plant and distribution networks including transmission main and generation of solid waste, sludge and waste water during water treatment plant operation. Major impacts during construction phase will be related to traffic congestion and community health and safety issues during laying of water supply system in populated areas.

551. The implementation of mitigation measures during construction 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 traffic, noise, air pollution, waste generation etc.

552. 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.

553. Based on the above, this report concludes that there are no potential adverse environmental impacts from proposed JICA 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 Abbottabad will ensure appropriate staffing and budgeting for effective implementation and monitoring of project EMP.

85. 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**:

- 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 labour standards;

# 11 References

Ahmed, M. and Suphachalasai, S. (2014). Assessing the Cost of Climate Change and Adaptation in South Asia. Manila: ADB

Anjum, B. F. et al. (2005). Climate Change Perspective in Pakistan. Pakistan Journal of Meteorology. 2(2). pp. 11–21

Asian Development Bank (2017a): Mainstreaming Climate Risk Management into Urban Infrastructure Investments through Urban Resilience Assessments (URAs), Peshawar City, Khyber Pakhtunkhwa, Pakistan (UCCRTF TA-8913 PAK).

Asian Development Bank (2017b). Climate Change Operational Framework 2017-2030: Enhancing Actions for Low Greenhouse Gas Emissions and Climate-Resilient Development, Retrieved from: https://www.adb.org/sites/default/files/institutional-document/358881/ccof-2017-2030.pdf

ADB, Safeguards Unit for Central & West Asia Department, Environmental Management for Construction Handbook.

Asian Development Bank (2017c). Climate Change Profile of Pakistan. ISBN 978-92-9257-721-6 (Print), 978-92-9257-722-3 (e-ISBN). Publication Stock No. TCS178761. DOI: http://dx.doi.org/10.22617/TCS178761. Retrieved from: https://www.adb.org/sites/default/files/publication/357876/climate-change-profile-pakistan.pdf

Asian Development Bank (2014). Midterm Review of Strategy 2020: Meeting the Challenges of a Transforming Asia and Pacific

National Disaster Management Authority 2008: Seismic Zoning Map of Pakistan

EIA of Hasanabdal – Havelian Section of E-35 Project.

1998 District census report of Abbottabad. Census publication. Islamabad: Population Census Organization, Statistics Division, Government of Pakistan. 1999

Chaudhry, Q. Z. et al. (2009). Climate Change Indicators of Pakistan. Technical Report. No. 22. Islamabad: Pakistan Meteorological Department.

IPCC (2014). Climate Change 2014: Impacts, Adaptation, and Vulnerability. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Field, C.B., V.R. Barros, D.J. Dokken, K.J. Mach, M.D. Mastrandrea, T.E. Bilir, M. Chatterjee, K.L. Ebi, Y.O. Estrada, R.C. Genova, B. Girma, E.S. Kissel, A.N. Levy, S. MacCracken, P.R. Mastrandrea, and L.L. White (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

Rehman, N., Adnan, M. and Ali, S. (2018) ‘Assessment of CMIP5 climate models over South Asia and climate change projections over Pakistan under representative concentration pathways’, Int. J. Global Warming, Vol. 16, No. 4, pp.381–415.

# 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 – KPCIP Abbottabad Water Supply Development & Water Treatment Plant

**Sector Division:** Water Supply Infrastructure Development

| Screening Questions | Yes | No | Remarks |
|---|---|---|---|
| **A. Project Siting**<br>Is the project area… | | | |
| ▪ Densely populated? | √ | | There are a number of clusters of residential settlements as well as scattered individual settlements in the project area at close proximity to the proposed water supply alignment. |
| ▪ Heavy with development activities? | | √ | No development activities presently being conducted in project area of the proposed water supply alignment. |
| ▪ Adjacent to or within any environmentally sensitive areas? | | | |
| • Cultural heritage site | | √ | Not applicable. |

| **Screening Questions** | **Yes** | **No** | **Remarks** |
|---|---|---|---|
| • Protected Area | | √ | Not applicable.<br>Two protected areas, the Ayubia National Park and the Qalandarabad game reserve, have been designated by KP wildlife department with in project area. Both protected areas are away from proposed WTP location. The closest is Ayubia National Park which is located at approximately 15 Kms from proposed WTP area. |
| • Wetland | | √ | Not applicable. |
| • Mangrove | | √ | Not applicable. |
| • Estuarine | | √ | Not applicable. |
| • Buffer zone of protected area | | √ | Not applicable. |
| • Special area for protecting biodiversity | | √ | Not applicable. |
| • Bay | | √ | Not applicable. |
| **B. Potential Environmental Impacts**<br>Will the Project cause… | | | |
| ▪ pollution of raw water supply from upstream wastewater discharge from communities, industries, agriculture, and soil erosion runoff? | √ | | Pollution of raw water supply from the existing community settlements is possible since although they will be advised to not pollute the river flow, however, it is possible they might discharge wastewater into it. |
| ▪ impairment of historical/cultural monuments/areas and loss/damage to these sites? | | √ | No sites of historical or cultural significance in project area of the water supply pipeline alignment. |
| ▪ hazard of land subsidence caused by excessive ground water pumping? | | √ | Not applicable since an existing river is to be used for obtaining water. |
| ▪ social conflicts arising from displacement of communities? | | √ | Not applicable since no communities are expected to be displaced due to the proposed sub-project activity. |
| ▪ conflicts in abstraction of raw water for water supply with other beneficial water uses for surface and ground waters? | | | Not applicable since the river water body has substantial flow in it year-round and thus no conflicts are expected. |
| ▪ unsatisfactory raw water supply (e.g. excessive pathogens or mineral constituents)? | √ | | It is possible that the raw water supply is unsatisfactory since it will be treated in the water treatment plant. |
| ▪ delivery of unsafe water to distribution system? | √ | | It is possible that the raw water to be abstracted from the river may be unsafe. |

| Screening Questions | Yes | No | Remarks |
|---|---|---|---|
| ▪ inadequate protection of intake works or wells, leading to pollution of water supply? | √ | | It is possible that pollution of water supply may take place due to inadequate protection of intake works. |
| ▪ over pumping of ground water, leading to salinization and ground subsidence? | | √ | Not applicable as no ground water will be abstracted. |
| ▪ excessive algal growth in storage reservoir? | √ | | It is possible that if proper maintenance of the water treatment plant is not conducted, it could lead to algal growth in the storage reservoir. |
| ▪ increase in production of sewage beyond capabilities of community facilities? | | √ | Not applicable since only the water supply network is being screened here. |
| ▪ inadequate disposal of sludge from water treatment plants? | √ | | It is possible that the sludge to be produced from the water treatment plant may not be disposed off properly. |
| ▪ inadequate buffer zone around pumping and treatment plants to alleviate noise and other possible nuisances and protect facilities? | √ | | No specific buffer is expected to be ensured around the pumping network and treatment plant. |
| ▪ impairments associated with transmission lines and access roads? | √ | | Considering the existing situation in the project area, it is quite possible that impairments of access roads might take place. |
| ▪ health hazards arising from inadequate design of facilities for receiving, storing, and handling of chlorine and other hazardous chemicals. | √ | | Such health hazards are possible if proper protocols for handling of chlorine and other hazardous chemicals are not implemented.<br>COVID-19 spread is possible if related measure/SOPs not implemented |
| ▪ 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? | √ | | Such health hazards are possible if proper protocols for handling of chlorine and other hazardous chemicals are not implemented.<br>COVID-19 spread is possible if related measure/SOPs not implemented |
| ▪ dislocation or involuntary resettlement of people? | | √ | No dislocation or resettlement is expected. |
| ▪ disproportionate impacts on the poor, women and children, Indigenous Peoples or other vulnerable groups? | | √ | No such impacts are expected. |

| Screening Questions | Yes | No | Remarks |
|---|---|---|---|
| ▪ noise and dust from construction activities? | √ | | High noise and dust levels are expected during the construction activities. |
| ▪ increased road traffic due to interference of construction activities? | √ | | Increase in road traffic is expected during the construction activities. |
| ▪ continuing soil erosion/silt runoff from construction operations? | √ | | Soil erosion runoff and silt runoff is possible, particularly considering the terrain of the project area. |
| ▪ 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? | √ | | Such a risk is realistic in case poor O&M of the treatment plant is conducted. |
| ▪ delivery of water to distribution system, which is corrosive due to inadequate attention to feeding of corrective chemicals? | √ | | Such an impact is possible if proper maintenance and injection of required chemicals is not conducted. |
| ▪ accidental leakage of chlorine gas? | √ | | It is possible that chlorine gas may leak accidentally from the water treatment plant. |
| ▪ excessive abstraction of water affecting downstream water users? | | √ | No such impacts are expected since the abstraction will be controlled to prevent any issues related to drying up of the river water source. |
| ▪ competing uses of water? | | √ | There is sufficient river flow year-round and thus no issues with competing for use of water is expected. |
| ▪ increased sewage flow due to increased water supply | | √ | No such impacts are expected. |
| ▪ increased volume of sullage (wastewater from cooking and washing) and sludge from wastewater treatment plant | √ | | An increase in volume of sullage is possible. |
| ▪ large population influx during project construction and operation that causes increased burden on social infrastructure and services (such as water supply and sanitation systems)? | | √ | Majority of local labor is expected to be hired and thus no large population influx is expected. |
| ▪ social conflicts if workers from other regions or countries are hired? | | √ | Majority of local labor is expected to be hired. |
| ▪ 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? | √ | | Risks to community do exist considering their proximity to the project works and the scope of activities to be conducted during the project construction and operation. |

| Screening Questions | Yes | No | Remarks |
|---|---|---|---|
| ▪ 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? | √ | | Such risks to the community do exist, particularly considering their proximity to the water supply alignment and the water treatment plant. |

* Hazards are potentially damaging physical events.

# Annexure B

# Questionnaires for Conducting FGDs & Surveys

Focal Group Discussion (FGD)

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 | | | | | |

[illegible]

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 Signatores, 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. [illegible]
iv. Educational (Social Welfare)
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/local organizations in your area and state their functional status?

| Sr. No. | Name of Organization | Category | Registered/ Unregistered | Function |
|---|---|---|---|---|
| 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 those 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 informal source
Formal source (s) ______________
Informal source (s) ______________
Percentage of amount ______________

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 raising | ☐ | ☐ |
| 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 [illegible]? Yes ______ No ______

If yes then

| Category | Area<br>Acre | Kanal | Value of Land (Rs.) | Remarks |
|---|---|---|---|---|
| Cultivated | | | | |
| Uncultivated | | | | |
| Grazing | | | | |
| Barren Land | | | | |
| Waste Land | | | | |
| Other | | | | |
| Total | | | | |

14.2 Affected Cropping Area

If yes then Yes ______ No ______

| 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

If yes then Yes ______ No ______

| 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 Tubewells | 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 residential 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

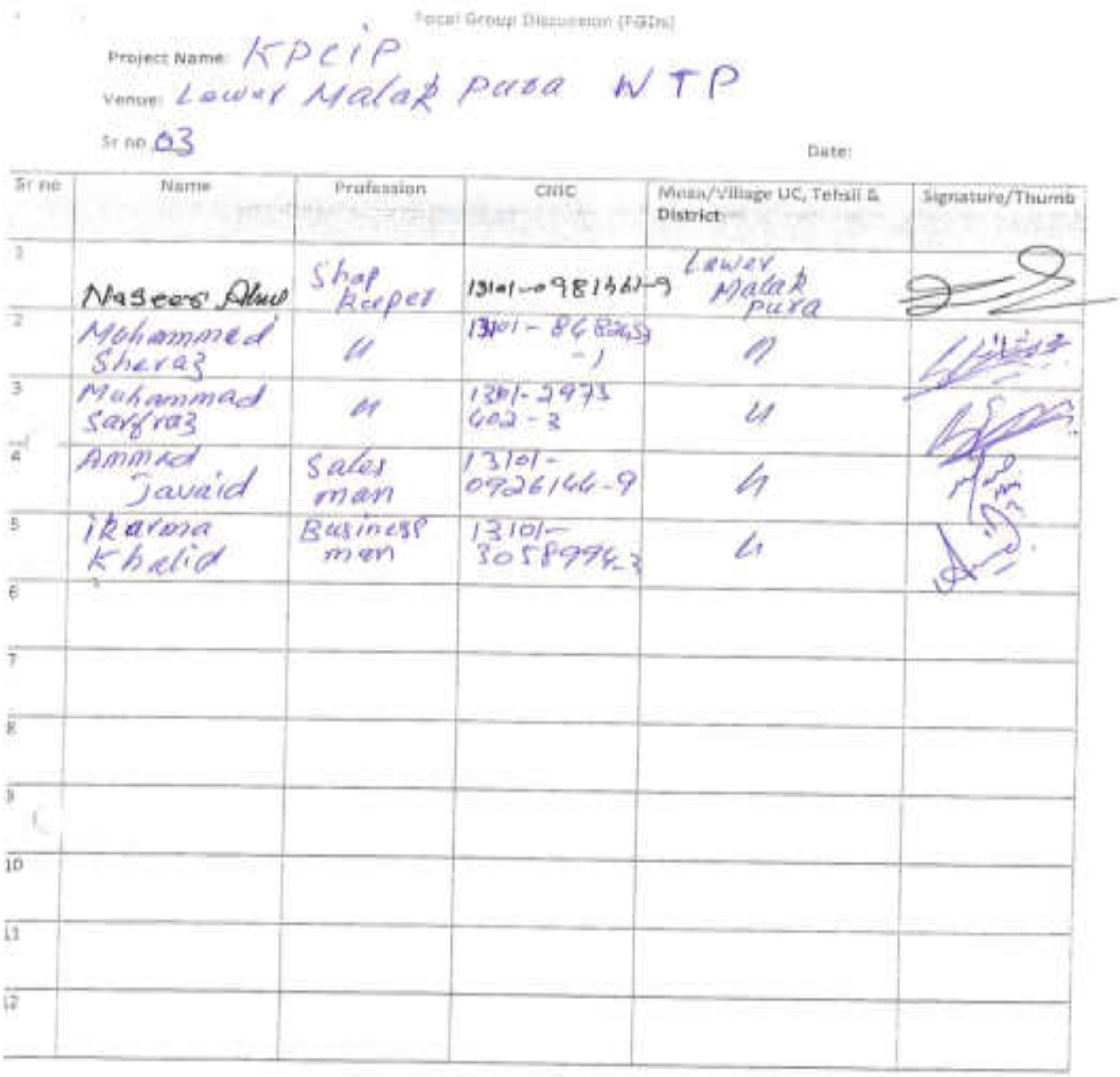
________________________________________

________________________________________

Name & Signature of Interviewer: ____________________ Date: ________

# Annexure C

# Details of public consultations



Focal Group Discussion (FGDs)

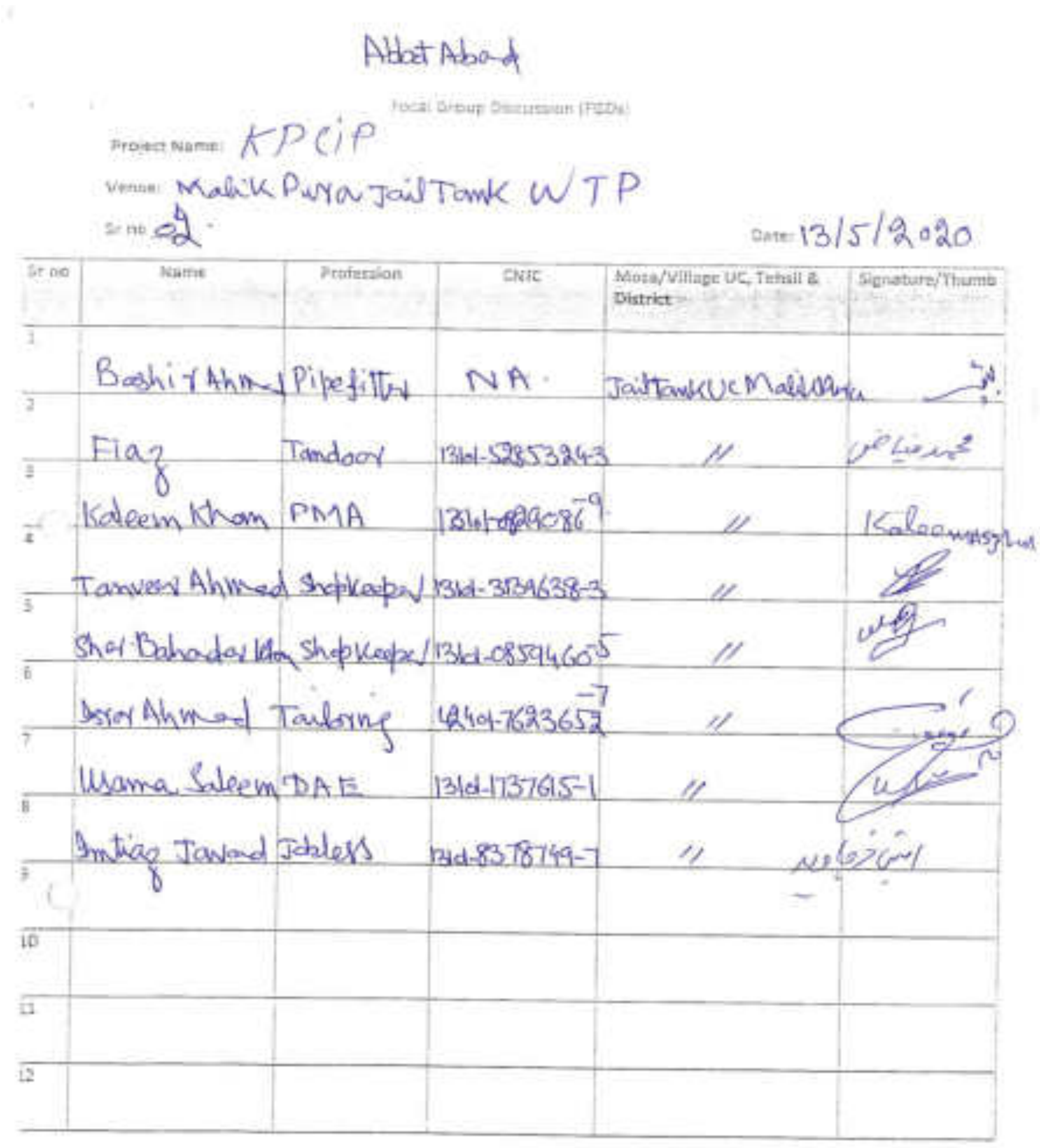
Project Name: KPCIP

Venue: Lower Malak pura WTP

Sr no 03

Date:

| Sr no | Name | Profession | CNIC | Mouza/Village UC, Tehsil & District | Signature/Thumb |
|---|---|---|---|---|---|
| 1 | Naseer Alam | Shop keeper | 13101-0981562-9 | Lower Malak pura | |
| 2 | Mohammed Sheraz | " | 13101-868265 -1 | " | |
| 3 | Mohammad Sarfraz | " | 1301-2973 602-3 | " | |
| 4 | Ammad Javaid | Sales man | 13101-0926166-9 | " | |
| 5 | ikrama Khalid | Business man | 13101-3058994-3 | " | |
| 6 | | | | | |
| 7 | | | | | |
| 8 | | | | | |
| 9 | | | | | |
| 10 | | | | | |
| 11 | | | | | |
| 12 | | | | | |



Abbot Abad

Focal Group Discussion (FGDs)

Project Name: KPCIP

Venue: Malik Pura Jail Tank WTP

Sr no 02

Date: 13/5/2020

| Sr no | Name | Profession | CNIC | Moza/Village UC, Tehsil & District | Signature/Thumb |
|---|---|---|---|---|---|
| 1 | Bashir Ahmad | Pipefitter | NA | Jail Tank UC Malik Pura | |
| 2 | Fiaz | Tandoor | 13101-5285324-3 | // | |
| 3 | Kaleem Khan | PMA | 1310[illegible]89086-9 | // | Kaleem[illegible] |
| 4 | Tanveer Ahmad | Shopkeeper | 13101-3134638-3 | // | |
| 5 | Sher Bahadar Khan | Shopkeeper | 13101-0859460-5 | // | |
| 6 | Israr Ahmad | Tailoring | 42401-7623652-7 | // | |
| 7 | Usama Saleem | DAE | 13101-1737615-1 | // | |
| 8 | Imtiaz Javed | Jobless | 13101-8378749-7 | // | |
| 9 | | | | | |
| 10 | | | | | |
| 11 | | | | | |
| 12 | | | | | |

110 km.

Focal Group Discussion (FGDs)

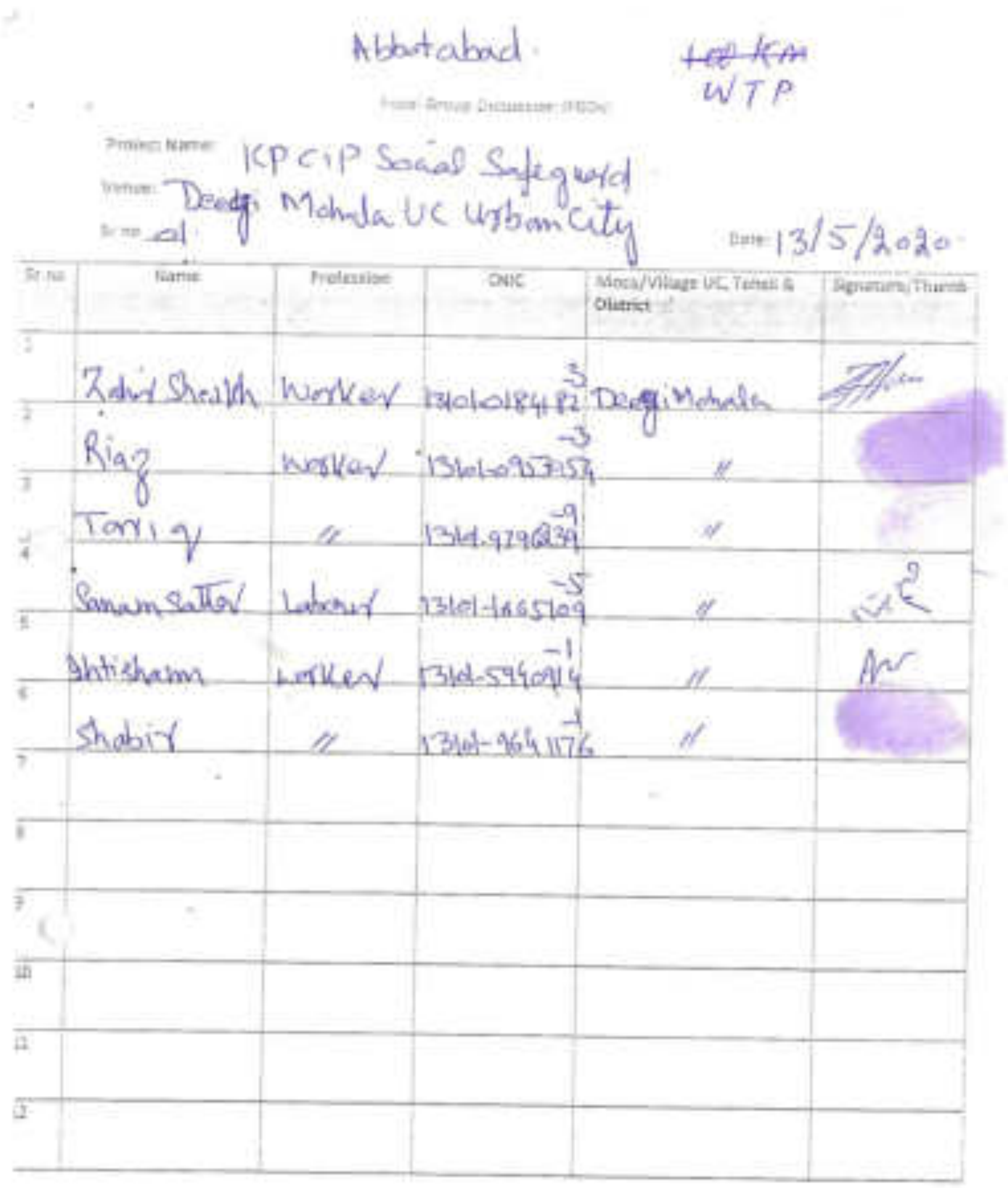
Project Name: KPCIP

Venue: Lower Khail AJJ office UC Khal word 13.

Sr no 05

Date:

| Sr no | Name | Profession | CNIC | Moza/Village UC, Tehsil & District | Signature/Thumb |
|---|---|---|---|---|---|
| 1 | Raja Fiaz | | 13101-1009830-7 | Lower Khel ward 13 | |
| 2 | Sultan Shams | Ex Nazim | 13101-8086869-3 | // | |
| 3 | Mchamad Wali | Ex Member | 13101-962777-7 | // | |
| 4 | Mchamad Naeem | Shopkeeper | 13101-3749052-9 | // | |
| 5 | Gull Ahmed | Shopkeeper | 13101-7003367-7 | // | |
| 6 | Mchamad Asif | pipe fitter | 13101-0588057-1 | // | |
| 7 | | | | | |
| 8 | | | | | |
| 9 | | | | | |
| 10 | | | | | |
| 11 | | | | | |
| 12 | | | | | |



Abbotabad ~~Lee KA~~ WTP

Focus Group Discussion (FGDs)

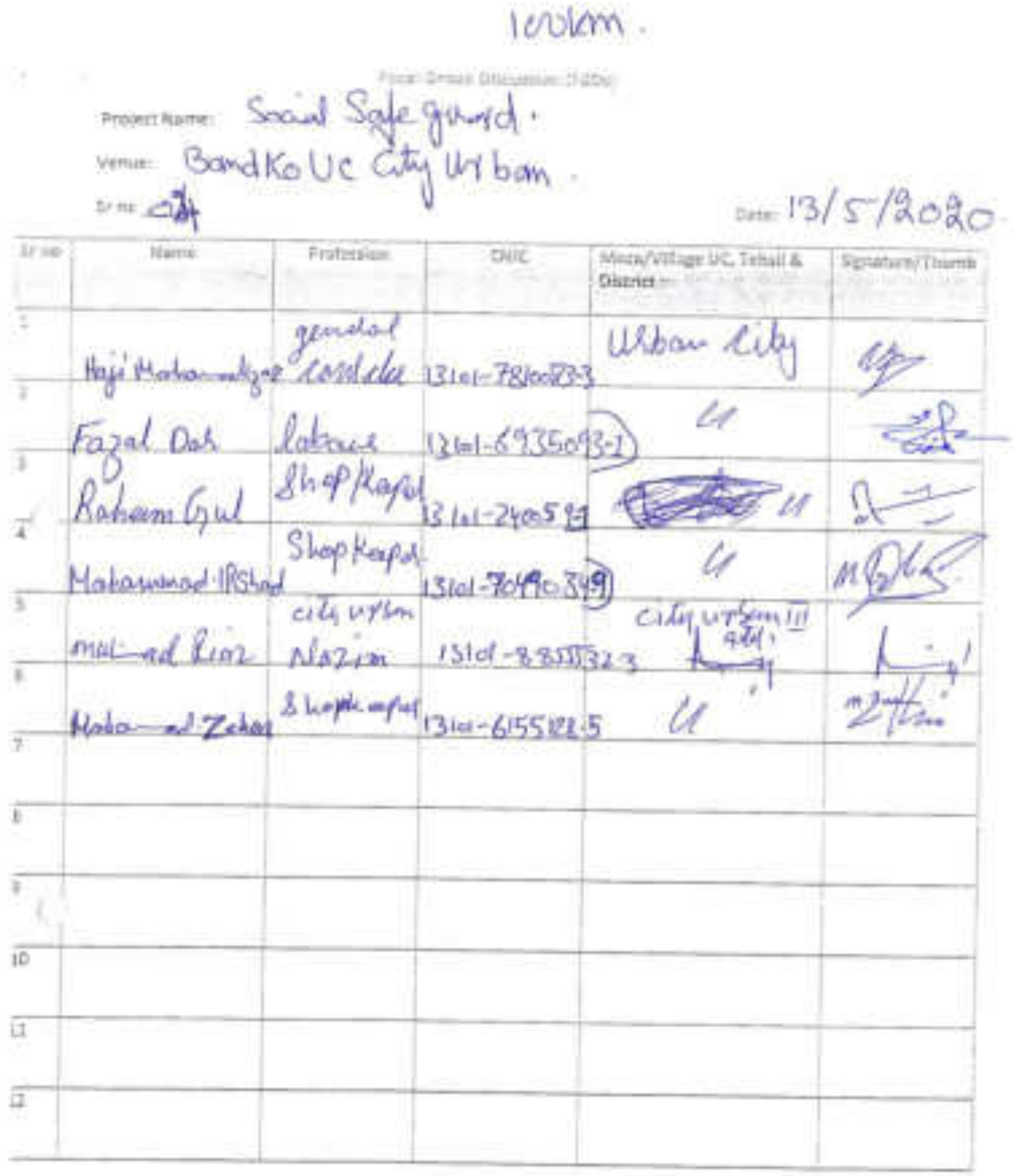
Project Name: KPCIP Social Safeguard

Venue: Deegi Mohala UC Urban City

Sr no: 01

Date: 13/5/2020

| Sr no | Name | Profession | CNIC | Moza/Village UC, Tehsil & District | Signature/Thumb |
|---|---|---|---|---|---|
| 1 | Zahid Sheikh | Worker | 1310101848 2-3 | Deegi Mohala | |
| 2 | Riaz | Worker | 1310109577157-3 | 〃 | |
| 3 | Tariq | 〃 | 13101-9798339-9 | 〃 | |
| 4 | Sanam Sattar | Labour | 13101-4865109-5 | 〃 | |
| 5 | Ihtisham | Worker | 13101-5940914-1 | 〃 | |
| 6 | Shabir | 〃 | 13101-9641176-1 | 〃 | |
| 7 | | | | | |
| 8 | | | | | |
| 9 | | | | | |
| 10 | | | | | |
| 11 | | | | | |
| 12 | | | | | |



1eolam.

Focal Group Discussion (FGDs)

Project Name: Social Safeguard.

Venue: Band Ko UC City Urban.

Sr no: 24

Date: 13/5/2020

| Sr no | Name | Profession | CNIC | Mouza/Village UC, Tehsil & District | Signature/Thumb |
|---|---|---|---|---|---|
| 1 | Haji Mohammadzar | general cordeler | 13101-7810073-3 | Urban City | |
| 2 | Fazal Dad | labour | 13101-6935093-1 | u | |
| 3 | Raham Gul | Shop Kapd | 13101-2400599 | u | |
| 4 | Mohammad IRShad | Shop Kapd | 13101-70490349 | u | |
| 5 | Muhammad Riaz | city urban Nazim | 13101-8855532-3 | city urban III | |
| 6 | Mohammad Zahoor | Shop kapra | 13101-6155122-5 | u | |
| 7 | | | | | |
| 8 | | | | | |
| 9 | | | | | |
| 10 | | | | | |
| 11 | | | | | |
| 12 | | | | | |

100 km

Focus Group Discussion (FGDs)

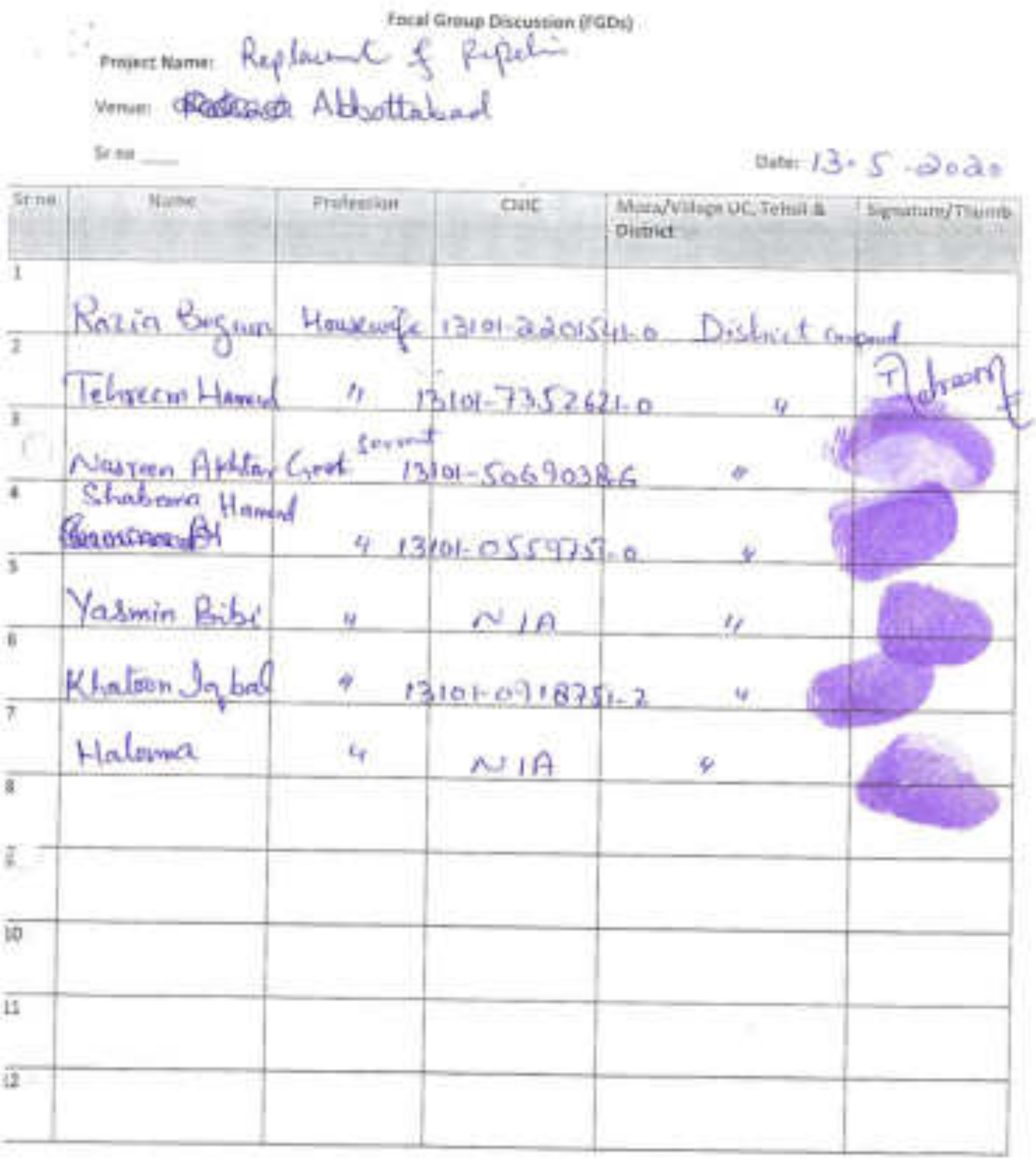
Project Name: KPCIP

Venue: old Seena Labartory chowk UC kehal ward #15

Sr no. 06

Date:

| Sr no | Name | Profession | CNIC | Mouza/Village UC, Tehsil & District | Signature/Thumb |
|---|---|---|---|---|---|
| 1 | Raja Nasir | Property Dealer | 13101-7197785-9 | old seena labartary chawk UC kehal ward #15 | |
| 2 | Farid Muhammad | Thekedar | 13101-9034556-5 | " | |
| 3 | Abeed ur Rehman | property Dealer | 131019495784- | " | |
| 4 | Faisal Iqbal | Business man | 13101-4357138-1 | " | |
| 5 | Muhammad Sabar | " | 13101-7468017-9 | " | |
| 6 | Muhammad Bashir | " | 13101-0986995-7 | " | محمد بشیر |
| 7 | Abdul Manan | Gov. servant | 13101-7853823-5 | " | |
| 8 | Muhammad Pervaiz | Driver | 13101-8343594-1 | " | |
| 9 | | | | | |
| 10 | | | | | |
| 11 | | | | | |
| 12 | | | | | |



Focal Group Discussion (FGDs)

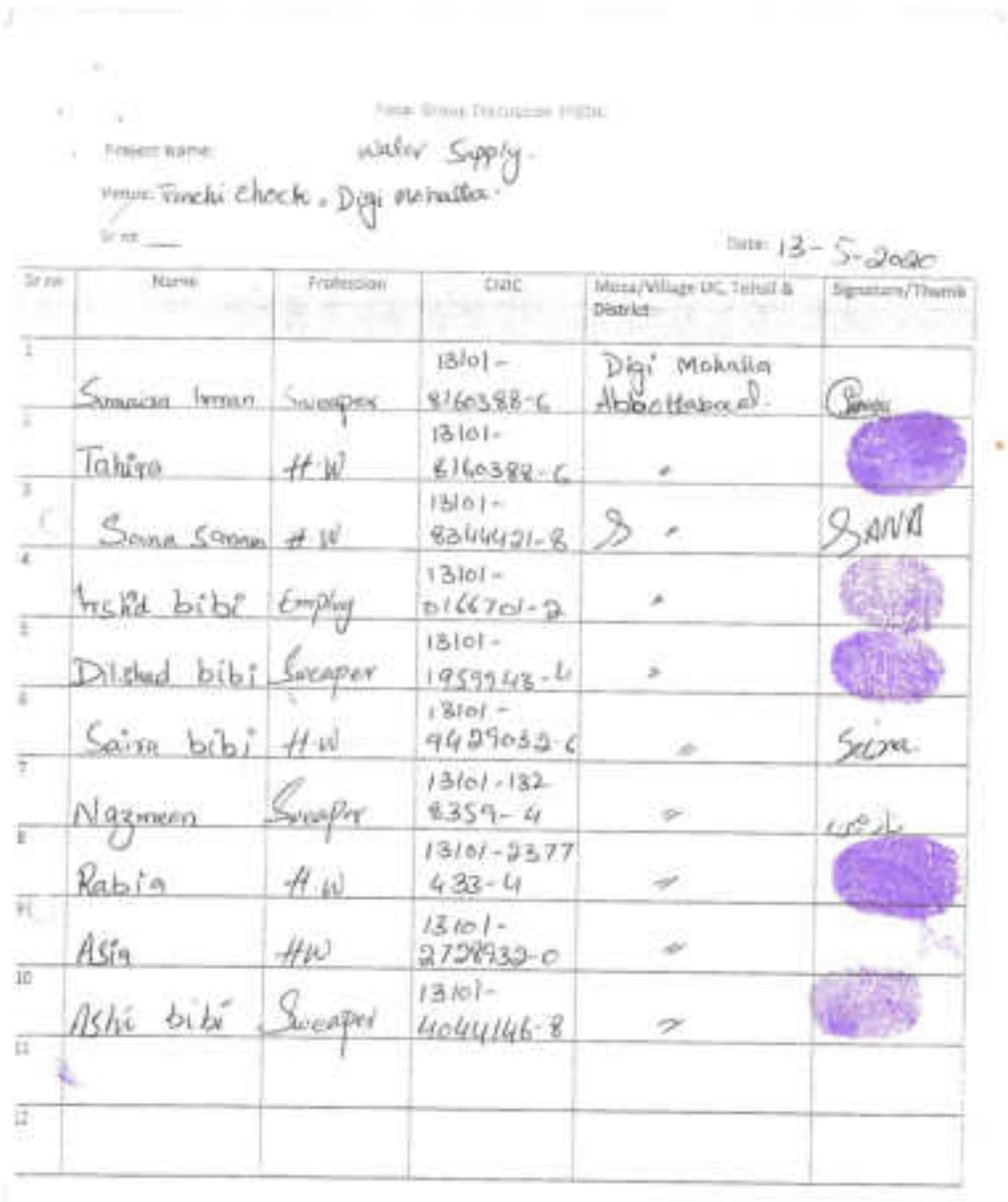
Project Name: Replacement of Pipeline

Venue: ~~[illegible]~~ Abbottabad

Sr no ____

Date: 13-5-2020

| Sr no | Name | Profession | CNIC | Mora/Village UC, Tehsil & District | Signature/Thumb |
|---|---|---|---|---|---|
| 1 | Razia Begum | Housewife | 13101-2201541-0 | District Council | |
| 2 | Tehreem Hamid | 〃 | 13101-7352621-0 | 〃 | Tehreem |
| 3 | Nasreen Akhtar | Govt Servant | 13101-5069038-6 | 〃 | 〃 |
| 4 | Shabana Hamid ~~[illegible]~~ | 〃 | 13101-0559757-0 | 〃 | |
| 5 | Yasmin Bibi | 〃 | N/A | 〃 | |
| 6 | Khatoon Iqbal | 〃 | 13101-0918751-2 | 〃 | |
| 7 | Halima | 〃 | N/A | 〃 | |
| 8 | | | | | |
| 9 | | | | | |
| 10 | | | | | |
| 11 | | | | | |
| 12 | | | | | |



[illegible]

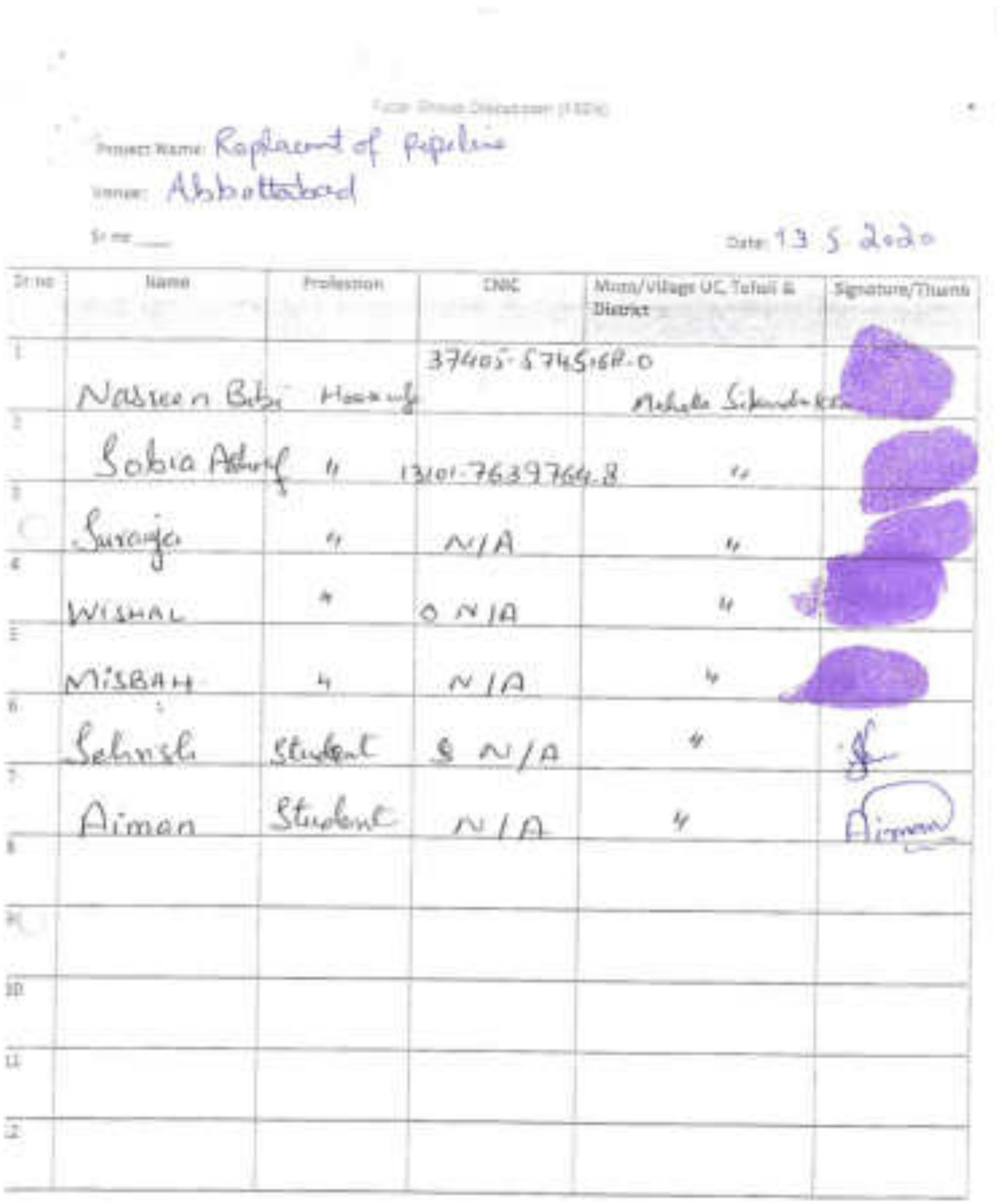
Project Name: Water Supply.

Venue: Fanchi check, Digi Mohalla.

Sr no: ___

Date: 13-5-2020

| Sr no | Name | Profession | CNIC | Moza/Village UC, Tehsil & District | Signature/Thumb |
|---|---|---|---|---|---|
| 1 | Samina Imran | Sweaper | 13101-8160388-6 | Digi Mohalla Abbottabad. |  |
| 2 | Tahira | H.W | 13101-8160388-6 | 〃 |  |
| 3 | Sana Saman | H.W | 13101-8344421-8 | S 〃 | Sana |
| 4 | Irshad bibi | Employ | 13101-0166701-2 | 〃 |  |
| 5 | Dilshad bibi | Sweaper | 13101-1959943-6 | 〃 |  |
| 6 | Saira bibi | H.W | 13101-9429032-6 | 〃 | Saira |
| 7 | Nazmeen | Sweapr | 13101-1828359-4 | 〃 |  |
| 8 | Rabia | H.W | 13101-2377433-4 | 〃 |  |
| 9 | Asia | HW | 13101-2728932-0 | 〃 |  |
| 10 | Ashi bibi | Sweaper | 13101-4044146-8 | 〃 |  |
| 11 |  |  |  |  |  |
| 12 |  |  |  |  |  |



Focus Group Discussion (FGDs)

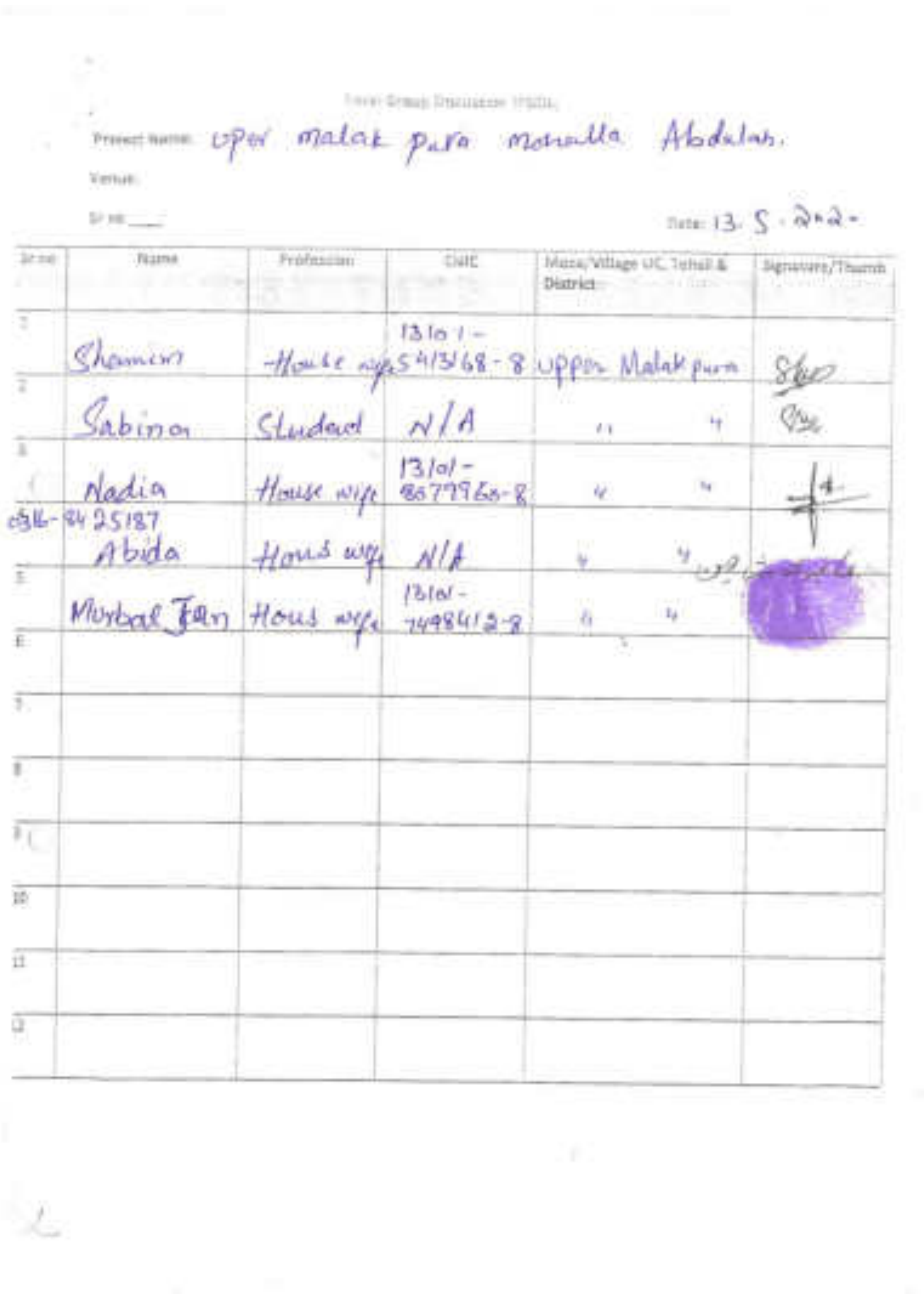
Project Name: Replacement of Pipeline

Venue: Abbottabad

Sr no ___

Date: 13 5 2020

| Sr no | Name | Profession | CNIC | Mohalla/Village UC, Tehsil & District | Signature/Thumb |
|---|---|---|---|---|---|
| 1 | Nasreen Bibi | House wife | 37405-5745168-0 | Mohala Sikandar | |
| 2 | Sobia Ashraf | " | 13101-7639764-8 | " | |
| 3 | Suraiya | " | N/A | " | |
| 4 | WISHAL | " | 0 N/A | " | |
| 5 | MISBAH | " | N/A | " | |
| 6 | Sehrish | Student | N/A | " | |
| 7 | Aiman | Student | N/A | " | Aiman |
| 8 | | | | | |
| 9 | | | | | |
| 10 | | | | | |
| 11 | | | | | |
| 12 | | | | | |



Focus Group Discussion (FGDs)

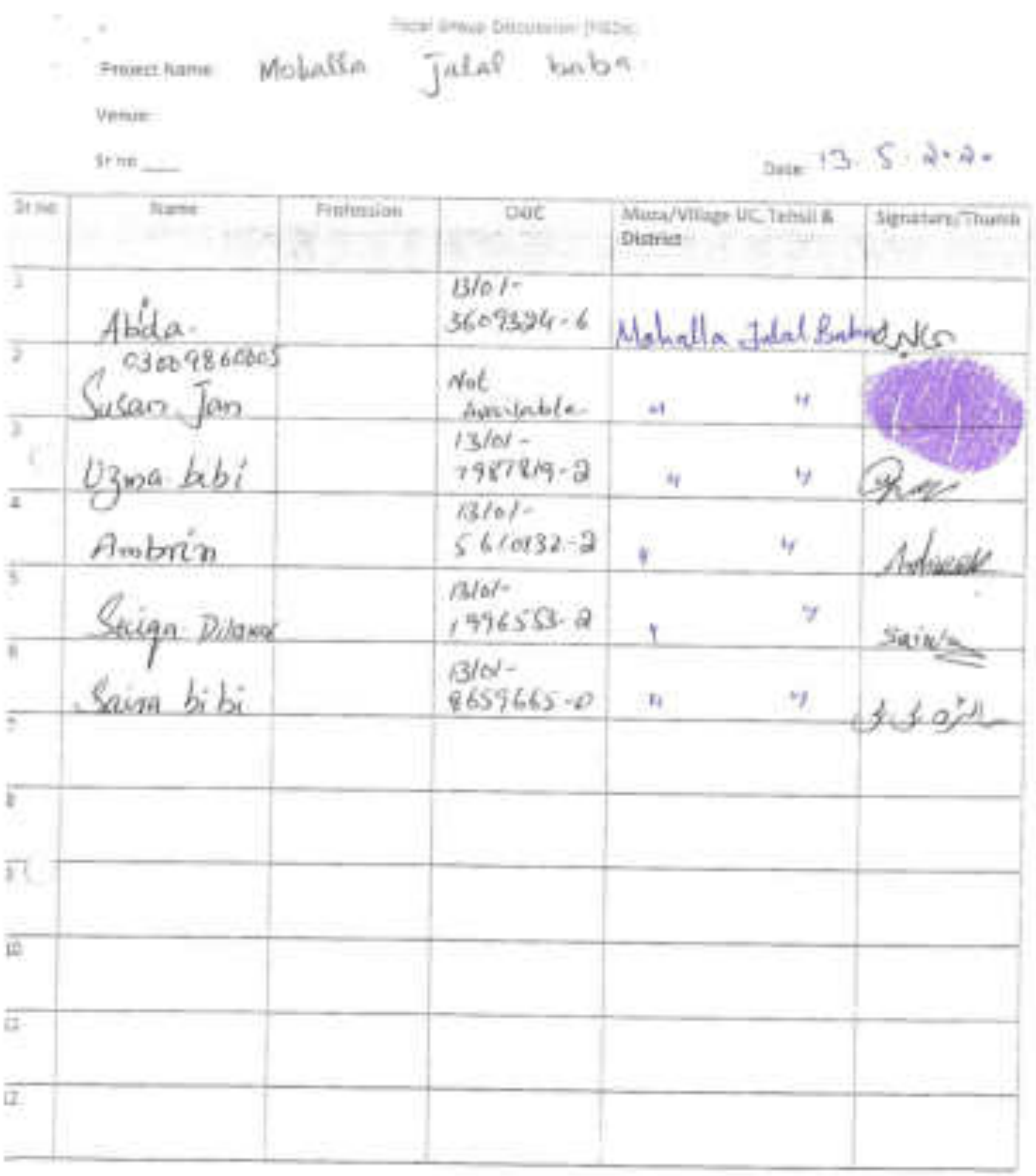
Project Name: uper malak pura mohalla Abdulah.

Venue:

Sr no: ___

Date: 13. 5. 2022

| Sr no | Name | Profession | CNIC | Moza/Village UC, Tehsil & District | Signature/Thumb |
|---|---|---|---|---|---|
| 1 | Shamim | House wife | 13101-5413168-8 | upper Malak pura | |
| 2 | Sabina | Studant | N/A | 〃 〃 | |
| 3 | Nadia | House wife | 13101-8577968-8 | 〃 〃 | |
| 4 | Abida<br>0316-8425187 | Hous wife | N/A | 〃 〃 | |
| 5 | Mubal Jan | Hous wife | 13101-7498412-8 | 〃 〃 | |
| 6 | | | | | |
| 7 | | | | | |
| 8 | | | | | |
| 9 | | | | | |
| 10 | | | | | |
| 11 | | | | | |
| 12 | | | | | |



Focal Group Discussion (FGDs)

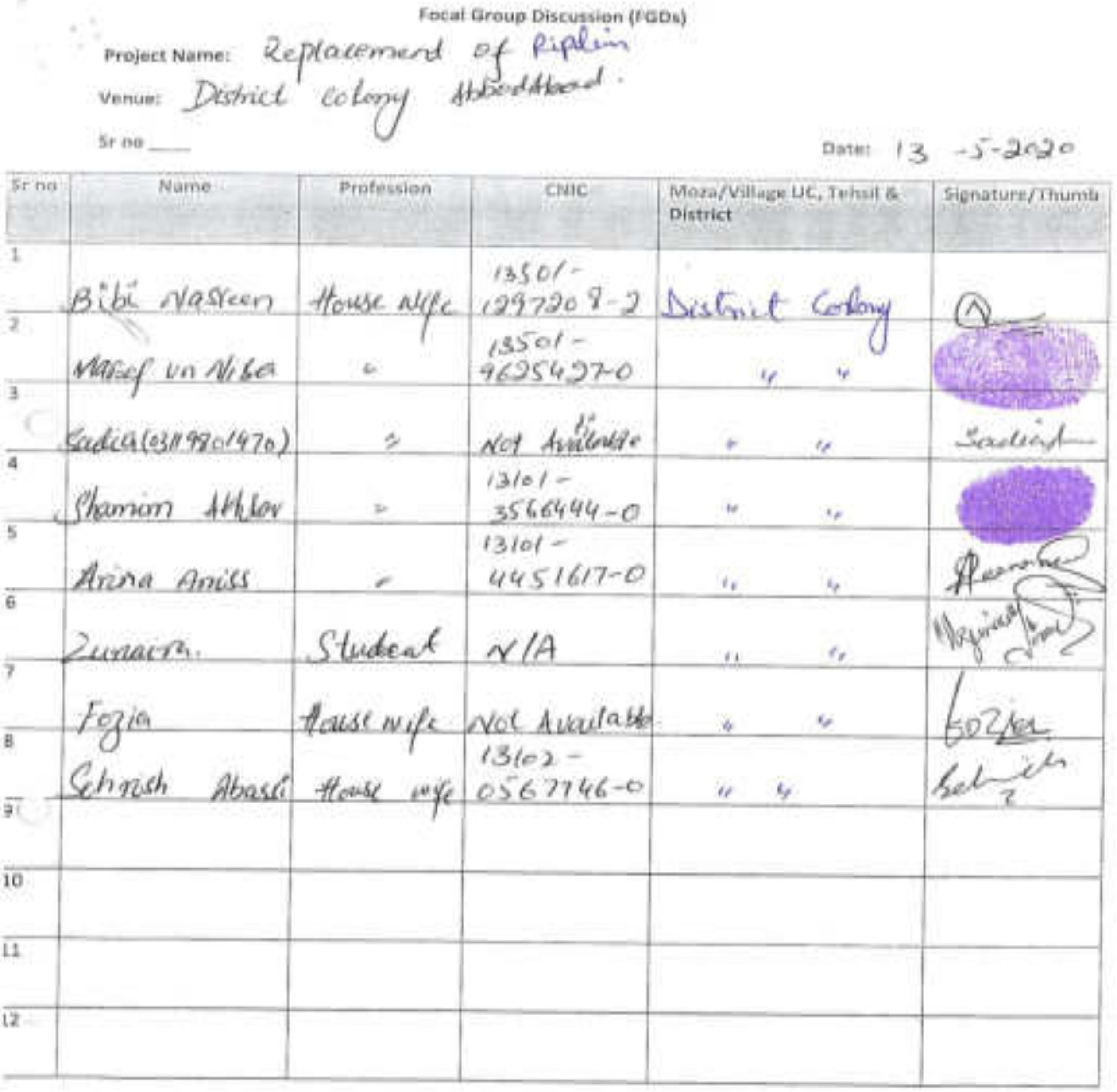
Project Name: Mohalla Jalal baba

Venue:

Sr no ____

Date: 13. 5. 2.2.

| Sr no | Name | Profession | CNIC | Mauza/Village UC, Tehsil & District | Signature/Thumb |
|---|---|---|---|---|---|
| 1 | Abida | | 13101-3609324-6 | Mohalla Jalal Baba | |
| 2 | 03009860005<br>Susan Jan | | Not Available | " " | |
| 3 | Uzma bibi | | 13101-7987819-2 | " " | |
| 4 | Ambrin | | 13101-5610132-2 | " " | |
| 5 | Saiqa Dilawar | | 13101-1996553-2 | " " | |
| 6 | Saira bibi | | 13101-8659665-0 | " " | |
| 7 | | | | | |
| 8 | | | | | |
| 9 | | | | | |
| 10 | | | | | |
| 11 | | | | | |
| 12 | | | | | |



**Focal Group Discussion (FGDs)**

Project Name: Replacement of Pipline

Venue: District colony Abbottabad.

Sr no ____

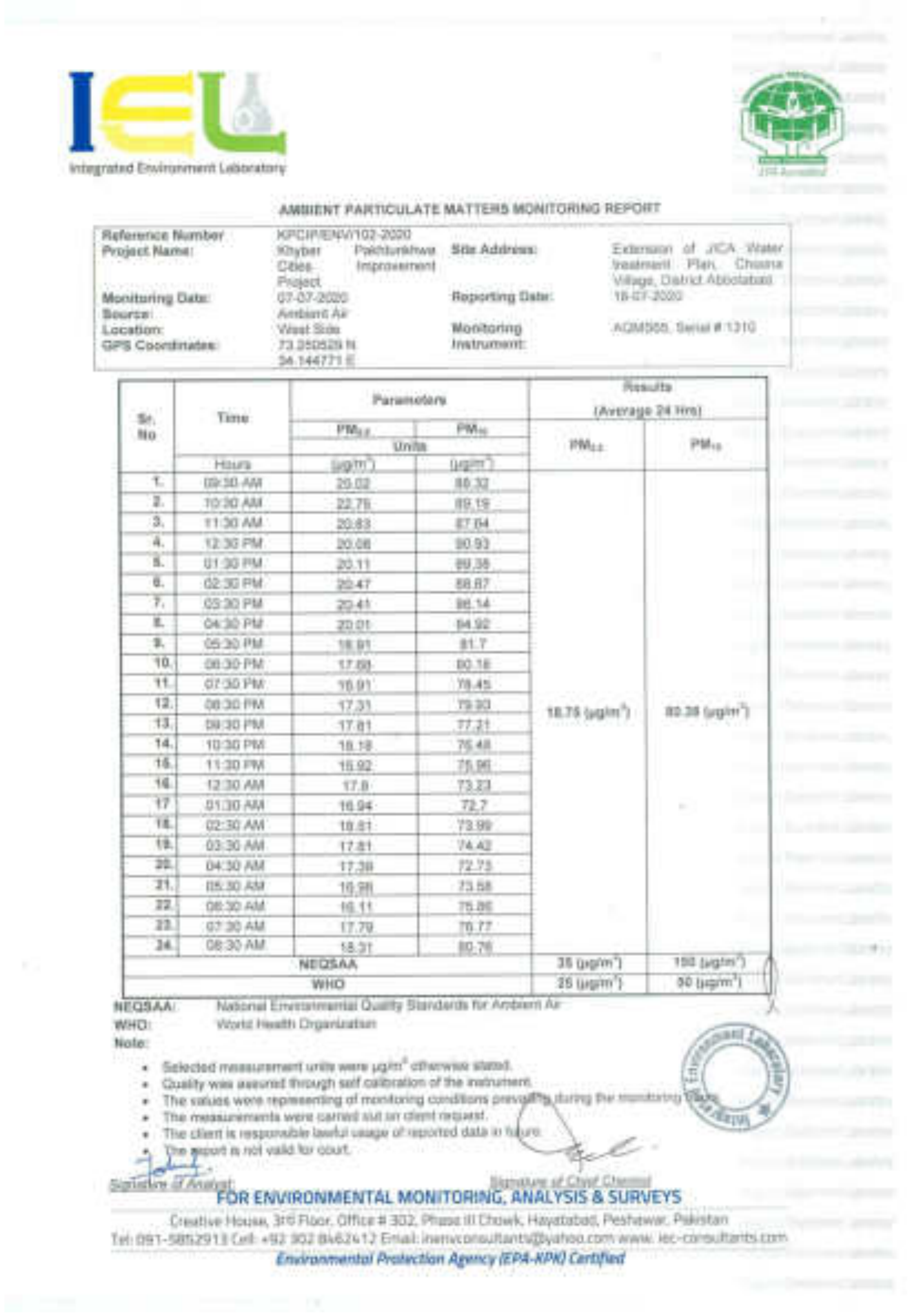
Date: 13 -5-2020

| Sr no | Name | Profession | CNIC | Moza/Village UC, Tehsil & District | Signature/Thumb |
|---|---|---|---|---|---|
| 1 | Bibi Nasreen | House wife | 13501-1297209-2 | District Colony | |
| 2 | Nafees un Nisa | " | 13501-9695497-0 | " " | |
| 3 | Sadia(03119801470) | " | Not Available | " " | Sadia |
| 4 | Shamim Akhtar | " | 13101-3566444-0 | " " | |
| 5 | Amna Aniss | " | 13101-4451617-0 | " " | |
| 6 | Zunaira. | Student | N/A | " " | |
| 7 | Fozia | House wife | Not Available | " " | Fozia |
| 8 | Sehrish Abasi | House wife | 13102-0567746-0 | " " | |
| 9 | | | | | |
| 10 | | | | | |
| 11 | | | | | |
| 12 | | | | | |

# Annexure D

# Environmental Baseline Monitoring

## Air Quality Particulate Matters



Integrated Environment Laboratory

### AMBIENT PARTICULATE MATTERS MONITORING REPORT

| | | | |
|---|---|---|---|
| **Reference Number** | KPCIP/ENV/102-2020 | | |
| **Project Name:** | Khyber Pakhtunkhwa Cities Improvement Project | **Site Address:** | Extension of JICA Water treatment Plan, Chosna Village, District Abbotabad |
| **Monitoring Date:** | 07-07-2020 | **Reporting Date:** | 16-07-2020 |
| **Source:** | Ambient Air | | |
| **Location:** | West Side | **Monitoring Instrument:** | AQM565, Serial # 1310 |
| **GPS Coordinates:** | 73.250529 N<br>34.144771 E | | |

| **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. | 09:30 AM | 20.02 | 86.32 | 18.75 (µg/m³) | 80.38 (µg/m³) |
| 2. | 10:30 AM | 22.76 | 89.19 | | |
| 3. | 11:30 AM | 20.83 | 87.64 | | |
| 4. | 12:30 PM | 20.08 | 90.93 | | |
| 5. | 01:30 PM | 20.11 | 89.38 | | |
| 6. | 02:30 PM | 20.47 | 88.87 | | |
| 7. | 03:30 PM | 20.41 | 86.14 | | |
| 8. | 04:30 PM | 20.01 | 84.92 | | |
| 9. | 05:30 PM | 18.91 | 81.7 | | |
| 10. | 06:30 PM | 17.88 | 80.16 | | |
| 11. | 07:30 PM | 16.91 | 78.45 | | |
| 12. | 08:30 PM | 17.31 | 79.30 | | |
| 13. | 09:30 PM | 17.81 | 77.21 | | |
| 14. | 10:30 PM | 18.18 | 76.48 | | |
| 15. | 11:30 PM | 16.92 | 75.96 | | |
| 16. | 12:30 AM | 17.8 | 73.23 | | |
| 17 | 01:30 AM | 16.94 | 72.7 | | |
| 18. | 02:30 AM | 18.81 | 73.99 | | |
| 19. | 03:30 AM | 17.81 | 74.42 | | |
| 20. | 04:30 AM | 17.38 | 72.73 | | |
| 21. | 05:30 AM | 16.98 | 73.58 | | |
| 22. | 06:30 AM | 16.11 | 75.86 | | |
| 23. | 07:30 AM | 17.79 | 76.77 | | |
| 24. | 08:30 AM | 18.31 | 80.76 | | |
| **NEQSAA** | | | | 35 (µg/m³) | 150 (µg/m³) |
| **WHO** | | | | 25 (µg/m³) | 50 (µg/m³) |

**NEQSAA:** National Environmental Quality Standards for Ambient Air
**WHO:** World Health Organization

**Note:**

- Selected measurement units were µg/m³ otherwise stated.
- Quality was assured through self calibration of the instrument.
- The values were representing of monitoring conditions prevailing during the monitoring days.
- 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.

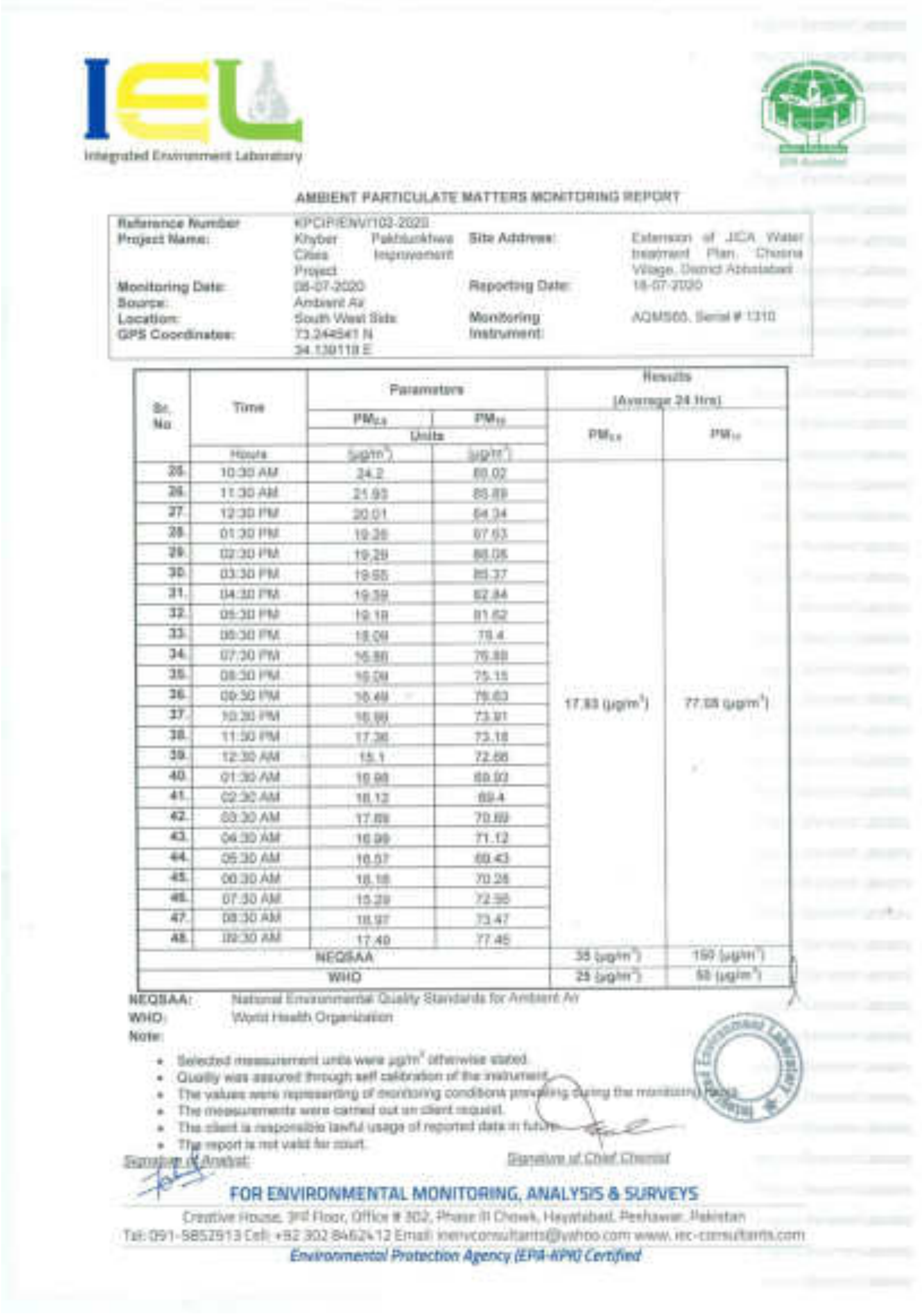
Signature of Analyst

Signature of Chief Chemist

**FOR ENVIRONMENTAL MONITORING, ANALYSIS & SURVEYS**

Creative House, 3rd Floor, Office # 302, Phase III Chowk, Hayatabad, Peshawar, Pakistan
Tel: 091-5852913 Cell: +92 302 8462412 Email: ienvconsultants@yahoo.com www. iec-consultants.com

*Environmental Protection Agency (EPA-KPK) Certified*



Integrated Environment Laboratory

## AMBIENT PARTICULATE MATTERS MONITORING REPORT

| | | | |
|---|---|---|---|
| **Reference Number** | KPCIP/ENV/102-2020 | | |
| **Project Name:** | Khyber Pakhtunkhwa Cities Improvement Project | **Site Address:** | Extension of JICA Water treatment Plan, Chorna Village, District Abbottabad |
| **Monitoring Date:** | 08-07-2020 | **Reporting Date:** | 18-07-2020 |
| **Source:** | Ambient Air | | |
| **Location:** | South West Side | **Monitoring Instrument:** | AQMS60, Serial # 1310 |
| **GPS Coordinates:** | 73.244541 N<br>34.139118 E | | |

| Sr. No | Time | Parameters | | Results (Average 24 Hrs) | |
|---|---|---|---|---|---|
| | | $PM_{2.5}$ | $PM_{10}$ | $PM_{2.5}$ | $PM_{10}$ |
| | | Units | | | |
| | Hours | ($\mu g/m^3$) | ($\mu g/m^3$) | | |
| 25. | 10:30 AM | 24.2 | 88.02 | 17.83 ($\mu g/m^3$) | 77.08 ($\mu g/m^3$) |
| 26. | 11:30 AM | 21.93 | 85.89 | | |
| 27. | 12:30 PM | 20.01 | 84.34 | | |
| 28. | 01:30 PM | 19.26 | 87.63 | | |
| 29. | 02:30 PM | 19.29 | 88.06 | | |
| 30. | 03:30 PM | 19.55 | 85.37 | | |
| 31. | 04:30 PM | 19.39 | 82.84 | | |
| 32. | 05:30 PM | 19.18 | 81.62 | | |
| 33. | 06:30 PM | 18.09 | 78.4 | | |
| 34. | 07:30 PM | 16.88 | 76.88 | | |
| 35. | 08:30 PM | 16.09 | 75.15 | | |
| 36. | 09:30 PM | 16.49 | 76.63 | | |
| 37. | 10:30 PM | 16.98 | 73.91 | | |
| 38. | 11:30 PM | 17.36 | 73.18 | | |
| 39. | 12:30 AM | 15.1 | 72.66 | | |
| 40. | 01:30 AM | 16.98 | 69.93 | | |
| 41. | 02:30 AM | 16.12 | 69.4 | | |
| 42. | 03:30 AM | 17.69 | 70.69 | | |
| 43. | 04:30 AM | 16.99 | 71.12 | | |
| 44. | 05:30 AM | 16.57 | 69.43 | | |
| 45. | 06:30 AM | 16.16 | 70.28 | | |
| 46. | 07:30 AM | 15.29 | 72.95 | | |
| 47. | 08:30 AM | 18.97 | 73.47 | | |
| 48. | 09:30 AM | 17.40 | 77.45 | | |
| 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
**WHO:** World Health Organization
**Note:**

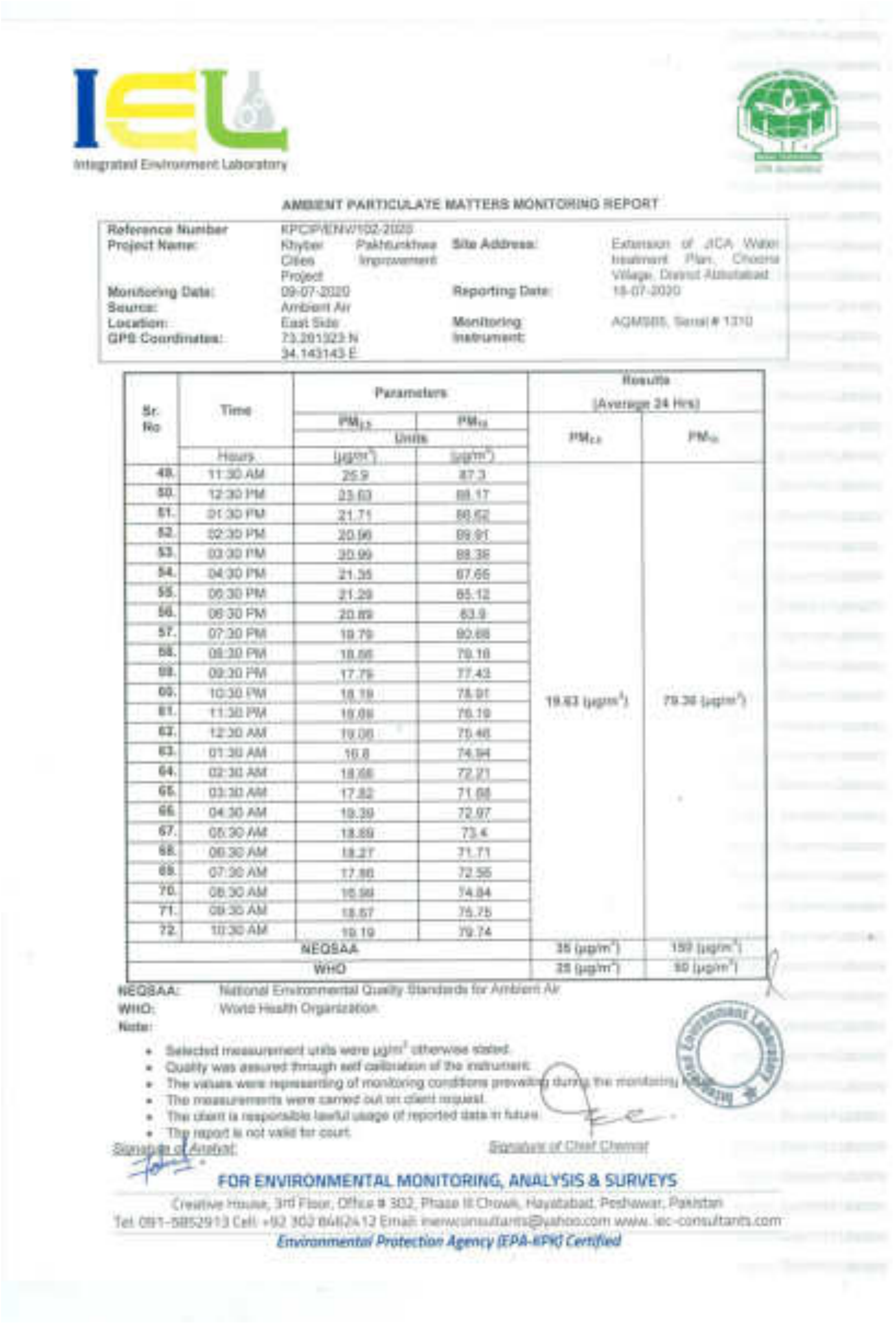
- Selected measurement units were $\mu g/m^3$ otherwise stated.
- Quality was assured through self calibration of the instrument.
- The values were representing of monitoring conditions prevailing during the monitoring hours.
- The measurements were carried out on client request.
- The client is responsible lawful usage of reported data in future.
- The report is not valid for court.

Signature of Analyst:

Signature of Chief Chemist

FOR ENVIRONMENTAL MONITORING, ANALYSIS & SURVEYS

Creative House, 3rd Floor, Office # 302, Phase III Chowk, Hayatabad, Peshawar, Pakistan
Tel: 091-5852913 Cell: +92 302 8462412 Email: ienvconsultants@yahoo.com www.iec-consultants.com
*Environmental Protection Agency (EPA-KPK) Certified*



Integrated Environment Laboratory

**AMBIENT PARTICULATE MATTERS MONITORING REPORT**

| | | | |
|---|---|---|---|
| **Reference Number** | KPCIP/ENV/102-2020 | | |
| **Project Name:** | Khyber Pakhtunkhwa Cities Improvement Project | **Site Address:** | Extension of JICA Water treatment Plan, Choona Village, District Abbottabad |
| **Monitoring Date:** | 09-07-2020 | **Reporting Date:** | 18-07-2020 |
| **Source:** | Ambient Air | | |
| **Location:** | East Side | **Monitoring Instrument:** | AQMS85, Serial # 1310 |
| **GPS Coordinates:** | 73.201323 N<br>34.143143 E | | |

| Sr. No | Time | Parameters | | Results (Average 24 Hrs) | |
|---|---|---|---|---|---|
| | | $PM_{2.5}$ | $PM_{10}$ | $PM_{2.5}$ | $PM_{10}$ |
| | | Units | | | |
| | Hours | (µg/m³) | (µg/m³) | | |
| 49. | 11:30 AM | 25.9 | 87.3 | 19.63 (µg/m³) | 79.38 (µg/m³) |
| 50. | 12:30 PM | 23.63 | 88.17 | | |
| 51. | 01:30 PM | 21.71 | 88.62 | | |
| 52. | 02:30 PM | 20.96 | 89.91 | | |
| 53. | 03:30 PM | 20.99 | 88.38 | | |
| 54. | 04:30 PM | 21.35 | 87.66 | | |
| 55. | 05:30 PM | 21.29 | 85.12 | | |
| 56. | 06:30 PM | 20.89 | 83.9 | | |
| 57. | 07:30 PM | 19.79 | 80.68 | | |
| 58. | 08:30 PM | 18.86 | 79.18 | | |
| 59. | 09:30 PM | 17.79 | 77.43 | | |
| 60. | 10:30 PM | 18.19 | 78.91 | | |
| 61. | 11:30 PM | 19.09 | 76.19 | | |
| 62. | 12:30 AM | 19.06 | 75.46 | | |
| 63. | 01:30 AM | 16.8 | 74.94 | | |
| 64. | 02:30 AM | 18.66 | 72.21 | | |
| 65. | 03:30 AM | 17.82 | 71.68 | | |
| 66. | 04:30 AM | 19.39 | 72.97 | | |
| 67. | 05:30 AM | 18.89 | 73.4 | | |
| 68. | 06:30 AM | 18.27 | 71.71 | | |
| 69. | 07:30 AM | 17.88 | 72.56 | | |
| 70. | 08:30 AM | 16.98 | 74.84 | | |
| 71. | 09:30 AM | 18.67 | 75.75 | | |
| 72. | 10:30 AM | 19.19 | 79.74 | | |
| NEQSAA | | | | 35 (µg/m³) | 150 (µg/m³) |
| WHO | | | | 25 (µg/m³) | 50 (µg/m³) |

NEQSAA: National Environmental Quality Standards for Ambient Air

WHO: World Health Organization

Note:

- Selected measurement units were µg/m³ otherwise stated.
- Quality was assured through self calibration of the instrument.
- The values were representing of monitoring conditions prevailing during the monitoring.
- 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.

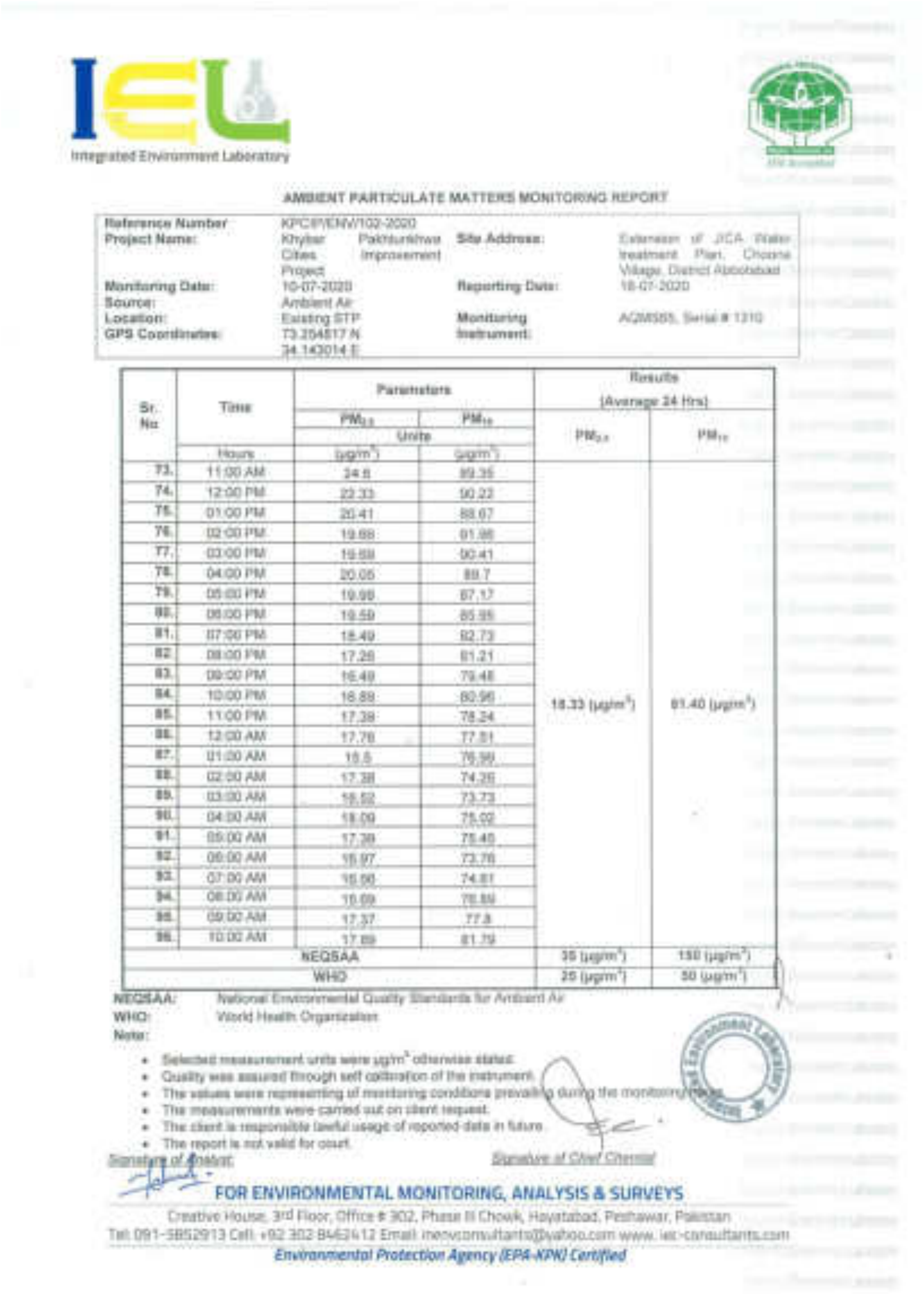
Signature of Analyst:

Signature of Chief Chemist

**FOR ENVIRONMENTAL MONITORING, ANALYSIS & SURVEYS**

Creative House, 3rd Floor, Office # 302, Phase III Chowk, Hayatabad, Peshawar, Pakistan
Tel: 091-5852913 Cell: +92 302 8462412 Email: inenvconsultants@yahoo.com www.iec-consultants.com

*Environmental Protection Agency (EPA-KPK) Certified*



Integrated Environment Laboratory

## AMBIENT PARTICULATE MATTERS MONITORING REPORT

| | | | |
|---|---|---|---|
| **Reference Number** | KPCIP/ENV/102-2020 | | |
| **Project Name:** | Khyber Pakhtunkhwa Cities Improvement Project | **Site Address:** | Extension of JICA Water treatment Plant, Choona Village, District Abbottabad |
| **Monitoring Date:** | 10-07-2020 | **Reporting Date:** | 18-07-2020 |
| **Source:** | Ambient Air | | |
| **Location:** | Existing STP | **Monitoring Instrument:** | AQM585, Serial # 1310 |
| **GPS Coordinates:** | 73.254817 N<br>34.143014 E | | |

| Sr. No | Time | Parameters | | Results (Average 24 Hrs) | |
|---|---|---|---|---|---|
| | | $PM_{2.5}$ | $PM_{10}$ | $PM_{2.5}$ | $PM_{10}$ |
| | | Units | | | |
| | Hours | (µg/m³) | (µg/m³) | | |
| 73. | 11:00 AM | 24.6 | 89.35 | 18.33 (µg/m³) | 81.40 (µg/m³) |
| 74. | 12:00 PM | 22.33 | 90.22 | | |
| 75. | 01:00 PM | 20.41 | 88.67 | | |
| 76. | 02:00 PM | 19.88 | 91.98 | | |
| 77. | 03:00 PM | 19.58 | 90.41 | | |
| 78. | 04:00 PM | 20.05 | 89.7 | | |
| 79. | 05:00 PM | 19.98 | 87.17 | | |
| 80. | 06:00 PM | 19.59 | 85.95 | | |
| 81. | 07:00 PM | 18.49 | 82.73 | | |
| 82. | 08:00 PM | 17.28 | 81.21 | | |
| 83. | 09:00 PM | 16.49 | 79.48 | | |
| 84. | 10:00 PM | 16.89 | 80.96 | | |
| 85. | 11:00 PM | 17.38 | 78.24 | | |
| 86. | 12:00 AM | 17.78 | 77.51 | | |
| 87. | 01:00 AM | 16.5 | 76.98 | | |
| 88. | 02:00 AM | 17.38 | 74.26 | | |
| 89. | 03:00 AM | 16.52 | 73.73 | | |
| 90. | 04:00 AM | 18.09 | 75.02 | | |
| 91. | 05:00 AM | 17.38 | 75.46 | | |
| 92. | 06:00 AM | 16.97 | 73.78 | | |
| 93. | 07:00 AM | 16.58 | 74.81 | | |
| 94. | 08:00 AM | 16.69 | 76.89 | | |
| 95. | 09:00 AM | 17.37 | 77.8 | | |
| 96. | 10:00 AM | 17.89 | 81.79 | | |
| NEQSAA | | | | 35 (µg/m³) | 150 (µg/m³) |
| WHO | | | | 25 (µg/m³) | 50 (µg/m³) |

**NEQSAA:** National Environmental Quality Standards for Ambient Air
**WHO:** World Health Organization
**Note:**

- Selected measurement units were µg/m³ 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.

Signature of Analyst

Signature of Chief Chemist

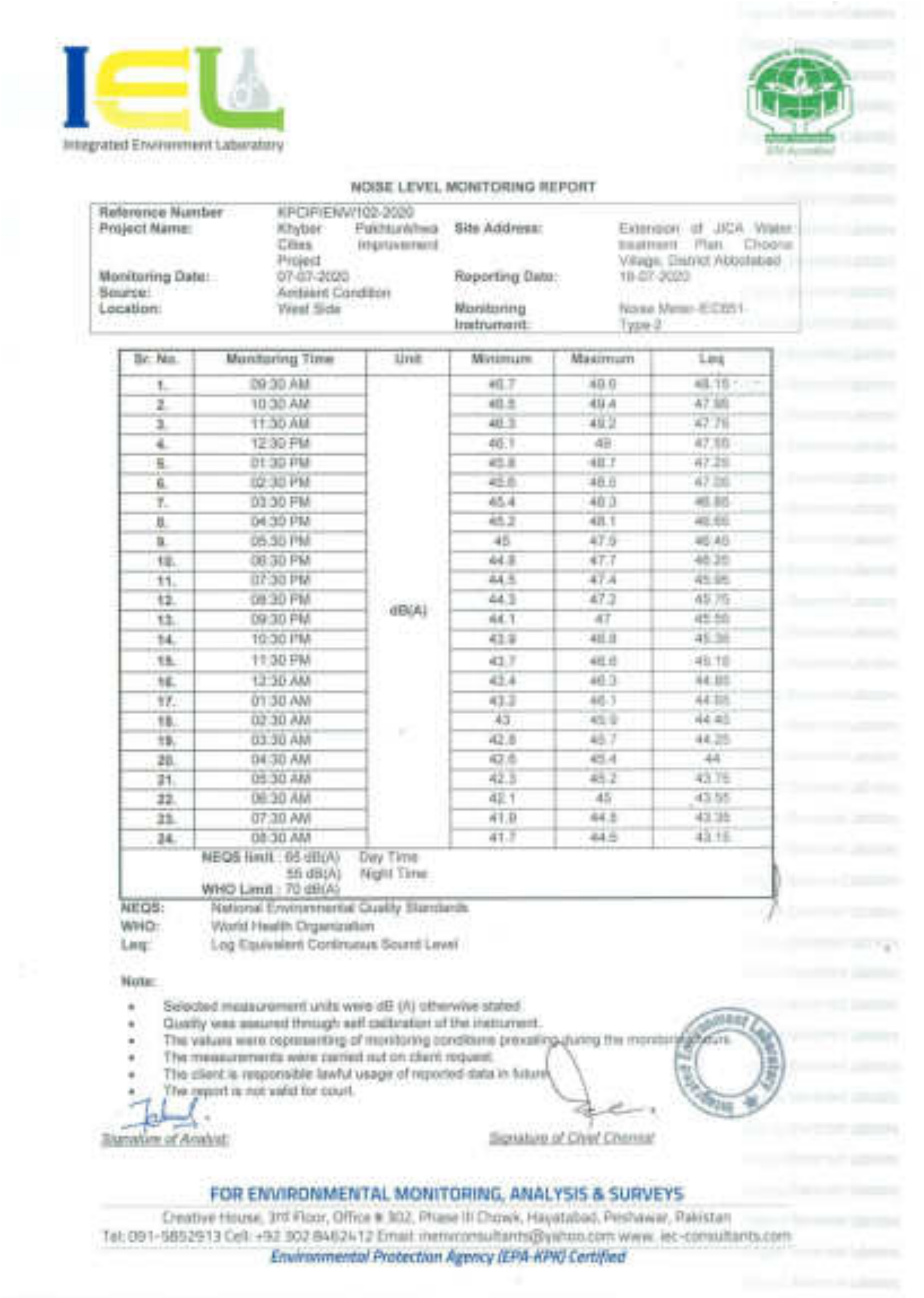
Integrated Environment Laboratory

FOR ENVIRONMENTAL MONITORING, ANALYSIS & SURVEYS

Creative House, 3rd Floor, Office # 302, Phase III Chowk, Hayatabad, Peshawar, Pakistan
Tel: 091-5852913 Cell: +92 302 8463412 Email: ineovconsultants@yahoo.com www.iel-consultants.com

*Environmental Protection Agency (EPA-KPK) Certified*

## Noise Level Monitoring



Integrated Environment Laboratory

**NOISE LEVEL MONITORING REPORT**

| | | | |
|---|---|---|---|
| **Reference Number** | KPCIP/ENV/102-2020 | | |
| **Project Name:** | Khyber Pakhtunkhwa Cities Improvement Project | **Site Address:** | Extension of JICA Water treatment Plan Choona Village, District Abbottabad |
| **Monitoring Date:** | 07-07-2020 | **Reporting Date:** | 18-07-2020 |
| **Source:** | Ambient Condition | | |
| **Location:** | West Side | **Monitoring Instrument:** | Noise Meter-EC851-Type-2 |

| Sr. No. | Monitoring Time | Unit | Minimum | Maximum | Leq |
|---|---|---|---|---|---|
| 1. | 09:30 AM | dB(A) | 46.7 | 49.6 | 48.15 |
| 2. | 10:30 AM | | 46.5 | 49.4 | 47.95 |
| 3. | 11:30 AM | | 46.3 | 49.2 | 47.75 |
| 4. | 12:30 PM | | 46.1 | 49 | 47.55 |
| 5. | 01:30 PM | | 45.8 | 48.7 | 47.25 |
| 6. | 02:30 PM | | 45.6 | 48.5 | 47.05 |
| 7. | 03:30 PM | | 45.4 | 48.3 | 46.85 |
| 8. | 04:30 PM | | 45.2 | 48.1 | 46.65 |
| 9. | 05:30 PM | | 45 | 47.9 | 46.45 |
| 10. | 06:30 PM | | 44.8 | 47.7 | 46.25 |
| 11. | 07:30 PM | | 44.5 | 47.4 | 45.95 |
| 12. | 08:30 PM | | 44.3 | 47.2 | 45.75 |
| 13. | 09:30 PM | | 44.1 | 47 | 45.55 |
| 14. | 10:30 PM | | 43.9 | 46.8 | 45.35 |
| 15. | 11:30 PM | | 43.7 | 46.6 | 45.15 |
| 16. | 12:30 AM | | 43.4 | 46.3 | 44.85 |
| 17. | 01:30 AM | | 43.2 | 46.1 | 44.65 |
| 18. | 02:30 AM | | 43 | 45.9 | 44.45 |
| 19. | 03:30 AM | | 42.8 | 45.7 | 44.25 |
| 20. | 04:30 AM | | 42.6 | 45.4 | 44 |
| 21. | 05:30 AM | | 42.3 | 45.2 | 43.75 |
| 22. | 06:30 AM | | 42.1 | 45 | 43.55 |
| 23. | 07:30 AM | | 41.9 | 44.8 | 43.35 |
| 24. | 08:30 AM | | 41.7 | 44.6 | 43.15 |

**NEQS limit** : 65 dB(A) Day Time
55 dB(A) Night Time
**WHO Limit** : 70 dB(A)

**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.
- 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.

Signature of Analyst

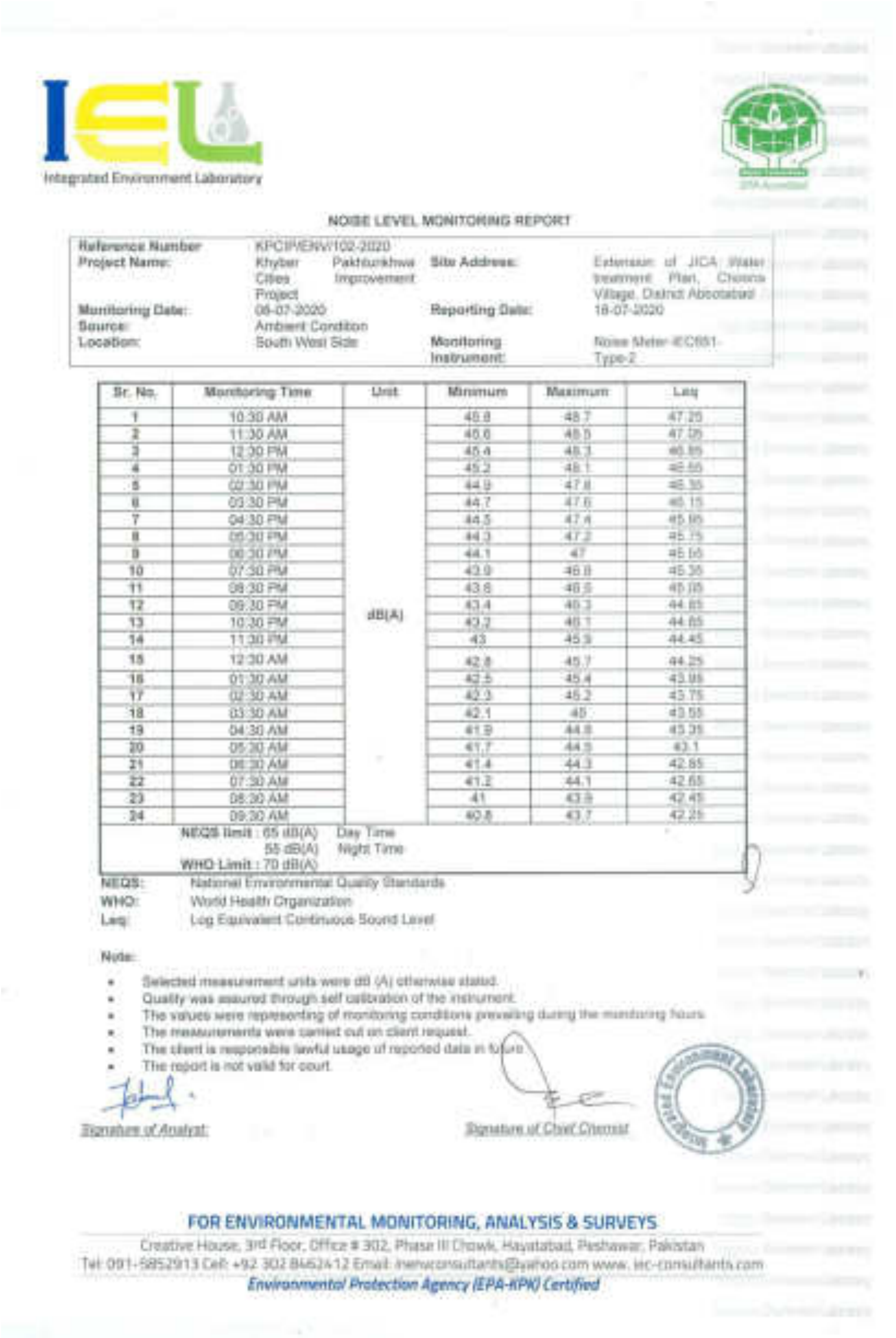
Signature of Chief Chemist

Integrated Environment Laboratory

FOR ENVIRONMENTAL MONITORING, ANALYSIS & SURVEYS

Creative House, 3rd Floor, Office # 302, Phase III Chowk, Hayatabad, Peshawar, Pakistan
Tel: 091-5852913 Cell: +92 302 8462412 Email: iecenvconsultants@yahoo.com www. iec-consultants.com

*Environmental Protection Agency (EPA-KPK) Certified*



Integrated Environment Laboratory

## NOISE LEVEL MONITORING REPORT

| | | | |
|---|---|---|---|
| **Reference Number** | KPCIP/ENV/102-2020 | | |
| **Project Name:** | Khyber Pakhtunkhwa Cities Improvement Project | **Site Address:** | Extension of JICA Water treatment Plant, Chorora Village, District Abbottabad |
| **Monitoring Date:** | 06-07-2020 | **Reporting Date:** | 18-07-2020 |
| **Source:** | Ambient Condition | | |
| **Location:** | South West Side | **Monitoring Instrument:** | Noise Meter IEC651-Type-2 |

| Sr. No. | Monitoring Time | Unit | Minimum | Maximum | Leq |
|---|---|---|---|---|---|
| 1 | 10:30 AM | dB(A) | 45.8 | 48.7 | 47.25 |
| 2 | 11:30 AM | | 45.6 | 48.5 | 47.05 |
| 3 | 12:30 PM | | 45.4 | 48.3 | 46.85 |
| 4 | 01:30 PM | | 45.2 | 48.1 | 46.65 |
| 5 | 02:30 PM | | 44.9 | 47.8 | 46.35 |
| 6 | 03:30 PM | | 44.7 | 47.6 | 46.15 |
| 7 | 04:30 PM | | 44.5 | 47.4 | 45.95 |
| 8 | 05:30 PM | | 44.3 | 47.2 | 45.75 |
| 9 | 06:30 PM | | 44.1 | 47 | 45.55 |
| 10 | 07:30 PM | | 43.9 | 46.8 | 45.35 |
| 11 | 08:30 PM | | 43.6 | 46.5 | 45.05 |
| 12 | 09:30 PM | | 43.4 | 46.3 | 44.85 |
| 13 | 10:30 PM | | 43.2 | 46.1 | 44.65 |
| 14 | 11:30 PM | | 43 | 45.9 | 44.45 |
| 15 | 12:30 AM | | 42.8 | 45.7 | 44.25 |
| 16 | 01:30 AM | | 42.5 | 45.4 | 43.95 |
| 17 | 02:30 AM | | 42.3 | 45.2 | 43.75 |
| 18 | 03:30 AM | | 42.1 | 45 | 43.55 |
| 19 | 04:30 AM | | 41.9 | 44.8 | 43.35 |
| 20 | 05:30 AM | | 41.7 | 44.5 | 43.1 |
| 21 | 06:30 AM | | 41.4 | 44.3 | 42.85 |
| 22 | 07:30 AM | | 41.2 | 44.1 | 42.65 |
| 23 | 08:30 AM | | 41 | 43.9 | 42.45 |
| 24 | 09:30 AM | | 40.8 | 43.7 | 42.25 |

**NEQS limit** : 65 dB(A) Day Time
55 dB(A) Night Time
**WHO Limit** : 70 dB(A)

| | |
|---|---|
| NEQS: | National Environmental Quality Standards |
| WHO: | World Health Organization |
| Leq: | Log Equivalent Continuous Sound Level |

**Note:**

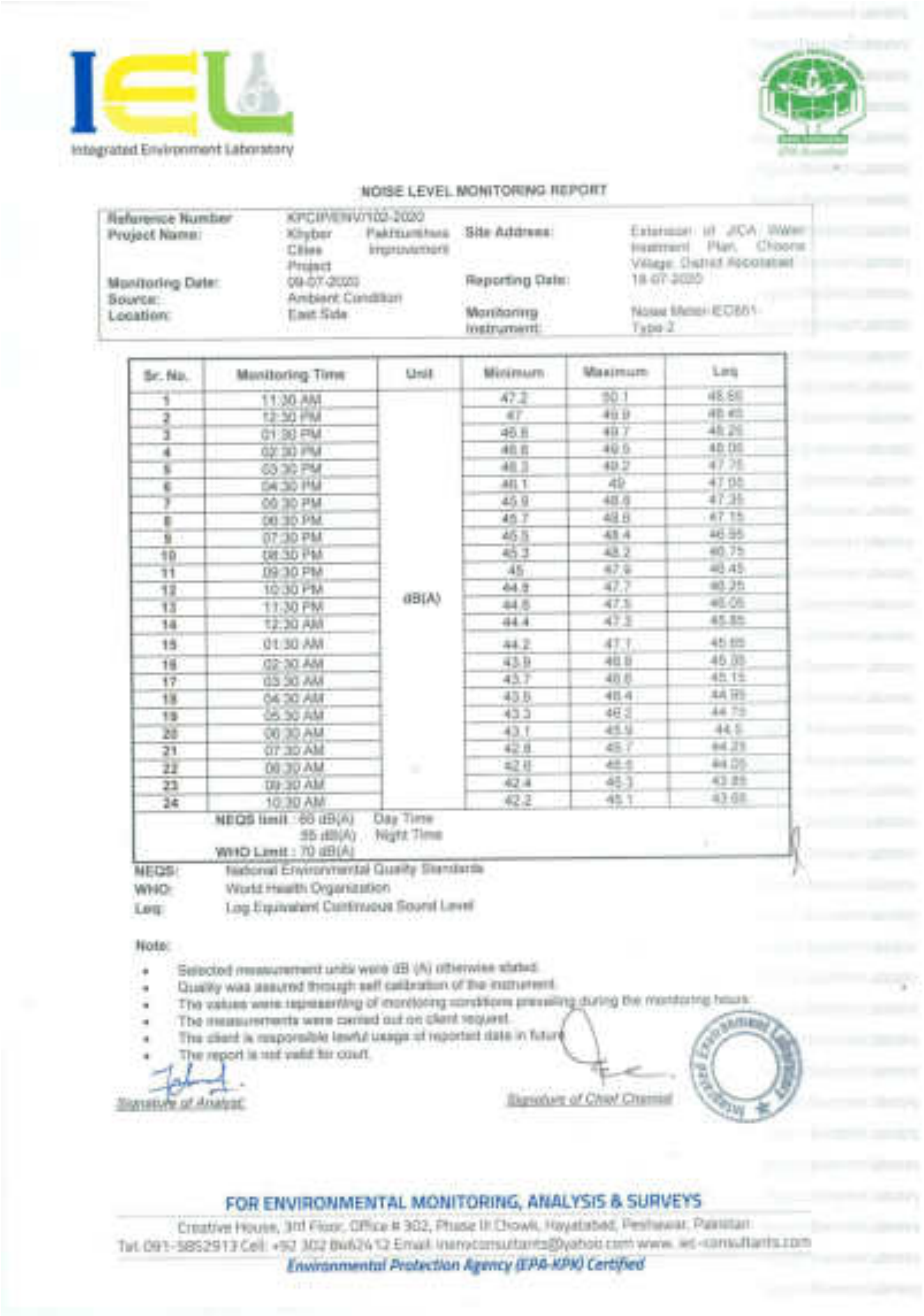
- Selected measurement units were dB (A) otherwise stated.
- Quality was assured through self calibration of the instrument.
- The values were representing of monitoring conditions prevailing during the monitoring hours.
- The measurements were carried out on client request.
- The client is responsible lawful usage of reported data in future.
- The report is not valid for court.

Signature of Analyst:

Signature of Chief Chemist

FOR ENVIRONMENTAL MONITORING, ANALYSIS & SURVEYS

Creative House, 3rd Floor, Office # 302, Phase III Chowk, Hayatabad, Peshawar, Pakistan
Tel: 091-5852913 Cell: +92 302 8462412 Email: ienvconsultants@yahoo.com www. iec-consultants.com
*Environmental Protection Agency (EPA-KPK) Certified*



Integrated Environment Laboratory

## NOISE LEVEL MONITORING REPORT

| | | | |
|---|---|---|---|
| **Reference Number** | KPCIP/ENV/102-2020 | | |
| **Project Name:** | Khyber Pakhtunkhwa Cities Improvement Project | **Site Address:** | Extension of JICA Water treatment Plan, Choona Village District Abbottabad |
| **Monitoring Date:** | 09-07-2020 | **Reporting Date:** | 18-07-2020 |
| **Source:** | Ambient Condition | | |
| **Location:** | East Side | **Monitoring Instrument:** | Noise Meter IEC651-Type 2 |

| Sr. No. | Monitoring Time | Unit | Minimum | Maximum | Leq |
|---|---|---|---|---|---|
| 1 | 11:30 AM | dB(A) | 47.2 | 50.1 | 48.65 |
| 2 | 12:30 PM | | 47 | 49.9 | 48.45 |
| 3 | 01:30 PM | | 46.8 | 49.7 | 48.25 |
| 4 | 02:30 PM | | 46.6 | 49.5 | 48.05 |
| 5 | 03:30 PM | | 46.3 | 49.2 | 47.75 |
| 6 | 04:30 PM | | 46.1 | 49 | 47.05 |
| 7 | 05:30 PM | | 45.9 | 48.8 | 47.35 |
| 8 | 06:30 PM | | 45.7 | 48.6 | 47.15 |
| 9 | 07:30 PM | | 45.5 | 48.4 | 46.95 |
| 10 | 08:30 PM | | 45.3 | 48.2 | 46.75 |
| 11 | 09:30 PM | | 45 | 47.9 | 46.45 |
| 12 | 10:30 PM | | 44.8 | 47.7 | 46.25 |
| 13 | 11:30 PM | | 44.6 | 47.5 | 46.05 |
| 14 | 12:30 AM | | 44.4 | 47.3 | 45.85 |
| 15 | 01:30 AM | | 44.2 | 47.1 | 45.65 |
| 16 | 02:30 AM | | 43.9 | 46.8 | 45.35 |
| 17 | 03:30 AM | | 43.7 | 46.6 | 45.15 |
| 18 | 04:30 AM | | 43.5 | 46.4 | 44.95 |
| 19 | 05:30 AM | | 43.3 | 46.2 | 44.75 |
| 20 | 06:30 AM | | 43.1 | 45.9 | 44.5 |
| 21 | 07:30 AM | | 42.8 | 45.7 | 44.25 |
| 22 | 08:30 AM | | 42.6 | 45.5 | 44.05 |
| 23 | 09:30 AM | | 42.4 | 45.3 | 43.85 |
| 24 | 10:30 AM | | 42.2 | 45.1 | 43.65 |

**NEQS limit** : 65 dB(A) Day Time
55 dB(A) Night Time
**WHO Limit** : 70 dB(A)

**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.
- 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.

Signature of Analyst

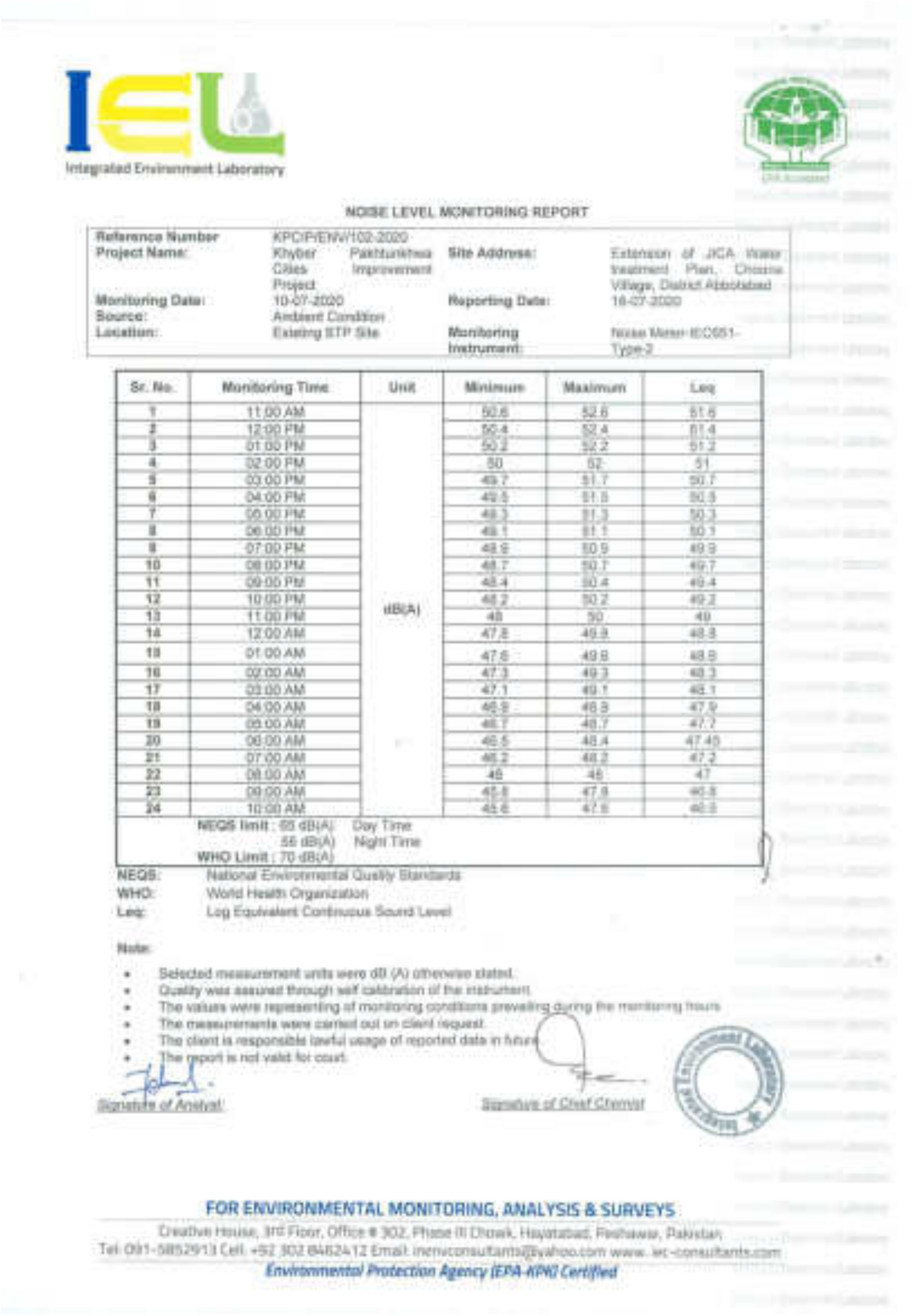
Signature of Chief Chemist

Integrated Environment Laboratory

FOR ENVIRONMENTAL MONITORING, ANALYSIS & SURVEYS

Creative House, 3rd Floor, Office # 302, Phase III Chowk, Hayatabad, Peshawar, Pakistan
Tel: 091-5852913 Cell: +92 302 8462412 Email: ienvconsultants@yahoo.com www.iel-consultants.com

*Environmental Protection Agency (EPA-KPK) Certified*



Integrated Environment Laboratory

## NOISE LEVEL MONITORING REPORT

| | | | |
|---|---|---|---|
| **Reference Number** | KPCIP/ENV/102-2020 | | |
| **Project Name:** | Khyber Pakhtunkhwa Cities Improvement Project | **Site Address:** | Extension of JICA Water treatment Plan, Choona Village, District Abbottabad |
| **Monitoring Date:** | 10-07-2020 | **Reporting Date:** | 16-07-2020 |
| **Source:** | Ambient Condition | | |
| **Location:** | Existing STP Site | **Monitoring Instrument:** | Noise Meter IEC651-Type-2 |

| Sr. No. | Monitoring Time | Unit | Minimum | Maximum | Leq |
|---|---|---|---|---|---|
| 1 | 11:00 AM | dB(A) | 50.6 | 52.6 | 51.6 |
| 2 | 12:00 PM | | 50.4 | 52.4 | 51.4 |
| 3 | 01:00 PM | | 50.2 | 52.2 | 51.2 |
| 4 | 02:00 PM | | 50 | 52 | 51 |
| 5 | 03:00 PM | | 49.7 | 51.7 | 50.7 |
| 6 | 04:00 PM | | 49.5 | 51.5 | 50.5 |
| 7 | 05:00 PM | | 49.3 | 51.3 | 50.3 |
| 8 | 06:00 PM | | 49.1 | 51.1 | 50.1 |
| 9 | 07:00 PM | | 48.9 | 50.9 | 49.9 |
| 10 | 08:00 PM | | 48.7 | 50.7 | 49.7 |
| 11 | 09:00 PM | | 48.4 | 50.4 | 49.4 |
| 12 | 10:00 PM | | 48.2 | 50.2 | 49.2 |
| 13 | 11:00 PM | | 48 | 50 | 49 |
| 14 | 12:00 AM | | 47.8 | 49.8 | 48.8 |
| 15 | 01:00 AM | | 47.6 | 49.6 | 48.6 |
| 16 | 02:00 AM | | 47.3 | 49.3 | 48.3 |
| 17 | 03:00 AM | | 47.1 | 49.1 | 48.1 |
| 18 | 04:00 AM | | 46.9 | 48.9 | 47.9 |
| 19 | 05:00 AM | | 46.7 | 48.7 | 47.7 |
| 20 | 06:00 AM | | 46.5 | 48.4 | 47.45 |
| 21 | 07:00 AM | | 46.2 | 48.2 | 47.2 |
| 22 | 08:00 AM | | 46 | 48 | 47 |
| 23 | 09:00 AM | | 45.8 | 47.8 | 46.8 |
| 24 | 10:00 AM | | 45.6 | 47.6 | 46.6 |

**NEQS limit** : 65 dB(A) Day Time
55 dB(A) Night Time
**WHO Limit** : 70 dB(A)

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.
- 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.

Signature of Analyst

Signature of Chief Chemist

FOR ENVIRONMENTAL MONITORING, ANALYSIS & SURVEYS

Creative House, 3rd Floor, Office # 302, Phase III Chowk, Hayatabad, Peshawar, Pakistan.
Tel: 091-5852913 Cell: +92 302 8462412 Email: ienvconsultants@yahoo.com www. iec-consultants.com
*Environmental Protection Agency (EPA-KPK) Certified*

## Water Quality Analysis

**Integrated Environment Laboratory**

### WATER ANALYSIS REPORT

| | | | |
|---|---|---|---|
| **Reference Number** | KPCIP/ENV/102-2020 | | |
| **Project Name:** | Khyber Pakhtunkhwa Cities Improvement Project. | **Site Address:** | Extension of JICA Water treatment Plan, Choona Village, District Abbotabad |
| **Sampling Date:** | 10-07-2020 | **Reporting Date:** | 18-05-2020 |
| **Source:** | Ground Water | **Sampling Done by:** | Analyst |
| **Location:** | Existing STP Site | | |
| | | **Analysis Method:** | APHA/USEPA Standard Methods |

| Sr. No. | Parameters | Analysis Methods | Units | NDWQS | Results |
|---|---|---|---|---|---|
| 1 | pH | APHA-4500H+ B | -- | 6.5-8.5 | 7.2 |
| 2 | Taste & Odor | In-house | -- | Non Objectionable | Non Objectionable |
| 3 | Color | APHA-2120 B/C | TCU | <15 | 3 |
| 4 | Turbidity | APHA-2130 B | NTU | <5 | 3 |
| 5 | E-Coli | APHA.9222 D | Number/100 mL | 0 Number/100 mL | 0 |
| 6 | Total Coliform | APHA.9222 B | Number/100 mL | 0 Number/100 mL | 0 |
| 7 | Total Dissolved Solids (TDS) | APHA-2540 C | mg/L | <1000 | 181 |
| 8 | Total Hardness | APHA-2340 C | mg/L | <500 | 72 |
| 9 | Nitrate | APHA-4500NO3 B | mg/L | ≤50 | 1.9 |
| 10 | Nitrite | APHA-4500NO2 B | mg/L | ≤3 | 0.0058 |
| 11 | Ammonia | APHA-4500 NH3-B | mg/L | — | N.D |
| 12 | Arsenic (As) | APHA-3500As B | mg/L | ≤0.05 | N.D |
| 13 | Antimony (Sb) | APHA-3500Sb B | mg/L | <0.006 | N.D. |
| 14 | Barium (Ba) | APHA-3500 Ba B | mg/L | 0.7 | 0.12 |
| 15 | Chloride (Cl) | APHA-4500Cl- B | mg/L | <250 | 86 |
| 16 | Fluoride | APHA-4500F- C | mg/L | ≤1.5 | 0.64 |
| 17 | Aluminum | APHA-3500 Al | mg/L | ≤0.2 | N.D. |
| 18 | Manganese (Mn) | APHA-3500 MN-B | mg/L | ≤0.5 | N.D |
| 19 | Mercury (Hg) | APHA-3500 Hg-B | mg/L | ≤0.001 | N.D |
| 20 | Iodine | | mg/L | — | 0.04 |
| 21 | Zinc (Zn) | APHA- 3500 Zn B | mg/L | 5.0 | 0.95 |
| 22 | Boron (B) | APHA 4500 B- C | mg/L | 0.3 | N.D |
| 23 | Chromium (Cr) | APHA 3500 Cr B | mg/L | ≤0.05 | N.D |
| 24 | Selenium (Se) | APHA- 3500 Se C | mg/L | 0.01 | N.D |

**NDWQS:** National Drinking Water Quality Standards

**N.D:** Not Detected

*Signature of Analyst:*

*Signature of Chief Chemist*

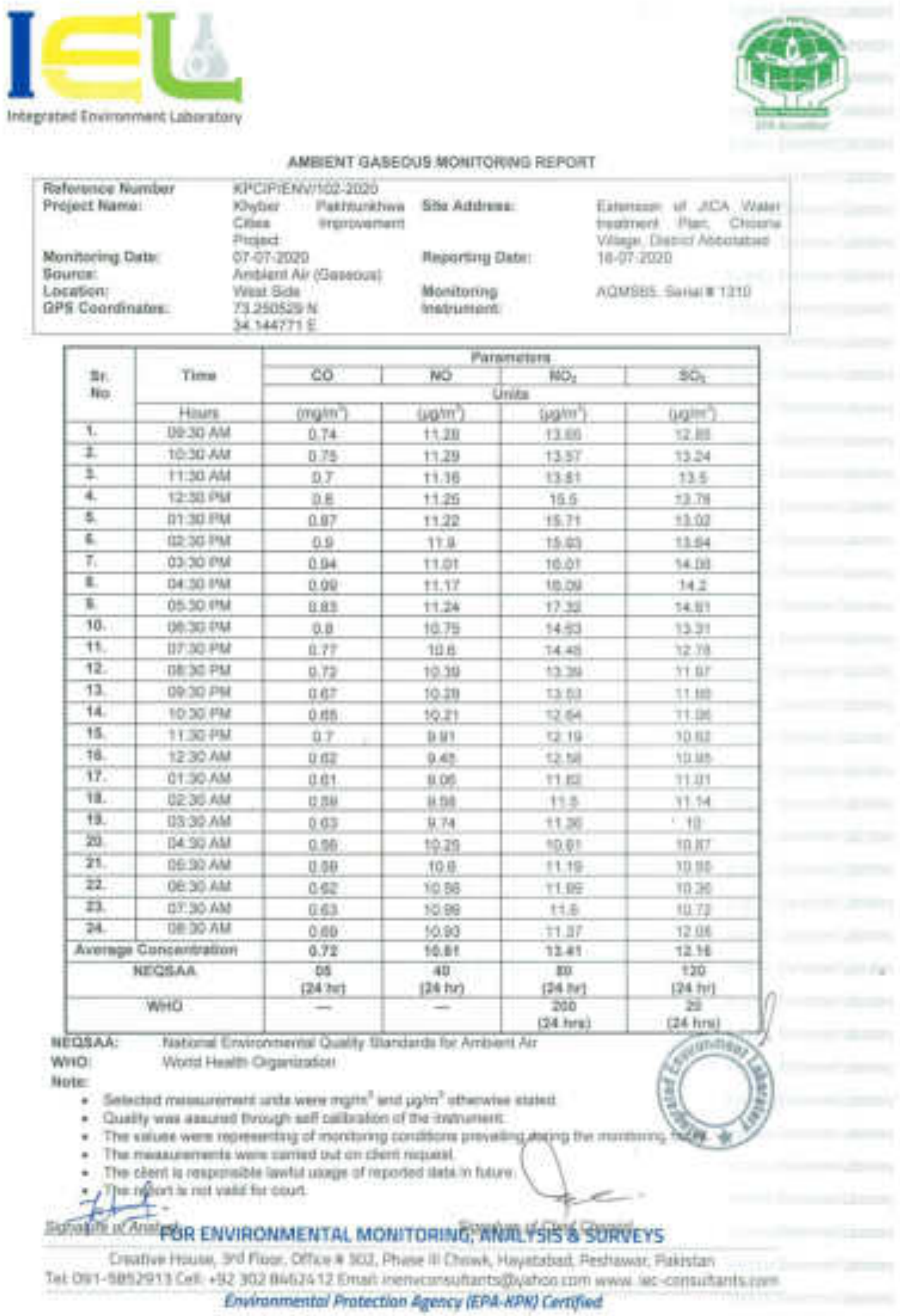
**FOR ENVIRONMENTAL MONITORING, ANALYSIS & SURVEYS**

Creative House, 3rd Floor, Office # 302, Phase III Chowk, Hayatabad, Peshawar, Pakistan

Tel: 091-5852913 Cell: +92 302 8462412 Email: inenyconsultants@yahoo.com www. iec-consultants.com

*Environmental Protection Agency (EPA-KPK) Certified*

## Air Quality



Integrated Environment Laboratory

### AMBIENT GASEOUS MONITORING REPORT

| | | | |
|---|---|---|---|
| **Reference Number** | KPCIP/ENV/102-2020 | | |
| **Project Name:** | Khyber Pakhtunkhwa Cities Improvement Project | **Site Address:** | Extension of JICA Water treatment Plan, Choona Village, District Abbottabad |
| **Monitoring Date:** | 07-07-2020 | **Reporting Date:** | 16-07-2020 |
| **Source:** | Ambient Air (Gaseous) | | |
| **Location:** | West Side | **Monitoring Instrument:** | AQMS85, Serial # 1310 |
| **GPS Coordinates:** | 73.250529 N<br>34.144771 E | | |

| 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. | 09:30 AM | 0.74 | 11.28 | 13.66 | 12.88 |
| 2. | 10:30 AM | 0.75 | 11.29 | 13.57 | 13.24 |
| 3. | 11:30 AM | 0.7 | 11.36 | 13.61 | 13.5 |
| 4. | 12:30 PM | 0.8 | 11.25 | 15.5 | 13.78 |
| 5. | 01:30 PM | 0.87 | 11.22 | 15.71 | 13.02 |
| 6. | 02:30 PM | 0.9 | 11.9 | 15.93 | 13.64 |
| 7. | 03:30 PM | 0.94 | 11.01 | 16.01 | 14.08 |
| 8. | 04:30 PM | 0.99 | 11.17 | 16.09 | 14.2 |
| 9. | 05:30 PM | 0.83 | 11.24 | 17.32 | 14.81 |
| 10. | 06:30 PM | 0.8 | 10.75 | 14.93 | 13.31 |
| 11. | 07:30 PM | 0.77 | 10.6 | 14.48 | 12.78 |
| 12. | 08:30 PM | 0.73 | 10.39 | 13.39 | 11.97 |
| 13. | 09:30 PM | 0.67 | 10.28 | 13.53 | 11.88 |
| 14. | 10:30 PM | 0.65 | 10.21 | 12.64 | 11.06 |
| 15. | 11:30 PM | 0.7 | 9.91 | 12.19 | 10.62 |
| 16. | 12:30 AM | 0.62 | 9.45 | 12.58 | 10.85 |
| 17. | 01:30 AM | 0.61 | 9.06 | 11.82 | 11.01 |
| 18. | 02:30 AM | 0.59 | 9.58 | 11.5 | 11.14 |
| 19. | 03:30 AM | 0.63 | 9.74 | 11.36 | 10 |
| 20. | 04:30 AM | 0.56 | 10.29 | 10.61 | 10.87 |
| 21. | 05:30 AM | 0.59 | 10.6 | 11.19 | 10.55 |
| 22. | 06:30 AM | 0.62 | 10.56 | 11.65 | 10.36 |
| 23. | 07:30 AM | 0.63 | 10.99 | 11.6 | 10.72 |
| 24. | 08:30 AM | 0.69 | 10.93 | 11.37 | 12.06 |
| **Average Concentration** | | **0.72** | **10.81** | **13.41** | **12.16** |
| **NEQSAA** | | 05<br>(24 hr) | 40<br>(24 hr) | 80<br>(24 hr) | 120<br>(24 hr) |
| **WHO** | | — | — | 200<br>(24 hrs) | 20<br>(24 hrs) |

**NEQSAA:** National Environmental Quality Standards for Ambient Air

**WHO:** World Health Organization

**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.

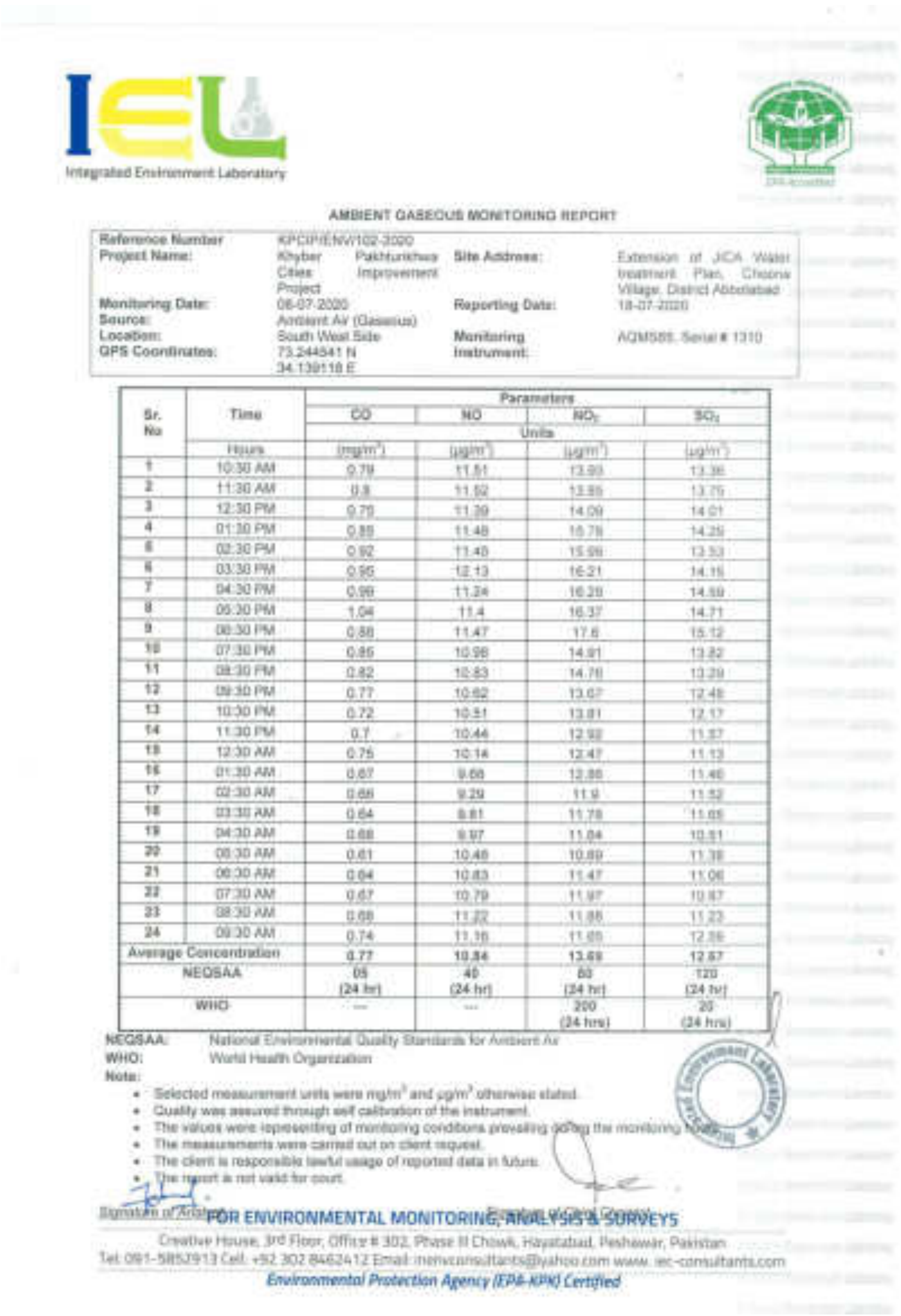
Signature of Analyst

Signature of Chief Chemist

FOR ENVIRONMENTAL MONITORING, ANALYSIS & SURVEYS

Creative House, 3rd Floor, Office # 302, Phase III Chowk, Hayatabad, Peshawar, Pakistan
Tel: 091-5852913 Cell: +92 302 8462412 Email: ienvconsultants@yahoo.com www. iec-consultants.com

*Environmental Protection Agency (EPA-KPK) Certified*



Integrated Environment Laboratory

EPA Accredited

## AMBIENT GASEOUS MONITORING REPORT

| | | | |
|---|---|---|---|
| **Reference Number** | KPCIP/ENV/102-2020 | | |
| **Project Name:** | Khyber Pakhtunkhwa Cities Improvement Project | **Site Address:** | Extension of JICA Water treatment Plan, Choona Village, District Abbottabad |
| **Monitoring Date:** | 08-07-2020 | **Reporting Date:** | 18-07-2020 |
| **Source:** | Ambient Air (Gaseous) | | |
| **Location:** | South West Side | **Monitoring Instrument:** | AQM585, Serial # 1310 |
| **GPS Coordinates:** | 73.244541 N<br>34.139118 E | | |

| 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 | 0.79 | 11.51 | 13.93 | 13.36 |
| 2 | 11:30 AM | 0.8 | 11.52 | 13.85 | 13.75 |
| 3 | 12:30 PM | 0.79 | 11.39 | 14.09 | 14.01 |
| 4 | 01:30 PM | 0.85 | 11.48 | 15.78 | 14.25 |
| 5 | 02:30 PM | 0.92 | 11.40 | 15.98 | 13.53 |
| 6 | 03:30 PM | 0.95 | 12.13 | 16.21 | 14.15 |
| 7 | 04:30 PM | 0.98 | 11.24 | 16.28 | 14.59 |
| 8 | 05:30 PM | 1.04 | 11.4 | 16.37 | 14.71 |
| 9 | 06:30 PM | 0.88 | 11.47 | 17.6 | 15.12 |
| 10 | 07:30 PM | 0.85 | 10.98 | 14.91 | 13.82 |
| 11 | 08:30 PM | 0.82 | 10.83 | 14.78 | 13.29 |
| 12 | 09:30 PM | 0.77 | 10.62 | 13.67 | 12.48 |
| 13 | 10:30 PM | 0.72 | 10.51 | 13.81 | 12.17 |
| 14 | 11:30 PM | 0.7 | 10.44 | 12.92 | 11.57 |
| 15 | 12:30 AM | 0.75 | 10.14 | 12.47 | 11.13 |
| 16 | 01:30 AM | 0.67 | 9.68 | 12.88 | 11.46 |
| 17 | 02:30 AM | 0.66 | 9.29 | 11.9 | 11.52 |
| 18 | 03:30 AM | 0.64 | 8.81 | 11.78 | 11.05 |
| 19 | 04:30 AM | 0.68 | 9.97 | 11.04 | 10.51 |
| 20 | 05:30 AM | 0.61 | 10.46 | 10.69 | 11.38 |
| 21 | 06:30 AM | 0.64 | 10.83 | 11.47 | 11.06 |
| 22 | 07:30 AM | 0.67 | 10.79 | 11.97 | 10.87 |
| 23 | 08:30 AM | 0.68 | 11.22 | 11.86 | 11.23 |
| 24 | 09:30 AM | 0.74 | 11.16 | 11.65 | 12.56 |
| Average Concentration | | **0.77** | **10.84** | **13.69** | **12.67** |
| NEQSAA | | 05<br>(24 hr) | 40<br>(24 hr) | 80<br>(24 hr) | 120<br>(24 hr) |
| WHO | | --- | --- | 200<br>(24 hrs) | 20<br>(24 hrs) |

**NEQSAA:** National Environmental Quality Standards for Ambient Air

**WHO:** World Health Organization

**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.

Signature of Analyst

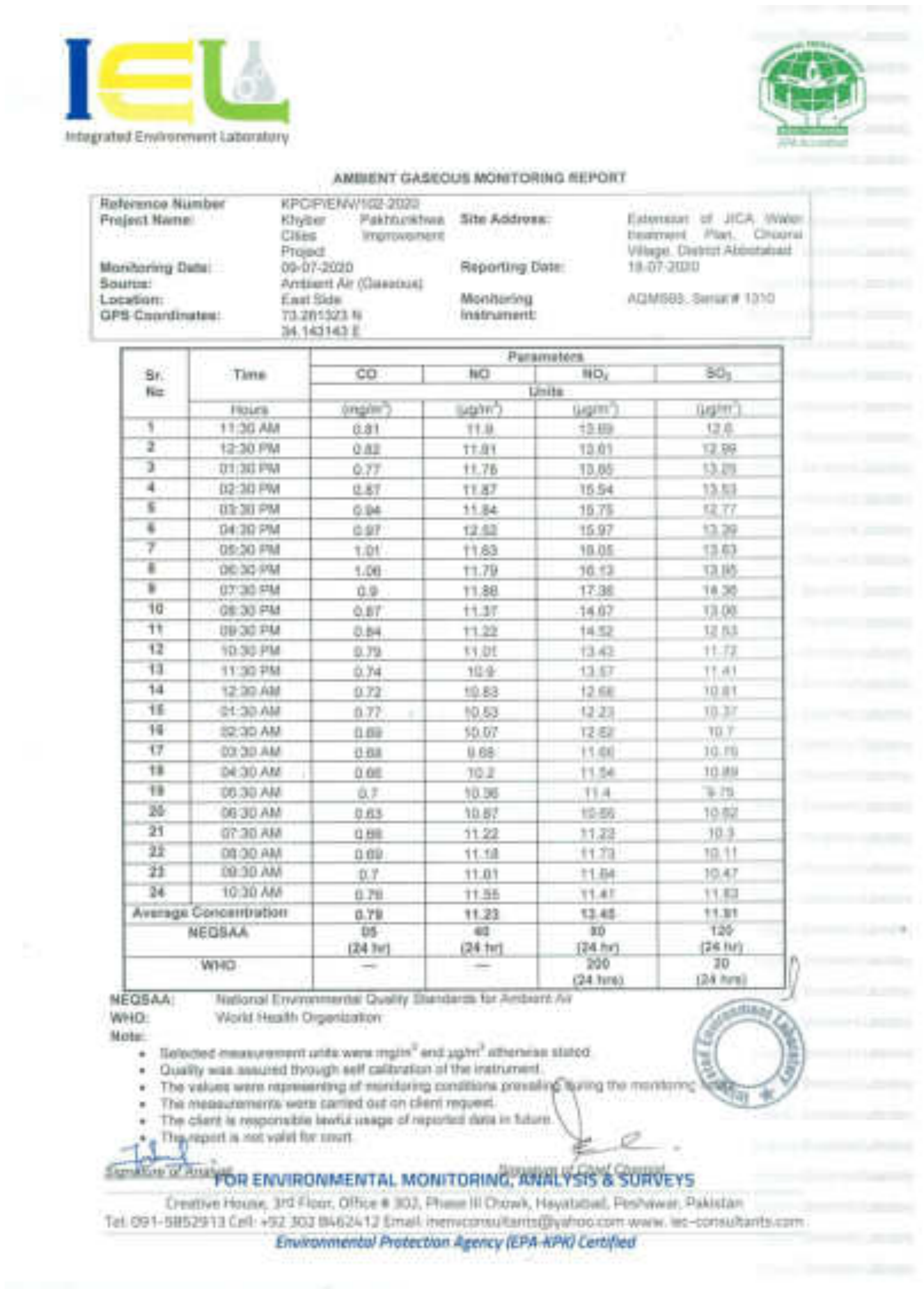
Signature of Chief Chemist

Integrated Environment Laboratory

**FOR ENVIRONMENTAL MONITORING, ANALYSIS & SURVEYS**

Creative House, 3rd Floor, Office # 302, Phase III Chowk, Hayatabad, Peshawar, Pakistan
Tel: 091-5852913 Cell: +92 302 8462412 Email: iemconsultants@yahoo.com www.iec-consultants.com

*Environmental Protection Agency (EPA-KPK) Certified*



Integrated Environment Laboratory

## AMBIENT GASEOUS MONITORING REPORT

| | | | |
|---|---|---|---|
| **Reference Number** | KPCIP/ENV/102-2020 | | |
| **Project Name:** | Khyber Pakhtunkhwa Cities Improvement Project | **Site Address:** | Extension of JICA Water treatment Plant, Choorai Village, District Abbottabad |
| **Monitoring Date:** | 09-07-2020 | **Reporting Date:** | 18-07-2020 |
| **Source:** | Ambient Air (Gaseous) | | |
| **Location:** | East Side | **Monitoring Instrument:** | AQM565, Serial # 1310 |
| **GPS Coordinates:** | 73.261323 N<br>34.143143 E | | |

| 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 | 11:30 AM | 0.81 | 11.9 | 13.69 | 12.6 |
| 2 | 12:30 PM | 0.82 | 11.91 | 13.01 | 12.99 |
| 3 | 01:30 PM | 0.77 | 11.76 | 13.65 | 13.29 |
| 4 | 02:30 PM | 0.87 | 11.87 | 15.54 | 13.53 |
| 5 | 03:30 PM | 0.94 | 11.84 | 15.75 | 12.77 |
| 6 | 04:30 PM | 0.97 | 12.52 | 15.97 | 13.39 |
| 7 | 05:30 PM | 1.01 | 11.63 | 16.05 | 13.63 |
| 8 | 06:30 PM | 1.06 | 11.79 | 16.13 | 13.95 |
| 9 | 07:30 PM | 0.9 | 11.88 | 17.38 | 14.36 |
| 10 | 08:30 PM | 0.87 | 11.37 | 14.07 | 13.06 |
| 11 | 09:30 PM | 0.84 | 11.22 | 14.52 | 12.53 |
| 12 | 10:30 PM | 0.79 | 11.01 | 13.43 | 11.72 |
| 13 | 11:30 PM | 0.74 | 10.9 | 13.57 | 11.41 |
| 14 | 12:30 AM | 0.72 | 10.83 | 12.68 | 10.81 |
| 15 | 01:30 AM | 0.77 | 10.53 | 12.23 | 10.37 |
| 16 | 02:30 AM | 0.69 | 10.07 | 12.82 | 10.7 |
| 17 | 03:30 AM | 0.68 | 9.68 | 11.66 | 10.76 |
| 18 | 04:30 AM | 0.66 | 10.2 | 11.54 | 10.89 |
| 19 | 05:30 AM | 0.7 | 10.36 | 11.4 | 9.75 |
| 20 | 06:30 AM | 0.63 | 10.87 | 10.66 | 10.82 |
| 21 | 07:30 AM | 0.68 | 11.22 | 11.23 | 10.3 |
| 22 | 08:30 AM | 0.69 | 11.18 | 11.73 | 10.11 |
| 23 | 09:30 AM | 0.7 | 11.01 | 11.84 | 10.47 |
| 24 | 10:30 AM | 0.78 | 11.55 | 11.47 | 11.83 |
| Average Concentration | | 0.79 | 11.23 | 13.45 | 11.91 |
| NEQSAA | | 05<br>(24 hr) | 40<br>(24 hr) | 80<br>(24 hr) | 120<br>(24 hr) |
| WHO | | — | — | 200<br>(24 hrs) | 20<br>(24 hrs) |

NEQSAA: National Environmental Quality Standards for Ambient Air
WHO: World Health Organization

**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 time.
- 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.

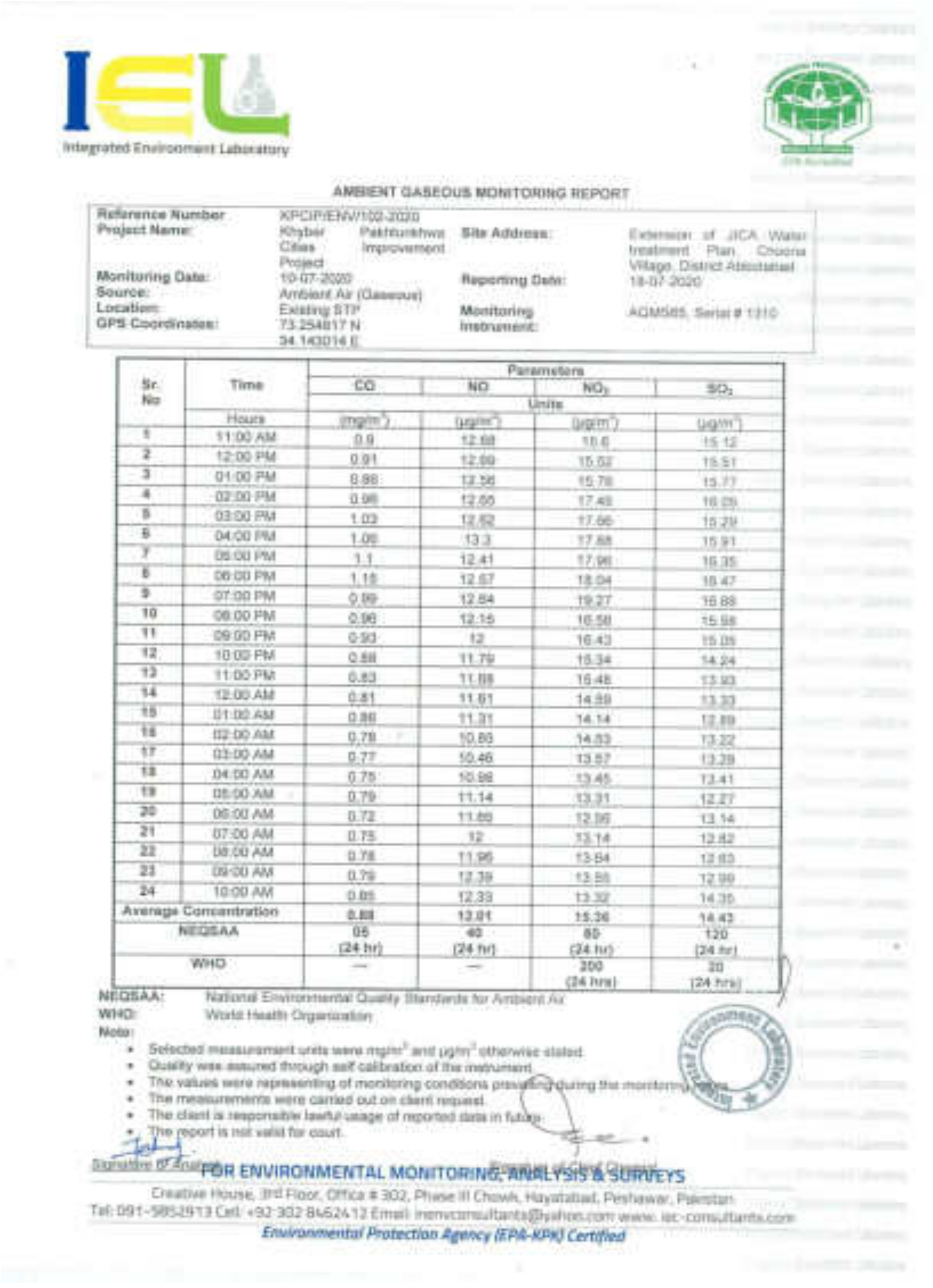
Signature of Analyst

Signature of Chief Chemist

FOR ENVIRONMENTAL MONITORING, ANALYSIS & SURVEYS

Creative House, 3rd Floor, Office # 302, Phase III Chowk, Hayatabad, Peshawar, Pakistan
Tel: 091-5852913 Cell: +92 302 8462412 Email: ienvconsultants@yahoo.com www. iec-consultants.com

*Environmental Protection Agency (EPA-KPK) Certified*



Integrated Environment Laboratory

## AMBIENT GASEOUS MONITORING REPORT

| | | | |
|---|---|---|---|
| **Reference Number** | KPCIP/ENV/102-2020 | | |
| **Project Name:** | Khyber Pakhtunkhwa Cities Improvement Project | **Site Address:** | Extension of JICA Water treatment Plan, Chuona Village, District Abbottabad |
| **Monitoring Date:** | 10-07-2020 | **Reporting Date:** | 18-07-2020 |
| **Source:** | Ambient Air (Gaseous) | | |
| **Location:** | Existing STP | **Monitoring Instrument:** | AQM565, Serial # 1310 |
| **GPS Coordinates:** | 73.254817 N<br>34.143014 E | | |

| 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 | 11:00 AM | 0.9 | 12.68 | 15.6 | 15.12 |
| 2 | 12:00 PM | 0.91 | 12.99 | 15.62 | 15.51 |
| 3 | 01:00 PM | 0.88 | 12.56 | 15.78 | 15.77 |
| 4 | 02:00 PM | 0.98 | 12.55 | 17.49 | 16.05 |
| 5 | 03:00 PM | 1.03 | 12.82 | 17.66 | 15.29 |
| 6 | 04:00 PM | 1.06 | 13.3 | 17.68 | 15.91 |
| 7 | 05:00 PM | 1.1 | 12.41 | 17.96 | 16.35 |
| 8 | 06:00 PM | 1.15 | 12.67 | 18.04 | 16.47 |
| 9 | 07:00 PM | 0.99 | 12.84 | 19.27 | 16.88 |
| 10 | 08:00 PM | 0.96 | 12.15 | 16.58 | 15.98 |
| 11 | 09:00 PM | 0.93 | 12 | 16.43 | 15.05 |
| 12 | 10:00 PM | 0.88 | 11.79 | 16.34 | 14.24 |
| 13 | 11:00 PM | 0.83 | 11.88 | 16.48 | 13.93 |
| 14 | 12:00 AM | 0.81 | 11.61 | 14.59 | 13.33 |
| 15 | 01:00 AM | 0.86 | 11.31 | 14.14 | 12.89 |
| 16 | 02:00 AM | 0.78 | 10.86 | 14.83 | 13.22 |
| 17 | 03:00 AM | 0.77 | 10.46 | 13.57 | 13.29 |
| 18 | 04:00 AM | 0.75 | 10.98 | 13.45 | 13.41 |
| 19 | 05:00 AM | 0.79 | 11.14 | 13.31 | 12.27 |
| 20 | 06:00 AM | 0.72 | 11.65 | 12.96 | 13.14 |
| 21 | 07:00 AM | 0.75 | 12 | 13.14 | 12.82 |
| 22 | 08:00 AM | 0.78 | 11.96 | 13.64 | 12.63 |
| 23 | 09:00 AM | 0.79 | 12.39 | 13.58 | 12.99 |
| 24 | 10:00 AM | 0.85 | 12.33 | 13.32 | 14.35 |
| **Average Concentration** | | **0.88** | **12.01** | **15.36** | **14.43** |
| **NEQSAA** | | 05<br>(24 hr) | 40<br>(24 hr) | 80<br>(24 hr) | 120<br>(24 hr) |
| **WHO** | | — | — | 200<br>(24 hrs) | 20<br>(24 hrs) |

**NEQSAA:** National Environmental Quality Standards for Ambient Air

**WHO:** World Health Organization

**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 period.
- 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.

Signature of Analyst

Signature of Chief Chemist

Integrated Environment Laboratory

FOR ENVIRONMENTAL MONITORING, ANALYSIS & SURVEYS

Creative House, 3rd Floor, Office # 302, Phase III Chowk, Hayatabad, Peshawar, Pakistan
Tel: 091-5852913 Cell: +92-302 8462412 Email: ienvconsultants@yahoo.com www. iec-consultants.com

*Environmental Protection Agency (EPA-KPK) Certified*

## Surface Water Quality

Integrated Environment Laboratory

**NULLAH WATER (JANDAR BARI) ANALYSIS REPORT**

| | | | |
|---|---|---|---|
| **Reference Number** | KPCIP/IEL/611/2020 | | |
| **Project Name:** | Khyber Pakhtunkhwa Cities Improvement Project (KPCIP) (Monsoon Season Sampling) | **Site Address:** | Jandar Bari, Abbottabad |
| **Sampling Date:** | From 23-09-2020 to 24-09-2020 | | |
| **Sample Code:** | Composite Sample (A) | **Report Issue Date:** | 30-09-2020 |
| **Source:** | Nullah Water | **Sampling Done by:** | Analyst IEL |
| **Site Coordinates:** | 34°08'30.0" N 73°22'40.5" E | **Analysis Method:** | APHA/AWWA/USEPA Standard Methods |

**PHYSICAL & CHEMICAL PARAMETERS**

| SR. NO | PARAMETERS | ANALYSIS METHOD | UNITS | WHO | NEQS | RESULTS |
|---|---|---|---|---|---|---|
| 1. | pH | APHA-4500H+ B | — | 6.5-8.5 | 6.5-8.5 | 7.20 |
| 2. | Temperature | APHA 2550 B | °C | — | — | 08 |
| 3. | Total Dissolved Solids (TDS) | APHA-2540 C | mg/l | < 1000 | < 1000 | 142 |
| 4. | Taste | APHA 2160 | — | Non Objectionable acceptable | Non Objectionable acceptable | Non Objectionable |
| 5. | Color | APHA 2120 C | TCU | ≤ 15 | ≤ 15 | 17 |
| 6. | Odor | APHA 2150 B | — | Non Objectionable acceptable | Non Objectionable acceptable | Non Objectionable |
| 7. | Turbidity | APHA 2130 B | NTU | <5 | < 5 | 21 |
| 8. | Total Hardness as $CaCO_3$ | APHA 2340 C | mg/l | — | < 500 | 18 |
| 9. | Total Suspended Solids (TSS) | APHA-2540 D | mg/l | NGV | NGV | 23 |
| 10. | Total Settable Solids | APHA 2540 F | mg/l | — | NGV | 14 |
| 11. | Total Not Settable Solids | APHA 2540 F | mg/l | — | NGV | 8 |
| 12. | Dissolved Oxygen as DO | APHA 4500 O | mg/l | NGV | NGV | 8.1 |
| 13. | Total Alkalinity | APHA 2320 A | mg/l | NGV | NGV | 12 |
| 14. | Aluminum | APHA 3500 Al B | mg/l | ≤ 0.2 | NGV | N.D. |
| 15. | Antimony | APHA 3500 Sb | mg/l | 0.005 | NGV | N.D. |
| 16. | Arsenic | APHA-3500As B | mg/l | 0.01 | ≤ 0.05 | N.D. |

**NEQS:** National Environmental Quality Standards for Drinking Water; **WHO:** World Health Organization
N.D.: Not Detected

**Note:**

- [illegible]
- 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.

Signature of Laboratory Manager:

Page 1 of 2

FOR ENVIRONMENTAL MONITORING, ANALYSIS & SURVEYS
Creative House, 3rd Floor, Office # 302, Phase III Chowk, Hayatabad, Peshawar, Pakistan
Tel: 091-5852913 Cell: +92 302 8462412 Email: ienvconsultants@yahoo.com www. iel-consultants.com
*Environmental Protection Agency (EPA-KPK) Certified*

Integrated Environment Laboratory

## NULLAH WATER (JANDAR BARI) ANALYSIS REPORT

| | | | |
|---|---|---|---|
| **Reference Number** | KPCIP/IEL/811/2020 | | |
| **Project Name:** | Khyber Pakhtunkhwa Cities Improvement Project (KPCIP) (Monsoon Season Sampling) | **Site Address:** | Jandar Bari, Abbottabad |
| **Sampling Date:** | From 23-09-2020 to 24-09-2020 | | |
| **Sample Code:** | Composite Sample (A) | **Report Issue Date:** | 30-09-2020 |
| **Source:** | Nullah Water | **Sampling Done by:** | Analyst-IEL |
| **Site Coordinates:** | 34°09'30.0" N 73°22'40.5" E | **Analysis Method:** | APHA/AWWA/USEPA Standard Methods |

**CHEMICAL PARAMETERS**

| SR. NO | PARAMETERS | ANALYSIS METHOD | UNITS | WHO | NEQS | RESULTS |
|---|---|---|---|---|---|---|
| 17. | Barium | APHA-3500Ba B | mg/l | 0.3 | 0.7 | N.D. |
| 18. | Boron | APHA-4500B-C | mg/l | 0.3 | 0.3 | N.D. |
| 19. | Cadmium | APHA-3500 Cd-B | mg/l | 0.003 | 0.01 | N.D. |
| 20. | Chloride | APHA-4500Cl- B | mg/l | 250 | < 250 | 14 |
| 21. | Chromium | APHA-3500Cr B | mg/l | 0.05 | ≤ 0.05 | N.D. |
| 22. | Copper | APHA-3500Cu B | mg/l | 2 | 2 | N.D. |
| 23. | Cyanide (as CN) total | APHA 4500-CN | mg/l | 0.07 | ≤ 0.05 | N.D. |
| 24. | Fluoride | APHA-4500F- C | mg/l | 1.5 | ≤ 1.5 | 0.09 |
| 25. | Lead | APHA-3500-Pb B | mg/l | 0.01 | ≤ 0.05 | N.D. |
| 26. | Manganese | APHA-3500-Mn B | mg/l | 0.5 | ≤ 0.5 | 0.08 |
| 27. | Mercury | APHA-3500 Hg-B | mg/l | 0.001 | ≤ 0.001 | N.D. |
| 28. | Nickel | ASTM E3047-16 | mg/l | 0.02 | ≤ 0.02 | N.D. |
| 29. | Nitrate | APHA-4500 $NO_3$ | mg/l | 50 | NGV | 0.21 |
| 30. | Nitrite | APHA-4500 $NO_2$ | mg/l | 3 | NGV | 1.4 |

**NEQS:** National Environmental Quality Standards for Drinking Water; **WHO:** World Health Organization
**NGV:** No Guideline Values **N.D.** Not Detected

Note:
- [illegible]
- [illegible]
- [illegible]

Signature of Laboratory Manager

Page 2 of 2

FOR ENVIRONMENTAL MONITORING, ANALYSIS & SURVEYS

Creative House, 3rd Floor, Office # 302, Phase III Chowk, Hayatabad, Peshawar, Pakistan
Tel: 091-5852913 Cell: +92 302 8462412 Email: iemconsultants@yahoo.com www. iec-consultants.com
*Environmental Protection Agency (EPA-KPK) Certified*

Integrated Environment Laboratory

## NULLAH WATER (JANDAR BARI) ANALYSIS REPORT

**Reference Number** KPCIP/IEL/611/2020

**Project Name:** Khyber Pakhtunkhwa Cities Improvement Project (KPCIP) (Monsoon Season Sampling)

**Site Address:** Jandar Bari, Abbottabad

**Sampling Date:** From 23-09-2020 to 24-09-2020

**Sample Code:** Composite Sample (A)

**Report Issue Date:** 30-09-2020

**Source:** Nullah Water

**Sampling Done by:** Analyst-IEL

**Site Coordinates:** 34°09'30.0" N 73°22'40.5" E

**Analysis Method:** APHA/AWWA/USEPA Standard Methods

**CHEMICAL PARAMETERS**

| SR. NO | PARAMETERS | ANALYSIS METHOD | UNITS | WHO | NEQS | RESULTS |
|---|---|---|---|---|---|---|
| 31. | Total Kjeldahl Nitrogen | APHA 4500 N | mg/l | NGV | NGV | 1.63 |
| 32. | Selenium | APHA- 3500 Se C | mg/l | 0.01 | 0.01 | N.D. |
| 33. | Zinc | APHA-3500-Zn B | mg/l | 3 | 5.0 | 1.2 |
| 34. | Total Organic Carbon | APHA-5310 B | mg/l | NGV | NGV | 5.12 |
| 35. | Total Phosphorus | APHA-4500 P E | mg/l | NGV | NGV | 0.001 |
| 36. | Sulphate (SO₄) | APHA-4500-SO4 C | mg/l | 500 | NGV | 18 |
| 37. | Iron | APHA-3500-Fe-B | mg/l | NGV | NGV | 1.41 |

**NEQS:** National Environmental Quality Standards for Drinking Water; **WHO:** World Health Organization
**NGV:** No Guideline Values **N.D.** Not Detected

**Note:**

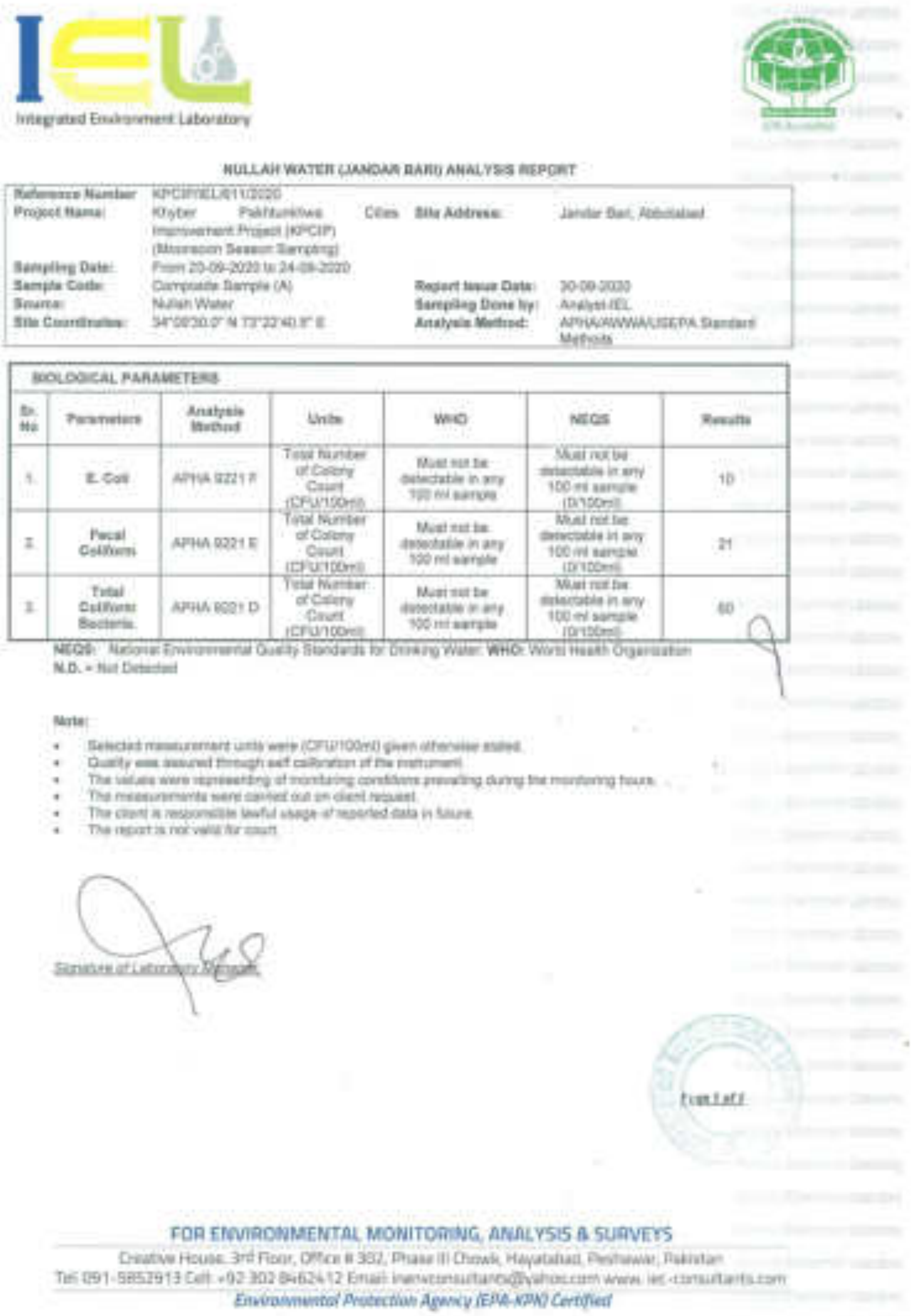
- Selected measurement units were mg/l given otherwise stated.
- Quality was assured through self calibration of the instrument.
- The values were representing of monitoring conditions prevailing during the monitoring hours. The measurements were carried out on client request. The client is responsible lawful usage of reported data in future. The report is not valid for court.

Signature of Laboratory Manager

FOR ENVIRONMENTAL MONITORING, ANALYSIS & SURVEYS

Creative House, 3rd Floor, Office # 302, Phase III Chowk, Hayatabad, Peshawar, Pakistan
Tel: 091-5852913 Cell: +92 302 8462412 Email: iemvconsultants@yahoo.com www. iec-consultants.com

*Environmental Protection Agency (EPA-KPK) Certified*



Integrated Environment Laboratory

## NULLAH WATER (JANDAR BARI) ANALYSIS REPORT

| | | | |
|---|---|---|---|
| **Reference Number** | KPCIP/IEL/611/2020 | | |
| **Project Name:** | Khyber Pakhtunkhwa Cities Improvement Project (KPCIP) (Monsoon Season Sampling) | **Site Address:** | Jandar Bari, Abbottabad |
| **Sampling Date:** | From 20-09-2020 to 24-09-2020 | | |
| **Sample Code:** | Composite Sample (A) | **Report Issue Date:** | 30-09-2020 |
| **Source:** | Nullah Water | **Sampling Done by:** | Analyst-IEL |
| **Site Coordinates:** | 34°08'30.0" N 73°22'40.8" E | **Analysis Method:** | APHA/AWWA/USEPA Standard Methods |

**BIOLOGICAL PARAMETERS**

| Sr. No. | Parameters | Analysis Method | Units | WHO | NEQS | Results |
|---|---|---|---|---|---|---|
| 1. | E. Coli | APHA 9221 F | Total Number of Colony Count (CFU/100ml) | Must not be detectable in any 100 ml sample | Must not be detectable in any 100 ml sample (0/100ml) | 10 |
| 2. | Fecal Coliform | APHA 9221 E | Total Number of Colony Count (CFU/100ml) | Must not be detectable in any 100 ml sample | Must not be detectable in any 100 ml sample (0/100ml) | 21 |
| 3. | Total Coliform Bacteria | APHA 9221 D | Total Number of Colony Count (CFU/100ml) | Must not be detectable in any 100 ml sample | Must not be detectable in any 100 ml sample (0/100ml) | 60 |

**NEQS:** National Environmental Quality Standards for Drinking Water; **WHO:** World Health Organization
**N.D.** = Not Detected

**Note:**

- Selected measurement units were (CFU/100ml) given 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.

Signature of Laboratory Manager

Page 1 of 1

FOR ENVIRONMENTAL MONITORING, ANALYSIS & SURVEYS

Creative House, 3rd Floor, Office # 302, Phase III Chowk, Hayatabad, Peshawar, Pakistan
Tel: 091-5852913 Cell: +92 302 8462412 Email: inenvconsultants@yahoo.com www. iec-consultants.com
*Environmental Protection Agency (EPA-KPK) Certified*

Integrated Environment Laboratory

## NULLAH WATER (JANDAR BARI) ANALYSIS REPORT

| | | | |
|---|---|---|---|
| **Reference Number:** | KPCIP/IEL/811/2020 | | |
| **Project Name:** | Khyber Pakhtunkhwa Cities Improvement Project.<br>(Monsoon Season Sampling) | **Site Address:** | Jandar Bari, Abbottabad |
| **Sampling Date:** | From 23-09-2020 to 24-09-2020 | | |
| **Sample Code:** | Grab Samples | **Report Issue Date:** | 30-09-2020 |
| **Source:** | Nullah Water | **Sampling Done by:** | Analyst IEL |
| **Site Coordinates:** | 34°09'30.0" N 73°22'45.9" E | **Analysis Method:** | APHA/USEPA Standard Methods |

| Sample code | Sampling Time | Parameter | Sampling Dated | Analysis Method | Unit | WHO | NEQS | Results |
|---|---|---|---|---|---|---|---|---|
| GS # 1 | 11:20 AM | Turbidity | September 23 & 24, 2020 | APHA - 2130 B | NTU | < 5 | < 5 | 24 |
| GS # 2 | 02:25 PM | | | | | | | 25 |
| GS # 3 | 05:30 PM | | | | | | | 23 |
| GS # 4 | 08:35 PM | | | | | | | 21 |
| GS # 5 | 12:00 AM | | | | | | | 18 |
| GS # 6 | 03:20 AM | | | | | | | 19 |
| GS # 7 | 06:20 AM | | | | | | | 23 |
| GS # 8 | 09:25 AM | | | | | | | 22 |

NEQS: National Environmental Quality Standards for Drinking Water
WHO: World Health Organization GS: Grab Sample

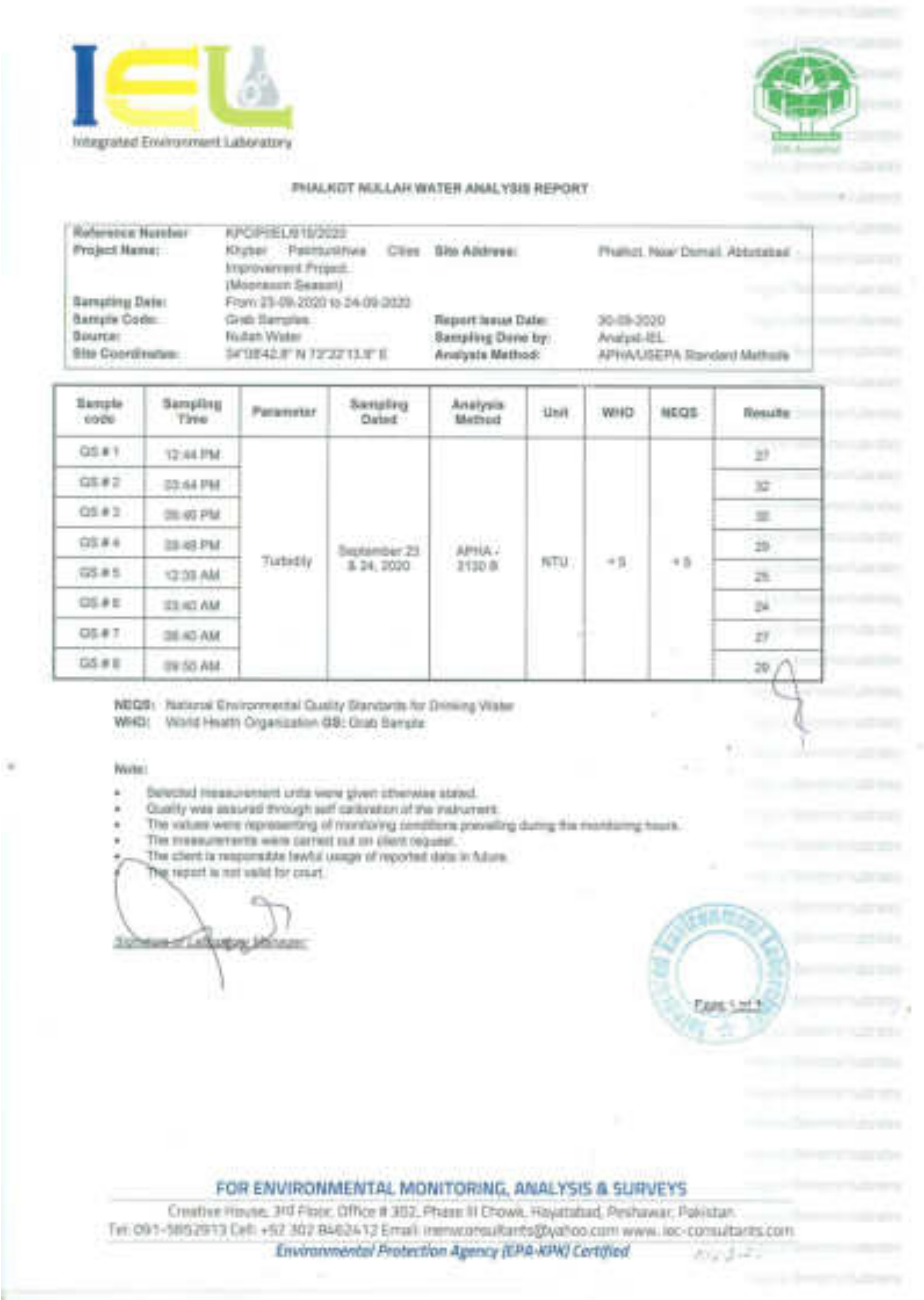
Note:

- Selected measurement units were given 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.

Signature of Laboratory Manager

Page 1 of 1

FOR ENVIRONMENTAL MONITORING, ANALYSIS & SURVEYS
Creative House, 3rd Floor, Office # 302, Phase III Chowk, Hayatabad, Peshawar, Pakistan
Tel: 091-5852913 Cell: +92 302 8463412 Email: ienviroconsultants@yahoo.com www. iec-consultants.com
*Environmental Protection Agency (EPA-KPK) Certified*



Integrated Environment Laboratory

## PHALKOT NULLAH WATER ANALYSIS REPORT

| | | | |
|---|---|---|---|
| **Reference Number** | KPCIP/IEL/010/2020 | | |
| **Project Name:** | Khyber Pakhtunkhwa Cities Improvement Project (Moonsoon Season) | **Site Address:** | Phalkot, Near Domail, Abbottabad |
| **Sampling Date:** | From 23-09-2020 to 24-09-2020 | | |
| **Sample Code:** | Grab Samples | **Report Issue Date:** | 30-09-2020 |
| **Source:** | Nullah Water | **Sampling Done by:** | Analyst-IEL |
| **Site Coordinates:** | 34°08'42.8" N 73°22'13.9" E | **Analysis Method:** | APHA/USEPA Standard Methods |

| Sample code | Sampling Time | Parameter | Sampling Dated | Analysis Method | Unit | WHO | NEQS | Results |
|---|---|---|---|---|---|---|---|---|
| GS # 1 | 12:44 PM | Turbidity | September 23 & 24, 2020 | APHA - 2130 B | NTU | < 5 | < 5 | 27 |
| GS # 2 | 03:44 PM | | | | | | | 32 |
| GS # 3 | 06:40 PM | | | | | | | 30 |
| GS # 4 | 09:48 PM | | | | | | | 29 |
| GS # 5 | 12:38 AM | | | | | | | 25 |
| GS # 6 | 03:40 AM | | | | | | | 24 |
| GS # 7 | 06:40 AM | | | | | | | 27 |
| GS # 8 | 09:50 AM | | | | | | | 29 |

**NEQS:** National Environmental Quality Standards for Drinking Water
**WHO:** World Health Organization **GS:** Grab Sample

**Note:**

- Selected measurement units were given 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.

Signature of Laboratory Manager

Page 1 of 1

FOR ENVIRONMENTAL MONITORING, ANALYSIS & SURVEYS
Creative House, 3rd Floor, Office # 302, Phase III Chowk, Hayatabad, Peshawar, Pakistan.
Tel: 091-5852913 Cell: +92 302 8462412 Email: ienvconsultants@yahoo.com www.iec-consultants.com
*Environmental Protection Agency (EPA-KPK) Certified*

Integrated Environment Laboratory

## PHALKOT NULLAH WATER ANALYSIS REPORT

| | | | |
|---|---|---|---|
| **Reference Number** | KPCIP/IEL/619/2020 | | |
| **Project Name:** | Khyber Pakhtunkhwa Cities Improvement Project (KPCIP) (Monsoon Season) | **Site Address:** | Phalkot, Near Domel, Abbotabad |
| **Sampling Date:** | From 23-09-2020 to 24-09-2020 | | |
| **Sample Code:** | Composite Sample (A) | **Report Issue Date:** | 30-09-2020 |
| **Source:** | Nullah Water | **Sampling Done by:** | Analyst-IEL |
| **Site Coordinates:** | 34°06'42.6" N 73°22'13.9" E | **Analysis Method:** | APHA/AWWA/USEPA Standard Methods |

PHYSICAL & CHEMICAL PARAMETERS

| Sr. No | Parameters | Analysis Method | Units | WHO | NEQS | Results |
|---|---|---|---|---|---|---|
| 1. | pH | APHA 4500H+ B | — | 6.5-8.5 | 6.5-8.5 | 7.1 |
| 2. | Temperature | APHA 2550 B | °C | — | — | 8.8 |
| 3. | Total Dissolved Solids (TDS) | APHA 2540 C | mg/l | < 1000 | < 1000 | 229 |
| 4. | Taste | APHA 2160 | — | Non Objectionable/ acceptable | Non Objectionable/ acceptable | Non Objectionable |
| 5. | Color | APHA 2120 C | TCU | ≤ 15 | ≤ 15 | 31 |
| 6. | Odor | APHA 2150 B | — | Non Objectionable/ acceptable | Non Objectionable/ acceptable | Non Objectionable |
| 7. | Turbidity | APHA 2130 B | NTU | <5 | < 5 | 24 |
| 8. | Total Hardness as $CaCO_3$ | APHA 2340 C | mg/l | — | < 500 | 71 |
| 9. | Total Suspended Solids (TSS) | APHA 2540 D | mg/l | NGV | NGV | 38 |
| 10. | Total Settable Solids | APHA 2540 F | mg/l | — | NGV | 23 |
| 11. | Total Not Settable Solids | APHA 2540 F | mg/l | — | NGV | 15 |
| 12. | Dissolved Oxygen as DO | APHA 4500 O | mg/l | NGV | NGV | 7.9 |
| 13. | Total Alkalinity | APHA 2320 A | mg/l | NGV | NGV | 34 |
| 14. | Aluminum | APHA 3500 Al B | mg/l | ≤ 0.2 | NGV | 0.07 |
| 15. | Antimony | APHA 3500 Sb | mg/l | 0.005 | NGV | 0.001 |
| 16. | Arsenic | APHA 3500As B | mg/l | 0.01 | ≤ 0.05 | N.D. |

**NEQS:** National Environmental Quality Standards for Drinking Water; **WHO:** World Health Organization

**Note:**

- [illegible]
- [illegible]
- [illegible]

Signature of Category Manager:

FOR ENVIRONMENTAL MONITORING, ANALYSIS & SURVEYS

Creative House, 3rd Floor, Office # 302, Phase III Chowk, Hayatabad, Peshawar, Pakistan
Tel: 091-5852913 Cell: +92 302 8462412 Email: inenvconsultants@yahoo.com www. iec-consultants.com

*Environmental Protection Agency (EPA-KPK) Certified*

Integrated Environment Laboratory

## PHALKOT NULLAH WATER ANALYSIS REPORT

| | | | |
|---|---|---|---|
| **Reference Number** | KPCIP/IEL/619/2020 | | |
| **Project Name:** | Khyber Pakhtunkhwa Cities Improvement Project (KPCIP) (Monsoon Season) | **Site Address:** | Phalkot, New Domail, Abbottabad |
| **Sampling Date:** | From 23-09-2020 to 24-09-2020 | | |
| **Sample Code:** | Composite Sample (A) | **Report Issue Date:** | 30-09-2020 |
| **Source:** | Nullah Water | **Sampling Done by:** | Analyst-IEL |
| **Site Coordinates:** | 34°09'42.8" N 73°22'13.9" E | **Analysis Method:** | APHA/AWWA/USEPA Standard Methods |

CHEMICAL PARAMETERS

| Sr. No | Parameters | Analysis Method | Units | WHO | NEQS | Results |
|---|---|---|---|---|---|---|
| 17. | Barium | APHA-3500Ba B | mg/l | 1.3 | 0.7 | 0.03 |
| 18. | Boron | APHA-4500B-C | mg/l | 0.3 | 0.3 | 0.01 |
| 19. | Cadmium | APHA-3500 Cd B | mg/l | 0.003 | 0.01 | N.D. |
| 20. | Chloride | APHA-4500Cl- B | mg/l | 250 | < 250 | 24 |
| 21. | Chromium | APHA-3500Cr B | mg/l | 0.05 | ≤ 0.05 | N.D. |
| 22. | Copper | APHA-3500Cu B | mg/l | 2 | 2 | N.D. |
| 23. | Cyanide (as CN) total | APHA-4500-CN | mg/l | 0.07 | ≤ 0.05 | N.D. |
| 24. | Fluoride | APHA-4500F- C | mg/l | 1.5 | ≤ 1.5 | 0.23 |
| 25. | Lead | APHA-3500-Pb B | mg/l | 0.01 | ≤ 0.05 | N.D. |
| 26. | Manganese | APHA-3500-Mn B | mg/l | 0.5 | ≤ 0.5 | 0.04 |
| 27. | Mercury | APHA-3500 Hg B | mg/l | 0.001 | ≤ 0.001 | N.D. |
| 28. | Nickel | ASTM E3047-16 | mg/l | 0.02 | ≤ 0.02 | N.D. |
| 29. | Nitrate | APHA-4500 $NO_3$ | mg/l | 50 | NGV | 1.31 |
| 30. | Nitrite | APHA-4500 $NO_2$ | mg/l | 50 | NGV | 1.32 |

**NEQS:** National Environmental Quality Standards for Drinking Water. **WHO:** World Health Organization
**NGV:** No Guideline Values **N.D.** Not Detected

**Note:**

- [illegible]
- Quality was assured through self calibration of the instrument.
- The values were representing of monitoring conditions prevailing during the monitoring hours. The measurements [illegible] client proceed. The client is responsible lawful usage of reported data in future. The report is not valid for court.

Signature of Laboratory Manager

Page 2 of 2

FOR ENVIRONMENTAL MONITORING, ANALYSIS & SURVEYS

Creative House, 3rd Floor, Office # 302, Phase III Chowk, Hayatabad, Peshawar, Pakistan
Tel: 091-5852913 Cell: +92 302 8462412 Email: iemconsultants@yahoo.com www. iel-consultants.com
*Environmental Protection Agency (EPA-KPK) Certified*

Integrated Environment Laboratory

## PHALKOT NULLAH WATER ANALYSIS REPORT

| | | | |
|---|---|---|---|
| **Reference Number** | KPCIP/IEL/619/2020 | | |
| **Project Name:** | Khyber Pakhtunkhwa Cities Improvement Project (KPCIP) (Monsoon Season) | **Site Address:** | Phalkot, Near Domail, Abbottabad |
| **Sampling Date:** | From 23-09-2020 to 24-09-2020 | | |
| **Sample Code:** | Composite Sample (A) | **Report Issue Date:** | 30-09-2020 |
| **Source:** | Nullah Water | **Sampling Done by:** | Analyst-IEL |
| **Site Coordinates:** | 34°08'42.8" N 73°22'13.8" E | **Analysis Method:** | APHA/AWWA/USEPA Standard Methods |

**CHEMICAL PARAMETERS**

| Sr. No | Parameters | Analysis Method | Units | WHO | NEQS | Results |
|---|---|---|---|---|---|---|
| 31. | Total Kjeldahl Nitrogen | APHA-4000 N | mg/l | NGV | NGV | 2.44 |
| 32. | Selenium | APHA- 3500 Se C | mg/l | 0.01 | 0.01 | N.D. |
| 33. | Zinc | APHA-3500-Zn B | mg/l | 3 | 5.0 | 1.10 |
| 34. | Total Organic Carbon | APHA-5310 B | mg/l | NGV | NGV | 1.12 |
| 35. | Total Phosphorus | APHA-4500 P E | mg/l | NGV | NGV | 0.03 |
| 36. | Sulphate ($SO_4$) | APHA-4500-SO4 C | mg/l | 500 | NGV | 25 |
| 37. | Iron | APHA-3500-Fe B | mg/l | NGV | NGV | 1.38 |

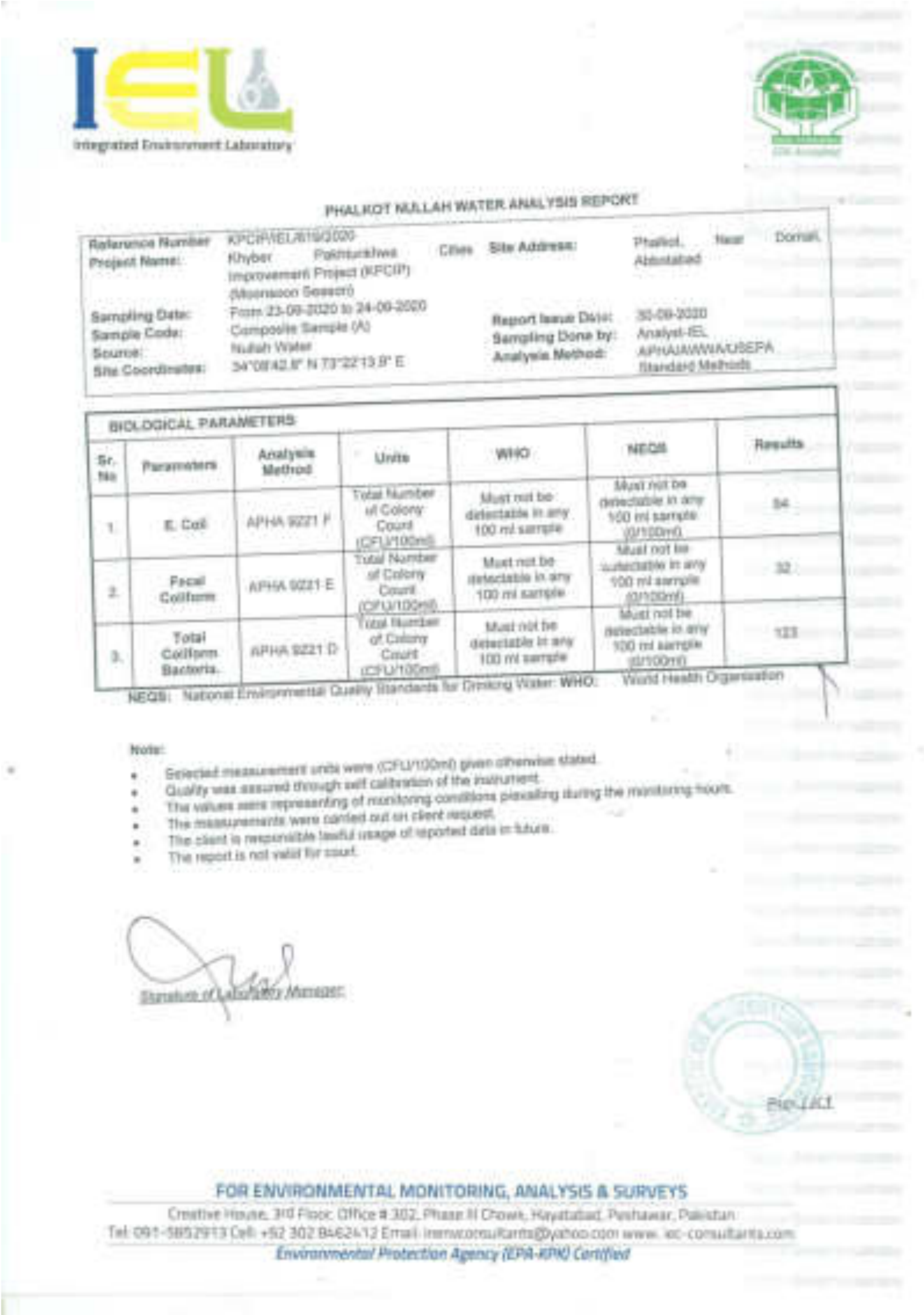
**NEQS:** National Environmental Quality Standards for Drinking Water; **WHO:** World Health Organization
**NGV:** No Guideline Values **N.D.** Not Detected

**Note:**

- Selected measurement units were not given 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 used for court.

*Signature of Laboratory Manager*

FOR ENVIRONMENTAL MONITORING, ANALYSIS & SURVEYS
Creative House, 3rd Floor, Office # 302, Phase III Chowk, Hayatabad, Peshawar, Pakistan
Tel: 091-5852913 Cell: +92 302 8462412 Email: [illegible]@yahoo.com www. iec-consultants.com
*Environmental Protection Agency (EPA-KPK) Certified*



Integrated Environment Laboratory

## PHALKOT NULLAH WATER ANALYSIS REPORT

| | | | |
|---|---|---|---|
| **Reference Number** | KPCIP/IEL/619/2020 | | |
| **Project Name:** | Khyber Pakhtunkhwa Cities Improvement Project (KPCIP) (Monsoon Season) | **Site Address:** | Phalkot, Near Domah, Abbottabad |
| **Sampling Date:** | From 23-09-2020 to 24-09-2020 | **Report Issue Date:** | 30-09-2020 |
| **Sample Code:** | Composite Sample (A) | **Sampling Done by:** | Analyst-IEL |
| **Source:** | Nullah Water | **Analysis Method:** | APHA/AWWA/USEPA Standard Methods |
| **Site Coordinates:** | 34°08'42.8" N 73°22'13.8" E | | |

**BIOLOGICAL PARAMETERS**

| Sr. No | Parameters | Analysis Method | Units | WHO | NEQS | Results |
|---|---|---|---|---|---|---|
| 1. | E. Coli | APHA 9221 F | Total Number of Colony Count (CFU/100ml) | Must not be detectable in any 100 ml sample | Must not be detectable in any 100 ml sample (0/100ml) | 94 |
| 2. | Fecal Coliform | APHA 9221-E | Total Number of Colony Count (CFU/100ml) | Must not be detectable in any 100 ml sample | Must not be detectable in any 100 ml sample (0/100ml) | 32 |
| 3. | Total Coliform Bacteria. | APHA 9221 D | Total Number of Colony Count (CFU/100ml) | Must not be detectable in any 100 ml sample | Must not be detectable in any 100 ml sample (0/100ml) | 123 |

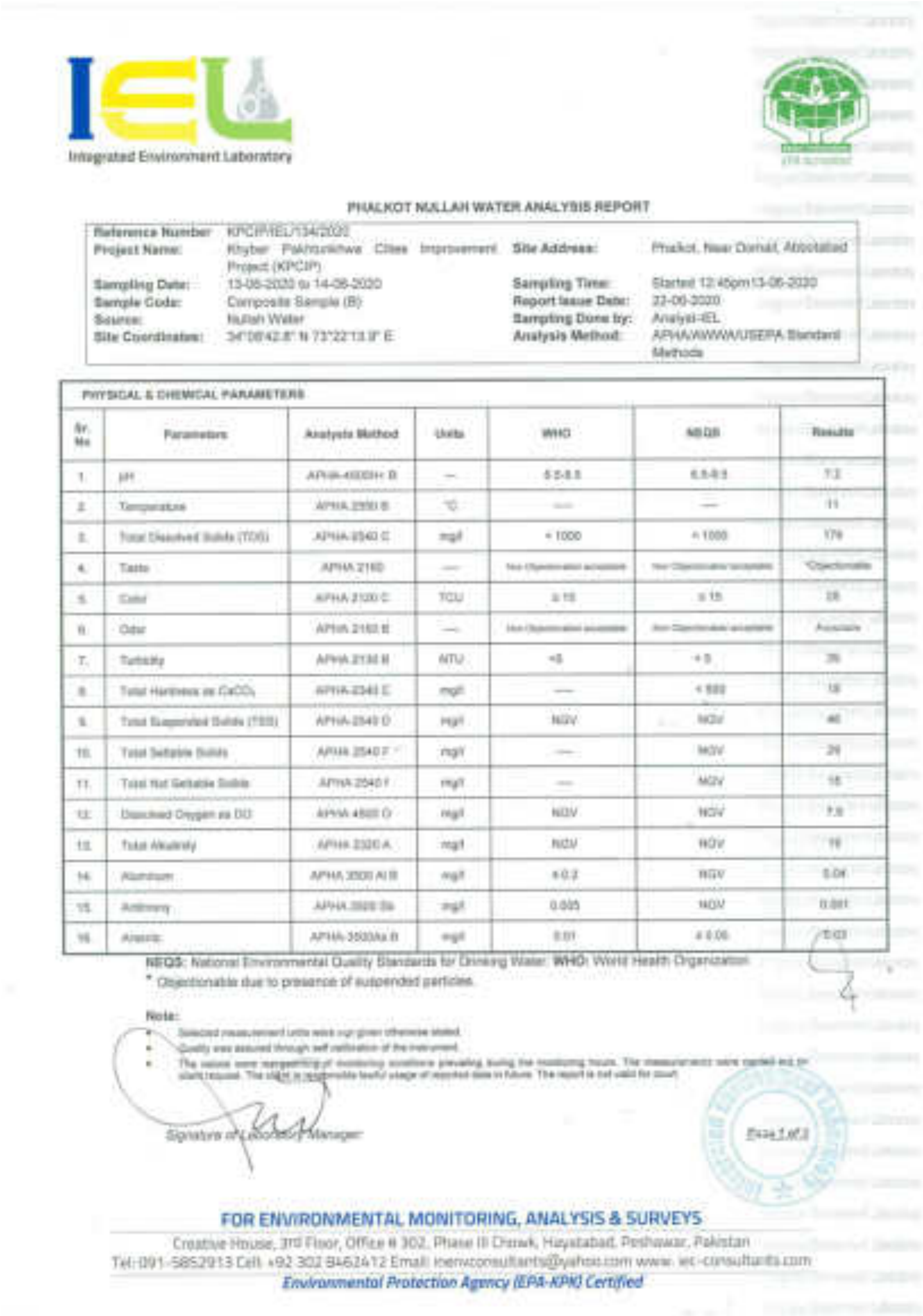
**NEQS:** National Environmental Quality Standards for Drinking Water; **WHO:** World Health Organization

**Note:**

- Selected measurement units were (CFU/100ml) given 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.

Signature of Laboratory Manager

FOR ENVIRONMENTAL MONITORING, ANALYSIS & SURVEYS
Creative House, 3rd Floor, Office # 302, Phase III Chowk, Hayatabad, Peshawar, Pakistan
Tel: 091-5852913 Cell: +92 302 8462412 Email: iremconsultants@yahoo.com www. iec-consultants.com
*Environmental Protection Agency (EPA-KPK) Certified*



Integrated Environment Laboratory

## PHALKOT NULLAH WATER ANALYSIS REPORT

| | | | |
|---|---|---|---|
| **Reference Number** | KPCIP/IEL/134/2020 | | |
| **Project Name:** | Khyber Pakhtunkhwa Cities Improvement Project (KPCIP) | **Site Address:** | Phalkot, Near Dohali, Abbottabad |
| **Sampling Date:** | 13-06-2020 to 14-06-2020 | **Sampling Time:** | Started 12:45pm13-06-2020 |
| **Sample Code:** | Composite Sample (B) | **Report Issue Date:** | 22-06-2020 |
| **Source:** | Nullah Water | **Sampling Done by:** | Analyst-IEL |
| **Site Coordinates:** | 34°08'42.8" N 73°22'13.9" E | **Analysis Method:** | APHA/AWWA/USEPA Standard Methods |

**PHYSICAL & CHEMICAL PARAMETERS**

| Sr. No | Parameters | Analysis Method | Units | WHO | NEQS | Results |
|---|---|---|---|---|---|---|
| 1. | pH | APHA-4500H+ B | — | 6.5-8.5 | 6.5-8.5 | 7.2 |
| 2. | Temperature | APHA 2550 B | °C | — | — | 11 |
| 3. | Total Dissolved Solids (TDS) | APHA-2540 C | mg/l | < 1000 | < 1000 | 179 |
| 4. | Taste | APHA 2160 | — | Non Objectionable/ acceptable | Non Objectionable/ acceptable | *Objectionable |
| 5. | Color | APHA 2120 C | TCU | ≤ 15 | ≤ 15 | 28 |
| 6. | Odor | APHA 2150 B | — | Non Objectionable/ acceptable | Non Objectionable/ acceptable | Acceptable |
| 7. | Turbidity | APHA 2130 B | NTU | <5 | < 5 | 35 |
| 8. | Total Hardness as $CaCO_3$ | APHA-2340 C | mg/l | — | < 500 | 18 |
| 9. | Total Suspended Solids (TSS) | APHA-2540 D | mg/l | NGV | NGV | 40 |
| 10. | Total Settable Solids | APHA 2540 F | mg/l | — | NGV | 26 |
| 11. | Total Not Settable Solids | APHA 2540 F | mg/l | — | NGV | 15 |
| 12. | Dissolved Oxygen as DO | APHA 4500 O | mg/l | NGV | NGV | 7.8 |
| 13. | Total Alkalinity | APHA 2320 A | mg/l | NGV | NGV | 19 |
| 14. | Aluminium | APHA 3500 Al B | mg/l | ≤ 0.2 | NGV | 0.04 |
| 15. | Antimony | APHA 3500 Sb | mg/l | 0.005 | NGV | 0.001 |
| 16. | Arsenic | APHA-3500As B | mg/l | 0.01 | ≤ 0.05 | 0.03 |

**NEQS**: National Environmental Quality Standards for Drinking Water; **WHO**: World Health Organization

* Objectionable due to presence of suspended particles.

**Note:**

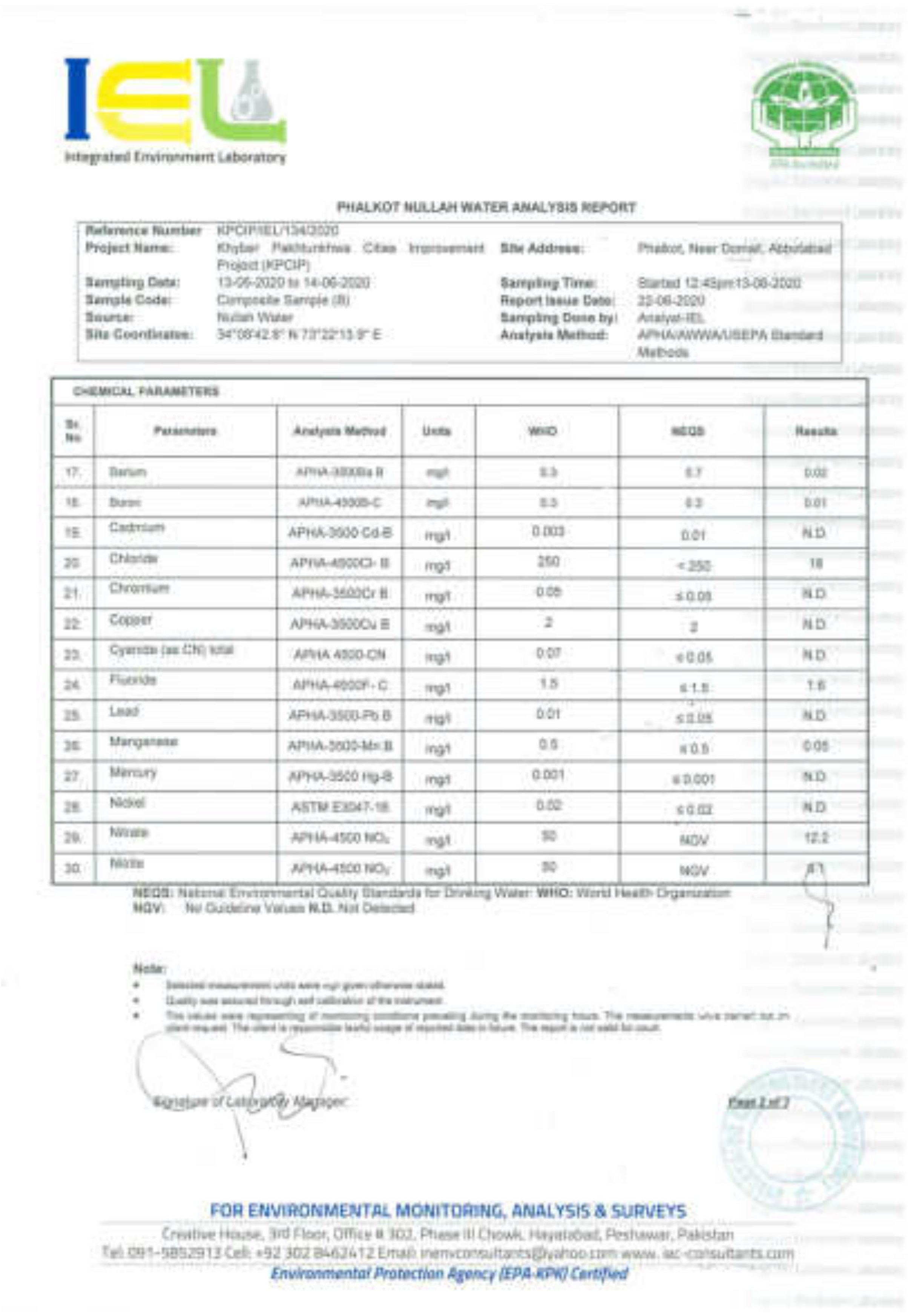
- Selected measurement units were [illegible] otherwise stated.
- Quality was assured through self calibration of the instrument.
- The values were representative of monitoring conditions prevailing during the monitoring hours. The measurements were carried out on client request. The client is responsible lawful usage of reported data in future. The report is not valid for court.

Signature of Laboratory Manager

Page 1 of 3

FOR ENVIRONMENTAL MONITORING, ANALYSIS & SURVEYS

Creative House, 3rd Floor, Office # 302, Phase III Chowk, Hayatabad, Peshawar, Pakistan
Tel:091-5852913 Cell: +92 302 8462412 Email: ienvconsultants@yahoo.com www. iec-consultants.com
*Environmental Protection Agency (EPA-KPK) Certified*



Integrated Environment Laboratory

### PHALKOT NULLAH WATER ANALYSIS REPORT

| | | | |
|---|---|---|---|
| **Reference Number** | KPCIP/IEL/134/2020 | | |
| **Project Name:** | Khyber Pakhtunkhwa Cities Improvement Project (KPCIP) | **Site Address:** | Phalkot, Near Domail, Abbottabad |
| **Sampling Date:** | 13-06-2020 to 14-06-2020 | **Sampling Time:** | Started 12:45pm 13-06-2020 |
| **Sample Code:** | Composite Sample (B) | **Report Issue Date:** | 22-06-2020 |
| **Source:** | Nullah Water | **Sampling Done by:** | Analyst-IEL |
| **Site Coordinates:** | 34°08'42.8" N 73°22'13.9" E | **Analysis Method:** | APHA/AWWA/USEPA Standard Methods |

**CHEMICAL PARAMETERS**

| Sr. No | Parameters | Analysis Method | Units | WHO | NEQS | Results |
|---|---|---|---|---|---|---|
| 17. | Barium | APHA-3000Ba B | mg/l | 0.3 | 0.7 | 0.02 |
| 18. | Boron | APHA-4500B-C | mg/l | 0.3 | 0.3 | 0.01 |
| 19. | Cadmium | APHA-3500 Cd-B | mg/l | 0.003 | 0.01 | N.D |
| 20. | Chloride | APHA-4500Cl- B | mg/l | 250 | < 250 | 18 |
| 21. | Chromium | APHA-3500Cr B | mg/l | 0.05 | ≤ 0.05 | N.D |
| 22. | Copper | APHA-3500Cu B | mg/l | 2 | 2 | N.D |
| 23. | Cyanide (as CN) total | APHA 4500-CN | mg/l | 0.07 | ≤ 0.05 | N.D |
| 24. | Fluoride | APHA-4500F- C | mg/l | 1.5 | ≤ 1.5 | 1.6 |
| 25. | Lead | APHA-3500-Pb B | mg/l | 0.01 | ≤ 0.05 | N.D |
| 26. | Manganese | APHA-3500-Mn B | mg/l | 0.5 | ≤ 0.5 | 0.05 |
| 27. | Mercury | APHA-3500 Hg-B | mg/l | 0.001 | ≤ 0.001 | N.D |
| 28. | Nickel | ASTM E3047-16 | mg/l | 0.02 | ≤ 0.02 | N.D |
| 29. | Nitrate | APHA-4500 $NO_3$ | mg/l | 50 | NGV | 12.2 |
| 30. | Nitrite | APHA-4500 $NO_2$ | mg/l | 50 | NGV | 8.1 |

**NEQS:** National Environmental Quality Standards for Drinking Water; **WHO:** World Health Organization
**NGV:** No Guideline Values **N.D.** Not Detected

**Note:**

- Selected measurement units were mg/l given 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.

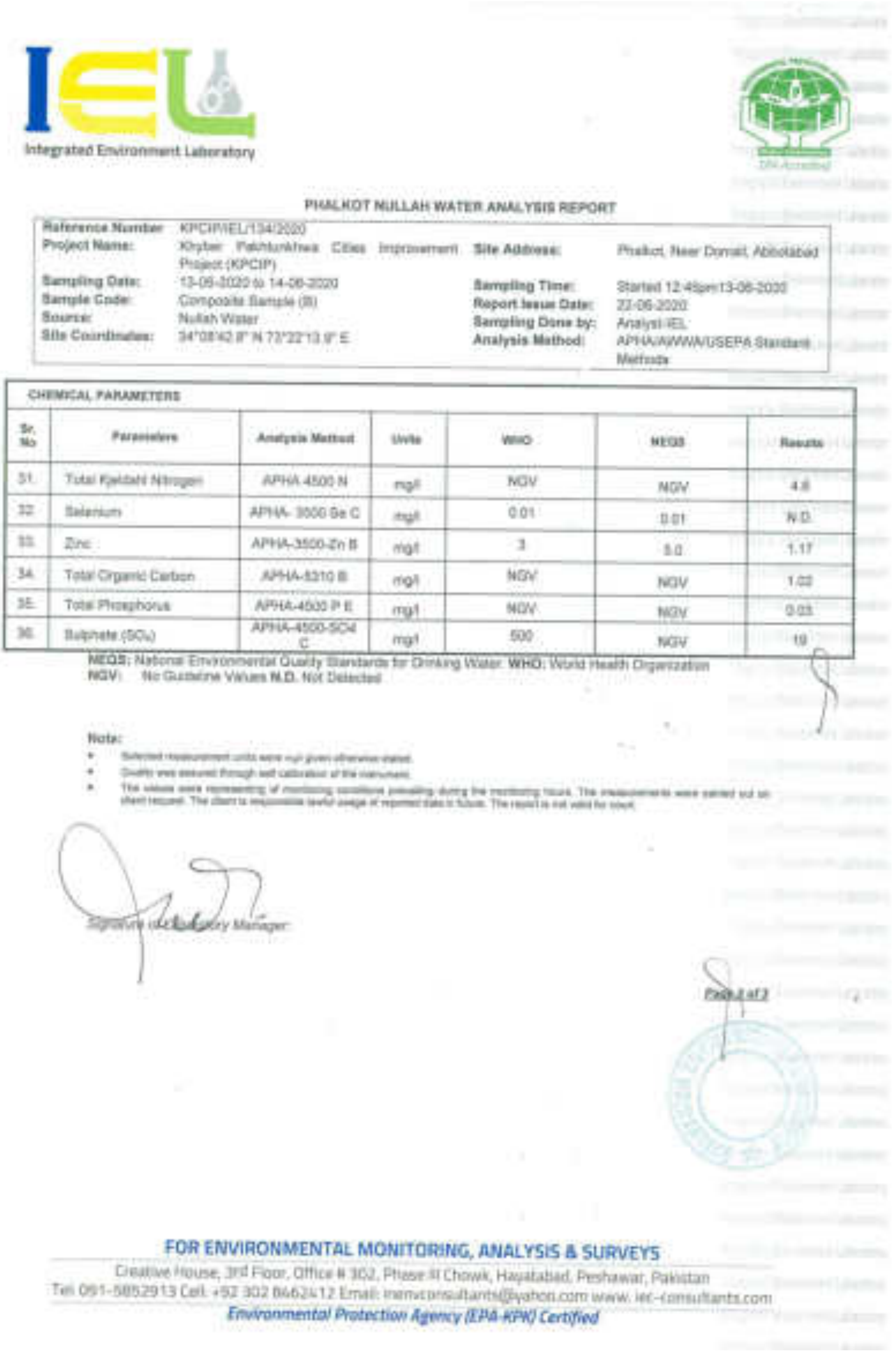
Signature of Laboratory Manager:

Page 2 of 3

FOR ENVIRONMENTAL MONITORING, ANALYSIS & SURVEYS

Creative House, 3rd Floor, Office # 302, Phase III Chowk, Hayatabad, Peshawar, Pakistan
Tel: 091-5852913 Cell: +92 302 8462412 Email: inemconsultants@yahoo.com www. iac-consultants.com

*Environmental Protection Agency (EPA-KPK) Certified*



Integrated Environment Laboratory

EPA Accredited

## PHALKOT NULLAH WATER ANALYSIS REPORT

| | | | |
|---|---|---|---|
| **Reference Number** | KPCIP/IEL/134/2020 | | |
| **Project Name:** | Khyber Pakhtunkhwa Cities Improvement Project (KPCIP) | **Site Address:** | Phalkot, Near Domail, Abbotabad |
| **Sampling Date:** | 13-06-2020 to 14-06-2020 | **Sampling Time:** | Started 12:45pm13-06-2020 |
| **Sample Code:** | Composite Sample (8) | **Report Issue Date:** | 22-06-2020 |
| **Source:** | Nullah Water | **Sampling Done by:** | Analyst IEL |
| **Site Coordinates:** | 34°08'42.8" N 73°22'13.9" E | **Analysis Method:** | APHA/AWWA/USEPA Standard Methods |

**CHEMICAL PARAMETERS**

| Sr. No | Parameters | Analysis Method | Units | WHO | NEQS | Results |
|---|---|---|---|---|---|---|
| 31. | Total Kjeldahl Nitrogen | APHA 4500 N | mg/l | NGV | NGV | 4.8 |
| 32. | Selenium | APHA- 3500 Se C | mg/l | 0.01 | 0.01 | N.D. |
| 33. | Zinc | APHA-3500-Zn B | mg/l | 3 | 5.0 | 1.17 |
| 34. | Total Organic Carbon | APHA-5310 B | mg/l | NGV | NGV | 1.02 |
| 35. | Total Phosphorus | APHA-4500 P E | mg/1 | NGV | NGV | 0.03 |
| 36. | Sulphate (SO₄) | APHA-4500-SO4 C | mg/1 | 500 | NGV | 19 |

**NEQS:** National Environmental Quality Standards for Drinking Water. **WHO:** World Health Organization
**NGV:** No Guideline Values **N.D.** Not Detected

**Note:**

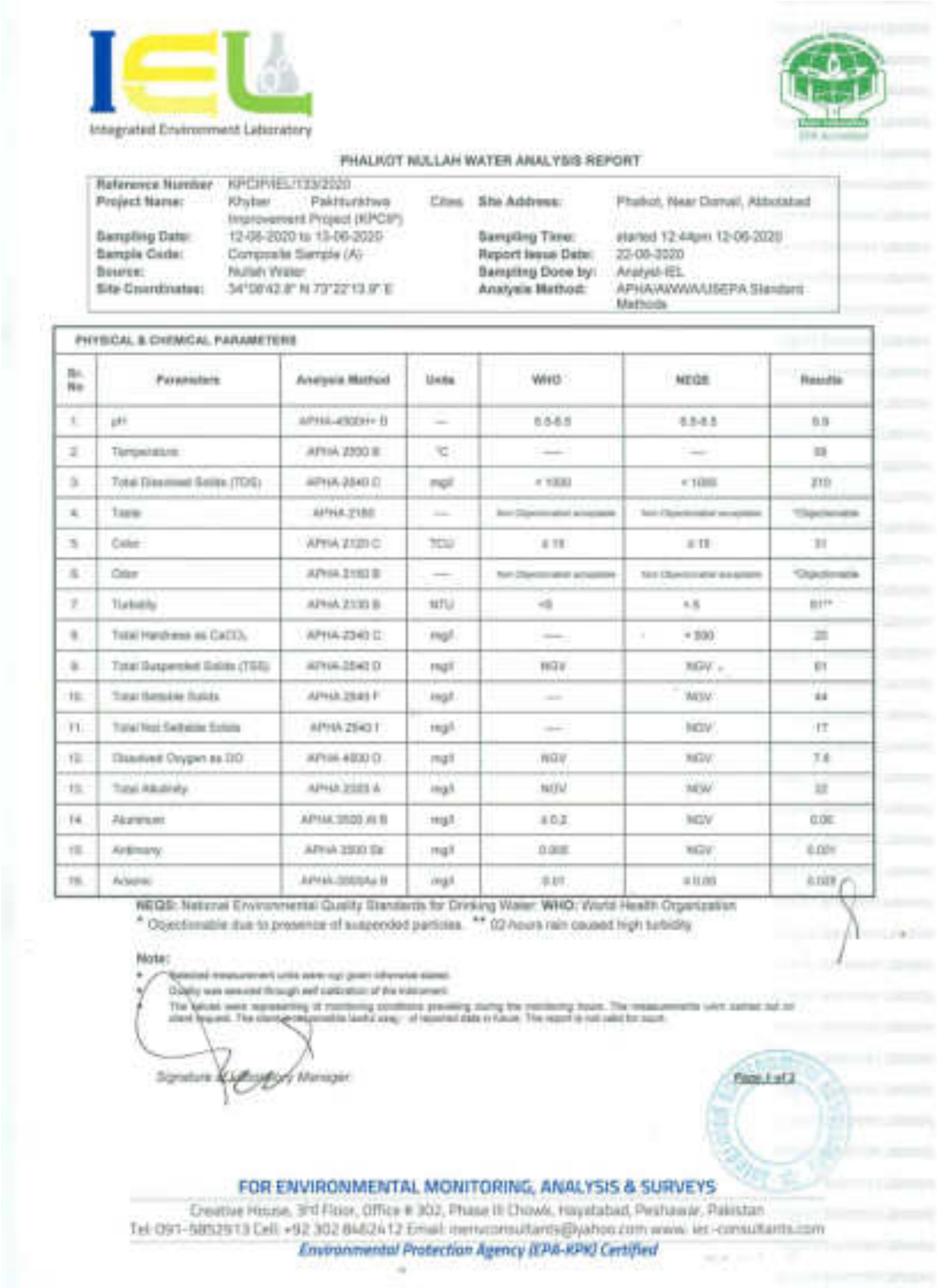
- Selected measurement units were mg/l given otherwise stated.
- Quality was assured through self calibration of the instrument.
- The values were representing of monitoring conditions prevailing during the monitoring hours. The measurements were carried out on client request. The client is responsible lawful usage of reported data in future. The report is not valid for court.

Signature of Laboratory Manager

Page 2 of 2

**FOR ENVIRONMENTAL MONITORING, ANALYSIS & SURVEYS**

Creative House, 3rd Floor, Office # 302, Phase III Chowk, Hayatabad, Peshawar, Pakistan
Tel: 091-5852913 Cell: +92 302 8462412 Email: ienvconsultants@yahoo.com www. iec-consultants.com
*Environmental Protection Agency (EPA-KPK) Certified*



Integrated Environment Laboratory

EPA Accredited

**PHALKOT NULLAH WATER ANALYSIS REPORT**

| | | | |
|---|---|---|---|
| **Reference Number** | KPCIP/IEL/133/2020 | | |
| **Project Name:** | Khyber Pakhtunkhwa Cities Improvement Project (KPCIP) | **Site Address:** | Phalkot, Near Domail, Abbottabad |
| **Sampling Date:** | 12-06-2020 to 13-06-2020 | **Sampling Time:** | started 12:44pm 12-06-2020 |
| **Sample Code:** | Composite Sample (A) | **Report Issue Date:** | 22-06-2020 |
| **Source:** | Nullah Water | **Sampling Done by:** | Analyst-IEL |
| **Site Coordinates:** | 34°08'42.8" N 73°22'13.9" E | **Analysis Method:** | APHA/AWWA/USEPA Standard Methods |

**PHYSICAL & CHEMICAL PARAMETERS**

| Sr. No | Parameters | Analysis Method | Units | WHO | NEQS | Results |
|---|---|---|---|---|---|---|
| 1. | pH | APHA-4500H+ B | — | 6.5-8.5 | 6.5-8.5 | 6.9 |
| 2. | Temperature | APHA 2550 B | °C | — | — | 33 |
| 3. | Total Dissolved Solids (TDS) | APHA-2540 C | mg/l | < 1000 | < 1000 | 210 |
| 4. | Taste | APHA-2160 | — | Non Objectionable/ acceptable | Non Objectionable/ acceptable | *Objectionable |
| 5. | Color | APHA 2120 C | TCU | ≤ 15 | ≤ 15 | 31 |
| 6. | Odor | APHA 2150 B | — | Non Objectionable/ acceptable | Non Objectionable/ acceptable | *Objectionable |
| 7. | Turbidity | APHA 2130 B | NTU | <5 | < 5 | 61** |
| 8. | Total Hardness as $CaCO_3$ | APHA-2340 C | mg/l | — | < 500 | 20 |
| 9. | Total Suspended Solids (TSS) | APHA-2540 D | mg/l | NGV | NGV | 61 |
| 10. | Total Settable Solids | APHA 2540 F | mg/l | — | NGV | 44 |
| 11. | Total Not Settable Solids | APHA 2540 I | mg/l | — | NGV | 17 |
| 12. | Dissolved Oxygen as DO | APHA 4500 O | mg/l | NGV | NGV | 7.6 |
| 13. | Total Alkalinity | APHA 2320 A | mg/l | NGV | NGV | 32 |
| 14. | Aluminum | APHA 3500 Al B | mg/l | ≤ 0.2 | NGV | 0.06 |
| 15. | Antimony | APHA 3500 Sb | mg/l | 0.005 | NGV | 0.001 |
| 16. | Arsenic | APHA-3500As B | mg/l | 0.01 | ≤ 0.05 | 0.028 |

**NEQS:** National Environmental Quality Standards for Drinking Water. **WHO:** World Health Organization

* Objectionable due to presence of suspended particles. ** 02-hours rain caused high turbidity

**Note:**

- Selected measurement units were mg/l given 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 responsible lawful usage of reported data in future. The report is not valid for court.

Signature of Laboratory Manager

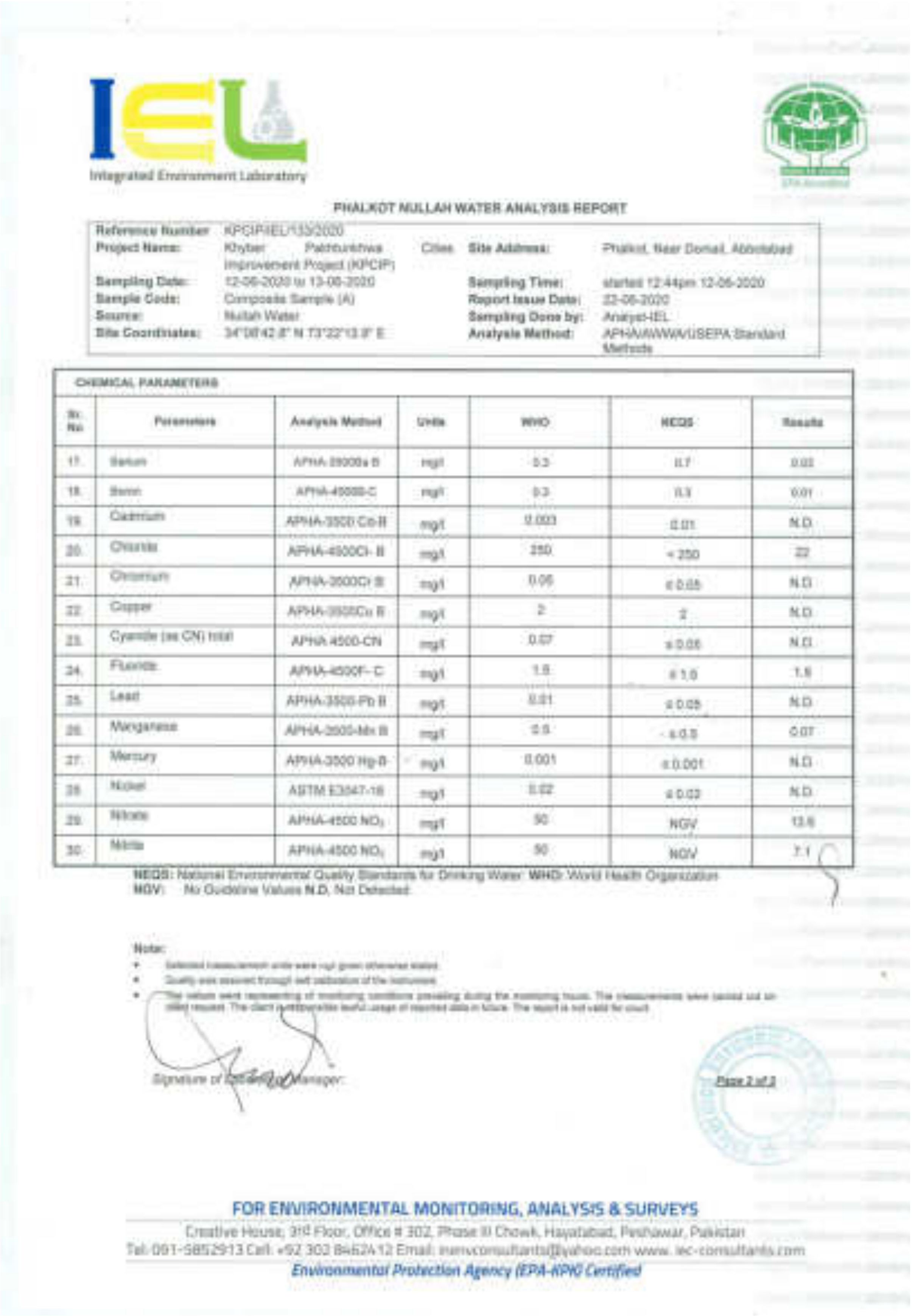
Page 1 of 3

FOR ENVIRONMENTAL MONITORING, ANALYSIS & SURVEYS

Creative House, 3rd Floor, Office # 302, Phase III Chowk, Hayatabad, Peshawar, Pakistan

Tel: 091-5852913 Cell: +92 302 8462412 Email: iemconsultants@yahoo.com www. iel-consultants.com

*Environmental Protection Agency (EPA-KPK) Certified*



Integrated Environment Laboratory

## PHALKOT NULLAH WATER ANALYSIS REPORT

| | | | |
|---|---|---|---|
| **Reference Number** | KPCIP/IEL/133/2020 | | |
| **Project Name:** | Khyber Pakhtunkhwa Cities Improvement Project (KPCIP) | **Site Address:** | Phalkot, Near Domail, Abbottabad |
| **Sampling Date:** | 12-06-2020 to 13-06-2020 | **Sampling Time:** | started 12:44pm 12-06-2020 |
| **Sample Code:** | Composite Sample (A) | **Report Issue Date:** | 22-06-2020 |
| **Source:** | Nullah Water | **Sampling Done by:** | Analyst-IEL |
| **Site Coordinates:** | 34°08'42.8" N 73°22'13.9" E | **Analysis Method:** | APHA/AWWA/USEPA Standard Methods |

**CHEMICAL PARAMETERS**

| Sr. No | Parameters | Analysis Method | Units | WHO | NEQS | Results |
|---|---|---|---|---|---|---|
| 17. | Barium | APHA-3500Ba B | mg/l | 0.3 | 0.7 | 0.02 |
| 18. | Boron | APHA-4500B-C | mg/l | 0.3 | 0.3 | 0.01 |
| 19. | Cadmium | APHA-3500 Cd-B | mg/l | 0.003 | 0.01 | N.D |
| 20. | Chloride | APHA-4500Cl- B | mg/l | 250 | < 250 | 22 |
| 21. | Chromium | APHA-3500Cr B | mg/l | 0.05 | ≤ 0.05 | N.D |
| 22. | Copper | APHA-3500Cu B | mg/l | 2 | 2 | N.D |
| 23. | Cyanide (as CN) total | APHA 4500-CN | mg/l | 0.07 | ≤ 0.05 | N.D |
| 24. | Fluoride | APHA-4500F- C | mg/l | 1.5 | ≤ 1.5 | 1.5 |
| 25. | Lead | APHA-3500-Pb B | mg/l | 0.01 | ≤ 0.05 | N.D |
| 26. | Manganese | APHA-3500-Mn B | mg/l | 0.5 | ≤ 0.5 | 0.07 |
| 27. | Mercury | APHA-3500 Hg-B | mg/l | 0.001 | ≤ 0.001 | N.D |
| 28. | Nickel | ASTM E3047-16 | mg/l | 0.02 | ≤ 0.02 | N.D |
| 29. | Nitrate | APHA-4500 $NO_3$ | mg/l | 50 | NGV | 13.6 |
| 30. | Nitrite | APHA-4500 $NO_2$ | mg/l | 50 | NGV | 7.1 |

**NEQS:** National Environmental Quality Standards for Drinking Water **WHO:** World Health Organization
**NGV:** No Guideline Values **N.D.** Not Detected

**Note:**

- Selected measurement units were mg/l given 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 for lawful usage of reported data in future. The report is not valid for court.

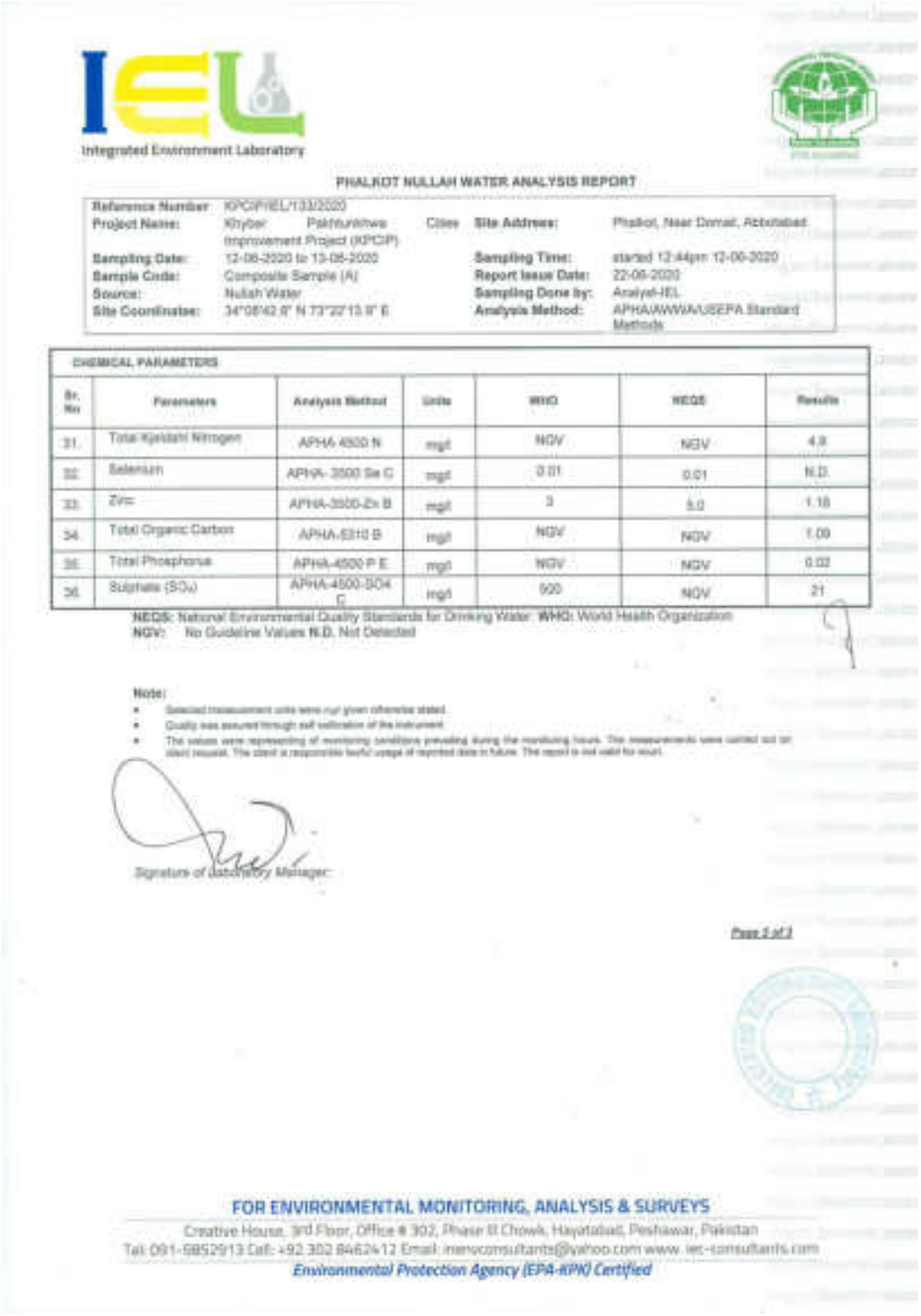
Signature of Lab Manager:

Page 2 of 2

FOR ENVIRONMENTAL MONITORING, ANALYSIS & SURVEYS

Creative House, 3rd Floor, Office # 302, Phase III Chowk, Hayatabad, Peshawar, Pakistan
Tel: 091-5852913 Cell: +92 302 8462412 Email: ienvconsultants@yahoo.com www.iec-consultants.com

*Environmental Protection Agency (EPA-KPK) Certified*



Integrated Environment Laboratory

## PHALKOT NULLAH WATER ANALYSIS REPORT

**Reference Number** KPCIP/IEL/133/2020
**Project Name:** Khyber Pakhtunkhwa Cities Improvement Project (KPCIP)
**Site Address:** Phalkot, Near Domail, Abbottabad
**Sampling Date:** 12-06-2020 to 13-06-2020
**Sampling Time:** started 12:44pm 12-06-2020
**Sample Code:** Composite Sample (A)
**Report Issue Date:** 22-06-2020
**Source:** Nullah Water
**Sampling Done by:** Analyst-IEL
**Site Coordinates:** 34°08'42.6" N 73°22'13.9" E
**Analysis Method:** APHA/AWWA/USEPA Standard Methods

CHEMICAL PARAMETERS

| Sr. No | Parameters | Analysis Method | Units | WHO | NEQS | Results |
|---|---|---|---|---|---|---|
| 31. | Total Kjeldahl Nitrogen | APHA 4500 N | mg/l | NGV | NGV | 4.8 |
| 32. | Selenium | APHA- 3500 Se C | mg/l | 0.01 | 0.01 | N.D. |
| 33. | Zinc | APHA-3500-Zn B | mg/l | 3 | 5.0 | 1.18 |
| 34. | Total Organic Carbon | APHA-5310 B | mg/l | NGV | NGV | 1.00 |
| 35. | Total Phosphorus | APHA-4500 P E | mg/l | NGV | NGV | 0.02 |
| 36. | Sulphate ($SO_4$) | APHA-4500-SO4 C | mg/l | 500 | NGV | 21 |

**NEQS:** National Environmental Quality Standards for Drinking Water. **WHO:** World Health Organization
**NGV:** No Guideline Values **N.D.** Not Detected

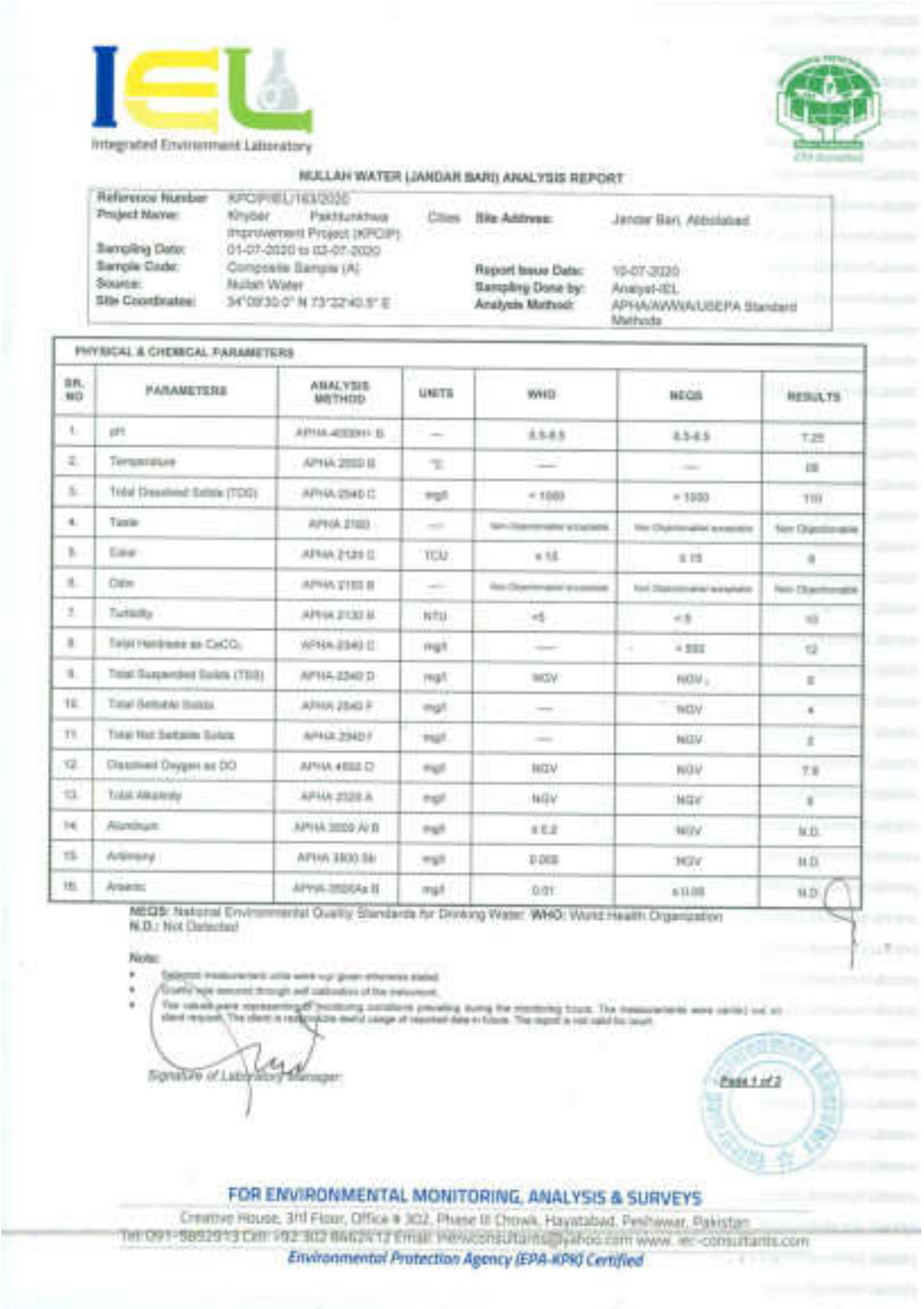
**Note:**

- Selected measurement units were mg/l given 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.

Signature of Laboratory Manager

Page 3 of 3

FOR ENVIRONMENTAL MONITORING, ANALYSIS & SURVEYS
Creative House, 3rd Floor, Office # 302, Phase III Chowk, Hayatabad, Peshawar, Pakistan
Tel: 091-5852913 Cell: +92 302 8462412 Email: ienvconsultants@yahoo.com www. iec-consultants.com
*Environmental Protection Agency (EPA-KPK) Certified*



Integrated Environment Laboratory

EPA Accredited

**NULLAH WATER (JANDAR BARI) ANALYSIS REPORT**

|  |  |  |  |
|---|---|---|---|
| **Reference Number** | KPCIP/IEL/163/2020 |  |  |
| **Project Name:** | Khyber Pakhtunkhwa Cities Improvement Project (KPCIP) | **Site Address:** | Jandar Bari, Abbottabad |
| **Sampling Date:** | 01-07-2020 to 02-07-2020 |  |  |
| **Sample Code:** | Composite Sample (A) | **Report Issue Date:** | 10-07-2020 |
| **Source:** | Nullah Water | **Sampling Done by:** | Analyst-IEL |
| **Site Coordinates:** | 34°09'30.0" N 73°22'40.5" E | **Analysis Method:** | APHA/AWWA/USEPA Standard Methods |

**PHYSICAL & CHEMICAL PARAMETERS**

| SR. NO | PARAMETERS | ANALYSIS METHOD | UNITS | WHO | NEQS | RESULTS |
|---|---|---|---|---|---|---|
| 1. | pH | APHA-4500H+ B | — | 6.5-8.5 | 6.5-8.5 | 7.25 |
| 2. | Temperature | APHA 2550 B | °C | — | — | 19 |
| 3. | Total Dissolved Solids (TDS) | APHA 2540 C | mg/l | < 1000 | < 1000 | 110 |
| 4. | Taste | APHA 2160 | — | Non Objectionable/ acceptable | Non Objectionable/ acceptable | Non Objectionable |
| 5. | Color | APHA 2120 C | TCU | ≤ 15 | ≤ 15 | 8 |
| 6. | Odor | APHA 2150 B | — | Non Objectionable/ acceptable | Non Objectionable/ acceptable | Non Objectionable |
| 7. | Turbidity | APHA 2130 B | NTU | <5 | < 5 | 10 |
| 8. | Total Hardness as $CaCO_3$ | APHA-2340 C | mg/l | — | < 500 | 12 |
| 9. | Total Suspended Solids (TSS) | APHA-2540 D | mg/l | NGV | NGV | 5 |
| 10. | Total Settable Solids | APHA 2540 F | mg/l | — | NGV | 4 |
| 11. | Total Not Settable Solids | APHA 2540 F | mg/l | — | NGV | 2 |
| 12. | Dissolved Oxygen as DO | APHA 4500 O | mg/l | NGV | NGV | 7.9 |
| 13. | Total Alkalinity | APHA 2320 A | mg/l | NGV | NGV | 8 |
| 14. | Aluminum | APHA 3500 Al B | mg/l | ≤ 0.2 | NGV | N.D. |
| 15. | Antimony | APHA 3500 Sb | mg/l | 0.005 | NGV | N.D. |
| 16. | Arsenic | APHA-3500As B | mg/l | 0.01 | ≤ 0.05 | N.D. |

**NEQS**: National Environmental Quality Standards for Drinking Water; **WHO**: World Health Organization
**N.D.**: Not Detected

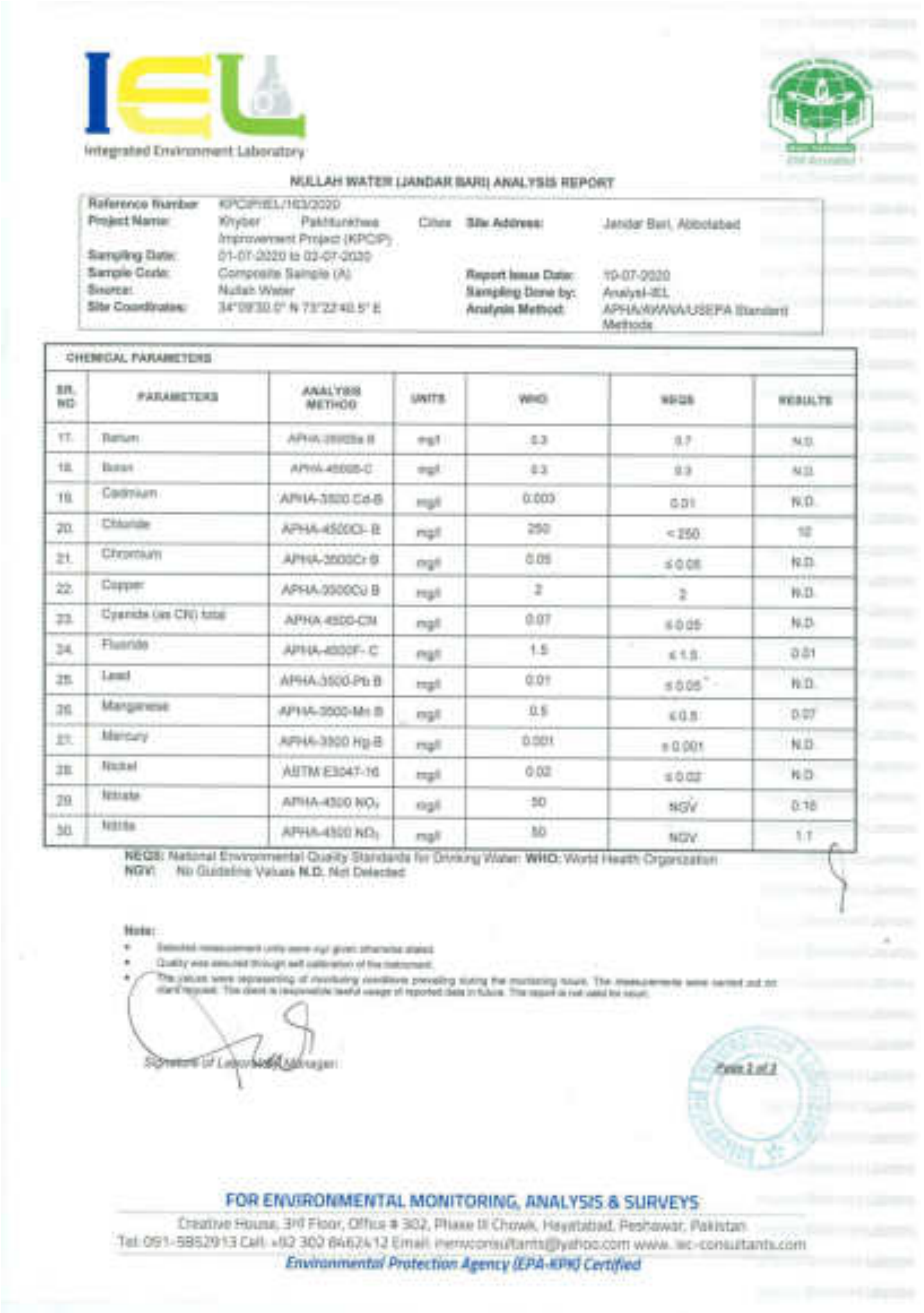
**Note:**

- [illegible]
- [illegible]
- The values were representing of monitoring conditions prevailing during the monitoring hours. The measurements were carried out on client request. The client is responsible for lawful usage of reported data in future. The report is not valid for court.

Signature of Laboratory Manager:

Page 1 of 2

FOR ENVIRONMENTAL MONITORING, ANALYSIS & SURVEYS
Creative House, 3rd Floor, Office # 302, Phase III Chowk, Hayatabad, Peshawar, Pakistan
Tel: 091-5852913 Cell: +92 302 8462412 Email: ievconsultants@yahoo.com www.iec-consultants.com
*Environmental Protection Agency (EPA-KPK) Certified*



Integrated Environment Laboratory

## NULLAH WATER (JANDAR BARI) ANALYSIS REPORT

| | | | |
|---|---|---|---|
| **Reference Number** | KPCIP/IEL/163/2020 | | |
| **Project Name:** | Khyber Pakhtunkhwa Cities Improvement Project (KPCIP) | **Site Address:** | Jandar Bari, Abbotabad |
| **Sampling Date:** | 01-07-2020 to 03-07-2020 | | |
| **Sample Code:** | Composite Sample (A) | **Report Issue Date:** | 10-07-2020 |
| **Source:** | Nullah Water | **Sampling Done by:** | Analyst-IEL |
| **Site Coordinates:** | 34°09'30.0" N 73°22'40.5" E | **Analysis Method:** | APHA/AWWA/USEPA Standard Methods |

**CHEMICAL PARAMETERS**

| SR. NO | PARAMETERS | ANALYSIS METHOD | UNITS | WHO | NEQS | RESULTS |
|---|---|---|---|---|---|---|
| 17. | Barium | APHA-3500Ba B | mg/l | 0.3 | 0.7 | N.D |
| 18. | Boron | APHA-4500B-C | mg/l | 0.3 | 0.3 | N.D |
| 19. | Cadmium | APHA-3500 Cd-B | mg/l | 0.003 | 0.01 | N.D |
| 20. | Chloride | APHA-4500Cl- B | mg/l | 250 | < 250 | 12 |
| 21. | Chromium | APHA-3500Cr B | mg/l | 0.05 | ≤ 0.05 | N.D |
| 22. | Copper | APHA-3500Cu B | mg/l | 2 | 2 | N.D |
| 23. | Cyanide (as CN) total | APHA 4500-CN | mg/l | 0.07 | ≤ 0.05 | N.D |
| 24. | Fluoride | APHA-4500F- C | mg/l | 1.5 | ≤ 1.5 | 0.01 |
| 25. | Lead | APHA-3500-Pb B | mg/l | 0.01 | ≤ 0.05 | N.D |
| 26. | Manganese | APHA-3500-Mn B | mg/l | 0.5 | ≤ 0.5 | 0.07 |
| 27. | Mercury | APHA-3500 Hg-B | mg/l | 0.001 | ≤ 0.001 | N.D |
| 28. | Nickel | ASTM E3047-16 | mg/l | 0.02 | ≤ 0.02 | N.D |
| 29. | Nitrate | APHA-4500 $NO_3$ | mg/l | 50 | NGV | 0.18 |
| 30. | Nitrite | APHA-4500 $NO_2$ | mg/l | 50 | NGV | 1.1 |

**NEQS:** National Environmental Quality Standards for Drinking Water **WHO:** World Health Organization
**NGV:** No Guideline Values **N.D:** Not Detected

**Note:**

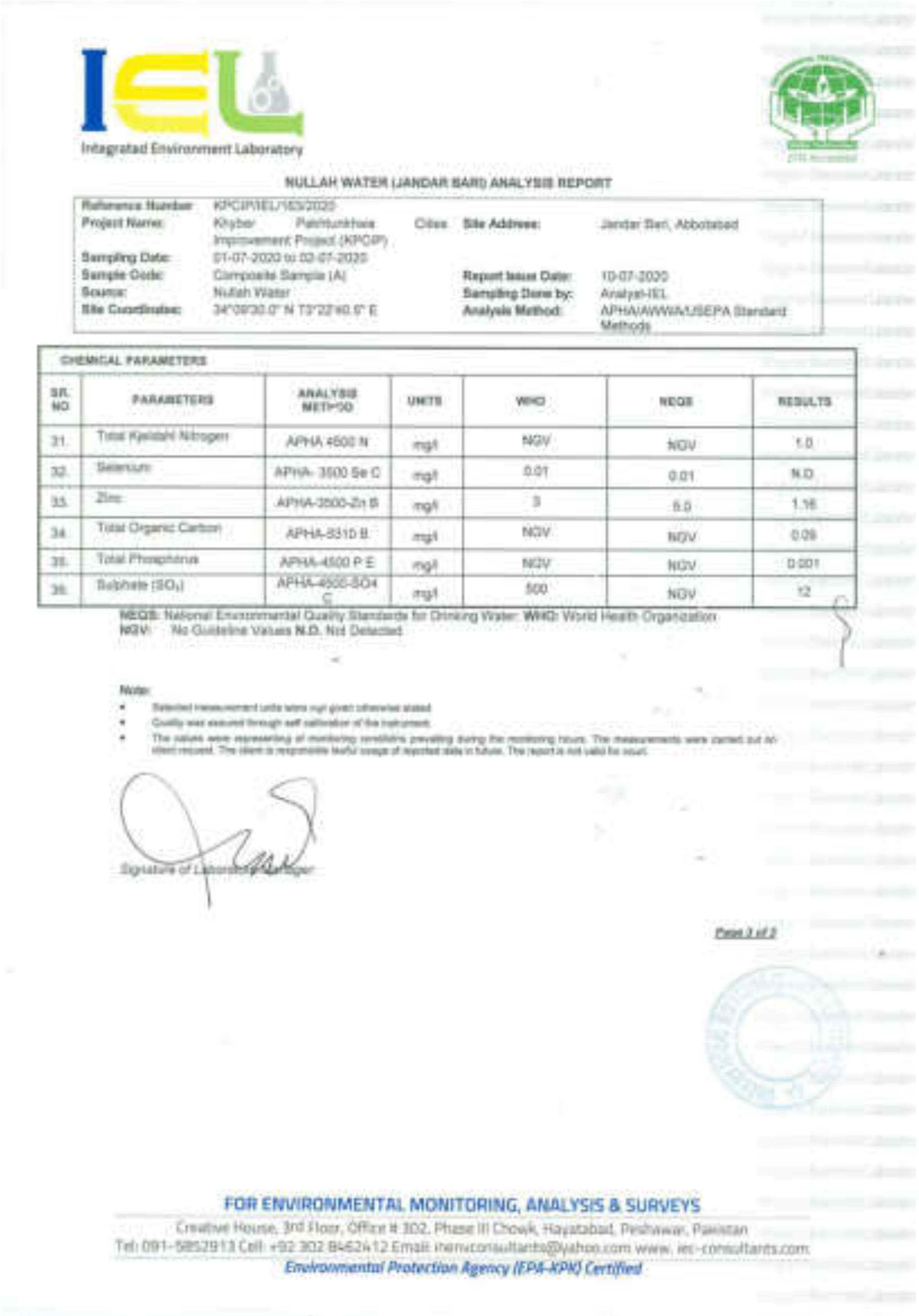
- Selected measurement units were mg/l given otherwise stated.
- Quality was assured through self calibration of the instrument.
- The values were representing of monitoring conditions prevailing during the monitoring hours. The measurements were carried out on client request. The client is responsible lawful usage of reported data in future. The report is not valid for court.

Signature of Laboratory Manager:

Page 2 of 2

FOR ENVIRONMENTAL MONITORING, ANALYSIS & SURVEYS

Creative House, 3rd Floor, Office # 302, Phase III Chowk, Hayatabad, Peshawar, Pakistan
Tel: 091-5852913 Cell: +92 302 8462412 Email: iemconsultants@yahoo.com www.iec-consultants.com
*Environmental Protection Agency (EPA-KPK) Certified*



Integrated Environment Laboratory

## NULLAH WATER (JANDAR BARI) ANALYSIS REPORT

| | | | | |
|---|---|---|---|---|
| **Reference Number** | KPCIP/IEL/163/2020 | | | |
| **Project Name:** | Khyber Pakhtunkhwa Cities Improvement Project (KPCIP) | | **Site Address:** | Jandar Bari, Abbottabad |
| **Sampling Date:** | 01-07-2020 to 02-07-2020 | | | |
| **Sample Code:** | Composite Sample (A) | | **Report Issue Date:** | 10-07-2020 |
| **Source:** | Nullah Water | | **Sampling Done by:** | Analyst-IEL |
| **Site Coordinates:** | 34°09'30.0" N 73°22'40.6" E | | **Analysis Method:** | APHA/AWWA/USEPA Standard Methods |

CHEMICAL PARAMETERS

| SR. NO | PARAMETERS | ANALYSIS METHOD | UNITS | WHO | NEQS | RESULTS |
|---|---|---|---|---|---|---|
| 31. | Total Kjeldahl Nitrogen | APHA 4500 N | mg/l | NGV | NGV | 1.0 |
| 32. | Selenium | APHA- 3500 Se C | mg/l | 0.01 | 0.01 | N.D |
| 33. | Zinc | APHA-3500-Zn B | mg/l | 3 | 5.0 | 1.16 |
| 34. | Total Organic Carbon | APHA-5310 B | mg/l | NGV | NGV | 0.09 |
| 35. | Total Phosphorus | APHA-4500 P E | mg/l | NGV | NGV | 0.001 |
| 36. | Sulphate ($SO_4$) | APHA-4500-SO4 C | mg/l | 500 | NGV | 12 |

**NEQS:** National Environmental Quality Standards for Drinking Water; **WHO:** World Health Organization
**NGV:** No Guideline Values **N.D.** Not Detected

**Note:**

- Selected measurement units were mg/l given 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.

Signature of Laboratory Manager

Page 3 of 3

FOR ENVIRONMENTAL MONITORING, ANALYSIS & SURVEYS

Creative House, 3rd Floor, Office # 302, Phase III Chowk, Hayatabad, Peshawar, Pakistan
Tel: 091-5852913 Cell: +92 302 8462412 Email: ienviconsultants@yahoo.com www. iec-consultants.com
*Environmental Protection Agency (EPA-KPK) Certified*

# Annexure E

# 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 horizontals.

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, 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 F

# 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 G.1** below.

**Table F.1 Emergency Response Team**

| Action Group | Responsibility |
|---|---|
| Emergency Coordinator | Overall control of personnel and resources.<br>The Emergency Coordinator will support and advise the Site Safety Supervision as necessary.<br>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<br>(Emergency Commander) | Overall responsibility for activating emergency plan and for terminating emergency actions.<br>Be alternative of emergency response chairpersons.<br>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.<br>Supervise the actions of the Emergency Response Team to ensure all persons are safe from the danger.<br>Notify outside authorities if assistance is required.<br>Carries the responsibility for coordinating actions including other organizations in accordance with the needs of the situation.<br>Ensure maximum co-operation and assistance is provided to any outside groups called to respond to an emergency.<br>Establish and appoint all emergency organization structure and team.<br>Assures adequate delegation of responsibilities for all key positions of assistants on the Project to assist with any foreseeable emergency.<br>Ensure resources available to purchase needed emergency response equipment and supplies.<br>Assures that all persons on the Emergency Response Team aware and fully understand their individual responsibilities for implementing and supporting the emergency plan.<br>Establish the emergency drill schedule of all identified emergency scenarios, track the status and evaluate the emergency. |

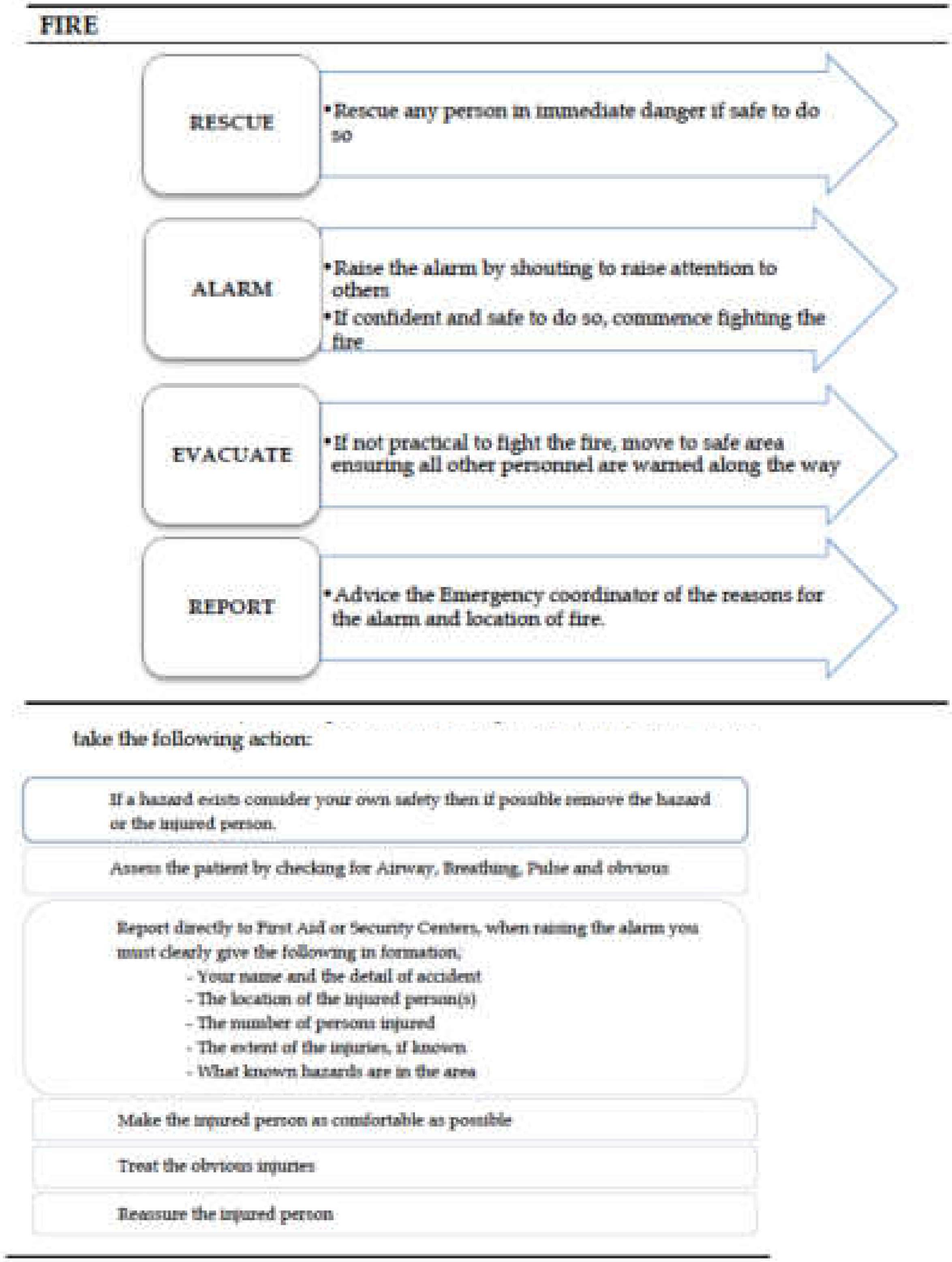
| | |
|---|---|
| | The Emergency Commander shall ensure that senior management personnel have been reported of the emergency as soon as practical after the event. |
| Security Team | Ensure that the exit route is regularly tested and maintained in good working order.<br>Maintain station at the security 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.<br>Assist with strong/activation of services during an emergency.<br>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.<br>Provide treatment to the victim(s) to the best of their ability by first aid and then transfer to hospital.<br>Remain familiar with the rescue activities and rescue apparatus.<br>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.<br>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.<br>Take immediate and appropriate action while Emergency Response Team is being mobilized.<br>Keep in touch with the Emergency Commander |

| | |
|---|---|
| | Control and supervise operators and contractors on the implementation of this procedure, with consultation with Safety Team as necessary.<br>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.<br>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.

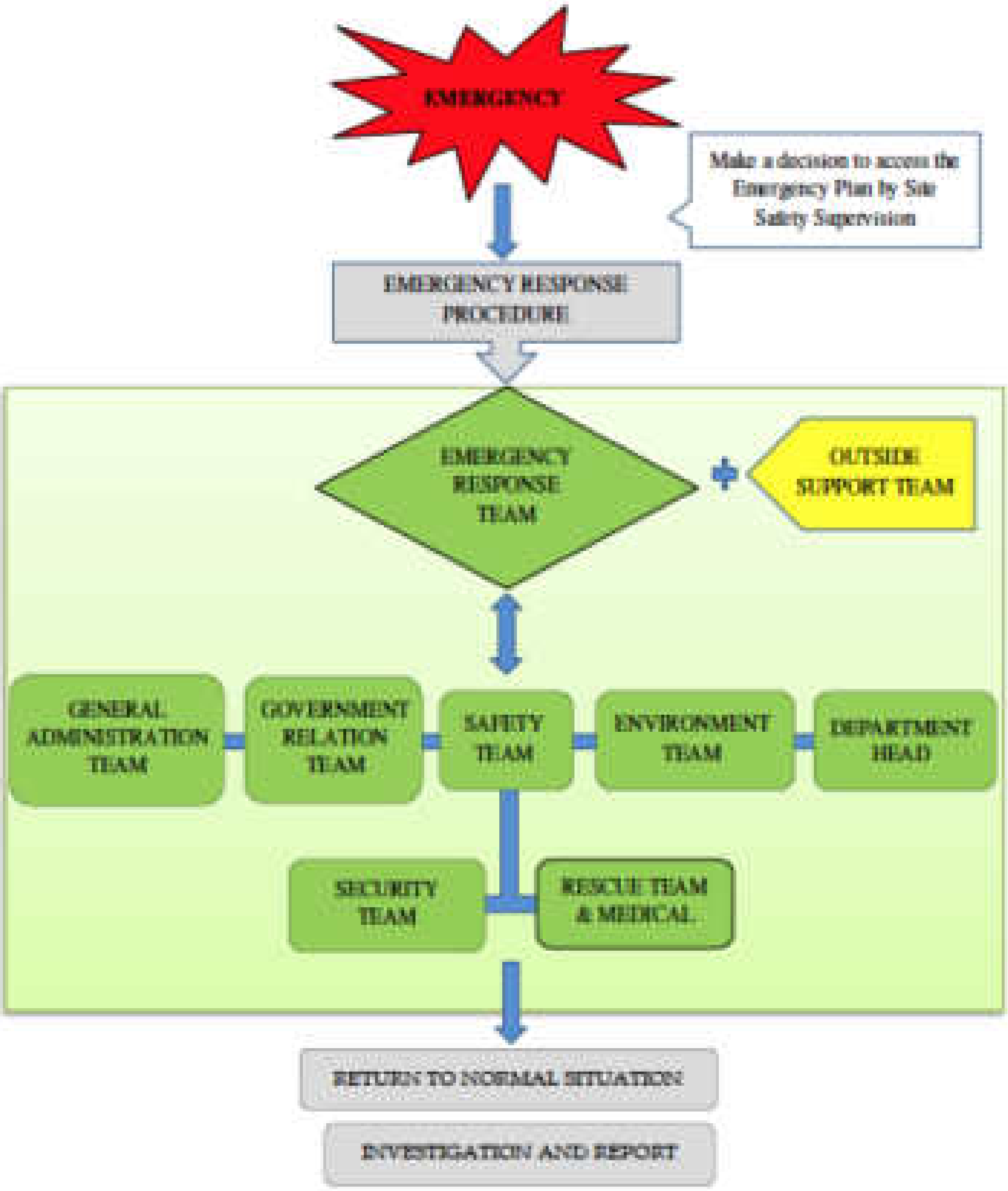
Prevent access to the site of unauthorized personnel (press, etc.).

Emergency Coordinator

The Emergency Coordinator shall assist emergency personnel at the scene as required through allocation of company resources.

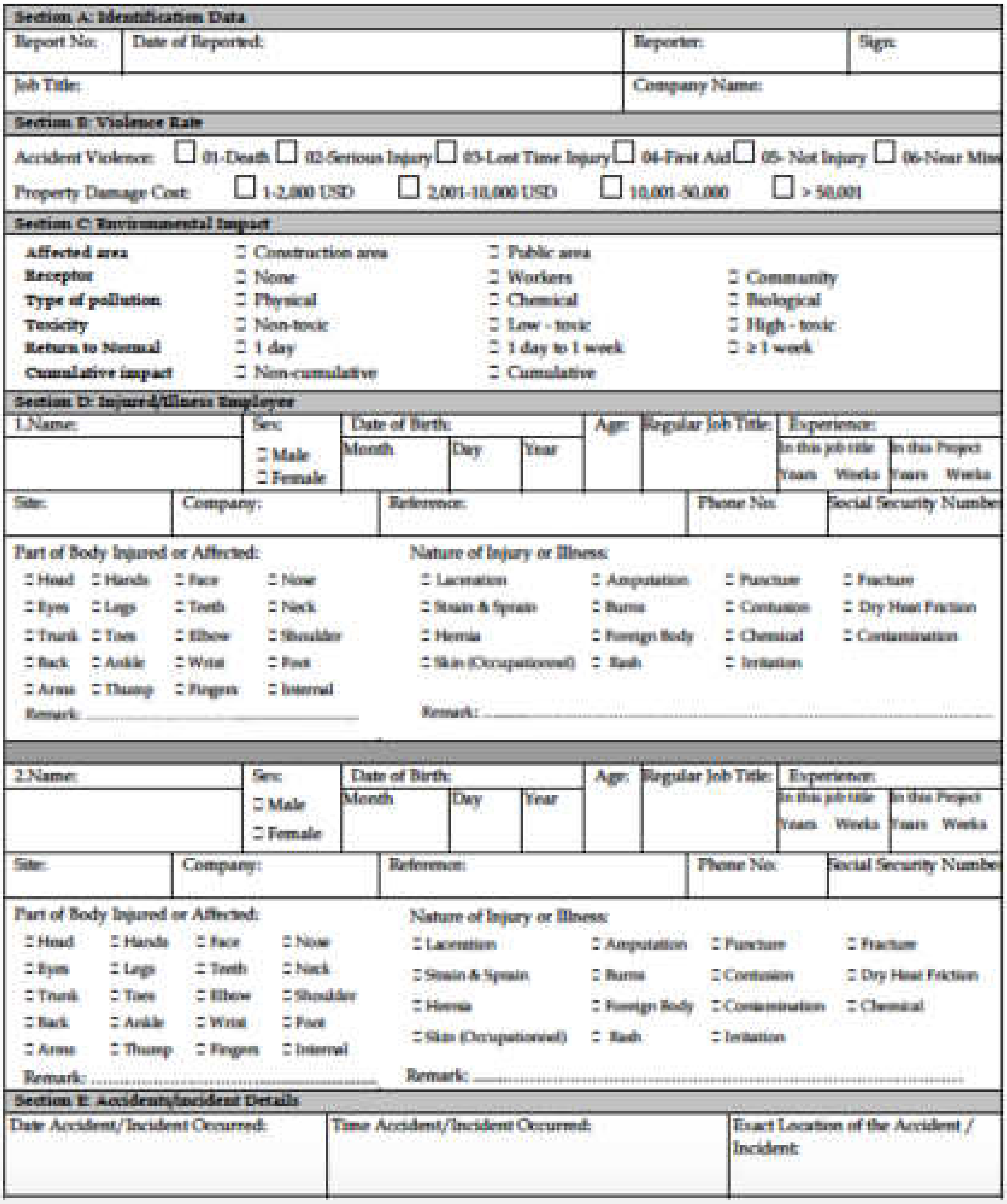
The Emergency Coordinator shall ensure next-of-kin are properly notified as soon as possible and give whatever company support and assistance is necessary to assist them bundle the situation

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<br>☐ Female | Month | Day | Year | | | In this job title | | In this Project | |
| | | | | | | | Years | Weeks | 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 (Occupational) | ☐ Rash | ☐ Irritation | |

Remark: ……………………………………

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 2.Name: | Sex: | Date of Birth: | | | Age: | Regular Job Title: | Experience: | | | |
| | ☐ Male<br>☐ Female | Month | Day | Year | | | In this job title | | In this Project | |
| | | | | | | | Years | Weeks | 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: ……………………………………

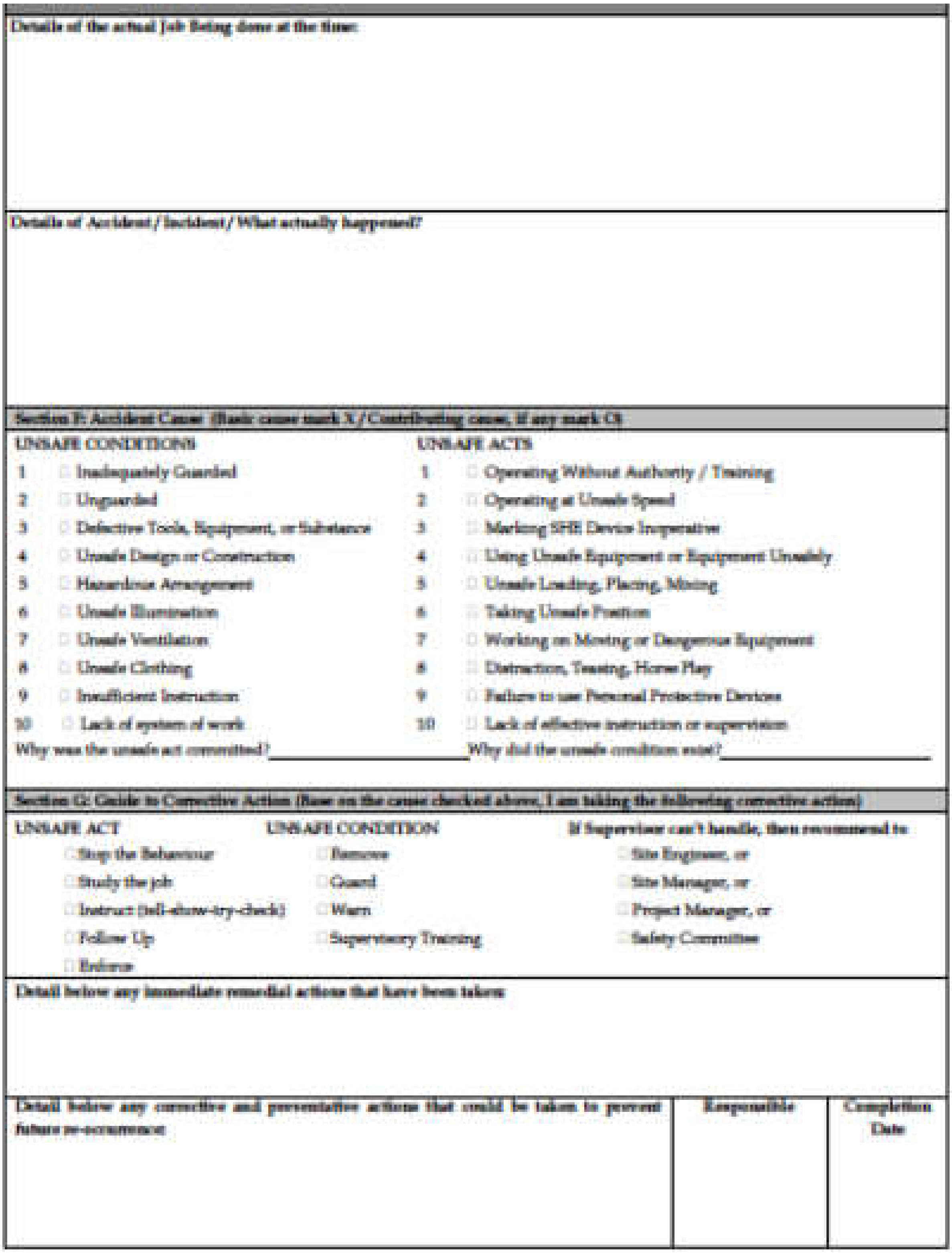
Nature of Injury or Illness:

| | | | |
|---|---|---|---|
| ☐ Laceration | ☐ Amputation | ☐ Puncture | ☐ Fracture |
| ☐ Strain & Sprain | ☐ Burns | ☐ Contusion | ☐ Dry Heat Friction |
| ☐ Hernia | ☐ Foreign Body | ☐ Contamination | ☐ Chemical |
| ☐ Skin (Occupational) | ☐ Rash | ☐ Irritation | |

Remark: ……………………………………

**Section E: Accident/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 |

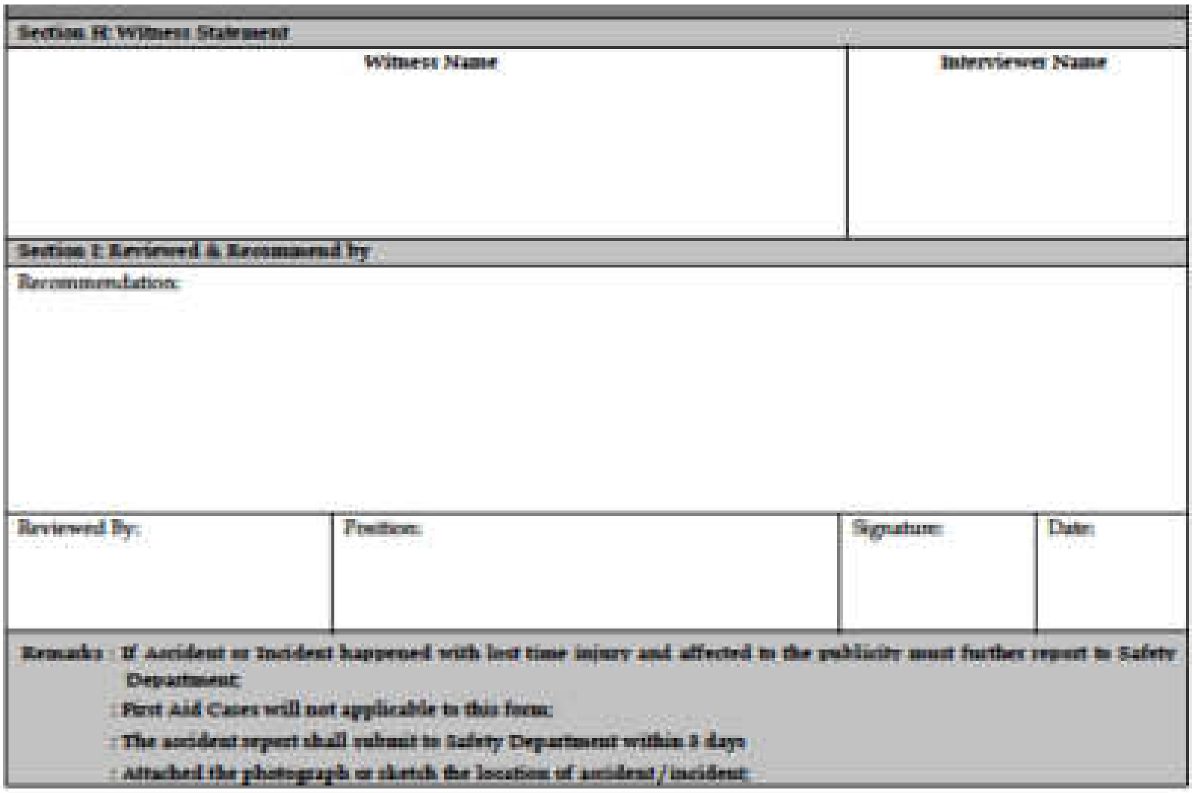
Why was the unsafe act committed?____________________ Why did the unsafe condition exist?____________________

**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 G

# 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 reachedbetween 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 H

# 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/Minimization
- 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.<br>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<br>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.<br>Dusty material will be damped down.<br>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.<br>Stock piles will be dampened down until stabilized, where necessary.<br>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.<br>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.<br>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.<br>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 I

# 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 storm water 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.<br>major loss of soil and water resources and quality from storm water runoff<br>major pollution of soil and water resources including contamination from hazardous materials<br>significant effects on ecosystems with isolated deaths of non-vulnerable flora and fauna<br>significant annoyance or nuisance to communities<br>major damage to or movement required to archaeological or historical sites | 3 |

| | | |
|---|---|---|
| | Occurrence may result in work being halted and a fine | |
| Moderate | No or minimal adverse environmental or social impacts e.g.<br>no measurable or noticeable changes in storm water quality. Water quality remains within tolerable limits<br>little noticeable effect on ecosystems<br>no or isolated community complaints<br>no or unlikely damage to archaeological or historical sites<br>no likelihood of being fined | 2 |
| Minor | No or minimal adverse environmental or social impacts e.g.<br>no measurable or noticeable changes in storm water quality. Water quality remains within tolerable limits<br>little noticeable effect on ecosystems<br>no or isolated community complaints<br>no or unlikely damage to archaeological or historical sites<br>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 measures are to be extracted from the EIA study for the project and should be added in the last column of the table below.

| No. | Construction Activity | Hazards to Consider | Likelihood<br>That the site or sensitive receptors will be affected? | Consequence<br>of the site or sensitive receptors being affected? | Risk Score<br>(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<br>(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 | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| 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 | | | | |
| | | 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)[25]:** 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 provided along 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

---

[25] ADB, Safeguards Unit for Central & West Asia Department, *Environmental Management for Construction Handbook.*

Risk Assessment

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 J

# Traffic Management Plan

## K.1 Need for Plan

The construction of the WTP and laying/replacement of distribution networks 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 minimize 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 Management 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 programmer

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 Extension of JICA WTP and GWSS 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 programmer in local newspapers.

# ANNEXURE K

# NEQS Guidelines

| **Parameter** | **Unit** | **Standards (maximum allowable limit)** |
|---|---|---|
| Temperature increase | °C | <3 |
| pH value (acidity / basicity) | pH | 6-9 |
| 5-day biochemical oxygen demand (BOD) AT 20 °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) Lea | |
|---|---|---|---|
| | | 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.

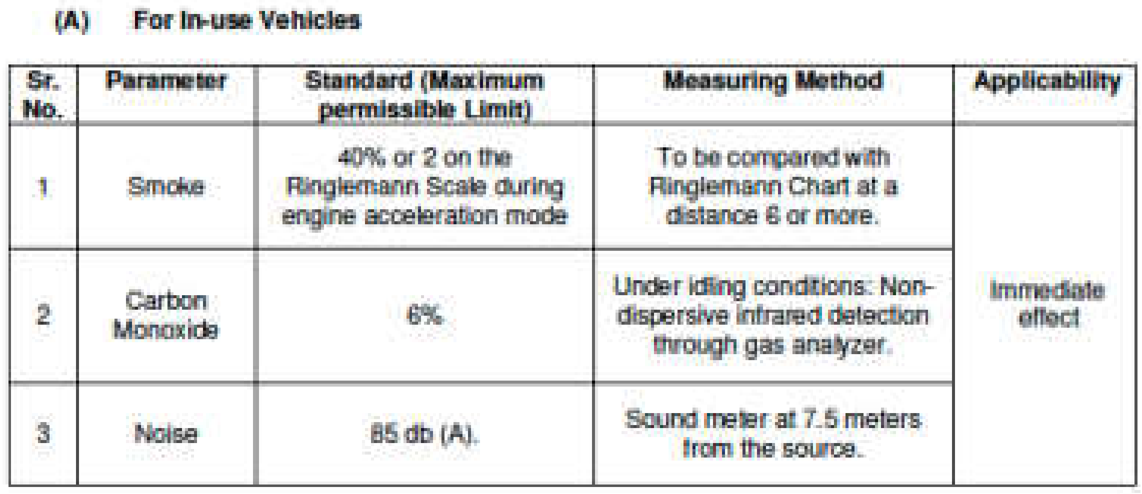
Note: 1. Day time hours: 6 am to 10 pm

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. | |

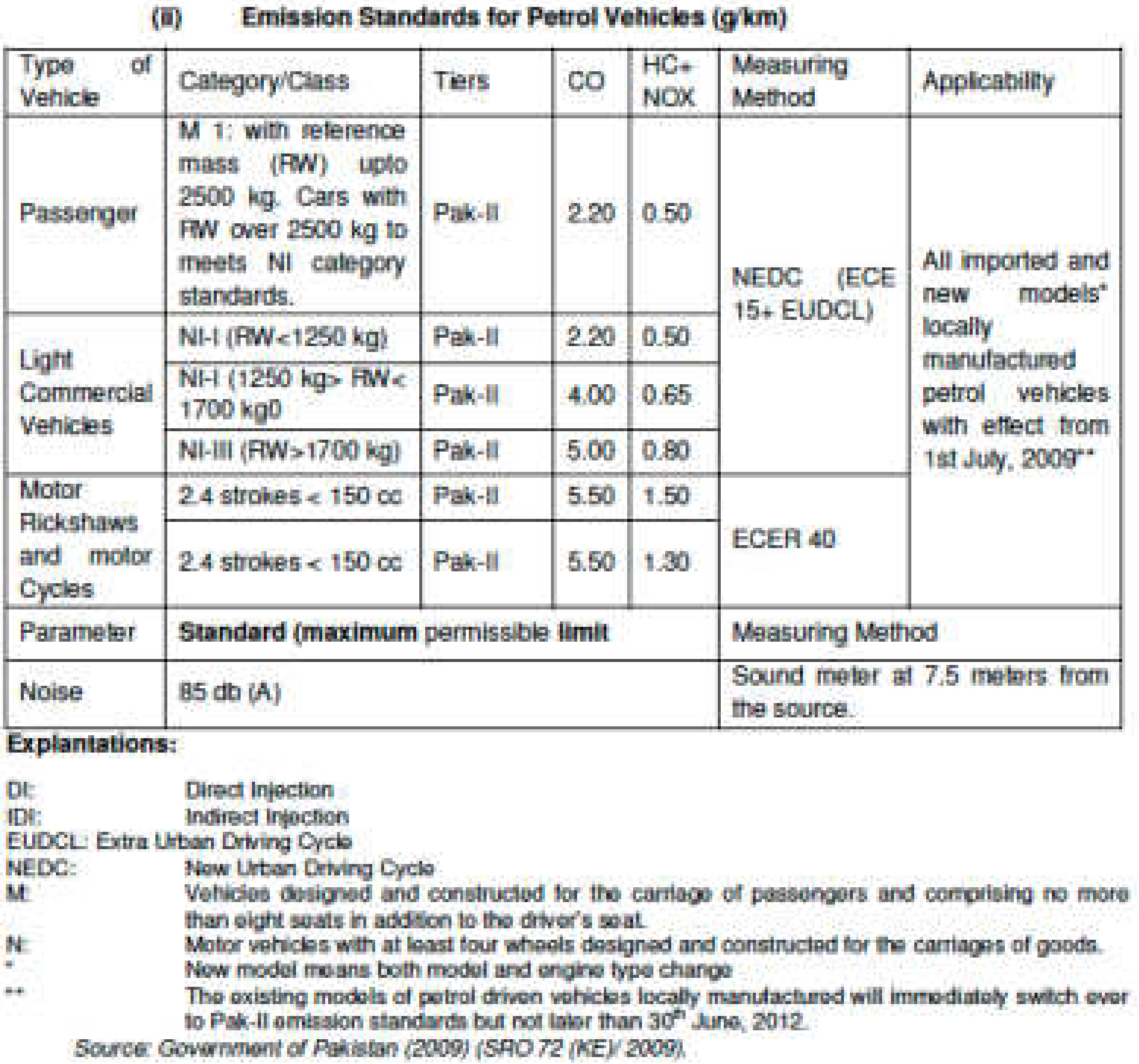
**(B) For New Vehicles**

(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 | | |

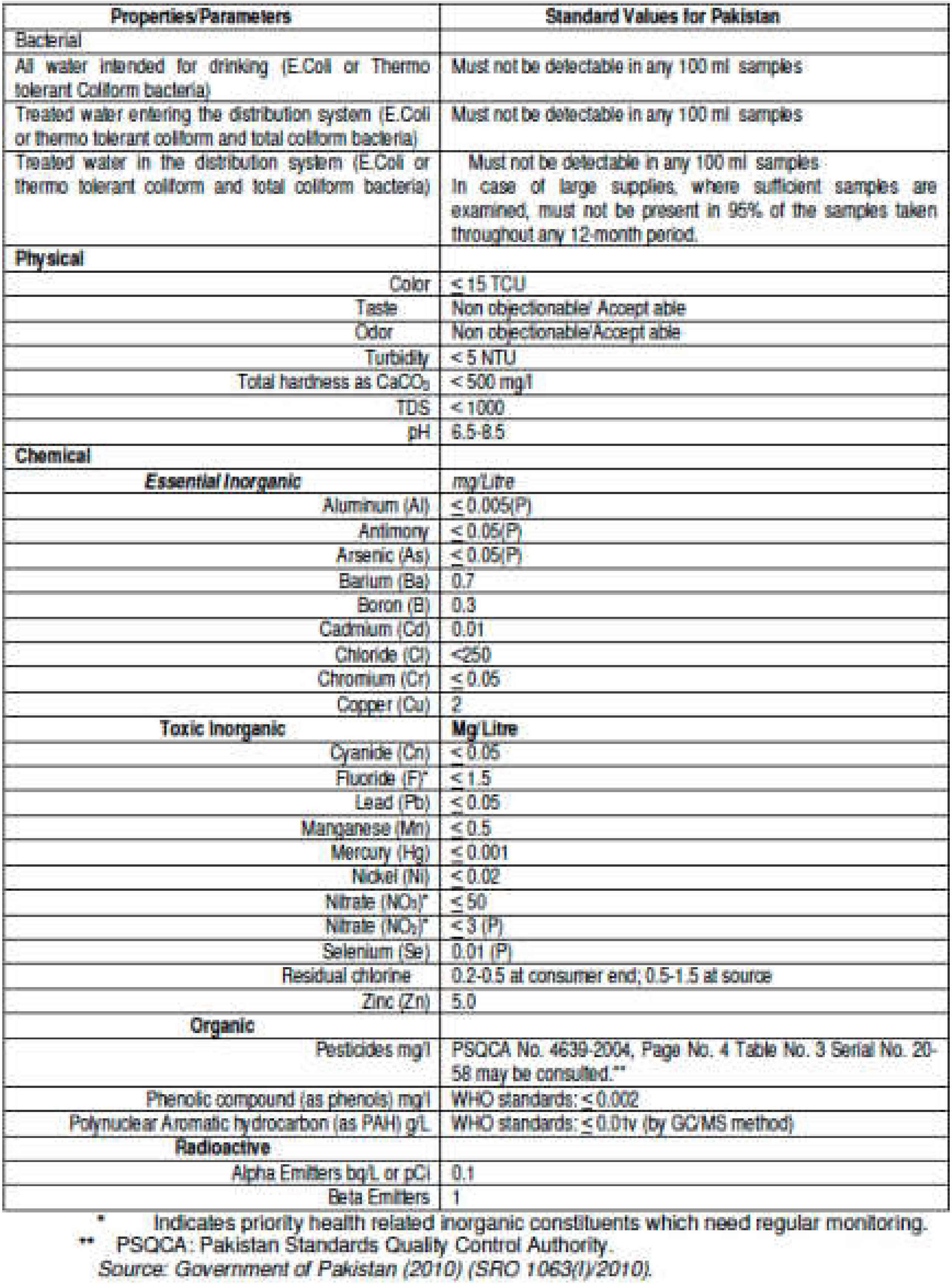
| Parameter | **Standard (maximum** permissible **limit** | Measuring Method |
|---|---|---|
| Noise | 85 db (A) | Sound meter at 7.5 meters from the source. |

**Explanations:**

| | |
|---|---|
| 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 over 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<br>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 | ≤ 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) | ≤ 0.005(P) |
| Antimony | ≤ 0.05(P) |
| Arsenic (As) | ≤ 0.05(P) |
| Barium (Ba) | 0.7 |
| Boron (B) | 0.3 |
| Cadmium (Cd) | 0.01 |
| Chloride (Cl) | <250 |
| Chromium (Cr) | ≤ 0.05 |
| Copper (Cu) | 2 |
| **Toxic Inorganic** | **Mg/Litre** |
| Cyanide (Cn) | ≤ 0.05 |
| Fluoride (F)* | ≤ 1.5 |
| Lead (Pb) | ≤ 0.05 |
| Manganese (Mn) | ≤ 0.5 |
| Mercury (Hg) | ≤ 0.001 |
| Nickel (Ni) | ≤ 0.02 |
| Nitrate ($NO_3$)* | ≤ 50 |
| Nitrate ($NO_2$)* | ≤ 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: ≤ 0.002 |
| Polynuclear Aromatic hydrocarbon (as PAH) g/L | WHO standards: ≤ 0.01v (by GC/MS method) |
| **Radioactive** | |
| Alpha Emitters bq/L or pCi | 0.1 |
| Beta Emitters | 1 |

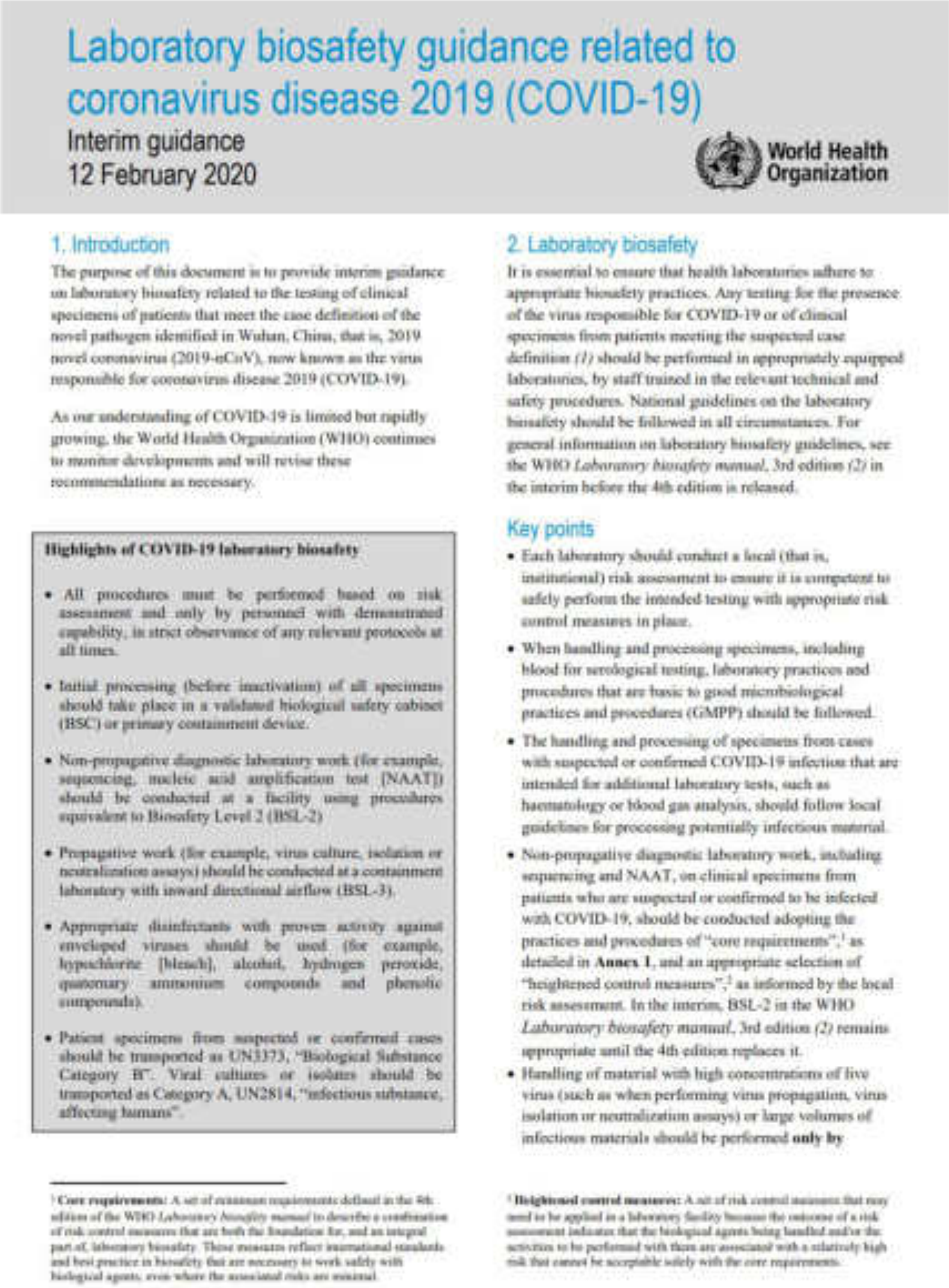
* Indicates priority health related inorganic constituents which need regular monitoring.

** PSQCA: Pakistan Standards Quality Control Authority.

*Source: Government of Pakistan (2010) (SRO 1063(I)/2010).*

# ANNEXURE L

# 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.

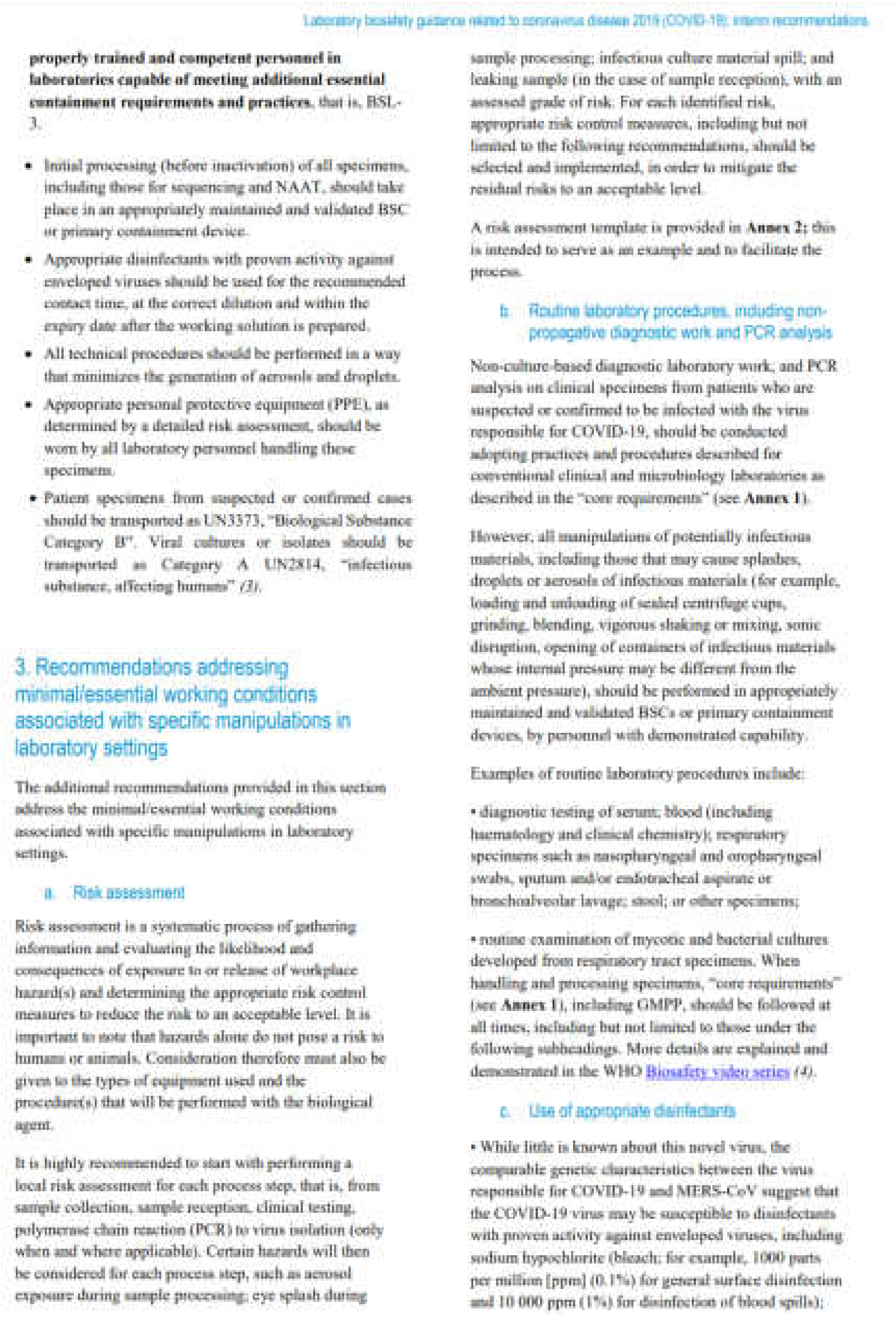
### Key points

- 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.

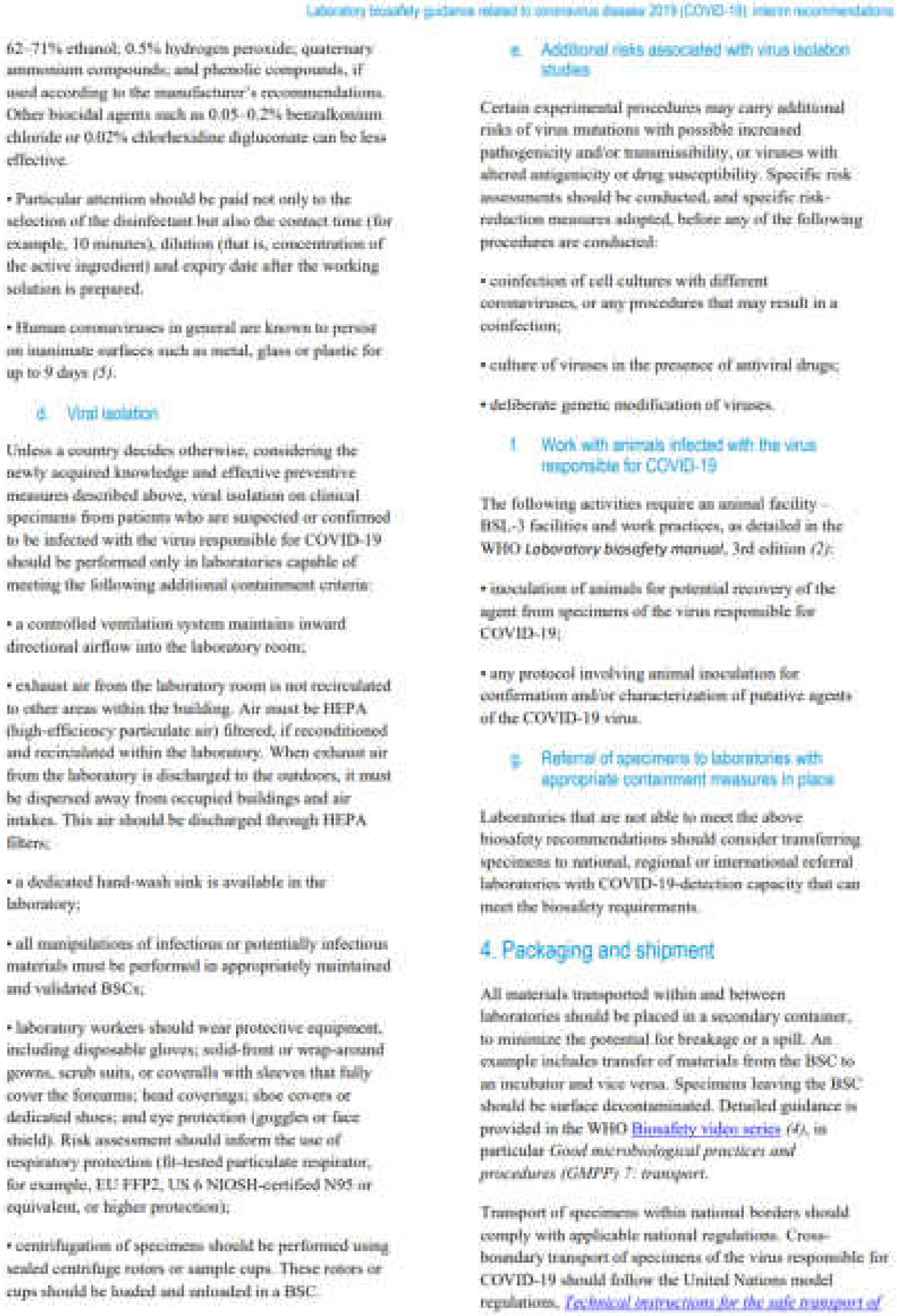
Examples of routine laboratory procedures include:

• 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.

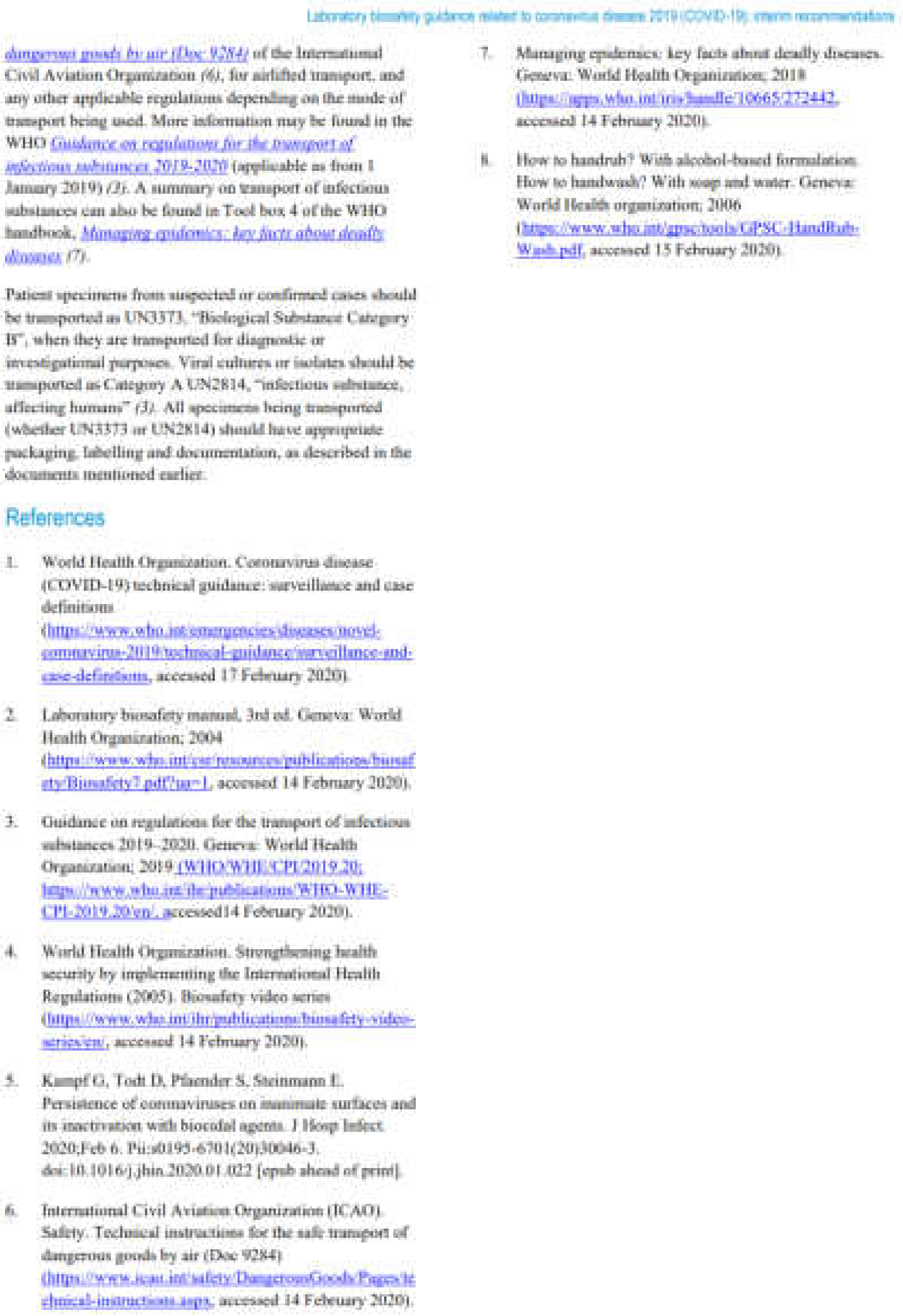
### g. Referral of specimens to laboratories with appropriate containment measures in place

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.

## References

1. World Health Organization. Coronavirus disease (COVID-19) technical guidance: surveillance and case definitions (https://www.who.int/emergencies/diseases/novel-coronavirus-2019/technical-guidance/surveillance-and-case-definitions, accessed 17 February 2020).

2. Laboratory biosafety manual, 3rd ed. Geneva: World Health Organization; 2004 (https://www.who.int/csr/resources/publications/biosafety/Biosafety7.pdf?ua=1, accessed 14 February 2020).

3. Guidance on regulations for the transport of infectious substances 2019–2020. Geneva: World Health Organization; 2019 (WHO/WHE/CPI/2019.20; https://www.who.int/ihr/publications/WHO-WHE-CPI-2019.20/en/, accessed14 February 2020).

4. World Health Organization. Strengthening health security by implementing the International Health Regulations (2005). Biosafety video series (https://www.who.int/ihr/publications/biosafety-video-series/en/, accessed 14 February 2020).

5. Kampf G, Todt D, Pfaender S, Steinmann E. Persistence of coronaviruses on inanimate surfaces and its inactivation with biocidal agents. J Hosp Infect. 2020;Feb 6. Pii:s0195-6701(20)30046-3. doi:10.1016/j.jhin.2020.01.022 [epub ahead of print].

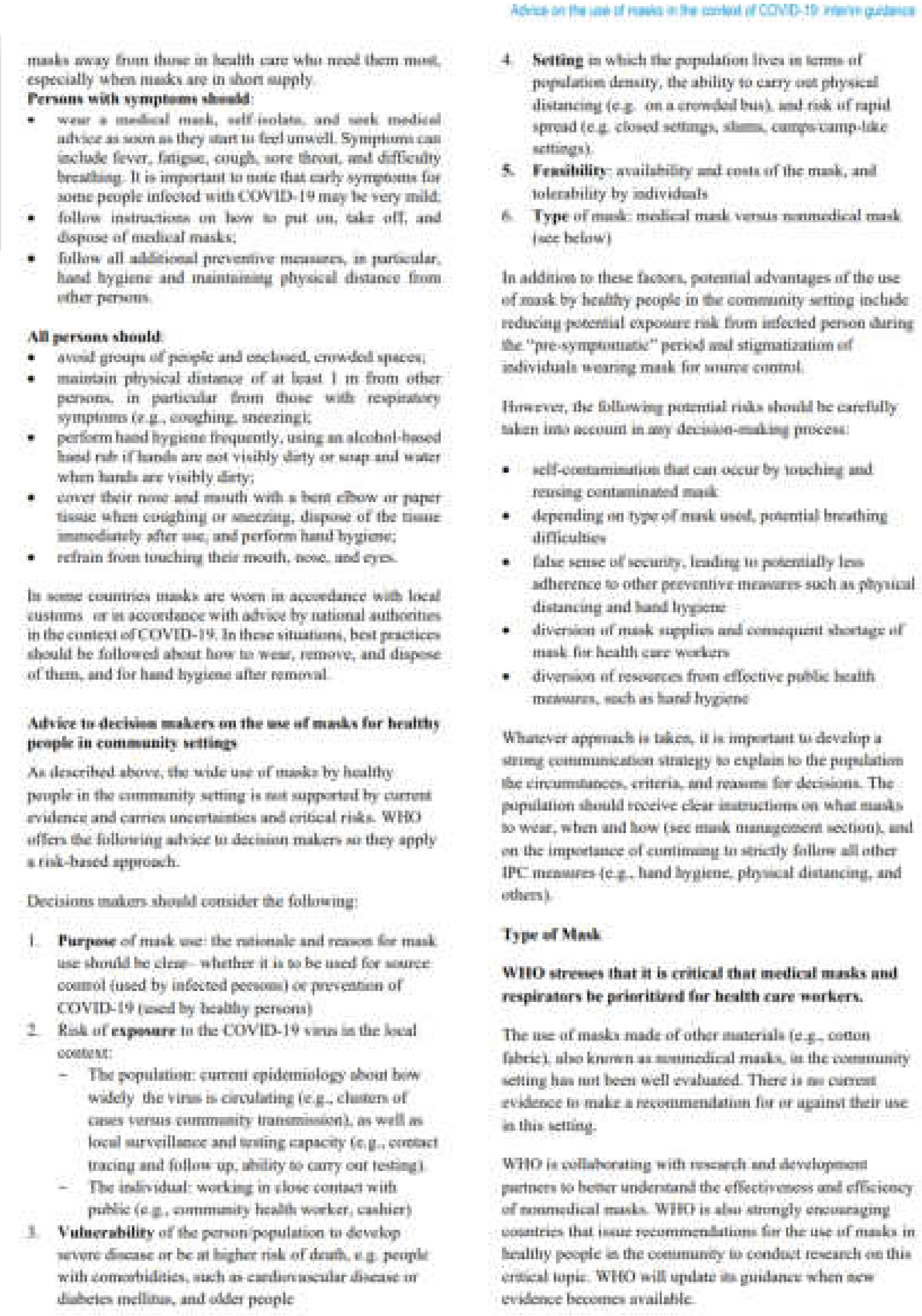
6. International Civil Aviation Organization (ICAO). Safety. Technical instructions for the safe transport of dangerous goods by air (Doc 9284) (https://www.icao.int/safety/DangerousGoods/Pages/technical-instructions.aspx, accessed 14 Febeuary 2020).

7. Managing epidemics: key facts about deadly diseases. Geneva: World Health Organization; 2018 (https://apps.who.int/iris/handle/10665/272442, accessed 14 February 2020).

8. How to handrub? With alcohol-based formulation. How to handwash? With soap and water. Geneva: World Health organization; 2006 (https://www.who.int/gpsc/tools/GPSC-HandRub-Wash.pdf, accessed 15 February 2020).

# ANNEXURE M

# 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

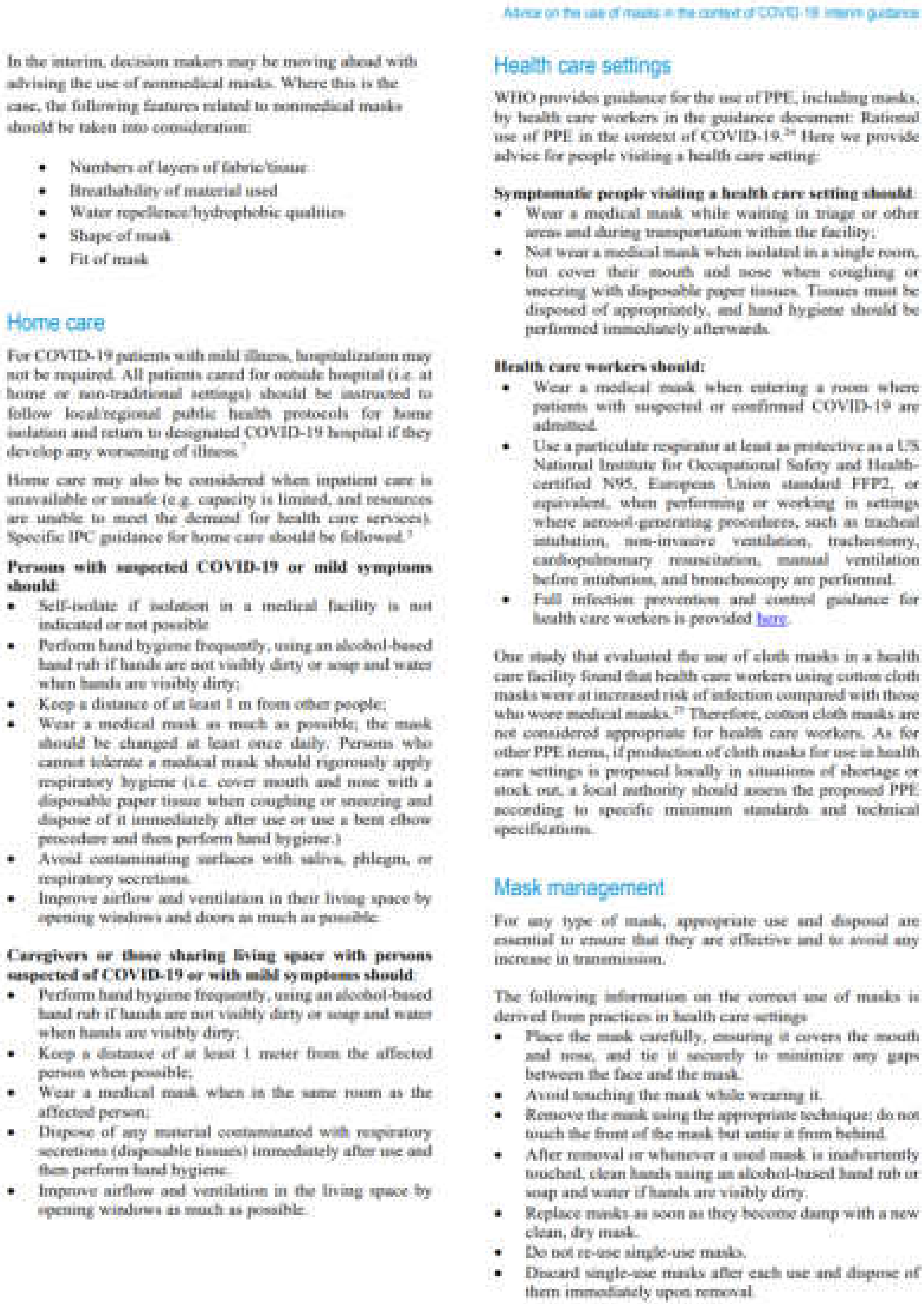
Whatever approach is taken, it is important to develop a strong communication strategy to explain to the population the circumstances, criteria, and reasons for decisions. The population should receive clear instructions on what masks to wear, when and how (see mask management section), and on the importance 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.[7]

**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, tracheostomy, 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.[77] 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.

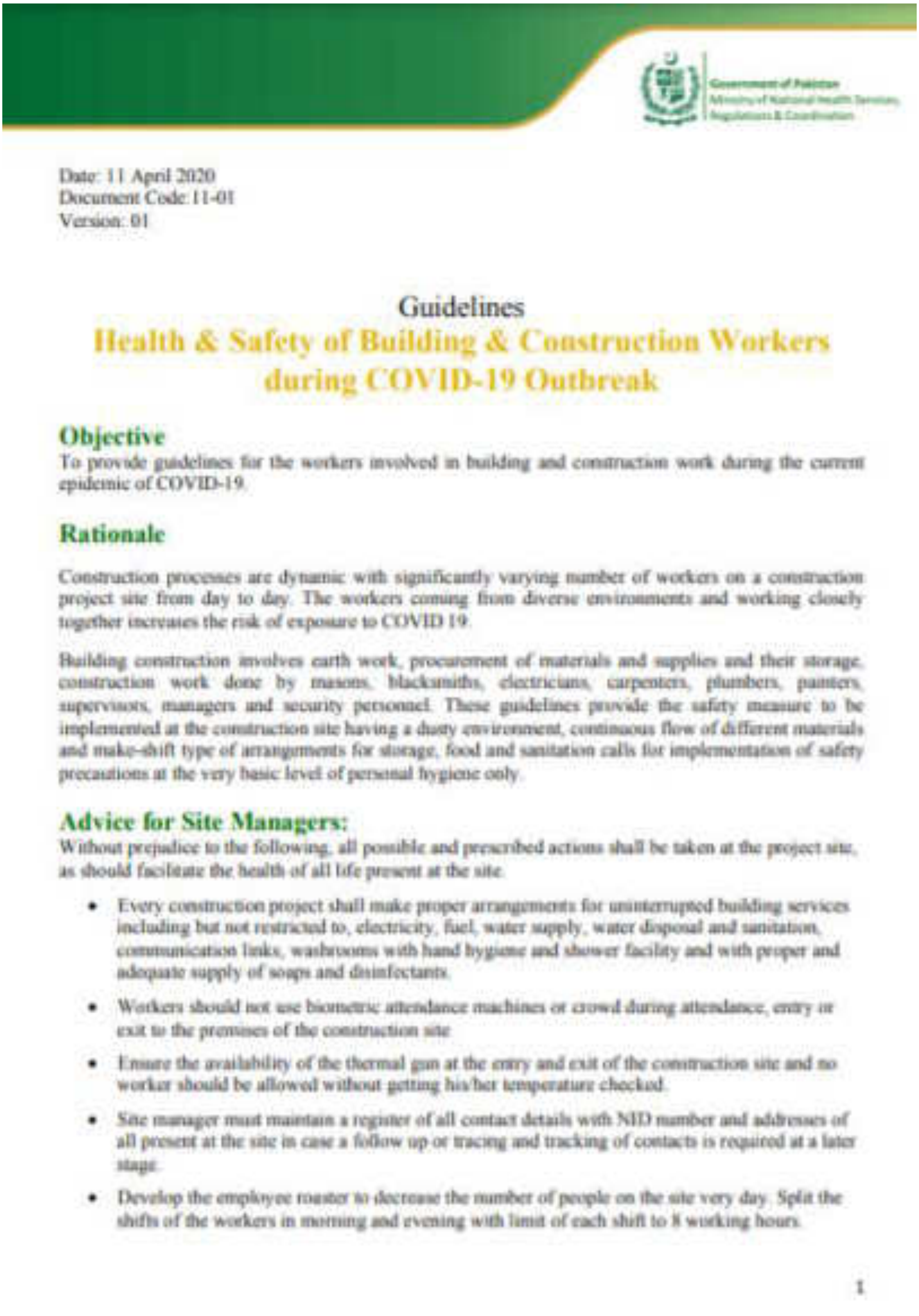
The following information on the correct use of masks is derived from practices in health care settings:

- 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.

## References

1. Water, sanitation, hygiene and waste management for COVID-19 https://www.who.int/publications-detail/water-sanitation-hygiene-and-waste-management-for-covid-19
2. Coronavirus disease 2019 (COVID-19) Situation Report – 73. https://www.who.int/docs/default-source/coronaviruse/situation-reports/20200402-sitrep-73-covid-19.pdf?sfvrsn=5ae25bc7_6
3. Yu P, Zhu J, Zhang Z, Han Y. A familial cluster of infection associated with the 2019 novel coronavirus indicating possible person-to-person transmission during the incubation period. J Infect 2020 doi:10.1093/jiaa077
4. Huang R, Xia J, Chen Y, Shan C, Wu C. A family cluster of SARS-CoV-2 infection involving 11 patients in Nanjing, China Lancet Infect Dis 2020 doi: 10.1016/ S1473-3099(20)30147-X
5. Pan X, Chen D, Xia Y et al. Asymptomatic cases in a family cluster with SARS-CoV-2 infection. Lancet Infect Dis 2020 doi: 10.1016/ S1473-3099(20)30114-6.
6. Tong Z-D, Tang A, Li K-F, Li P, Wang H-L, Yi J-P, et al. Potential presymptomatic transmission of SARS-CoV-2, Zhejiang Province, China, 2020. Emerg Infect Dis. 2020 doi: 10.3201/eid2605.200198
7. Wei WE, Li Z, Chiew CJ, Yong SE, et al. Presymptomatic Transmission of SARS-CoV-2 — Singapore, January 23–March 16, 2020. MMWR, 1 April 2020/69.
8. Kimball A, Hatfield KM, Arons M, James A, et al. Asymptomatic and Presymptomatic SARS-CoV-2 Infections in Residents of a Long-Term Care Skilled Nursing Facility — King County, Washington, March 2020. MMWR, 3 April 2020, 69(13);377–381.
9. WorldHealthOrganization.ReportoftheWHO-ChinaJointMissiononCoronavirusDisease2019(COVID-19) 16-24 February 2020 [Internet]. Geneva: World Health Organization; 2020 Available from: https://www.who.int/docs/default-source/coronaviruse/who-china-joint-mission-on-covid-19-final- report.pdf
10. Wei WE, Li Z, Chiew CJ, Yong SE, et al. Presymptomatic Transmission of SARS-CoV-2 — Singapore, January 23–March 16, 2020. MMWR, 1 April 2020/69.
11. World Health Organization. Infection prevention and control during health care when COVID-19 is suspected: interim guidance, (accessed 29 January 2020).
12. World Health Organization. Home care for patients with COVID-19 presenting with mild symptoms and management of contacts: interim guidance (accessed 29 January 2020)
13. Infection prevention and control of epidemic- and pandemic-prone acute respiratory diseases in health care. Geneva: World Health Organization, 2014 (https://apps.who.int/iris/bitstream/handle/10665/112656/9789241507134_eng.pdf, accessed 17 January 2020).
14. Aiello AE, Coulborn RM, Perez V, et al. A randomized intervention trial of mask use and hand hygiene to reduce seasonal influenza-like illness and influenza infections among young adults in a university setting. International Journal of Infectious Diseases 2010;14:E320-E20. doi: 10.1016/j.ijid.2010.02.2201
15. Cowling BJ, Fung ROP, Cheng CKY, et al. Preliminary Findings of a Randomized Trial of Non-Pharmaceutical Interventions to Prevent Influenza Transmission in Households. Plos One 2008;3(5) doi: 10.1371/journal.pone.0002101
16. Suess T, Remschmidt C, Schink SB, et al. The role of facemasks and hand hygiene in the prevention of influenza transmission in households: results from a cluster randomised trial; Berlin, Germany, 2009-2011. BMC Infect Dis 2012;12:26. doi: 10.1186/1471-2334-12-26 [published Online First: 2012/01/28]
17. Aiello AE, Perez V, Coulborn RM, et al. Facemasks, hand hygiene, and influenza among young adults: a randomized intervention trial. PLoS One 2012;7(1):e29744. doi:10.1371/journal.pone.0029744. Epub 2012 Jan 25. [published Online First: 2012/02/02]
18. Barasheed O, Almasri N, Badahdah AM, et al. Pilot Randomised Controlled Trial to Test Effectiveness of Facemasks in Preventing Influenza-like Illness Transmission among Australian Hajj Pilgrims in 2011. Infect Disord Drug Targets 2014;14(2):110-6. doi: 10.2174/1871526514666141021112855 [published Online First: 2014/10/23]
19. Canini L, Andreoletti L, Ferrari P, et al. Surgical mask to prevent influenza transmission in households: a cluster randomized trial. PLoS One 2010;5(11):e13998. doi:10.1371/journal.pone.0013998. [published Online First: 2010/11/26]
20. MacIntyre CR, Zhang Y, Chughtai AA, et al. Cluster randomised controlled trial to examine medical mask use as source control for people with respiratory illness. BMJ Open 2016;6(12):e012330. doi: 10.1136/bmjopen-2016-012330. [published Online First: 2017/01/01]
21. Lau JT, Tsui H, Lau M, Yang X. SARS transmission, risk factors, and prevention in Hong Kong. Emerg Infect Dis. 2004 Apr;10(4):587-92.
22. Wu J, Xu F, Zhou W et al. Risk factors for SARS among persons without known contact with SARS patients, Beijing, China. Emerg Infect Dis. 2004 Feb;10(2):210-6.



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.

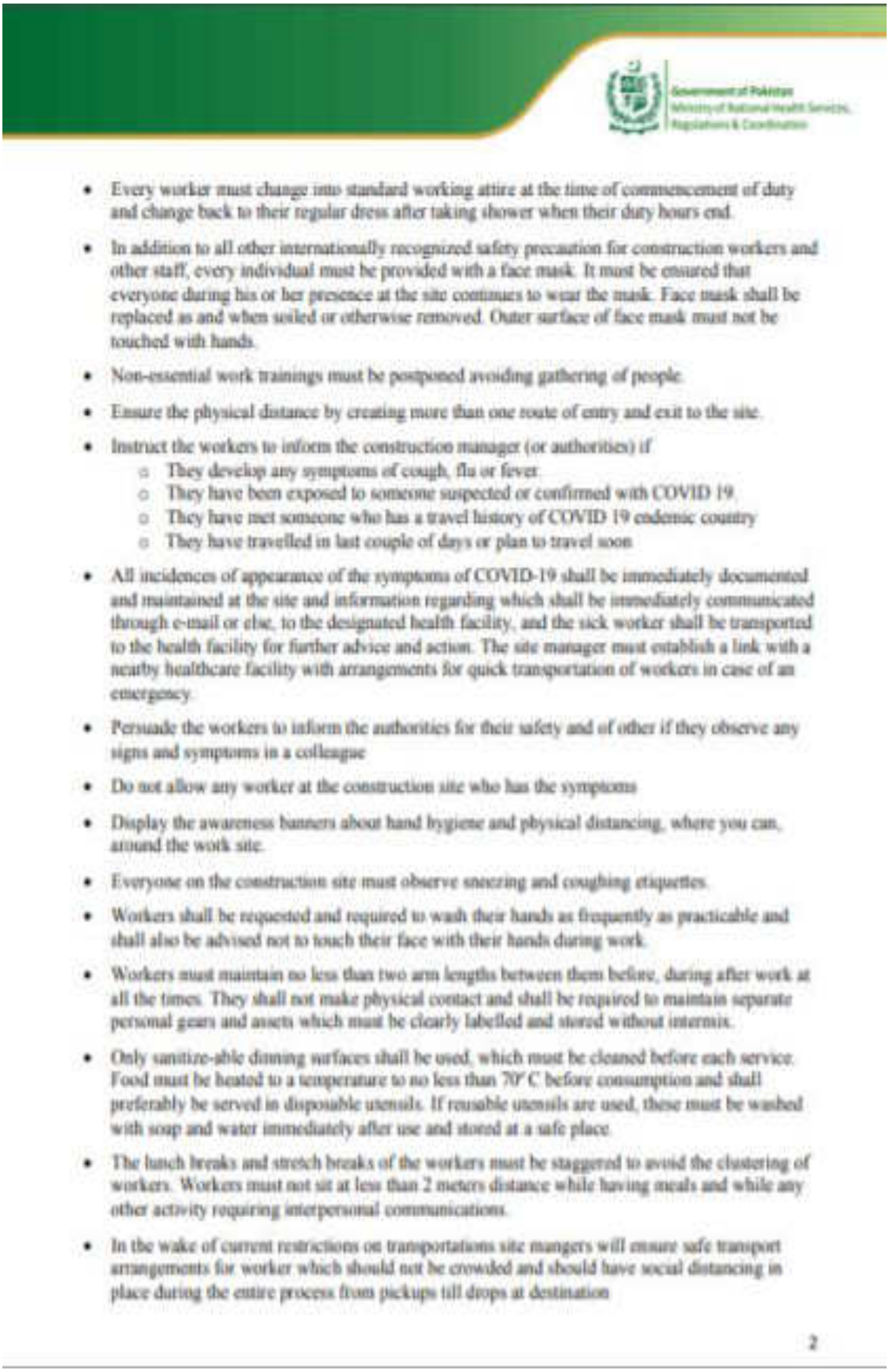
Building construction involves earth work, procurement of materials and supplies and their storage, construction work done by masons, blacksmiths, electricians, carpenters, plumbers, painters, supervisors, managers and security personnel. These guidelines provide the safety measure to be implemented 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.

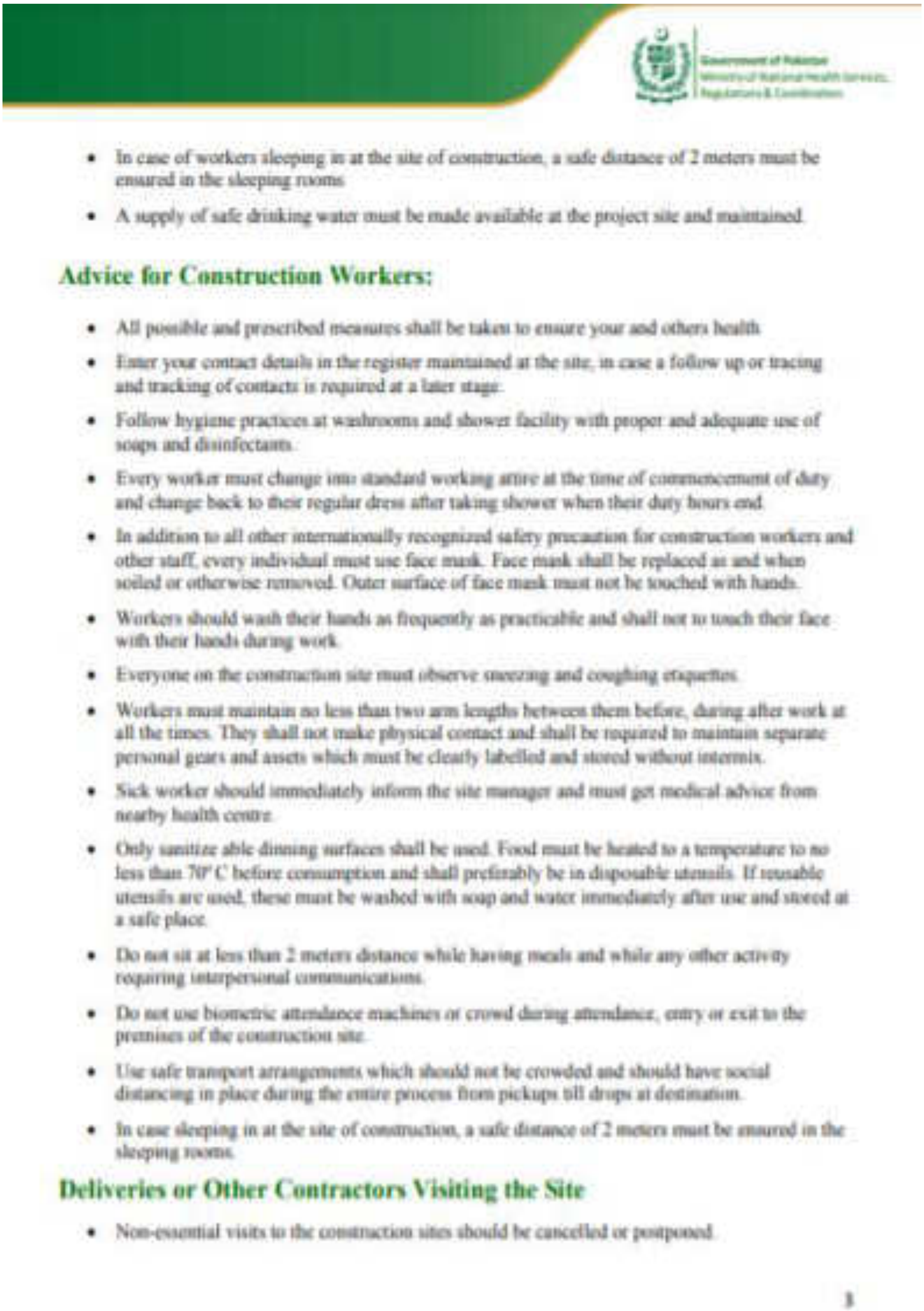
1



Government of Pakistan
Ministry of National Health Services,
Regulations & Coordination

- 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

2



Government of Pakistan
Ministry of National Health Services,
Regulations & Coordination

- 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.

3

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, Saida Shehrbano 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/UCdYszeSP8Ug1f__ZZKI |

# ANNEXURE N

# Solid Waste Management Framework

# Framework for Solid Waste Management

## 1. INTRODUCTION

Framework Solid Waste Management Plan for the development of JICA Abbottabad 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 Abbottabad 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 ABBOTABAD 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 Choona Hill, Abbottabad at a distance of 10km from city center. Administration wise proposed WTP located in UC Dhamtour *tehsil* and District Abbottabad Khyber Pakhtunkhwa Province. The proposed WTP will be developed on 3.5 Acres of land. WTP site can be accessed from Abbottabad city via Murree road to Choona Hill.

The proposed project “extension of JICA water treatment plant (WTP) and gravity water supply scheme (GWSS)” aims to fulfill water supply requirements of Abbottabad 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 Phalkot and Jandar Bari streams. 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 Abbottabad 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 O

# 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.

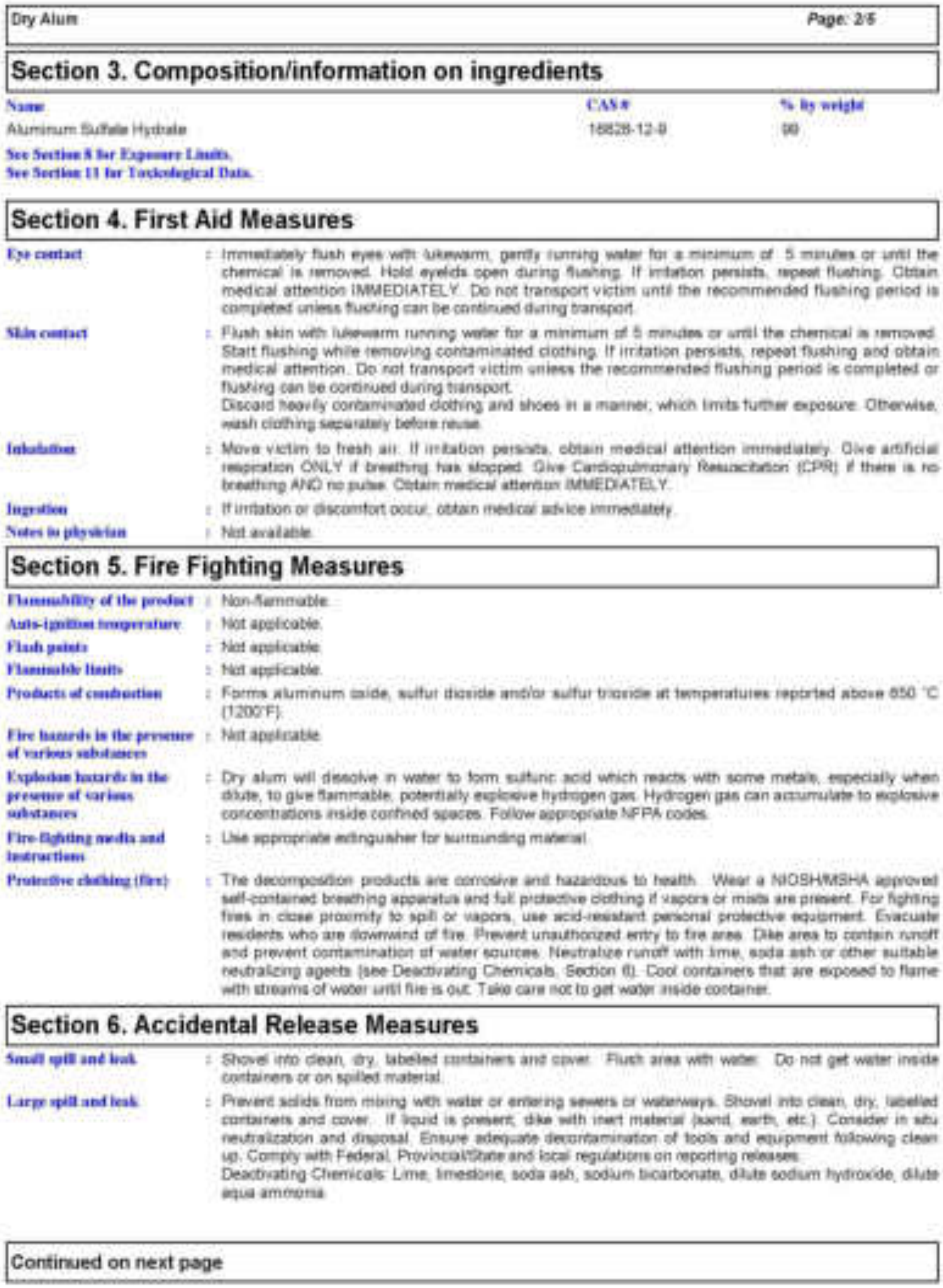
**Potential chronic health effects** : CARCINOGENIC EFFECTS: Not classified or listed by IARC, NTP, OSHA, EU and ACGIH.
MUTAGENIC EFFECTS: Not available.
TERATOGENIC EFFECTS: Not available.

**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



Dry Alum Page: 2/6

## 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.

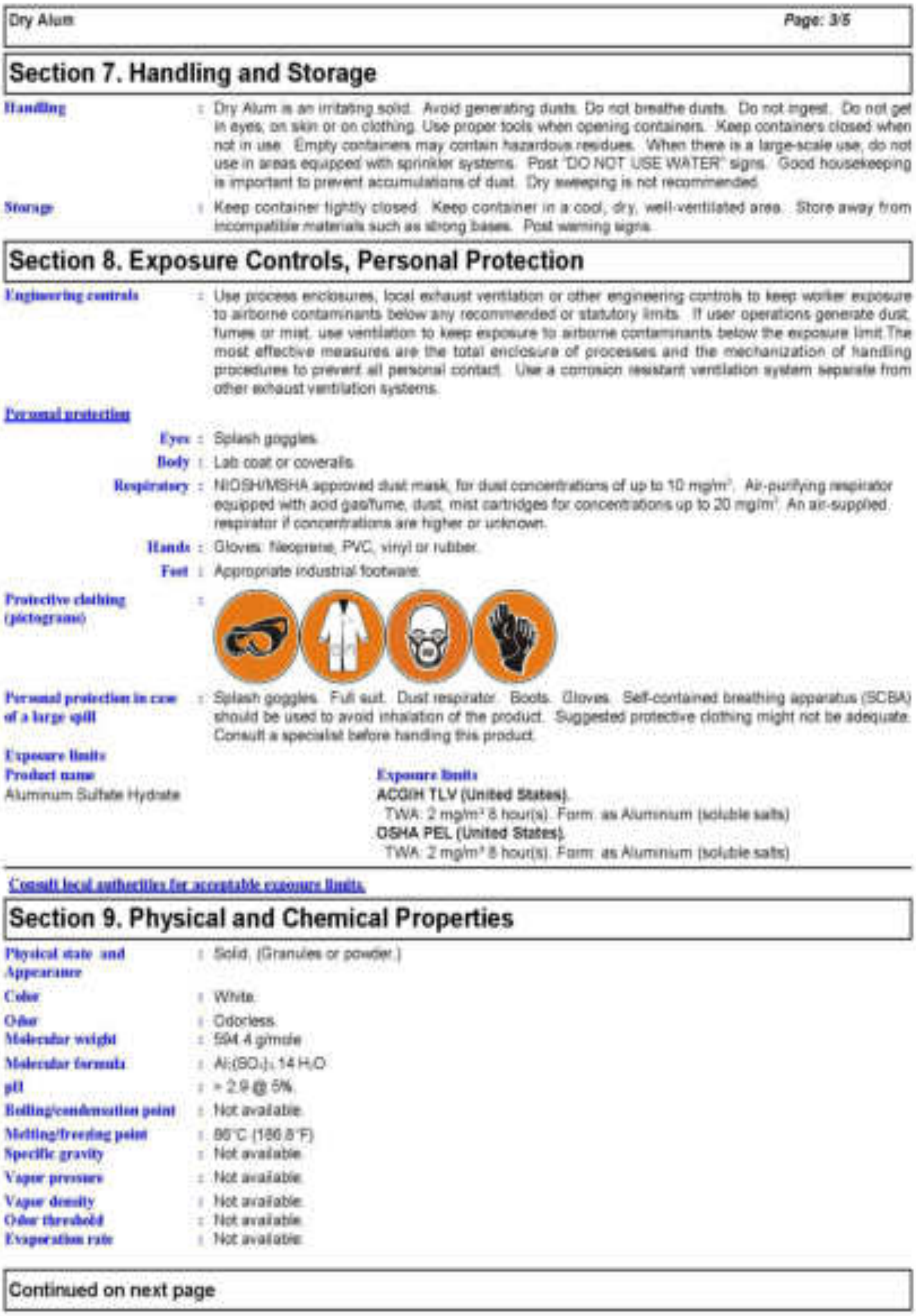
**Protective clothing (fire)** : The decomposition products are corrosive and hazardous to health. Wear a NIOSH/MSHA approved self-contained breathing apparatus and full protective clothing if vapors or mists are present. For fighting fires in close proximity to spill or vapors, use acid-resistant personal 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



Dry Alum **Page: 3/5**

## 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 handing this product. |

**Exposure limits**

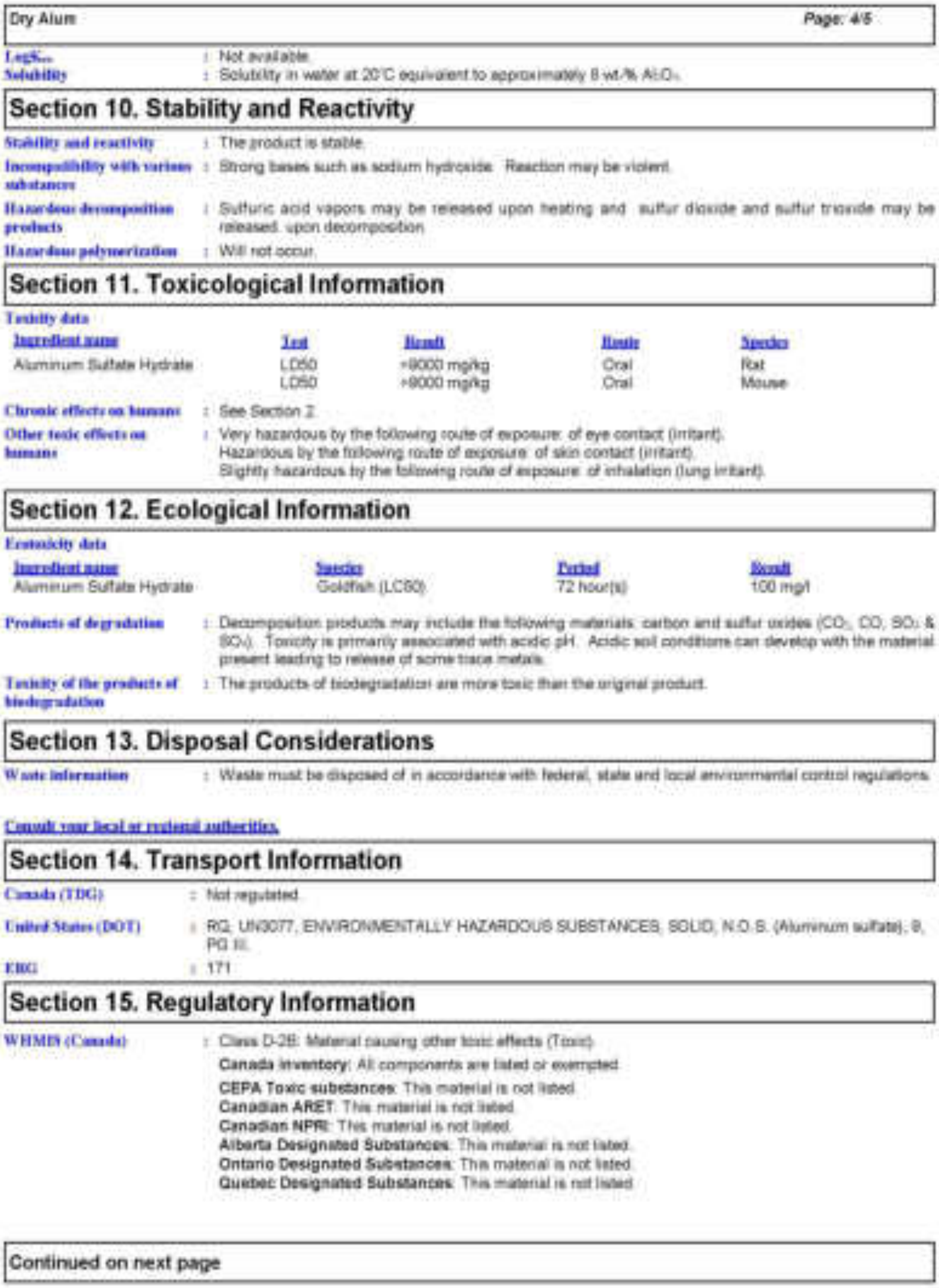
| **Product name** | **Exposure limits** |
|---|---|
| Aluminum Sulfate Hydrate | **ACGIH TLV (United States).**<br>TWA: 2 mg/m$^3$ 8 hour(s). Form: as Aluminium (soluble salts)<br>**OSHA PEL (United States).**<br>TWA: 2 mg/m$^3$ 8 hour(s). Form: as Aluminium (soluble salts) |

**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, $SO_2$ & $SO_3$). 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

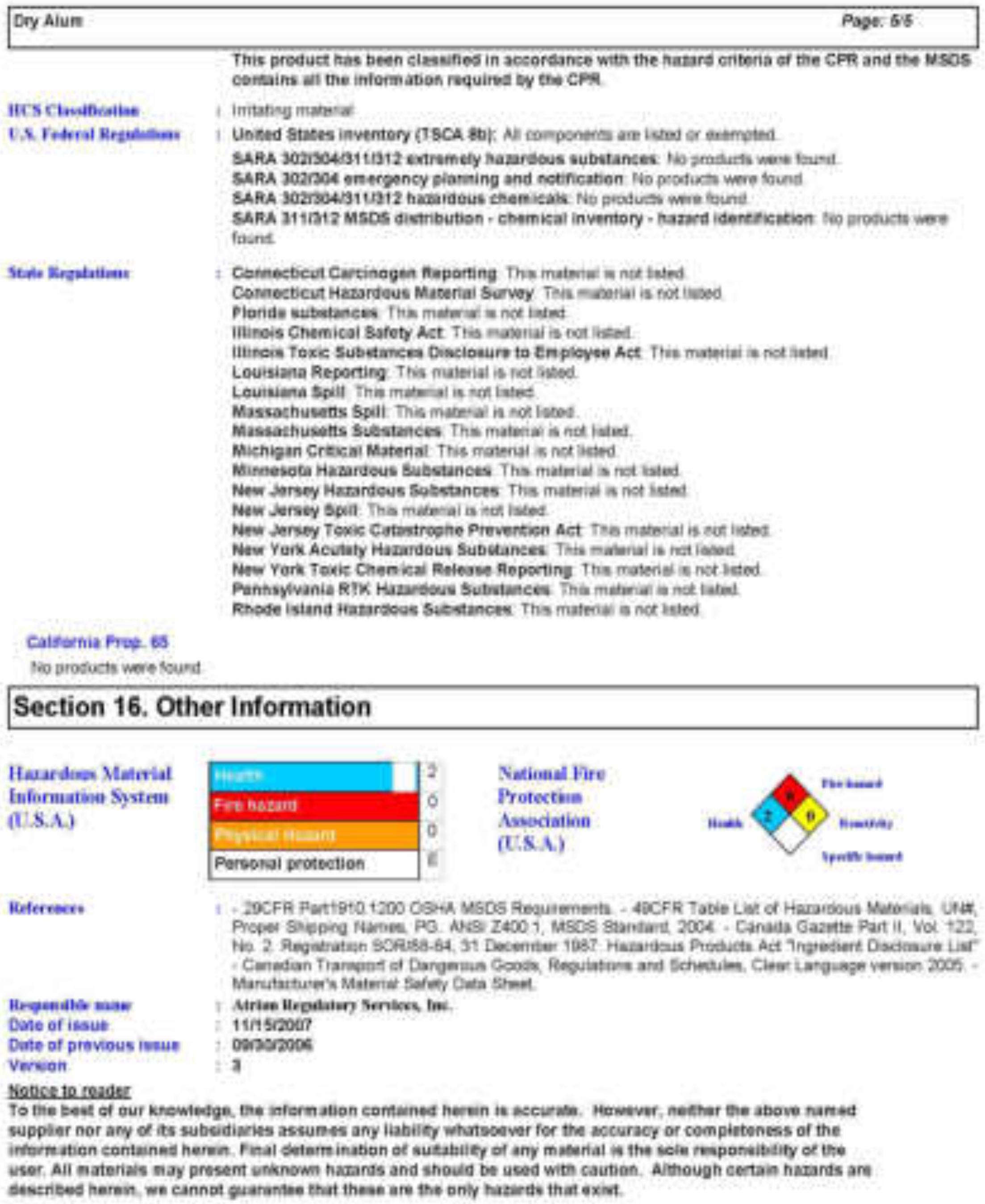
## Section 15. Regulatory Information

**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** : **Ariel Regulatory Services, Inc.**
**Date of issue** : 11/15/2007
**Date of previous issue** : 09/30/2006
**Version** : 3

Notice to reader

**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

# 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<br>Sodium hypochlorite |

**Label In Accordance With (EC) No. 1272/2008**

2 / 7

## 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)<br>Skin Corr. 1A - H314 | Classification (67/548/EEC)<br>C;R35 | |

| | | |
|---|---|---|
| **Sodium hypochlorite** | | **5-20%** |
| **CAS-No.: 7681-52-9** | **EC No.: 231-668-3** | |
| Classification (EC 1272/2008)<br>Met. Corr. 1 - H290<br>EUH031<br>Skin Corr. 1B - H314<br>Aquatic Acute 1 - H400<br>Aquatic Chronic 2 - H411 | Classification (67/548/EEC)<br>C;R34.<br>N;R50.<br>R31. | |

3 / 7

# 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 (especially ammonia).

### 7.2. Conditions for safe storage, including any incompatibilities

Unsuitable containers: metals. Store in vented vessels of rubber lined mild steel or HDPE. Uncontrolled 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<br>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. |

# ANNEXURE P

# Env. Audit Report of Existing Facilities

## Table 1: Audit of Existing JICA Water Treatment Facility and Required Corrective Actions

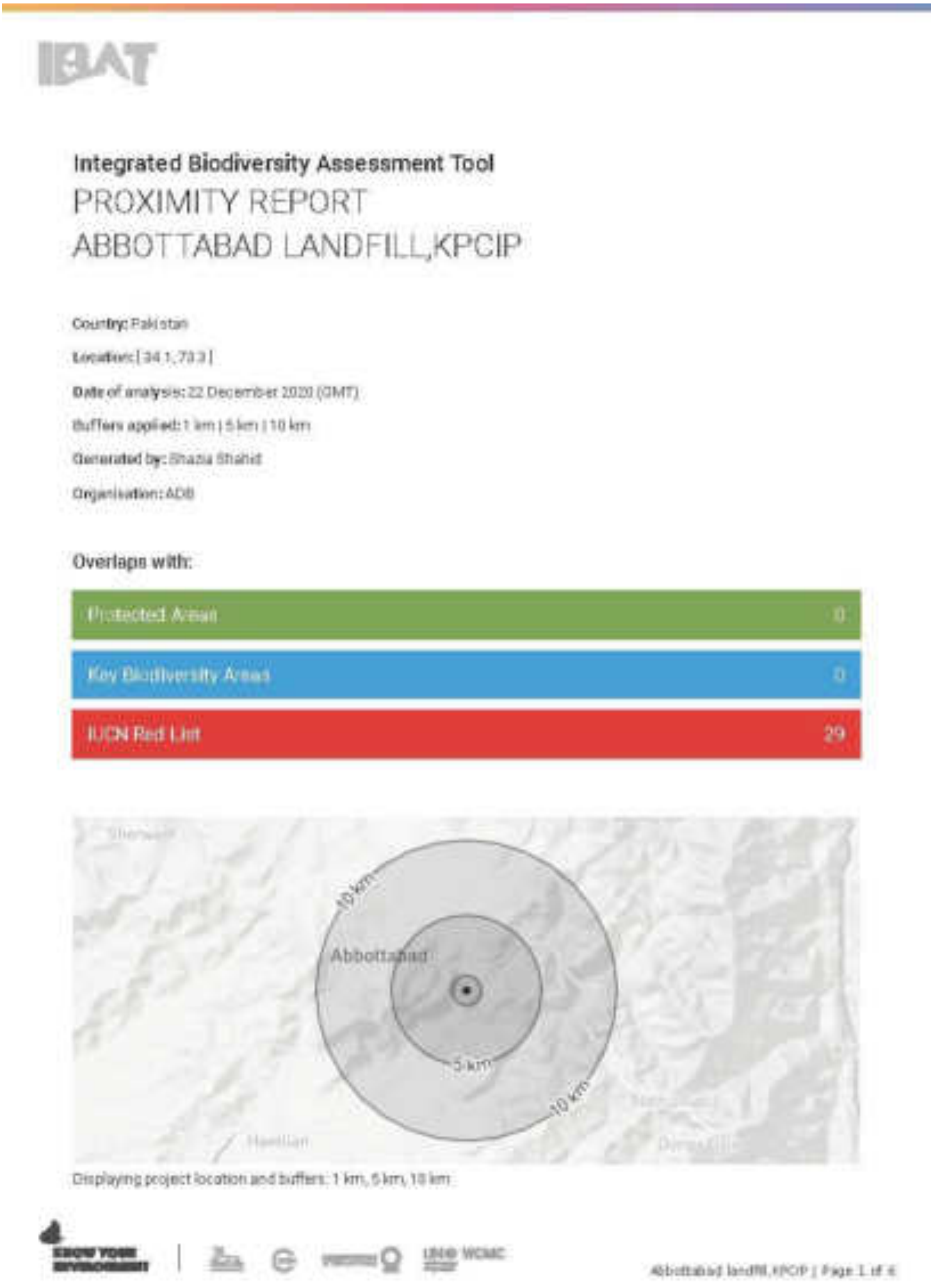
| S/No. | Component | Env. Audit Findings | Required Corrective Action |
|---|---|---|---|
| **1** | **Existing Phalkot Intake Structure** | ▪ Phalkot structure (100 l/s capacity) was designed to supplement the water to JICA water treatment plant to overcome the shortfall in the current supply during winters and low flow period<br>▪ The civil works for intake structure along with a 6 km raw water transmission main (300 mm diameter) has been already completed<br>▪ Intake structure is run of stream weir<br>▪ Flow of Phalkot is 450 liter/sec in 2020<br>▪ Flow of Phalkot was 280 l/s in 2015<br>▪ Flow reduces by about 40% in the dry months of November to January<br>▪ Intake structure is operational and in good condition<br>▪ No environmental pollution observed along the structures | ▪ Surface water intake from existing Phalkot structure should be done in sustainable<br>▪ Periodic flow monitoring at Phalkot intake structure<br>▪ Limited water intake during dry months of Nov-Jan<br>▪ Detailed catchment analysis should be carried out to ensure sustainability of intake structure<br>▪ Surface water quality (upstream and downstream of intake structure) should be monitored periodically<br>▪ Other downstream water uses should be explored to ensure that any necessary rights are not compromised. |
| **2** | **Existing JICA Water Treatment Plant** | ▪ SOPs related to CIP and filter change are in place<br>▪ There is no water quality analysis lab within the plant<br>▪ Water quality analysis is being carried out by WASA lab on monthly basis however frequency can be changed as per requirement<br>▪ Existing JICA WTP cannot treat high turbid water i.e. >20 NTU, in such case water coming from transmission main in directly bypassed to nearby Nullah<br>▪ About 1-2 inch sludge generated in sedimentation tank which is being removed through flushing<br>▪ Wash water is being disposed of nearby Nullah located at foothill of Choona Hill<br>▪ Surface water quality monitoring at Intake is carried out as per requirement or request from PHED<br>▪ Cleaning of slow sand filters is being done after 2 months to remove algae | ▪ Water quality analysis lab will be developed as part of extension of JICA WTP.<br>▪ Proposed extension of WTP will treat high turbid water reducing the chances to bypass water<br>▪ There would be organized system of sludge removal and disposal from the WTP facility<br>▪ Wash water quality should be tested before final discharge<br>▪ Frequency of surface water quality at intake structure should be defined.<br>▪ Cleaning of slow sand filters shall be more frequent instead of waiting for Algae to grow.<br>▪ Large size/capacity sand washing machines shall be available at the facilty<br>▪ Sand transfer should be through mechanically means instead of manual to improve housekeeping of the area<br>▪ |

| | | | |
|---|---|---|---|
| | | ▪ Washing of sand filter is carried out by sand washing machine however to transfer sand to machine wheel borrows are used.<br>▪ Manual sand washing is resulting in poor housekeeping and high manpower requirement<br>▪ Over the year, plant remains closed about 30 days on intermittent basis due to high NTU values<br>▪ There are about 18 staff members working on the ETP in 03 shifts<br>▪ Power requirements of the plant are being met by WAPDA. Backup power supply sources are solar panel and generator.<br>▪ No environmental pollution observed within WTP facility.<br>▪ There is need for more plantation to improve aesthetics of the area. | |
| **3** | **Transmission Mains** | ▪ Water is being transported from Phalkot source through transmission main of 06 Km length<br>▪ There is no environmental issue with transmission main<br>▪ Transmission main is traversing bridge, culvert and road<br>▪ Transmission main is laid underground however it is above ground near bridge | ▪ Periodic monitoring of transmission main shall be carried out to ensure its functionality<br>▪ Purging of transmission main shall be planned as per requirement |
| **4** | **Overhead Reservoirs** | ▪ Overhead reservoirs are located in 04 UCs of Abbottabad<br>▪ Chlorination is being done on monthly basis<br>▪ There are cleaning issues with overhead reservoirs<br>▪ Cleaning of Overhead reservoirs is being done on 06 months basis<br>▪ Cleaning washouts goes into nearby drain through piped network<br>▪ There are 02 persons usually deployed at site<br>▪ Power requirements are being met through WAPDA.<br>▪ There is need to maintain plantation at overhead reservoirs. | ▪ SOPs for cleaning of overhead reservoirs shall be robust<br>▪ There is need to increased cleaning frequency of overhead reservoirs<br>▪ No washouts should be drained openly. These should be disposed of through piped network.<br>▪ More plantation should be carried out to improve aesthetics of the area. |
| **5** | **Distribution Network** | ▪ Currently distribution network is in good condition and operational<br>▪ Laying of other utilities i.e. SNGPL, cable, sewerage some time result in damage to distribution networks<br>▪ Water quality is being monitored at 60 points within the situation network | ▪ Damage to distribution network by other utilities should be avoided.<br>▪ Water quality monitoring points should be increased as distribution network will be extended.<br>▪ Frequency of purging of distribution network should be defined. |

| | | | |
|---|---|---|---|
| | | ▪ There are negligible chance of sewerage mixing with distribution network<br>▪ Storm water mixing to distribution network occurs in case of high flow. | ▪ Hotspots for storm water mixing within distribution network should be identified and mixing points should be fixed prior to rainy season. |

# ANNEXURE Q

# IBAT Proximity Report of Nearby Landfill Site



IBAT

**Integrated Biodiversity Assessment Tool**

PROXIMITY REPORT
ABBOTTABAD LANDFILL,KPCIP

**Country:** Pakistan

**Location:** [ 34.1, 73.3 ]

**Date of analysis:** 22 December 2020 (GMT)

**Buffers applied:** 1 km | 5 km | 10 km

**Generated by:** Shazia Shahid

**Organisation:** ADB

**Overlaps with:**

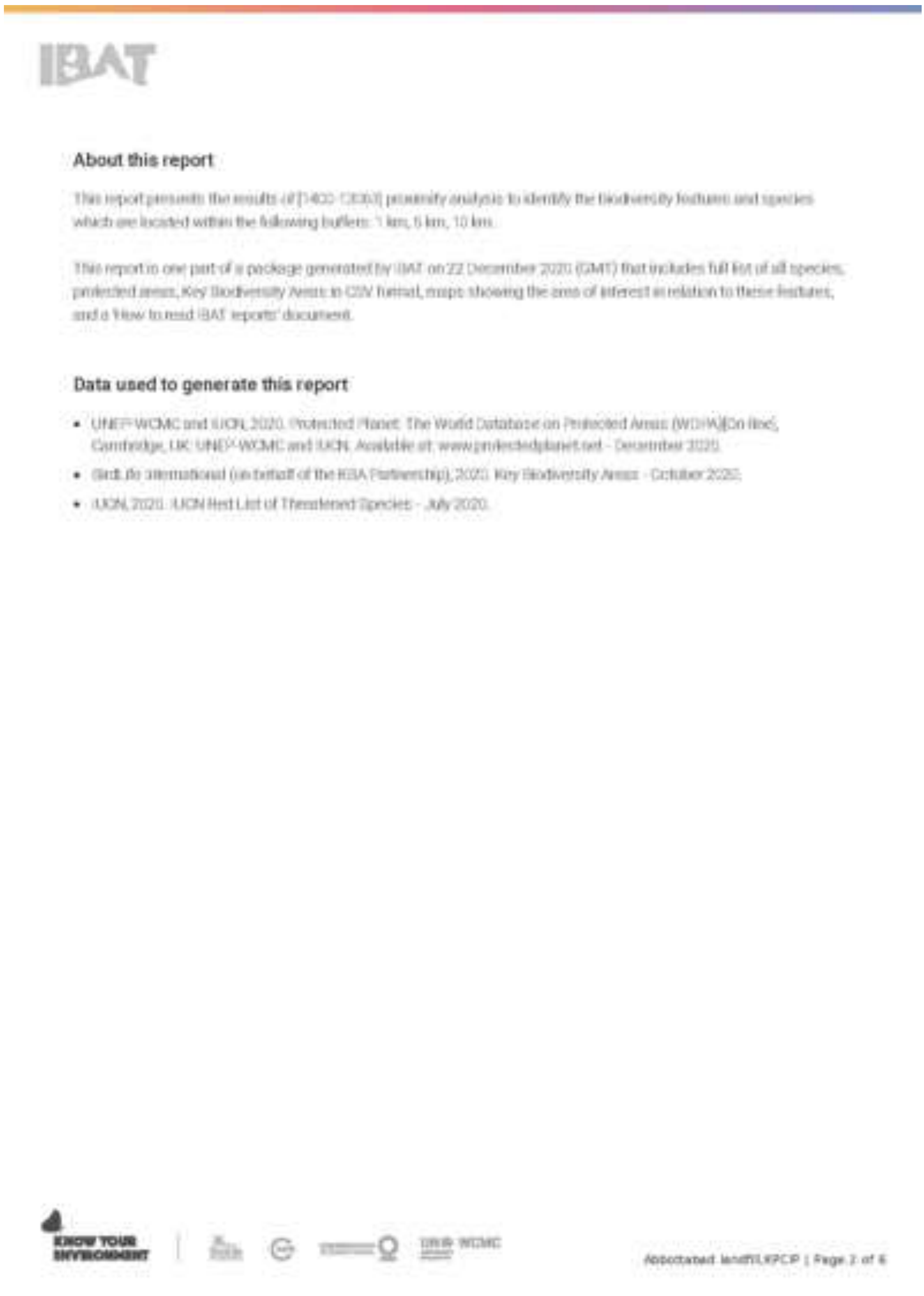
| | |
|---|---|
| Protected Areas | 0 |
| Key Biodiversity Areas | 0 |
| IUCN Red List | 29 |

Displaying project location and buffers: 1 km, 5 km, 10 km

KNOW YOUR ENVIRONMENT

UNEP WCMC

Abbottabad landfill,KPCIP | Page 1 of 6



IBAT

## About this report

This report presents the results of [illegible] proximity analysis to identify the biodiversity features and species which are located within the following buffers: 1 km, 5 km, 10 km.

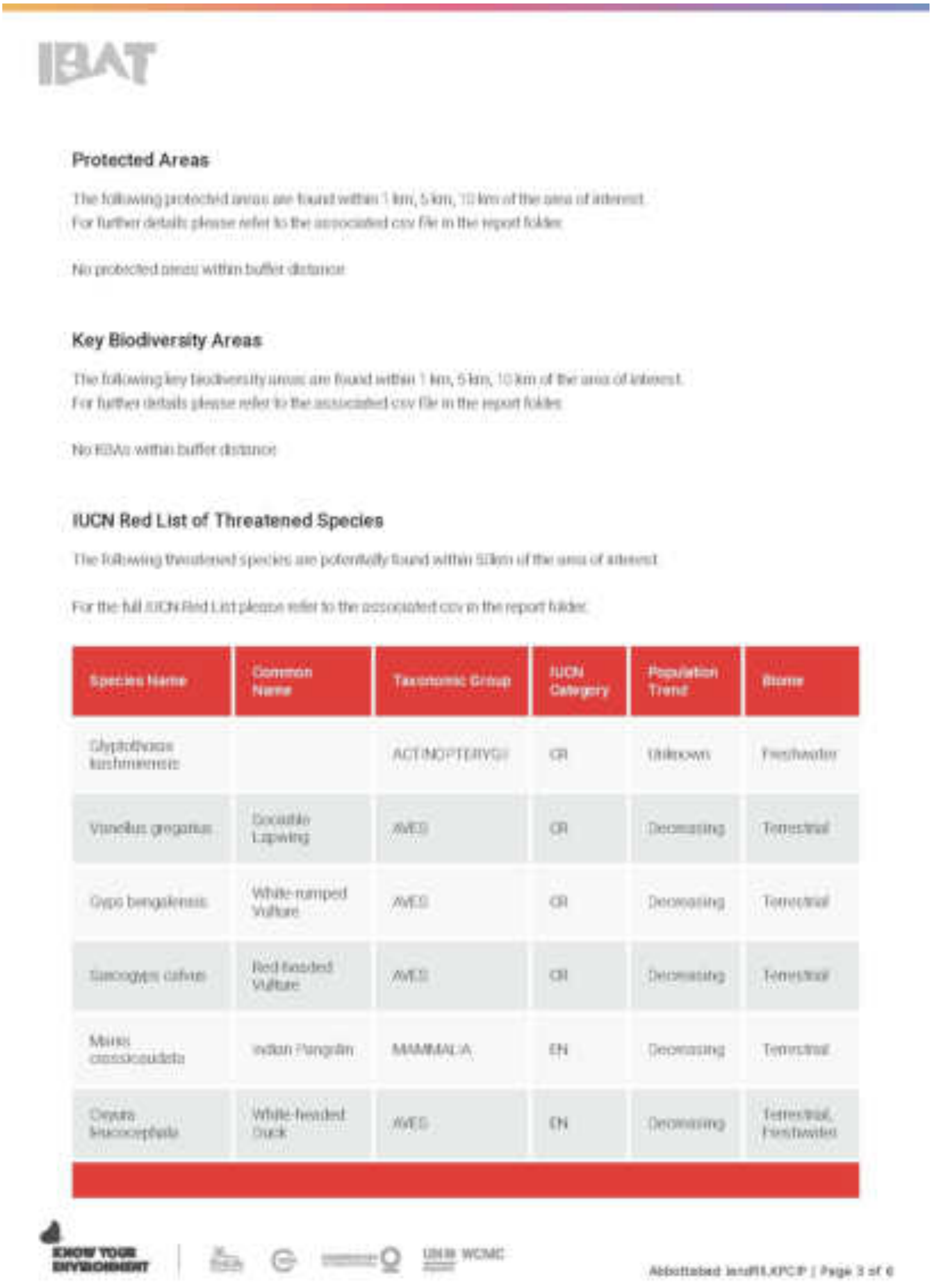
This report is one part of a package generated by IBAT on 22 December 2020 (GMT) that includes full list of all species, protected areas, Key Biodiversity Areas in CSV format, maps showing the area of interest in relation to these features, and a 'How to read IBAT reports' document.

## Data used to generate this report

- UNEP-WCMC and IUCN, 2020. Protected Planet: The World Database on Protected Areas (WDPA)[On-line], Cambridge, UK: UNEP-WCMC and IUCN. Available at: www.protectedplanet.net - December 2020.
- BirdLife International (on behalf of the KBA Partnership), 2020. Key Biodiversity Areas - October 2020.
- IUCN, 2020. IUCN Red List of Threatened Species - July 2020.

KNOW YOUR ENVIRONMENT

Abbottabad landfill,KPCIP | Page 2 of 6



IBAT

## Protected Areas

The following protected areas are found within 1 km, 5 km, 10 km of the area of interest.
For further details please refer to the associated csv file in the report folder.

No protected areas within buffer distance

## Key Biodiversity Areas

The following key biodiversity areas are found within 1 km, 5 km, 10 km of the area of interest.
For further details please refer to the associated csv file in the report folder.

No KBAs within buffer distance

## IUCN Red List of Threatened Species

The following threatened species are potentially found within 50km of the area of interest.

For the full IUCN Red List please refer to the associated csv in the report folder.

| Species Name | Common Name | Taxonomic Group | IUCN Category | Population Trend | Biome |
|---|---|---|---|---|---|
| Glyptothorax kashmirensis | | ACTINOPTERYGII | CR | Unknown | Freshwater |
| Vanellus gregarius | Sociable Lapwing | AVES | CR | Decreasing | Terrestrial |
| Gyps bengalensis | White-rumped Vulture | AVES | CR | Decreasing | Terrestrial |
| Sarcogyps calvus | Red-headed Vulture | AVES | CR | Decreasing | Terrestrial |
| Manis crassicaudata | Indian Pangolin | MAMMALIA | EN | Decreasing | Terrestrial |
| Oxyura leucocephala | White-headed Duck | AVES | EN | Decreasing | Terrestrial, Freshwater |

KNOW YOUR ENVIRONMENT

Abbottabad landfill.KPCIP | Page 3 of 6

IBAT

| Species Name | Common Name | Taxonomic Group | IUCN Category | Population Trend | Biome |
|---|---|---|---|---|---|
| Haliaeetus leucoryphus | Pallas's Fish-eagle | AVES | EN | Decreasing | Terrestrial, Freshwater |
| Neophron percnopterus | Egyptian Vulture | AVES | EN | Decreasing | Terrestrial, Freshwater |
| Aquila nipalensis | Steppe Eagle | AVES | EN | Decreasing | Terrestrial |
| Falco cherrug | Saker Falcon | AVES | EN | Decreasing | Terrestrial, Marine, Freshwater |
| Tor putitora | | ACTINOPTERYGII | EN | Decreasing | Freshwater |
| Panthera pardus | Leopard | MAMMALIA | VU | Decreasing | Terrestrial |
| Panthera uncia | Snow Leopard | MAMMALIA | VU | Decreasing | Terrestrial |
| Ursus thibetanus | Asiatic Black Bear | MAMMALIA | VU | Decreasing | Terrestrial |
| Wallago attu | | ACTINOPTERYGII | VU | Decreasing | Freshwater |
| Bagarius yarrelli | | ACTINOPTERYGII | VU | Decreasing | Freshwater |
| Anacyclus pyrethrum | Atlas Daisy | MAGNOLIOPSIDA | VU | Decreasing | Terrestrial |
| Tragopan melanocephalus | Western Tragopan | AVES | VU | Decreasing | Terrestrial |
| Catreus wallichii | Cheer Pheasant | AVES | VU | Decreasing | Terrestrial |
| Marmaronetta angustirostris | Marbled Teal | AVES | VU | Decreasing | Terrestrial, Marine, Freshwater |

Abbottabad landfill KPCP | Page 4 of 6

IBAT

| Species Name | Common Name | Taxonomic Group | IUCN Category | Population Trend | Biome |
|---|---|---|---|---|---|
| Aythya ferina | Common Pochard | AVES | VU | Decreasing | Terrestrial, Marine, Freshwater |
| Rynchops albicollis | Indian Skimmer | AVES | VU | Decreasing | Terrestrial, Freshwater |
| Clanga clanga | Greater Spotted Eagle | AVES | VU | Decreasing | Terrestrial, Freshwater |
| Aquila rapax | Tawny Eagle | AVES | VU | Decreasing | Terrestrial, Freshwater |
| Aquila heliaca | Eastern Imperial Eagle | AVES | VU | Decreasing | Terrestrial, Freshwater |
| Saxicola macrorhynchus | White browed Bushchat | AVES | VU | Decreasing | Terrestrial |
| Ciconia episcopus | Asian Woollyneck | AVES | VU | Decreasing | Terrestrial, Marine, Freshwater |
| Ovis vignei | Urial | MAMMALIA | VU | Decreasing | Terrestrial |
| Capricornis sumatraensis | Mainland Serow | MAMMALIA | VU | Decreasing | Terrestrial |

KNOW YOUR ENVIRONMENT

UNEP WCMC

Abbottabad landfill,KPCIP | Page 5 of 6

## Recommended citation

IBAT Proximity Report. Generated under licence 1400-13063 from the Integrated Biodiversity Assessment Tool on 22 December 2020 (GMT). www.ibat-alliance.org

## How to use this report

This report provides an indication of the potential biodiversity-related features - protected areas, key biodiversity areas and species - close to the specified location. It provides an early indication of potential biodiversity concerns, and can provide valuable guidance in making decisions. For example, this information can be helpful when assessing the potential environmental risk and impact of a site, categorising investments/projects, preparing the terms of reference for an impact assessment, focusing attention on key species of conservation concern and sites of known conservation value, and reviewing the results of an impact assessment.

The report does not provide details of potential indirect, downstream or cumulative impacts. Furthermore, the report should be regarded as a "first step", providing a set of conservation values sourced from global data sets, and is not a substitute for further investigation and due diligence, especially concerning national and/or local conservation priorities.

Abbottabad landfill,KFCIP | Page 6 of 6