Environmental Impact Assessment (Updated)

Project Number: 47024-004
June 2016

Pakistan: Pehur High Level Canal Extension Project

Prepared by the Khyber Pakhtunkhwa Irrigation Department for the Asian Development Bank.

ASIAN DEVELOPMENT BANK

PEHUR HIGH LEVEL CANAL EXTENSTION PROJECT (PHLCEP)

ADB TA 8488PAK

FINAL REPORT

Appendix 17

ENVIRONMENTAL IMPACT ASSESSMENT

JUNE 2016

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PEHUR HIGH LEVEL CANAL EXTENSION PROJECT
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ENVIRONMENTAL IMPACT ASSESSMENT

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LIST OF ACRONYMS

ACCA	Additional Culturable Command Area
ADB	Asian Development Bank
Bcm	Billion Cubic Meter
CCA	Culturable Command Area
CLL	Concurrent Legislative List
BOD	Biological Oxygen Demand
CCA	Culturable Command Area
COD	Chemical Oxygen Demand
CSP	Core sub-Project
DC	Deputy Commissioner
DGSD	Director General Small Dams
DO	Dissolved oxygen
EA	Executive Agency
EC	Electrical Conductivity
ECA	EMMPloyment of Children Act
EIA	Environmental Impact Assessment
EMMP	Environmental Management and Monitoring Plan
EMMP	Environmental Management Plan
EPA	Environmental Protection Agency
ESIA	Environmental and Social Impacts Assessment
EU	Environmental Unit
FGD	Focussed Group Discussion
GPS	Global Positioning System
HEIS	High Efficiency irrigation System
HIV	Hepatitis Inter Virus
IA	Implementing Agency
IEE	Initial Environmental Examination
IUCN	International Union for Conservation of Nature
IRSA	Indus River System Authority
LAA	Land Acquisition Act
KII	Key Informants Interview
KPAD	Khyber Pakhtunkhwa Agriculture Department
KPID	Khyber Pakhtunkhwa Irrigation Department
KP	Khyber Pakhtunkhwa
KMZ	Keyhole Markup language Zipped
NCS	National Conservation Strategy
NEQS	National Environment Quality Standards
NGOs	Non-Governmental Organizations
NOx	Nitrous Oxides
O&M	Operation and Maintenance
OFWM	On Farm Water Management
PAK-EPA	Pakistan Environmental Protection Agency
PC-I	Planning Commission Document-I
PD	Project Director
P&DD	Planning and Development Department

PEPA	Pakistan Environment Protection Act
PEPC	Pakistan Environmental Protection Council
PESCO	Peshawar Electricity Corporation
pH	Power of Hydrogen
PHLC	Pehur High Level Canal
PHLCE	Pehur High Level Canal Extension
PIEDAR	Pakistan Institute for Environment-Development Action
PMC	Pehur Main Canal/Planning Management Cell
PHED	Public Health Engineering Department
PM	Particulate Matters
P.C	Public Consultation
P.P	Pressure pipe
PPTA	Project Preparatory Technical Assistance
PRA	Participatory Rural Appraisal
PSC	Project Steering Committee
LARP	Resettlement Action Plan
RCC	Reinforced Concrete Cement
REA	Rapid Environmental Assessment
RD	Reduce Distance
RoW	Right of Way
RR and SD	Relief, Rehabilitation and Settlement Department
SDPI	Sustainable Development Policy Institute
SPM	Suspended Particulate Matters
SPS	Safeguard Policy Statement
TA	Technical Assistance
TSP	Total Suspended Particles
SCOPE	Society of Conservation and Protection of Environment
SO2	Sulphur Dioxides
SSEM	Site Specific Environmental Management Plan
UNDSS	United Nations Department of Safety and Security
USEPA	United States Environmental Protection Agency
WAPDA	Water and Power Development Authority
WHO	World Health Organization
WRSP	Water Resources Sector Project
WWF	World Wide Fund
USCS	Upper Swat Canal System
USC	Upper Swat Canal
VOC	Volatile Organic Compound

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EXECUTIVE SUMMARY

Introduction

1. **The Project:** The proposed Pehur High Level Canal Extension Project (PHLCEP) is located along the right bank of Indus River 96% in Districts Swabi and 4% in District Nowshera of Khyber Pakhtunkhwa Province. The Project area can be accessed through Peshawar-Islamabad motorway by taking exit from Swabi-Interchange.

2. The main objective of this project is supply of irrigation water to the Project Area. Under the proposed PHLCEP, a new irrigation system will be constructed for enhancing agricultural production in the Project Area. The project comprises two target areas, which are presently dependent on rainfed agriculture i.e., Janda Boka and Indus-Ambar project areas.

3. Government of Khyber Pakhtunkhwa has requested ADB to provide a loan for a stand alone Project of PHLCEP. ADB has agreed with the Government and a standalone loan of about $ 86.4 million is being processed for the Project

4. **Scope and Objectives of the EIA**: This report is the environmental impact assessment (EIA) for the PHLCEP and complies with the environmental assessment guidelines and requirements of the Asian Development Bank Safeguard Policy Statement (SPS, 2009) and the Government of Pakistan. The EIA has been prepared to present the environmental assessment process of the project and ensure that the potential adverse environmental impacts are appropriately mitigated. The scope of work for the preparation of the EIA included, a detailed scoping exercise, study of the relevant baseline information, assessment of environmental impacts of the Project and its ancillary activities, assessment of the cumulative environmental impacts of the project, preparation of mitigation measures with an environmental management plan and an environmental monitoring plan.

B Critical Facts

5. **Policy Legal and Administrative Framework:** The Government of Pakistan has formulated and proclaimed a comprehensive policy and legal framework for environmental assessment and protection.

6. **The** main provisions for environmental protection and pollution control in Pakistan are proclaimed in the Pakistan Environmental Protection Act (PEPA), 1997, which empowers the KP government to frame regulations for the protection of the environment under the KP Environmental Protection Act, 2014.

7. **PEPA** provides the framework for protection and conservation of species, wildlife habitats and biodiversity, conservation of renewable resources, establishment of standards for the quality of ambient air, water and land, establishment of Environmental Tribunals, appointment of Environmental Magistrates, and Initial Environmental Examination (IEE) and Environmental Impact Assessment (EIA) approval. This Act has a direct bearing on the proposed PHLCEP as the project requires an Environmental Impacts Assessment (EIA). Further, as PHLCEP is located mainly in the district of Swabi, it falls under the jurisdiction of the KP Environmental Protection Agency which will be responsible for approval of the EIA of the project.

8. **Project Categorization for Environmental Assessment:** As per the classification of ADB, PHLCE Project has been classified under Category A and requires an EIA. Pak-EPA regulations, formulated in 2000 for 'Review of IEE and EIA', categorise development projects under three schedules and PHLCEP has been categorized as Schedule II which requires an EIA.

9. **The Project:** The project is a water resources development project with the objective of providing irrigation supply to communities who have not been provided these services earlier. The project area is spread in the form of two major chunks i.e. Janda Boka and Indus-Ambar.

C Description of the Environment

10. **Land use:** The land use in the area is primarily rainfed irrigation for production of food crops for domestic consumption and is dependent on water availability from some tube wells and barani cultivation. Land in the command area is being used for general cropping with rain water supplemented by tube well water for restricted cropping under dry farming, and limited area under poor grazing.

11. **Soils:** The results of soil analysis reveal that all the soils are loam, silty loam, sandy loam, and loamy sand nature. These soils are medium to loose in texture and have high water percolation rate. The samples exhibit no problem of salinity or sodicity as the pH and salt contents are within safe limits. The soil is deficient in organic matter (OM), Nitrogen (N), Phosphorus (P), and Potassium (K).

12. **Surface Water:** The major surface water resources in the area are, River Swat through Upper Swat Canal system; Indus River Water from Tarbela Reservoir through Pehur High Level Canal; and, roposed/under construction small dams on perennial / seasonal streams. The Tarbela Reservoir is the source of water for the proposed PHLCEP for irrigation supplies.

13. **By** comparing surface water quality results with the standards set by WAPDA, the results of all parameters were found within the required water quality standards.

14. **Groundwater Resources:** Sweet ground water is found in the command area. As the population of the project area continues to grow, it is expected that, in future, the availability of groundwater resources shall continue to decline as further abstractions are made for irrigation and drinking water purposes..

15. **Salinity and Water Logging**: The project area has no water logging and salinity problem and most of the land in the command area is cultivated and fallow land.

16. **Air Quality**: Ambient air monitoring were carried out at seven (07) locations within the project area and NO_X, SO_2, CO, PM ($PM_{2.5}$, $PM_{10}$and TSP, SPM were found to be within the permissible limit.

17. **Noise Level:** The noise level was also analysed along the pressure pipe and canal at locations close to sensitive receptors, and baseline noise level was within the permissible limit of NEQS and WHO standards.

18. **Pesticide Residue Analysis:** The pesticides residue in produce used for consumption from the area was analyzed and found to be within the permissible limit of

FAO-WHO standards for food limit in ground water except in Besik and Janda Boka where, the limit of Dimethoate was found exceeding the standards.

19. **Protected Sites**: As per assessment during the baseline surveys there are no protected sites and protected forests within or close to the potential impact zone of the PHLCEP.

20. **Tree Removal and Tree Inventory**: Notwithstanding that a total 6,415 trees were considered to be within the RoW of the proposed pressure pipes, and main and minor canals, only 800-1200 trees are aniticipated to be removed completely.

21. **Flora:** There are 5 dominant shrubs and 10 tree species in and around the project area. The tree species are common and used as timber and fuelwood.

22. **Wetlands**: Thre are no wetlands in the project area.

23. **Avifauna**: Fifteen common birds have been reported from the area and migratory birds have been observed in the general area, though no landing zones are found within the project area.

24. **Mammals**: Five species of mammals that were recorded during the field visits are not listed as of concern in IUCN Red List.

25. **Aquatic Fauna**: No fish or fishery activity was observed within or in the near **vicinity** of the project area.

26. **Archaeology and Cultural Heritage**: Sites of importance in regard to cultural heritage are not reported from the specific area of the project except the tomb of Gajoo Khan Baba situated outside the RoW on the right side of the pressure pipe and **Indus** Ambar Canal connecting point.

27. **Population**: the total population of Swabi District is 1,026,804 as per Census of 1998 with an intercensal percentage increase of 64.3 since March 1981 when it was 625,035 souls. The average annual growth rate is 3.0 percent during this period. The total area of the District is 1,543 square Kilometers.

28. **Livelihood:** In general, the literacy rate is not very high and most of the people earn their livelihood as tenants on land owned by the Khowaneen (Land-lords). However, large numbers of educated persons are employed inland or abroad and thus are adding to the prosperity of the area by sending their returns to the area.

29. **Education**: There are 41 Girl’s primary schools, 52 Boy’s primary schools, one Girl’s middle school, 4 Boy’s middle schools and 5 Girl’s high schools. The numbers of male and female teachers are 314 and 180 respectively. For college and higher studies, the students go to Swabi town and Peshawar.

30. **Literacy Rate**: The literacy ratio for male is 54.0% as against 18.3% for females. The ratio is much higher in urban areas when compared with rural areas both for males and females.

31. **Health:** There are five (05) health facilities in the project area.

32. **Utilities**: Local Electricity Department is responsible for electrification / service facilities in their respective domain. The total number of telephone connections in the district is 25,404. There are 23 Exchanges functioning in the district. The main Exchange is at Swabi.

D Significant Findings

33. **Potential Impacts and Mitigation**- In order to formulate practical safeguards environmental impacts were identified in the EIA process. A summary of the environmental impacts and mitigation measures which are discussed in detail in Chapter 6 of the EIA, are presented below.

(a) **Ambient Air Quality**: Air quality may decrease as a result of the project interventions. Construction machinery, diesel generators and project vehicles will release exhaust emissions containing carbon monoxide (CO), sulfur dioxide (SO_2), oxides of nitrogen (NO_X), and particulate matter (PM). These emissions can deteriorate the ambient air quality in the project site and along the road leading to it. Furthermore, fuel combustion will release smoke emissions. ***Mitigtion***: A mitigation regime containing 11 stipulations is proposed for mitigation of air quality deterioration.

(b) **Noise and Vibration**: Sources of noise during construction will be generators, concrete batching plants etc. Increased noise and vibration levels during construction activities can be a source of nuisance for locals and a source of disturbance to wildlife. ***Mitigation***: Although there are no sensitive receptors close to the construction sites except the SMKM College, mitigation action has been proposed to monitor and control emanation of high noise. Timing the construction activities in the vicinity of the SMKM College has been proposed to avoid impact on the students and teachers.

(c) **Surface water**: Improper disposal of solid waste or washout from concrete batching plants may contaminate the perennial sources of water. Additionally, other impurities such as oil spills from operational equipment may contaminate surrounding surface water including ponds and the nullhas, which may affect aquatic organisms and the surrounding ecosystem. Contaminated surface water also holds potential health hazards if the contaminated water is used for drinking purposes. ***Mitigation***: 17 specific measures have been proposed as mitigation.

(d) **Dust Emission**: Concentrations of airborne particulate matter will result from the earthwork, lining of canal, construction of canal road, trench excavation and installation of the pressure pipes. Generation of dust from these activities is likely to be significant given the prevailing wind direction from the north to north-east. ***Mitigation*:** A series of mitigation measures has been recommended in Chapter 7 to minimise the impact of dust emission.

(e) **Waste Management**: It is expected that large quantities of solid waste including domestic waste, food waste, sewage (waste water), workshop waste, medical waste, packing waste, demolition material (concrete, masonry and steel gates), debris from construction sites (excess aggregate, sand etc.) and excavated material unsuitable for earth fill will be generated during construction. ***Mitigation:*** Mitigation measures have been proposed considering the relevant guidelines from IFC and location specific considerations.

(f) **Traffic**: The PHLCE project will take approximately three years to complete and during this time there will be increased traffic within the project area as well as on the link roads and other approach routes of the project area. Traffic movement will interrupt the local vehicular and pedestrian traffic disrupting travel to school of school children on some routes during specific periods of peak activities. Due to increased use of trucks and other vehicles on the roads in the project area elderly people, women and children will be more exposed to dangerous situations, which may lead to traffic accidents and unrest. ***Mitigation:*** A traffic management plan to be prepared and implemented by the contractor, inter alia, has been proposed as mitigation..

(g) **Occupational Health and Safety**: The construction activities will involve operations which pose risks to the health and safety of the contractor's staff as well as the surrounding communities. ***Mitigation***: Occupational health and safety issues to be included in contraction specifications and other location specific action has been specified as mitigation.

(h) **Induced Economic Development**: It is anticipated that the influx of a migrant workforce will induce a degree of economic development. As a result of the influx of a workforce, there would be a higher demand for locally produced food, goods and services benefiting local farmers, producers, traders including small businesses within Topi and Swabi, such as hotels, restaurants, shops, fruit sellers, tea stallsand poultry stalls.

(i) **Employment Generation:** During the peak of works, it is estimated that approximately 500 skilled, semi skilled and unskilled personnel will be engaged on site. It is anticipated that the project will be able to draw a large part of the unskilled workforce from within the project area. This shall depend in part on the extent to which the contractors will engage external workers. Temporary employment within the area has the potential to contribute to a reduction in local poverty.

(j) **Stakeholder Consultation:** Two rounds of public/stakeholder consultation was carried out during the preparation of the EIA. The consultations assisted in dissemination of project information among the project stakeholders and obtain their feedback with local knowledge on baseline, mitigation measures, and also perception of the PAPs regarding impact significance and their views on project interventions.

E Recommendations

34. **Environmental Management Plan:** The Environmental Management Plan (EMP) for PHLCE Project has been prepared keeping in view the anticipated environmental impacts during pre-construction, 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.

35. **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

36. **Grievance Redress Mechanism (GRM):** A GRM has been proposed to receive, evaluate and facilitate the resolution of affected people's concerns, complaints, and grievances. The GRM will provide a time bound and transparent mechanism to voice out and resolve social and environmental concerns linked to the project.

F Conclusion

37. Assuming the effective implementation of the mitigation measures and monitoring plan as outlined in the Environmental Management Plan (Chapter 11), the Project is not expected to have significant adverse environmental impacts.

1. INTRODUCTION

1.1 Background

38. Khyber Pakhtunkhwa (KP) Province, located in the Northwest of Pakistan, is one of the four provinces of Pakistan bordering the Federally Administered Tribal Areas (FATA) to the west and south, Gilgit-Baltistan to the north-east, Azad Jammu and Kashmir to the east, Punjab and the Islamabad Capital Territory to the south-east, and Afghanistan to the north-west.

39. Asian Development Bank (ADB) launched a Project Preparatory Technical Assistance (PPTA) for preparing the Khyber Pakhtunkhwa Water Resources Sector Project (KPWRSP) under ADB TA 8488-PAK. Under the TA, the assignment included the preparation of a $ 100 million sector loan investment project for increased farm incomes and non-farm incomes of households engaged in agriculture in arid/rainfed areas in Khyber Pakhtunkhwa (KP) Province. The PPTA services have been provided by Joint Venture of Integrated Consulting Services and Halcrow Pakistan.

40. The indicative outcome of the proposed investment project were increased agriculture productivity in arid/rainfed areas in KP Province, the key indicative outputs include: (i) increased irrigation water supply capacities in arid/rainfed areas; and (ii) increased water-use and on farm management capacities. At the commencement of the PPTA a portfolio of 12 potential subprojects prepared by the Executing Agenecy was provided for evaluation. The initial feasibility study for the Project was prepared in May, 2012[1].

41. The 12 subprojects were evaluated and ranked on the basis of evaluation criteria developed by the Consultants and approved by ADB and the EA. Based on this ranking, 3 core subprojects were selected for further studies and updating of feasibility studies, under the current PPTA. The joint venture of Integrated Consulting Services (ICS) and Halcrow Pakistan (ICS-HPK Joint Venture) was retained by ADB to review and update the feasibility studies and undertake the environmental studies for the selected three core sub-projects. Preliminary engineering designs, cost estimates, and Planning Commission Proforma No.1 (PC-1) of the 3 core subprojects will also be reviewed and updated as required.

42. The selected Core subprojects include:

- ❑ Pehur High Level Canal Extension
- ❑ Chapra Dam
- ❑ Chamak Mira Dam

43. In May 2015, the Government of Khyber Pakhtunkhwa requested ADB to unbundle the Pehure High Level Canal Extension Project from KPWRSP, and to process this Project as a standalone loan facility. Thus, an ADB loan of about $ 86.4 million is being processed for the Project.

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[1]2012 Irrigation Department, Government of Khyber Pakhtunkhwa. Feasibility Study for Pehur High Level Canal Extension.

44. This environmental impacts assessment (EIA) report is prepared for the Pehur High Level Canal Extension Project.

1.2 Pehur High Level Canal Extension

45. During construction of the Tarbela Dam Project, between 1968 and 1974, a decision was made to provide an irrigation supply tunnel through the right abutment of the dam, which later on was to provide irrigation water to the rain fed areas lying in the adjacent districts of the Tarbela Reservoir and to supplement the Upper Swat Canal in its tail reaches. Accordingly the initial 500 m length of Gandaf Tunnel was constructed to provide irrigation water in the future. The implementation of the project was delayed due to provincial disputes on the division of Indus river waters. In March 1991, the Water Apportionment Accord was signed by the provinces, which allocated about 7.03 billion cubic meter (BCM) water to the North West Frontier Province (NWFP) now Khyber Pakhtunkhwa (KP). In May 1994, Government of Pakistan approved the construction of Pehur High Level Canal to provide supply to the rain fed areas of Swabi district of NWFP (now KP) and to augment supplies of Upper Swat Canal System (USCS) with a gross water allocation of 0.654 BCM from Tarbela reservoir. The construction of the remaining length of the Gandaf Tunnel was undertaken with the construction of Pehur High Level Canal (PHLC) during 1994-2003, financed by ADB. The tunnel as constructed has a capacity of 28.3 m^3/s and is 4.65 km long.

46. Upper Swat Canal (USC) System was commissioned in 1914 after the construction of “Benton Tunnel” across the Malakand Hills. The offtakes water from Swat River from Amandara Headworks. After crossing through Malakand Hill, USC passes through the Pitched Channel and bifurcates into two major branches, namely Machai and Abazai, at Dargai. Soon after construction of Benton Tunnel, a 20 MW hydel powerhouse was installed at Jabban by diverting water through a connection tunnel known as “Birkett Tunnel”. Later the same water was conveyed downstream through a power channel and another power station of 20 MW with the name of Dargai powerhouse was constructed after Independence. Machai Branch after passing about 74 km length was again bifurcated into two major branches i.e. Maira and Indus.

47. Due to the longer length in the sandy belt, the Indus Branch was often facing tail shortages since its commissioning. To overcome this problem, the Indus Branch was cut off along its length and a Link channel was taken off from Maira Branch at about 17 km downstream. This link channel bifurcates at its end into two sub-branches. The right one is called Indus and the Left one is called Ambar Branch, whereas the original Indus Branch was renamed as Old Indus Branch. Due to the limitation of water in Swat River in Rabi, the tail end was still suffering shortages of water. Therefore, a lift canal called Pehur Main Canal was taken off from the Indus River downstream of Tarbela. It flows parallel to the Indus and Ambar Branches but at a lower elevation. The original minors from the Indus and Ambar Branches were cut off at their crossing points with Pehur Main Canal (PMC) and downstream reaches of all the minors are now fed from the PMC. After the construction of Ghazi Barotha barrage, the PMC was converted into a gravity canal. A significant area being at a higher altitude is still left unirrigated between the Maira Branch and Indus/Ambar Branches.

48. In the nineties, the USC was remodelled under Swabi Salinity Control and Reclamation Project (Swabi SCARP) with the construction of a new Auxiliary Tunnel beneath Malakand Hills parallel to the existing Benton Tunnel. Meanwhile the Water Apportionment Accord among the provinces was signed in March, 1991, that defined the water share of provinces. In late nineties, revised PC-1 of PHLC project was approved

wherein water allocation was made for existing as well as newly proposed areas to be developed in two stages. About 113,297 ha (279,963 acres) of land was intended to be served from the combined USC-PHLC system upon commissioning of PHLC. At full development, an additional 15,293 ha (37,654 acres) of Cultivable Command Area was proposed to be brought under irrigation. The areas proposed for future development included Ballar-4,047 ha (10,000 acres), Bazai Lift Irrigation Scheme-4,661 ha (11,517 acres), Janda Boka Lift Irrigation Scheme-1,741 ha (4,302 acres), Ambar Lift Irrigation Scheme 2,242 ha (5,539 acres) and Indus Lift Irrigation Scheme-2,548 ha (6,296 acres) through either USC, PHLC or from combination of both UCS and PHLC. The commissioning of PHLC in 2003 not only ensured the availability of water to the tail end of the USC but also provided an opportunity to develop new areas for irrigation. Meanwhile Ballar area, too, was developed. Bazai Lift Irrigation scheme was converted to Gravity and its construction is now in progress. The areas under the remaining three lift schemes i.e. Janda Boka, Ambar and Indus are still awaiting irrigation development.

1.3 Project Rationale

49. About 113,297 ha of land was intended to be served under the PHLC after commissioning it in 2003. At full development, an additional area of 15,238 ha of cultivable command area (CCA) was to be brought under irrigation. The newly proposed areas to be developed included Bazai, Ballar, Janda Boka, Ambar and Indus through either USC, PHLC and combined PHLC – USC, respectively. Ballar area has already been developed and construction work of a gravity scheme for Bazai has already started. However, the remaining areas i.e. Janda Boka-Malikabad, Ambar and Indus could not be supplied with irrigation water from USC, PHLC or combined PHLC-USC.

50. The objective of the previous Feasibility Study for Extension of Pehur High Level Canal Project[2] was to find possible development scenarios for Janda Boka, Ambar and Indus areas, by proposing options to irrigate these lands. The initial concept proposed in this feasibility study report for irrigating Indus and Ambar areas as well as Janda Boka area was by lifting water from the PHLC.

51. These lift schemes, however, were not implemented due to constraints imposed by high energy costs and maintenance issues. The usual main constraints in the implementation of such schemes are the high cost of the imported electro-mechanical components and high Operation and Maintenance costs. In addition, choosing such options have become more difficult under the prevalent energy crisis in the country where electricity could hardly be provided to even the domestic users. Similarly, operations of diesel pumps for lift irrigation, in addition to generating greenhouse gases, are also expensive due to the high cost of oil prices in the international market.

52. Therefore, all efforts were made to find gravity options as substitute for the proposed lift schemes and bring the maximum possible area under gravity mode of irrigation inplace of opting for lift irrigation.

[2] 2012. Irrigation Department.Government of Khyber Pakhtunkhwa: Feasibility Study for Pehur High Level Canal Extension prepared by BAK-AGES Joint venture

53. Ambar and Indus areas can be brought under cultivation through a pressure pipe line and canal from Gandaf Tunnel outlet. The minimum operating levels of Tarbela Dam has been raised by about 24.3 m from the originally designed level and is estimated to vary between 423.07 m to 472m (Lower and Upper Operating Limits) during canal operatio period (2021 onwards). Most of the areas of Indus and Ambar are below 390m. Using the available head at Tarbela dam, irrigation water can be conveyed through a pressure pipe to Ambar area. From there onwards, gravity canals can easily irrigate the rest of the area.

54. The availability of a minimum of 24.3 m additional head in the Gandaf Tunnel Outlet portion due to raising of the minimum operating level of Tarbela Reservoir renders it possible to irrigate the high lands of the Janda-Boka by gravity. An outlet for the Janda Boka scheme has been provided in the design of PHLC. This outlet was then plugged in a valve chamber during the construction of PHLC. A pressure pipe of about 3.94 km in length and 1.22 m diameter will be constructed take the discharge to the high lands of the Janda Boka where from a gravity canal of 10.5 km would irrigate the command area of about Gross Command Area (GCA) 1,374 ha and Cultivable Command Area (CCA) of 1,316 ha.

55. The gravity option has a great advantage in terms of operation and maintenance costs as compared to the pumping/lift irrigation schemes.

1.4 Location of the Project

56. Most of the proposed area (96%) of Pehur High Level Canal Extension Project (PHLCEP) falls within the district of Swabi of KP Province, and about 4 % at the tail end extends to the district of Nowshehra. The whole area is spread in the form of two major chunks i.e. Janda Boka and Indus-Ambar. The proposed Janda Boka area lies near the Gandaf Tunnel outlet from Tarbela reservoir towards the right of PHLC, while the Ambar area start about 5 km to the west of Swabi town, and is spread on the left side of Maira Branch. Similarly, the Indus area adjoins the Ambar area towards the west and extends on the left side till the end reaches of Maira Branch. The location of the project is shown in Figure 1-1.

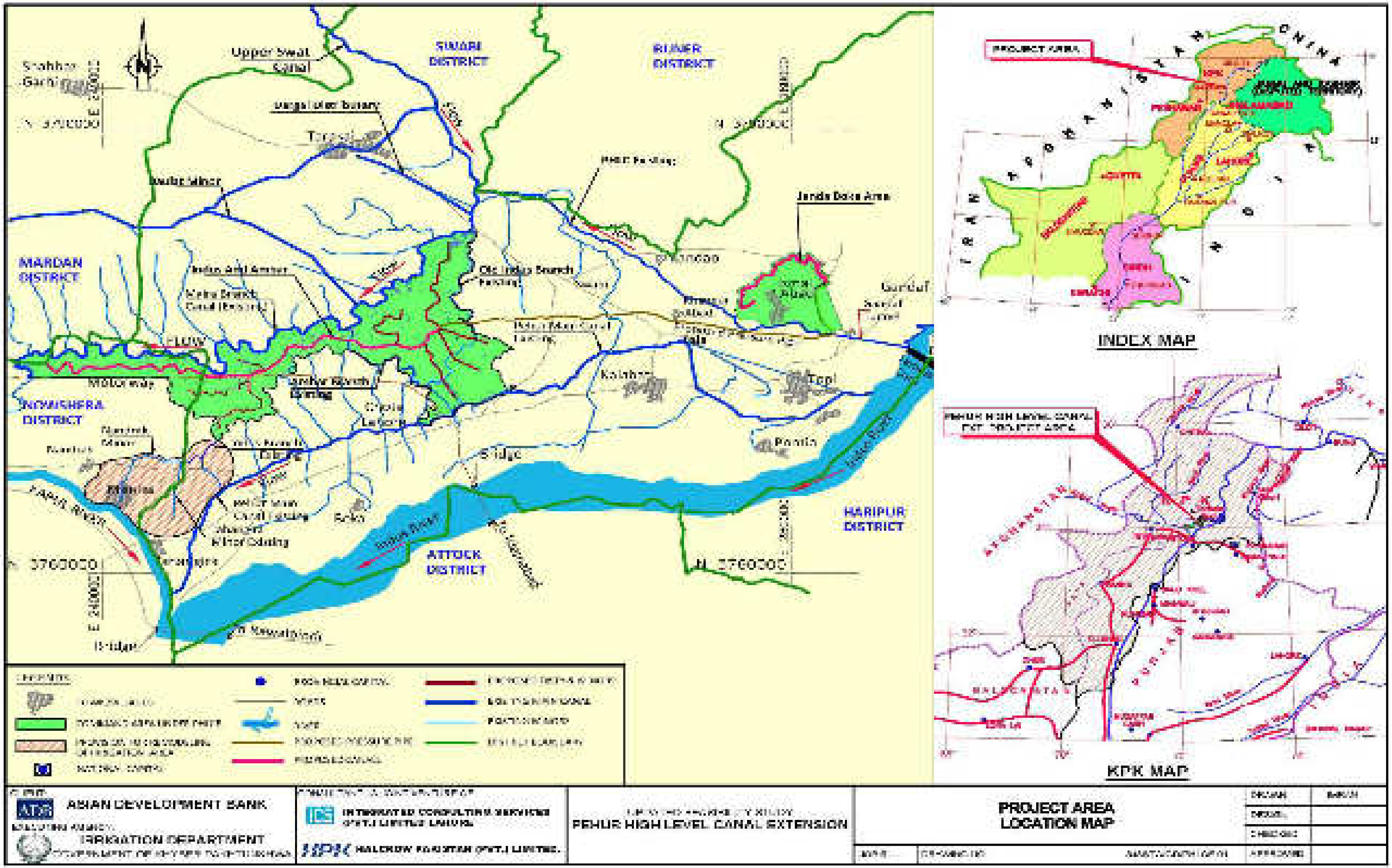


Figure 1-1: Pehur High Level Canal Extension Project Location

1.5 Project Components and Implementation

57. The Project envisages provision of irrigation supplies to an area of 8,727 ha. The Project include two separate command areas: (a) Janda-Boka-Malikabad Area of about 1,316 ha, and (b) Indus Ambar Area 7,411 ha. In addition the Indus-Ambar canal includes provision of additional supplies for irrigating about 1,400 ha for meeting shortfall in tail areas of Indus Branch (Nandrak minor and Jahangira minor etc) of the Upper Swat Canal. Under the project, only discharge capacity of the pressure pipe and canal system has been kept so that the water can be conveyed, however, remaining system rehabilitation of Indus Branch is not part of the project. Thus agriculture benefits have been computed on the area that is directly benefitting from the Project. Major works are listed below and are described in Section 3 of this report;

58. Main components of Janda Boka-Malikabad area include:

- Connection with Gandaf Tunnel
- Pressure Pipe and Outlet Works
- Main Janda Boka Canal
- Canal and Drainage Structures
- On Farm works including watercourses

59. Main components of Indus Ambar area include:

- Connection with Gandaf Tunnel
- Pressure Pipe and Outlet Works
- Ambar High Area pressure pipe and outlet works
- Main Indus Ambar Canal
- Distribution canals system in Ambar area
- Distribution canals system in Indus area
- Distribution canals system in Ambar High area
- On Farm works including watercourses

1.5.1 Administrative Setup

60. The Khyber Pakhtunkhwa Irrigation Department (KPID) is the executing agency (EA) for PHLCEP. There will be two implementing agencies (IAs) for implementing different components of the Project. KPID will be the IA with responsibility to manage and implement the components relating to increased irrigation water supply capacities and ensuring that an efficient and effective project management system is operational. The Khyber Pakhtunkhwa Agriculture Department (KPAD) will be the IA responsible for implementing components relating to increased water-use and farm-management capacities of the project.

61. A Project Steering Committee (PSC) has been established to review progress and make key decisions under the PPTA and will continue during project implementation. The PSC will be chaired by the Additional Chief Secretary, Planning and Development Department (P&DD) and will have Secretary KPID, Secretary KPAD, Member Board of Revenue, Project Coordinator, Project Director, and Consultant team leader as members. The Project Coordinator will be the secretary of the PSC.

1.6 Purpose of the EIA Report

62. The main aim and objectives of this EIA report are to:

- Provide information for decision-making on the environmental and social consequences of proposed project interventions;
- Establish an environmental baseline
- Determine potential environmental impacts and assess these in terms of severity, magnitude and timescale;
- Devise mitigation measures to mitigate the identified environmental and social impacts;
- Promote environmentally and socially sound and sustainable development through the identification of appropriate enhancement and mitigation measures and monitoring programmes that will be required to ensure development of the project without significant adverse impacts;
- Meet the provincial, national, international and ADB standards;
- Ensure compliance with ADB SPS; and local Environment Laws;
- Public consultation and information disclosure, including amongst the local community;
- Development of an environmental management plan (EMP) for the adverse impacts, and,
- Determine tentative costs for implementation of the EMP.

1.7 Scope of the EIA Study

63. The scope of the EIA study complying with the requirement of the ADB SPS and requirements of KP EPA included but not limited to a detailed scoping exercise.

64. Study of the relevant baseline information including: biodiversity, noise, air quality and water quality; baseline surveys for each parameter that establish the prevalent environmental conditions in the area.

65. An assessment of environmental impacts of the Project and its ancillary activities.

66. An assessment of the cumulative environmental impacts of the project;

67. 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).

68. An Institutional review to assess the EA's implementation capacity with regard to environmental safeguards and a capacity development program to deal with each of the identified capacity gaps.

1.8 EIA Methodology

69. The Environmental impact assessment of the proposed project was risk based sensitivity approach where significance was categorized very high, high, medium and low. This study has been conducted using standard EIA methodologies and the assessment process included use of information from previous studies and incorporation of additional information gathered through site visits, discussions with officials of government departments and non-governmental organization (NGOs), and meetings with groups from the communities living in as well as adjacent to the project area. The contents of this report comply with the requirements of the Safeguard Policy Statement (2009) of ADB and also the requirements of the Khyber Pakhtunkhwa Environmental Protection Agency (KP EPA).

1.8.1 Review of previous studies

70. The earlier feasibility study[3] was reviewed and the required information was accordingly reflected in the EIA report supplemented by additional information from PPTA's Studies and the updated feasibility study. In addition, secondary data from available relevant reports were also reviewed for completing this EIA report. The ESIA report prepared for Tarbela 4TH Extension Hydro Power Project prepared in 2011 by Mott Macdonald for WAPDA was also reviewed.

1.8.2 Rapid Environmental Assessment

71. A Rapid Environmental Assessment (REA) survey was carried out by a team comprising environment specialists, engineers, irrigation engineer, resettlement specialists jointly with the Executive Engineer, Swabi KPID, in October, 2014. The site was revisited by environment specialists (national and international), engineers and ADB team along with the Executive Engineer, Swabi KPID in November, 2014. During these visits, preliminary environmental data was collected for project categorization in accordance with the REA Checklist and as required by the KP Environmental Protection Act 2014 (Pakistan Environmental Protection Act -1997), and the Pakistan Environmental Assessment Regulations, 2000 (also adapted by KP Environmental Protection Agency). The approach and methodology during data gathering was a combination of qualitative and quantitative techniques.

1.8.3 Baseline survey

72. Baseline information on prevailing environmental conditions was collected from both primary and secondary sources. The methodology adopted to acquire baseline information on the Project is as follows:

1.8.3.1 Primary data collection

73. Primary data on flora, fauna, soil and water quality and noise levels were collected through site visits and surveys. Walk through surveys were conducted by the field team along the alignment of the proposed interventions. As the RD (Reduce Distance) markers and bench marks installed during the topographic survey in 2012 could not be

[3] 2012. Irrigation Department.Government of Khyber Pakhtunkhwa Feasibility Study for Pehur High Level Canal Extension

located, a map was prepared from the available longitudinal profile (Drawings) of the proposed interventions in a KMZ file on Google Earth. This included the land features as well as GPS coordinates of the proposed alignment of pressure pipes and canals.

1.8.3.2 Secondary data collection

74. Secondary data was collected from the KPID, KP Wildlife and Forest Departments, Education and Social Welfare Departments and by reviewing the relevant studies/reports.

1.8.4 Public consultation

75. Fulfilling the requirement of the ADB SPS, effective and meaningful public consultation with the stakeholders was carried out in the core and secondary impact zones.

76. The PPTA team carefully noted the views and opinions of the local people, residents and interested groups, and incorporated these in the EIA preparation. The first round of public consultation was carried out from 1 March, 2015 to 23 April, 2015 and the second round of public consultation was completed during the period 8 June, 2015 to 14 June, 2015.

1.8.5 Use of geo-reference based Information

77. Geo-reference satellite imageries available in free domain were used to locate the project infrastructure, contractor’s camp sites, existing settlements, land use, soil and water sampling sites as well as other socio-environmental features.

1.8.6 Information disclosure

78. After completion/revision and approval from the ADB, the KP Irrigation Department will disclose the EIA to all the stakeholders as part of public consultation process. The summary of the EIA report will be made available to the stakeholders at sites designated by KP-EPA in accordance with KPEPA Act, 2014. In addition, a non-technical summary of the EIA will be translated into Urdu language and made available to the local communities in the project area. This will ensure that local communities are aware of project key impacts, mitigation measures and project implementation mechanism. This summary will also be disclosed through the official website of KPID.

2. POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK

2.1 Introduction

79. This chapter provides an overview of the policy, legal and administrative framework that apply to the proposed PHLCE Project. The Project is expected to comply with all national and provincial legislations relating to environmental protection in Pakistan. This section also describes the applicable regulations of ADB and its guidelines as well as other relevant international policies.

80. Subsequent to the 18th Amendment of the Constitution of Pakistan in 2010, 'Environmental pollution and ecology' was transferred from the Concurrent Legislative List (CLL) to the legislative domain of the Provincial Assemblies. The legislation of Pakistan (now also applicable to, and adapted by, each province) contains many laws in the form of acts and ordinances which are driven by policies and have direct or indirect relevance and implications in the design, construction and operation of the PHLCE Project. The project has been assessed for compliance with the existing legal framework in Pakistan including the KP Province as well as relevant international policies and guidelines.

2.2 National Environmental Policies and Guidelines

2.2.1 National Conservation Strategy (1992)

81. The Pakistan National Conservation Strategy (NCS) is the principal policy document for environmental issues in the country which was developed and approved by the Government of Pakistan in March, 1992. The NCS works on a ten-year planning and implementation cycle. It deals with fourteen core areas as follows:

i. Maintaining soils in cropland;
ii. Increasing irrigation efficiency;
iii. Protecting watersheds;
iv. Supporting forestry and plantations;
v. Restoring rangelands and improving livestock;
vi. Protecting water bodies and sustaining fisheries;
vii. Conserving biodiversity;
viii. Increasing energy efficiency;
ix. Developing and deploying material and energy renewable;
x. Preventing and abating pollution;
xi. Managing urban wastes;
xii. Supporting institutions for common resources;
xiii. Integrating population and environmental programmes;
xiv. Preserving the cultural heritages;

2.2.2 The National Environmental Policy (2005)

82. The National Environmental Policy (NEP) describes integration of the environment into development planning through the implementation of the IEE and EIA process at the scheme level. The NEP is the overarching framework which aims to protect, conserve and restore Pakistan's environment in order to improve the quality of life of the citizens through sustainable development. The policy includes guidelines to Federal, Provincial and Local Governments under the following headings:

- Water supply and management
- Air quality and noise
- Waste management
- Forestry
- Biodiversity and protected areas
- Climate change and ozone depletion
- Energy efficiency and renewable energy
- Multilateral environmental agreements

83. Cross-sectoral guidelines are also included which link the environment to poverty, population, gender, health, trade, local governance and natural disaster management.

2.2.3 Guidelines for Sensitive and Critical Areas (1997)

84. The Guidelines for Sensitive and Critical Areas, 1997, identify officially notified protected areas in Pakistan, including critical ecosystems, archaeological sites etc., and provides checklists for environmental assessment procedures to be carried out inside or near such sites. Environmentally sensitive areas include, among others, archaeological sites, biosphere reserves and natural parks, and wildlife sanctuaries and preserves.

2.2.4 The Solid Waste Management Policy (2000)

85. This policy was promulgated by Pakistan Environmental Protection Act (PEPA), which aims to facilitate control on waste by providing principles of good waste management and reducing waste at source. The Guidelines would be consulted during planning and designing the disposal of solid waste from contractor’s camps and other construction waste.

2.3 Applicable Laws

2.3.1 KP Environmental Protection Act (2014)

86. In the light of the provisions of Article 270 AA (6), as amended by section 96 of the18th Amendment, PEPA Act 1997, shall continue to remain in force until repealed or amended by the competent authority, which is now the Provincial Assembly in respect of the KP Province.

87. The first draft of the KP Environmental Protection Act 2014 was passed on 25 Nov, 2014, by the provincial assembly.

88. The Pakistan Environmental Protection Act (PEPA), 1997, is still the basic legislative tool empowering the KP government to frame regulations for the protection of the environment.

89. The Act is applicable to environmental parameters such as air, water, soil, and noise pollution, as well as to the handling of hazardous wastes. The Act provides the framework for protection and conservation of species, wildlife habitats and biodiversity, conservation of renewable resources, establishment of standards for the quality of the ambient air, water and land, establishment of Environmental Tribunals, appointment of Environmental Magistrates, Initial Environmental Examination (IEE) and EIA approval. Penalties have been prescribed for those who contravene the Act.

90. This Act has a direct bearing on the proposed PHLCEP as the project requires an Environmental Impacts Assessment (EIA). Further, as PHLCEP is located mainly in the district of Swabi, it falls under the jurisdiction of the KP Environmental Protection Agency that will be responsible for approval of the EIA of the project.

91. The following are the key features of the Act that have a direct bearing on the project area.

- Section 11 (Prohibition of Certain Discharges or Emissions) states that “Subject to the provisions of this Act and the rules and regulations made thereunder, no person shall discharge or emit, or allow the discharge or emission of, any effluent or waste or air pollutant or noise in an amount, concentration or level which is in excess of the KP Environmental Quality Standards (KP EQS)”.
- Section 13-I (Initial Environmental Examination and Environmental Impact Assessment) requires that “No proponent of a project shall commence construction or operation unless he has filed with the KPEPA an IEE or, where the project is likely to cause an adverse environmental effect, an EIA, and has obtained from the Agency approval in respect thereof.” This EIA has been prepared for the PHLCEP to comply with this Section of the Act.
- Section 13-2b (Review of IEE and EIA): The KP EPA shall review the Environmental Impact Assessment report and accord its approval subject to such conditions as it may deem fit to impose, or require that the IEE/EIA be re-submitted after such modifications as may be stipulated, or rejected, the project as being contrary to environmental objectives.
- Section 15 (Handling of Hazardous Substances) requires that “Subject to the provisions of this Act, no person shall generate, collect, consign, transport, treat, dispose of, store, handle, or import any hazardous substance except (a) under a license issued by the KP EPA and in such manner as may be prescribed; or (b) in accordance with the provisions of any other law for the time being in force, or of any international treaty, convention, protocol, code, standard, agreement, or other Instrument to which Pakistan or province of the KP is a party.” Enforcement of this clause requires the EPA to issue regulations regarding licensing procedures and to define ‘hazardous substance.
- Section 16 (Regulation of Motor Vehicles): Subject to provision of this clause of the Act and the rules and regulations made there under, no person shall operate a motor vehicle from which air pollutants or noise are being emitted in an amount, concentration or level which is in excess of the KP EQS, or where the applicable standards established under clause (vii) of subsection (1) of Section-6 of the Act.

2.3.2 Factories Act (North-West Frontier Province Amendment) Ordinance. 1971.

92. The clauses of the Factories Act relevant to the project are those which concern health, safety and welfare of workers, disposal of solid wastes and effluents, and damage to private and public property. The Factories Act also provides regulations for handling and disposal of toxic and hazardous materials. As construction activity is classified as ‘industry’, these regulations will be applicable to the project construction contractor.

2.3.3 Forest Act (1927)

93. This federal Forestry Act of 1927 authorises Provincial Forest Departments to establish forest reserves and protected forests. The Act prohibits any person to set fire in the forest, quarry stone, remove any forest produce or cause any damage to the forest by cutting trees or clearing up area for cultivation or any other purpose.

2.3.4 Protection of Trees and Brushwood Act(1949)

94. The Protection of Trees and Brushwood Act prohibits illegal cutting or lopping of trees along roads and canals planted by the Forest Department. The matter of permission to remove any trees, their compensation, and plantation to replace the lost trees will be taken up with the KP Forest authorities.

2.3.5 Antiquity Act (1975)

95. The Antiquity Act provides for the protection of cultural resources in Pakistan. This act is designed to protect antiquities from destruction, theft, negligence, unlawful excavation, trade and export. Antiquities have been defined in this act as “Ancient products of human activity, historical sites, sites of anthropological or cultural interest and national monuments etc”.

96. The Act prohibits new construction in the proximity of a protected antiquity and EMMPowers the Government of Pakistan to prohibit excavation in any area that may contain articles of archaeological significance.

97. Under this Act, the proponents are obligated to ensure that no activity is undertaken in the proximity of a protected antiquity, and during the course of the project if an archaeological discovery is made, it should be reported to the Department of Archaeology accordingly.

98. No protected or unprotected antiquity has been identified in the project area that may be affected by the project interventions. However a chance find procedure has been included in this EIA in case of any, as yet, unidentified antiquity.

2.3.6 KP Wildlife and Biodiversity Act, 2015

99. The KP Wildlife and Biodiversity Act aims to consolidate the laws relating to protection, preservation, conservation and management of wildlife and biodiversity in the Province of the Khyber Pakhtunkhwa. The aims and objects of this Act are (a) strengthening the administration of the organization to effectively manage wild animals and their habitats; (b) to holistically manage Protected Areas in a sustainable manner for the best interest of the indigenous communities and local stakeholders; (c) securing appropriately the goods and services produced from wild animals and their habitats at the level of local communities; (d) fulfilling the obligations envisaged under the biodiversity related multilateral environmental agreements ratified by the Government of Pakistan; (e) promotion of public awareness and capacity building for proper appreciation of the environmental significance and socio-economic values of wildlife; and (f) conservation of biological diversity and realization of its intrinsic and extrinsic values through sustainable use and community participation.

2.3.7 National Environmental Quality Standards (2010)

100. The National Environmental Quality Standards (NEQS) were first promulgated in 1993 and have been amended in 1995 and 2000 including standards for liquid effluent and gaseous emissions. The standards for ambient air, drinking water quality and noise levels were published on November, 2010 and standards for motor vehicle exhaust, diesel vehicle, and petrol vehicles published in August, 2009.

101. The relevant NEQS are provided in Annexure-I and the contractor shall be bound to comply with these.

2.3.8 The Land Acquisition Act (LAA)1894

102. The Land Acquisition Act (LAA) of 1894 is the key legislation that has direct relevance to land acquisition, resettlement and compensation in Pakistan. Each province has its own interpretation of the LAA, and some provinces have also passed provincial legislations. The LAA and its implementation rules require that before implementation of any development project the privately owned land and crops are compensated to titled landowners and/or registered tenants/users etc.

103. It is envisaged that implementation of PHLCEP interventions will require the acquisition of about 250 ha of land along the alignments of pressure pipes and canals and for construction of storage tanks etc. The project offices and contractor camps will be established on private land which is available adjacent to proposed alignments.

2.3.9 National Resettlement Policy (Draft March 2002)

104. Following a national consultative process, a National Resettlement Policy and related ordinance were drafted. The draft policy and ordinance are presently being reviewed by the provinces, and are yet to be approved and notified by the provincial governments. The salient applicable features of the Draft Resettlement Policy are given below:

- The Pak-EPA will be responsible for both environment-related as well as resettlement-related matters.
- The responsibilities for implementation at provincial level are to be delegated to the concerned provincial EPAs with overall control of the Planning and Development Department.
- All categories of ‘loss’ arising from development projects that entail resettlement, need to be addressed: these include not only loss of land, built-up property, other infrastructure, and crops and trees, but also loss of income, job opportunities, and access to natural resources.
- Vulnerable groups whose issues need to be addressed in particular include: women, children, destitute persons, tribal communities, squatters, those with usufruct rights, and landless groups.
- There should be a particular Emphasis on consultation with affected groups when preparing a LARP.

2.3.10 Project Implementation and Resettlement Ordinance 2001

105. The government of Pakistan has proclaimed an ordinance entitled “Project Implementation and Resettlement of the affected Persons Ordinance 2001”. This ordinance establishes that the resettlement of involuntary displaced persons is done as a matter of right and not by way of charity and affected persons (APs) shall be accepted as a special group, who in the supreme interest of the country have accepted/undergone involuntary displacement. The proposed ordinance shall be supplementary to the LAA1894 as well as others laws of land wherever applicable under resettlement policy.

2.4 Applicable Provincial Rules, Laws and Policies in KP

106. In addition to the KP Environmental Protection Act (KP EPA ACT) 2014; the other provincial acts, rules and laws which are applicable in the implementation PHLCEP are presented below;

2.4.1 NWFP Wildlife Act, 1975

107. The NWFP Wildlife Act, 1975, is for the preservation, protection, and conservation of wildlife by the formation and management of protected areas and prohibition of hunting of wildlife species declared protected under the Act. The Act also specifies three broad classifications of the protected areas: National parks, Wildlife sanctuaries and Game reserves. However, threr are no National parks, Game reserves and Wildlife sanctuaries in the project area.

2.4.2 NWFP Private Game Reserve Rules, 1993

108. The Rules specifies that any private land having potential for the development of game reserve and dedicated by its owner in writing is a game reserve. The government by notification declares it as game reserve and hunting and trapping of the game as well as wild animals are prohibited in the area. There are no Game Reserves in the project area.

109. A community game reserve is an area dedicated by village community for the purpose similar to a game reserve. Hunting and shooting of wild animals by any person is not allowed in a community game reserve except by the permission of village community.The numbers of community game reserves in Swabi District are given in the chapter 4 but no community game reserve exists in the project area.

110. A private game reserve is an area dedicated by its owner for the purpose similar to a community game reserve. There are no private game reservesin the proposed PHLCEP area.

2.4.3 NWFP Wildlife Protection Act, 1975

111. The NWFP Wildlife Protection Act of 1975 provides for the preservation, protection, and conservation and management of wildlife by the formation and management of protected areas and prohibition of hunting of wildlife species declared protected under the Act.

112. A wildlife refuge is an area set aside to provide safe heaven to the species of wildlife. Hunting and shooting of all wildlife species found in the refuge is strictly prohibited. No wildlife refuges exist in the project area.

113. A wildlife park is usually a fenced area set aside for the conservation of endangered wildlife species under semi natural conditions. The wildlife park is also used for conservation education and public recreation. Hunting, killing, capturing, polluting the water and damaging or destruction of the vegetation is strictly prohibited. There are two wildlife parks: Cherat and Manglot wild life protection areas are situated in Nowshehra District but outside the project area.

2.4.4 Other Applicable Laws

114. The other applicable rules and laws of the KP province are listed below

a. West Pakistan Fisheries Ordinance 1961
b. NWFP Forest Ordinance 2002
c. NWFP Forestry Commission Act 1999
d. NWFP Forest Development Corporation Ordinance 1980
e. NWFP Management of Protected Forests Rules 1975
f. NWFP Protection of Trees and Brushwood Act 1949

2.5 International Policies and Guidelines

115. It is a requirement of international financing agencies, particularly, Asian Development Bank, World Bank, Japan International Co-operation Agency, and KfW[4] that the governments seeking financial assistance from these financiers for development projects should carry out Environmental and Social Assessments and Resettlement Planning, as specified in their safeguard policies and guidelines.

2.5.1 ADB Safeguard Policies

116. Governments seeking financing from the ADB are required to comply with the applicable environmental and social safeguards policies. ADB safeguard policy statement (1996) consists of three OPs i.e. (a) the environment (b) indigenous people and, (c) involuntary resettlement. ADB requirements as stated in ADB SPS (2009) are that the EIA should at least include:

- A detailed scoping exercise
- Study of the relevant baseline information including: biodiversity, noise, air quality and water quality; baseline surveys for each parameter that establish the prevalent environmental conditions in the area.
- An assessment of environmental impacts of the operation and its ancillary activities;
- Include an assessment of the cumulative environmental impacts of the project.

[4]Government-owned development bank of Germany,

- 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).

- An Institution review with regards to the EAs implementation capacity with regards to Environmental safeguards. Prepare a capacity development program to deal with each of the identified capacity gaps.

- Meaningful public consultation at least twice during the environmental assessment process, once at the planning stage and once when the detailed design is available for sharing with all stakeholders. Consult all local and national level stakeholders, including Community based organization as and national and international NGOs actively working in the area.

117. The key ADB Policy Principles with regard to involuntary resettlement are; (i) the need to screen the project early in the planning stage, (ii) carry out meaningful consultation, (iii) at the minimum restore livelihood levels to what they were before the project, improve the livelihoods of displaced vulnerable groups (iv) prompt compensation at full replacement cost to be paid (v) provide displaced people with adequate assistance, (vi) ensure that displaced people who have no statutory rights to the land that they are working are eligible for resettlement assistance and compensation for the loss of no-land assets and (vii) disclose all reports.

2.5.2 Relevant International Treaties and Conventions

118. Pakistan is a signatory to a number of international environment related treaties, conventions, declarations and protocols. The following are the relevant international treaties and conventions to which Pakistan is a party:

- Convention on Conservation of Migratory Species of Wild Animals 1979;
- International Plant Protection Convention, 1951
- Convention on Wetlands of International importance especially as Waterfowl Habitat, Ramsar,1971 and its amending protocol, Paris,1982
- Convention concerning the Protection of World Culture and Natural Heritage (World Heritage Convention), 1972
- Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), Washington, 1973;
- Vienna Convention for the Protection of the Ozone Layer, Montreal, 1987.
- Convention on Biological Diversity, Rio de Janeiro, 1992.
- United Nations Framework Convention on Climate Change, Rio de Janeiro, 1992
- Convention on the Control of Trans boundary Movements of Hazardous Wastes and their Disposal, 1992
- Plant protection Agreement for the Asia and Pacific Region, 1956
- Male Declaration on Control and Prevention of Air Pollution and its Likely Trans boundary Effects for South Asia, 1998.
- Kyoto Protocol, 2005
- Ramsar Convention:

2.6 Environment Regulatory Framework

119. The success of EIA as a mean of ensuring that development projects are environmentally sound and sustainable depends in large measure on the capability of regulatory institutions for environmental management.The institutional framework for decision making and policy formulation in environmental conservation is briefly described below.

2.6.1 National Disaster Management Authority- Climate Change Division

120. Subsequent to the 18th Amendment to the Constitution, the Environment Ministry functions were devolved to the provinces and a new Ministry of National Disaster Management was created. The Government of Pakistan renamed the Ministry of National Disaster Management in 2012, as the Ministry of Climate Change to deal with the threats posed by global warming and to protect environment in the country. The National Policy of Climate Change was also approved in the same year.

121. The Climate Change policy stipulates the following measures regarding environmental assessment:

- Adopt necessary measures to redesign administrative structures and procedures of Federal and Provincial EPAs and Planning and Development Division to integrate climate change concerns into Initial Environmental Examination (IEE) processes;
- Ensure that IEE/EIA and other mechanisms are strictly observed in all development projects, particularly infrastructure projects, by the concerned agencies.

122. The ministry has now been dissolved and transformed into a division under National Disaster Management Authority that would implement the National Policy on Climate Change with coordination of Provincial Governments.

2.6.2 Pakistan Environmental Protection Council (PEPC)

123. The PEPC is the highest inter-ministerial statutory body in the country headed by the Chief Executive of Pakistan for formulation of national environmental policy, enforcement of Pakistan Environmental Protection Act (PEPA) 1997, approval of the NEQS, incorporation of environmental considerations into national development plans and policies, to provide guidelines for the protection and conservation of biodiversity in general and for the conservation of renewable and non-renewable resources. The PEPC oversees the functioning of the Pakistan Environment Protection Agency.

124. Through a notification dated 29th June, 2011, the Secretariat of Pakistan Environmental Protection Council under the Pakistan Environmental Act, 1997(XXXIV of 1997)" was assigned to the Inter-Provincial Coordination Division under National Disaster Management Division.

2.6.3 Pakistan Environmental Protection Agency

125. The Pakistan Environmental Protection Agency (Pak-EPA) headed by a Director General has wide ranging functions given under the PEPA including preparation and co-ordination of national environmental policy for approval by the PEPC, administering and implementing the PEPA and preparation, establishment or revision of the National Environment Quality Standards (NEQS). The Pak-EPA also has the responsibility for reviewing and approving IEE and EIA reports for the following projects:

- Projects on federal land
- Military projects
- Projects involving trans-country or trans-province impacts

126. The responsibility for the review and approval of all other IEE and EIAs was delegated to the relevant Provincial Environmental Protection Agencies.

127. Under notification dated 29th June, 2011 the Pakistan Environmental Protection Agency was assigned to the Capital Administration and Development Division under National Disaster Management Division.

2.6.4 Non-Government Organizations

128. International environmental and conservation organisations, such as the International Union for the Conservation of Nature (IUCN) and the World Wide Fund for Nature (WWF) are active in Pakistan. Both these Organisations have worked closely with the Government and have played an advisory role with regard to the formulation of environmental and conservation policies. Since the Rio Summit (1992), a number of national environmental Non-Governmental Organisations (NGOs) have also been established, and have been engaged in advocacy and, in some cases, research. The other prominent environmental NGOs include, Sustainable Development Policy Institute (SDPI), Leadership for Environment and Development (LEAD), Society for Conservation and Protection of Environment (SCOPE) and Pakistan Institute for Environmental Development and Research (PIEDAR).

129. Environmental NGOs have been particularly active in advocacy and promoting sustainable development approaches. Much of the Government's environmental and conservation policy has been formulated in consultation with leading NGOs, who have also been involved in drafting new legislation on conservation.

2.7 KP Institutional Framework

130. The institutions which have the responsibility in KP to regulate interventions which could have potential impacts on the environment are detailed below.

2.7.1 KP Environment Department/Environment Protection Agency (KP EPA)

131. EPA NWFP (now Khyber Pakhtunkhwa (KP)) was established in 1989 under the administrative control of Provincial Planning and Housing (PPandH) Department. Later, in 1992, it was transferred to the Planning and Development (P&D) Department as an attached department. Recently it has been placed under the newly established Environment Department. The functions of the KP EPA are;

- Administer and implement the Act of 1997, its rules and regulations; Review of IEE/EIA, preparation procedures and guidelines;
- Preparation revision and enforcement of NEQS (industries, municipalities, vehicular emission etc);
- Establish and maintain laboratories, certification of laboratories for conducting "tests and analysis" ;
- Assist local Councils/Authorities, Government Agencies in execution of projects, establish a system for surveys, monitoring, examination and inspection to combat pollution;

- Conduct training for Governmentfunctionaries and industrial management;
- Provide information and education to the public on environmental issues;
- Publish the annual State of the Environment report; Survey qualitative andquantitative data on air, soil, water, industrial/municipal and traffic emissions;
- Take measures to promote environment related RandD activities

2.7.2 KP Disaster Management Authority

132. The Government of Khyber Pakhtunkhwa established the Provincial Disaster Management Commission (PDMC) as well as the Provincial Disaster Management Authority (PDMA) in October, 2008, under the National Disaster Management Ordinance, 2007 to cater to the whole spectrum of policy and coordination for Disaster Management. The Provincial Relief, Rehabilitation and Settlement Authority (PRRSA) has also been created under the PDMA to plan and coordinate the overall reconstruction, rehabilitation and settlement efforts, and provide ease, facilitation, speed and one window facilitation to donors.

133. A Separate Relief, Rehabilitation and Settlement Department (RRand SD) had been in existence since 2002. However, in order to meet the challenges in handling of disaster management and also to provide policy linkage to PDMA at strategic level, it was strengthened and its revised functions were drawn up and reflected in the Khyber Pakhtunkhwa Rules of Business, 1985. PDMA was declared as its attached authority.

2.7.3 KP Irrigation Department

134. The Irrigation Department is headed by the Secretary, Irrigation who is assisted at Secretariat level by Additional Secretary, Deputy Secretary (Tech) and the Planning and Monitoring Cell (PMC). In all technical matters the Secretary is assisted by the PMC Cell which prepares draft proposals for annual development programs and public sector development plans. The PMC prepares plans, liaises with Federal Government and donor agencies regarding new schemes and also monitors progress of implementation of the existing portfolios. For execution of the water sector schemes and their operation and maintenance the secretary is assisted by two chief engineers; (Chief Engineer North Zone and Chief Engineer South Zone) and Director General, Small Dams and other secretariat staff. The Chief Engineers are assisted by Superintending Engineers (SEs), Executive Engineers (XENs) and other technical and administrative staff.Project Directors are appointed to manage large construction projects. A Project Director is in charge of construction of Rehabilitation of Warsak Canal. Similarly a Project Director is to be appointed to manage the implementation of PHLCEP.

135. The proposed PHLCEP falls under the jurisdiction of Chief Engineer, North Zone of KPID and under him Superintending Engineer, Mardan. The KPID does not have an environmental and social management cell to oversee the environmental and social aspects of the projects. There is only oneenvironmental specialist in the Planning and Management Cell of KPID. Accordingly, provision has been made in the Terms of Reference of Project Implementation Consultants to provide services of international and a national environmental specialists.

2.7.4 Agriculture, Livestock and Co-Operatives Department

136. Agriculture Department, Khyber Pakhtunkhwa (KPAD) has a mandate to improve the socio-economic conditions of the rural masses through development and application of innovative technologies in agriculture and livestock sub-sectors and for efficient management of

natural resources through institutional arrangements in the province. The Director General, On Farm Water Management (OFWM) will be the implementing agency for on farm components of all subprojects. (KPAD) hasthe following divisions:

- Directorate of Livestock and Dairy Development
- Veterinary Research Institute
- Directorate of Agriculture Engineering
- Directorate of On Farm Water Management
- Directorate of Agriculture Research
- Directorate of Agriculture
- Directorate of Fisheries.

137. The On Farm Water Management Directorate (OFWMD) was established as a department attached to KPAD. OFWMD is responsible for: (a) organization and establishment of water users' associations (WUAs), which can participate with the Government on cost sharing basis, (b) enhancing agricultural production through optimal use of irrigation water and improved water management and agronomic practices, and improving the overall application efficiency of irrigation system below the farm outlet by providing training to the members of the WUAs and OFWMD staff.

2.7.5 KP Wildlife Department

138. KP Wildlife Department was proclaimed as an attached Department in August, 1994. The functions of the department are to:

- Enforce the KP Wildlife (Protection, Preservation, Conservation and Management) Act of 1975 and the rules made there under.
- Conduct surveys of the wildlife and establish the distribution and status of various species.
- Identify, notify and manage National Parks, Wildlife Parks, Wildlife Refuges, Wildlife Sanctuaries and Game Reserves.
- Monitor the wildlife population trends in the Province.
- Manage the wildlife resources so as to maintain a healthy population of all existing species and at the same time provides a sustained harvest for sport purposes.
- Conduct management oriented research.
- Replenish the depleted wildlife population through protection and/or reintroduction programs.
- Carry out an extendededucation programme for creating awareness of wildlife conservation among people.

139. The proposed PHLCEP area falls under the jurisdiction of KP Wildlife Department, Mardan Division.

2.7.6 KP Forests Department

140. Since establishment of the Forest Department in 1871, a series of policy guidelines were issued during different periods for better management and development of the Forest resources and a number of developmental projects were launched to implement these policy

guidelines. Recognizing the significance of forests at the national level a country vide Forestry Sector Master Plan was prepared in 1991 by the Federal Government for the improved management of the country's forest resources.To implement the recommendations of this Master Plan, Forestry Sector Project was launched in 1996 in NWFP (now KP) with the financial assistance of ADB. The recommendations of this project were translated into NWFP Forest Policy approved in 1990. Major guiding principles of this policy are:

- Integrated resource management whereby different land use types (forests, watershed areas, range lands, bio-diversity areas etc.) and vegetation and other resource type (trees, shrubs, grasses, wild animals and fisheries) will be managed in an integrated way as part of the overall ecological system.
- Participation of the local communities and other stakeholders in the planning, implementation and monitoring of natural resource management activities.

141. The proposed PHLCEP falls under the jurisdiction of KP Forest Department, Mardan Division.

2.8 Project Categorization for Environmental Assessment

2.8.1 ADB Project category:

142. Subsequent to an environmental screening process ADB classifies development projects into three categories, A, B and C, depending on the type, location, sensitivity, and scale of the project, as well as the nature and magnitude of its potential environmental impacts[5]. As per ADB screening process, PHLCE Project has been classified as a Category A project which requires an EIA.

2.8.2 National Categorization and Approval Procedure

143. The Pak-EPA formulated regulations in 2000 for ‘Review of IEE and EIA’ which categorise 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 frem the schedule under which the project is categorised.

144. 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.

145. 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. PHLCEP has been categorized as Schedule II and requires an EIA.

[5]ADB. 2009 SPS Environmental safeguards, Manila

146. KP Irrigation Department 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.

147. According to the regulations no construction, preliminary or otherwise, relating to the project shall be undertaken until and unless approval of the Environmental Impact Assessment Report has been issued by the KP Environmental Protection Agency.

148. The Irrigation Department will submit the EIA Report on a prescribed application along with the processing fee to KP EPA. After submission of the EIA report, a thirty (30) day period for public comments will be provided. The assessment will be completed within a period of ninety days from receipt of the complete documents, and earlier than this wherever practicable. Following the completion of public hearing, if required, and the provision of any further data from the proponent, the decision shall be made and conveyed after thirty days thereafter.

2.8.3 Policy and Procedures for the Filing, Review and Approval of Environmental Assessments, 2000

149. The Policy and Procedures for Filing, Review and Approval of IEE/EIA, 2000, define the policy context and the administrative procedures that will govern the environmental assessment process, from the project pre-feasibility stage to the approval of the environmental report.

2.8.4 Guidelines for the Preparation and Review of Environmental Reports, 1997

150. The Guidelines for the Preparation and Review of Environmental Reports, 1997, address the project proponents, and specify:

- The nature of the information to be included in environmental reports
- The minimum qualifications of the EIA consultant
- The need to incorporate suitable mitigation measures into every stage of project implementation
- The need to specify monitoring procedures.
- The terms of reference for the reports are to be prepared by the project proponents themselves.

151. The reports must contain baseline data on the project area, a detailed assessment thereof, and mitigation measures.

2.8.5 Guidelines for Public Consultation, 1997

152. The Guidelines for Public Consultation, 1997, deal with approaches to public consultation and techniques for designing an effective programme of consultation that reaches out to all major stakeholders and ensures the incorporation of their concerns in impact assessment. The basic principles of these guidelines have been followed, and the public and other agencies were consulted in preparation of this study.

3. DESCRIPTION OF THE PROJECT

3.1 Introduction

153. This chapter describes the Project with focus on size and magnitude of the operation, salient features of the project, project components, resource use and proposed schedule for implementation.

3.2 Project Type and Objectives

154. The project is a water resources development project with the objective of providing irrigation supplies to communities who have not been provided with these services. The Project envisages extension of irrigation water supply to areas located at higher elevations and, therefore, not within the present commanded area of PHLC. It is proposed to utilize the available head from Tarbela Dam through pressure pipes offtaking from the Gandaf Tunnel opening into cultivable land at higher elevations to irrigate about 10,130 ha (in Janda Boka and Indus Ambar command areas.

155. The project area for enhancing the irrigation water supply is in Swabi District of Khyber Pakhtunkhwa Province and most of the proposed project area (96%) falls in District Swabi and extends partially (4%), at the tail end, into Nowshehra district. The whole area is spread in the form of two major chunks i.e. Janda Boka and Indus-Ambar. The proposed Janda Boka area lies near the Gandaf Tunnel outlet from Tarbela reservoir towards the right of Pehur High Level Canal (PHLC), while the Ambar area start about 5 km to the west of Swabi town, and is spread on the left side of Maira Branch. Similarly, the Indus area adjoins the Ambar area towards the west and extends to the left till the end reaches of Maira Branch.

3.3 Project Outputs

156. The outputs of the Project are (i) increased irrigation water-supply capacities (Output 1): this will be achieved by construction of new irrigation infrastructure to convey additional irrigation water supplies to the project area; and (ii) increased water-use and on farm management capacities (Output 2): this output will involve development of on-farm works including water courses, land levelling as required, introduction of high efficiency irrigation systems in part of the area, establishment of demonstration centres and capacity development of farmers for efficient utilization of available water resources.

157. Potential for hydropower generation exists at pressure pipe outlet(s) before the pressure pipes discharge into the main canals. During detailed design the Consultant will make an appraisal of hydropower potential and if the results indicate that hydropower generation is feasible, the project designs will make provisions for installation of a future power plant. The feasibility study and design of a power house, if any, does not form part of this assignment, and the inclusion of this additional assignment will be subject to the results of the appraisal for the hydropower potential, fund availability, and considerations by KP Government and ADB. At the moment, the hydropower component is not being considered and is not part of the scope of the present project.

3.4 Corridor of Impact

158. The Corridor of Impact (CoI) is the area in which there could be a direct impact as a result of project activities. The CoI includes the footprint of the temporary and permanent works or the working area required for completing the works and the surrounding area where project implementations would have an effect. Impacts would be due to land use changes, removal of structures, relocation of inhabitants, falling of trees, and disturbance during construction.

3.5 Salient Features of the Project

159. The salient features of the Project are shown in Table 3-1 and the project layout is presented in Figure 3-1.

Table 3-1: Salient Features of PHLCE Project

S.No.	Description	Unit	Indus and Ambar	Janda Boka	Total
1	Cultivable Command Area CCA	ha	7,411	1,316	8,727
2	Provision for additional command area	ha	1,400	0	1,400
3	Ultimate command area	ha	8,811	1,316	10,127
4	Discharge	Cumecs	4.19	0.65	4.84
5	Diameter of Pressure pipe	mm	2,000	1220/850	-
6	Maximum Command Level	m	390	408	-
7	Lengths	m	62,565	11,780	74,345
a	Length of Pressure pipe	m	24,170	3,939	27,668
b	Main Canal	m	27,400	10,530	37,930
c	Distributaries and Minor	m	35,165	1,250	36,415
8	RoW for Pressure Pipe (R/L)	m	5/9	5/9	
9	RoW for Canal (R/L)	m	21.5/20.5 Maximum	15/12 Maximum	

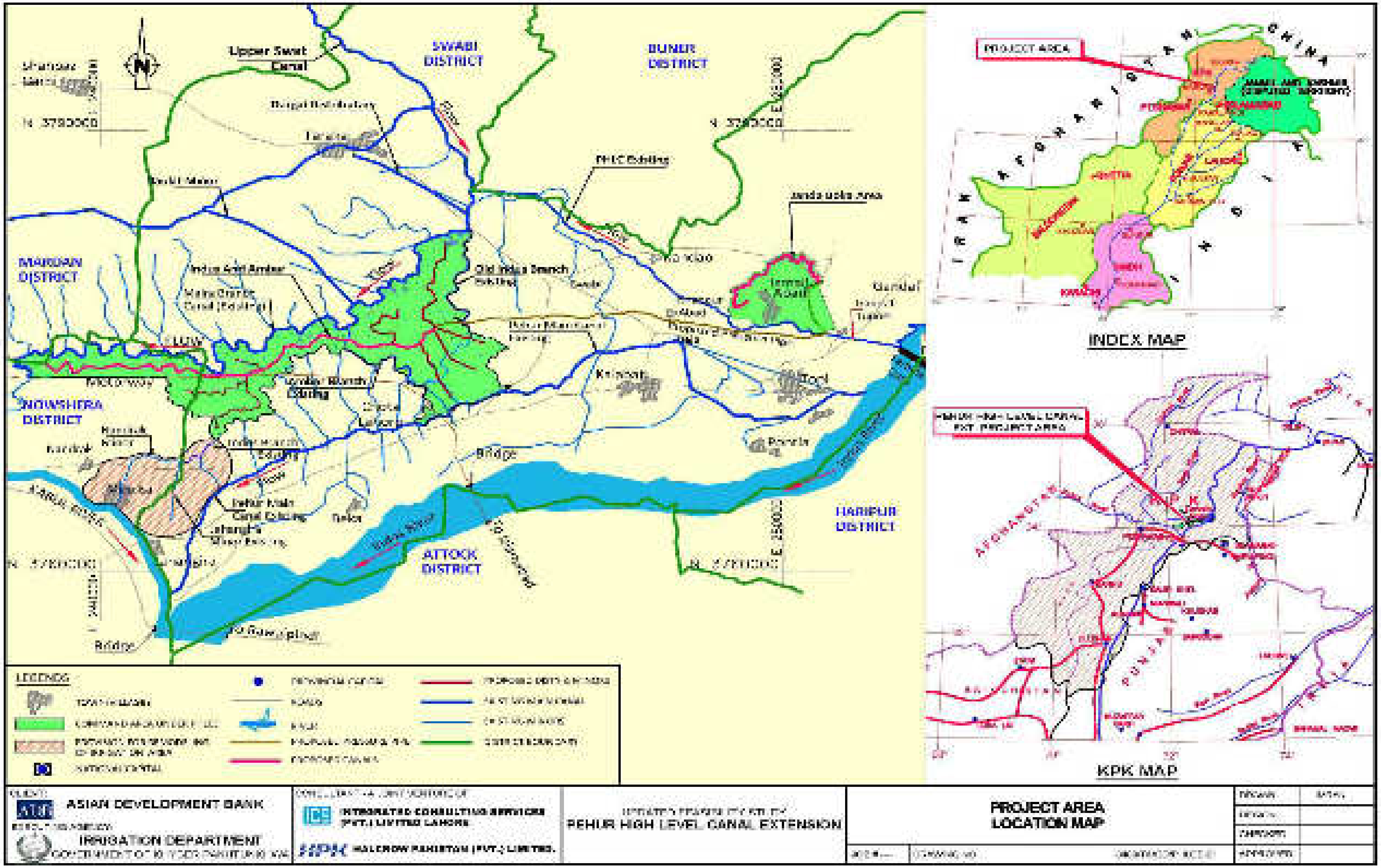


Figure 3-1 Layout Plan Showing Project Components

3.6 Description of the Proposed Action

3.6.1 Project Components

160. Project components include construction of new pressure pipes, canal system (main canal, distributary and minor canals); command area works including water courses, farm turnouts and promotion of precise land levelling and high efficiency irrigation system, establishment of demonstration centres and farmer field schools. A maximum discharge of about 4.84 m3/sec (171 ft3/s) is proposed to be diverted to provide irrigation supplies to the areas in the vicinity of PHLC, Machai Branch and Maira Branch Canals which as of today could not be brought under irrigation. The main canal and water courses in PHLCEP are proposed to be concrete lined, which would reduce the conveyance losses to 2%. By saving part of this water command areas can increase, cropping intensities and yields/ha can be improved which will help in achieving more agricultural production and higher incomes for the beneficiaries.

3.6.2 Main components of Janda Boka Area:

161. Main components of Janda Boka-Malikabad area include:

- Connection with Gandaf Tunnel
- Pressure Pipe and Outlet Works
- Main Janda-Boka Canal
- Canal and Drainage Structures

a) **Connection with Gandaf Tunnel:** An outlet has already been left for the proposed Janda-Boka area during the construction of Gandaf Tunnel. This outlet is off-taking from the tunnel just downstream of the access chamber before the Pehur Hydropower off-take point. A valve chamber was constructed at a distance of 21m from the tunnel centerline with a valve inside. The 0.60m dia pipe was plugged for the future Janda Boka Irrigation Scheme. This arrangement is much easier to be connected with the proposed pressure pipe to be extended to irrigate the Janda-Boka command area.

   The level of the tunnel's centerline at off-take point is 385m. Just after the valve, the pipe will be connected with a larger dia pipe of 1.22 m.

b) **Pressure Pipe and Outlet Works:** A 3.94 km long proposed pressure pipe connects the Gandaf Tunnel with the Janda Boka area. This pipe is 1.22 m diameter steel pipe with 6mm wall thickness in the initial 2.14 km reach after which the diameter is reduced to 0.85m for the remaining length. The pressure pipe will not only sustain the maximum Tarbela reservoir water head but also the water hammer due to sudden closure of the outlet valve. The pipe having coating against the corrosion will be embedded (minimum 1.5m from NSL) in the ground and will be provided with a reinforced concrete cover. There are two drainage and two air/vacuum valves proposed along the pipe to protect against the abnormal flow conditions in the pipe. The drainage valves are Globe valves to discharge the pipe flow to the nearest drain in case of emergency repair.

The pipe outlet is provided with a control system to regulate the flow for seasonal variation. Before the valve and operation room, a thrust block is proposed to absorb the transient of the emergency wave. The control system comprises of the two valves i.e. gate valve for open/shutdown conditions and a sleeve valve for regulation and energy dissipation. A stilling well is proposed at the outlet to dissipate excess energy during the higher level in the reservoir. The well is protected with steel sheets against the high pressure jets of the incoming water. Sleeve valve is protected against vibration by anchoring with the chamber walls. A control room is provided for the operator and emergency spare parts. A weir at the other side of well has been proposed to spill the water into a stabilizing pool which carries it to the canal.

c) **Janda Boka Main Canal and Minor:** From the outlet dissipation well, a 10.53 km long canal runs in the hill toe and commands the area to the left of canal. In addition a Minor is drawn from Pressure Pipe, which is 1,250m in length. There are a number of hill torrents crossed by the canal alignment along with a main river. Maximum discharge of the main canal is 0.48 cumecs having lined section i.e trapezoidal) with 1:1 side slope. Maximum discharge of minor is 0.17 cumecs, which too is a lined channel (trapezoidal section), in the initial reach and precast parabolic sections are provided in the tail reach. Bed width varies according to the discharge variation. Summary of structures along Janda Boka System is presented in Table 3-2.

Table 3-2: Structures on Janda Boka Main Canal

Structure's Type	No of Structures
Falls / Drops	4
Aqueducts	1
Cross Drainage Culverts	9
Road Bridges	14
Foot Bridges	11
Outlets	20

d) **Development of On Farm Works:** It is estimated that 20 water courses will be constructed, land will be levelled, high efficiency irrigation systems will be installed for demonstration purposes, demonstration plots will be set up and capacity building of farmers will be carried out to enable efficient utilization of available water resources. The proposed on farm works are described in Appendix 04 to the Final Report (Increased water-use and farm-management capacities in target areas).

162. The typical cross sections of canal are given in Figure 3-9.

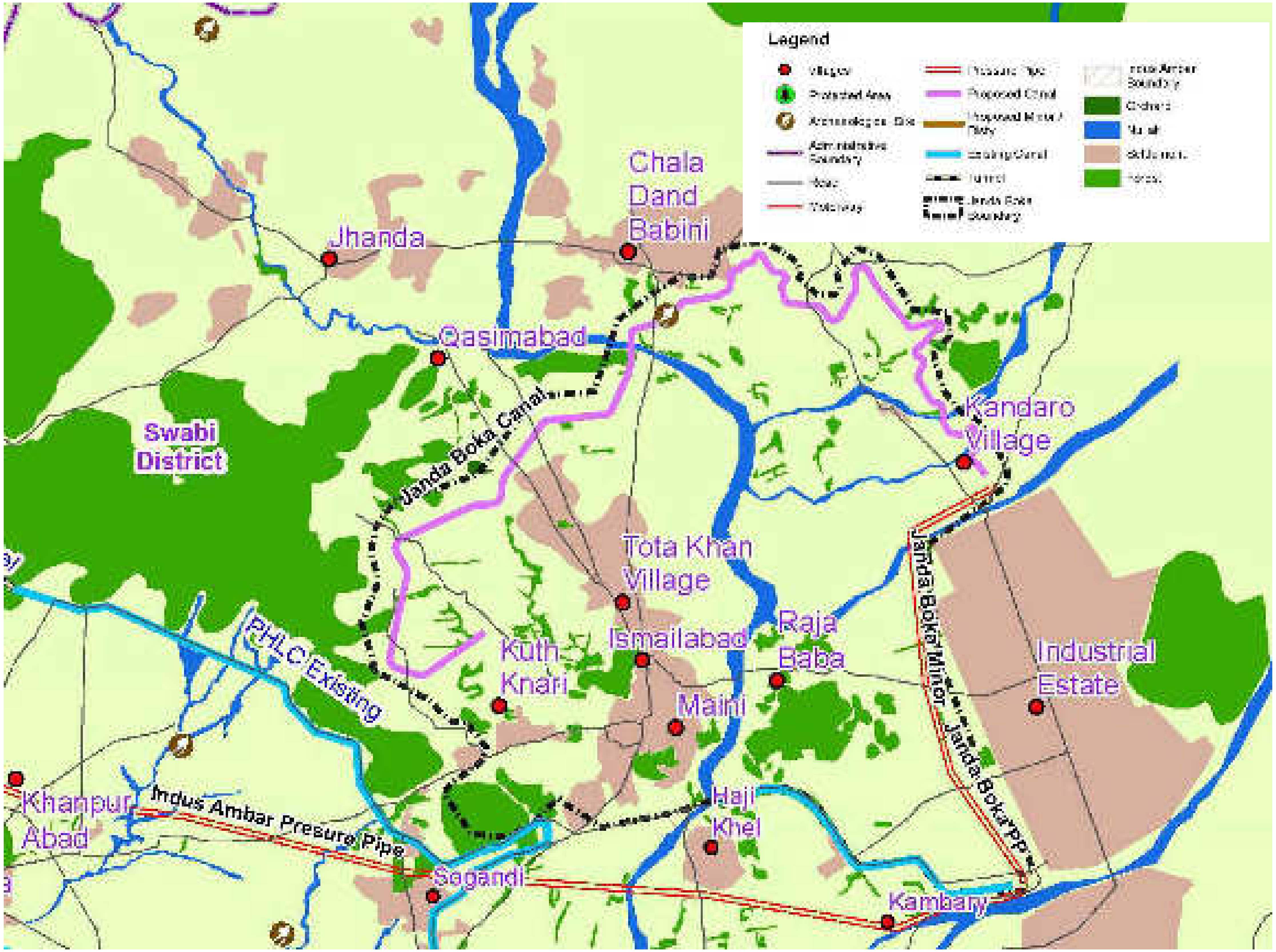


Figure 3-2: Detailed plan of pressure pipe of Janda Boka area with settlements

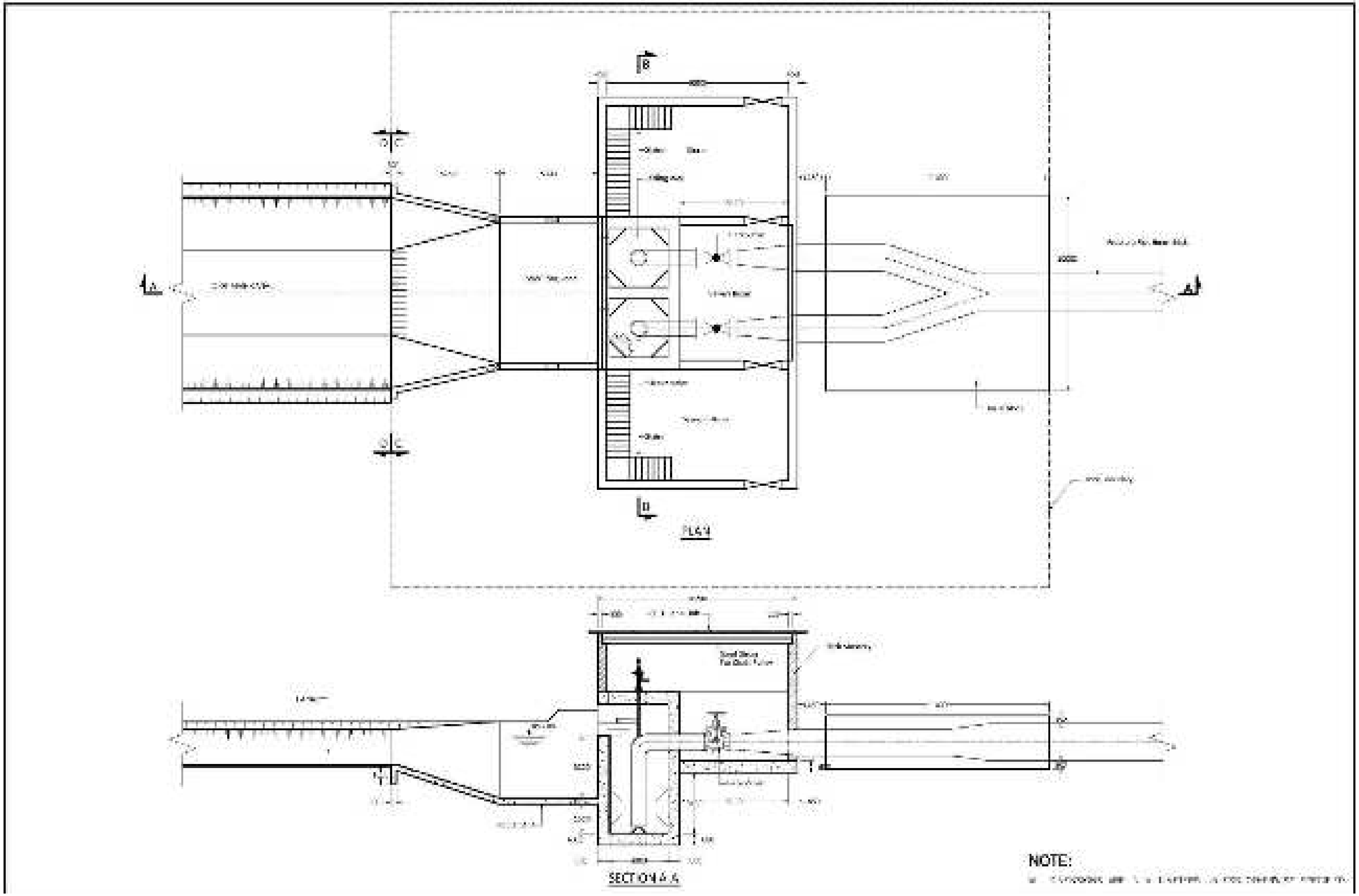


Figure 3-3: Longitudinal Section of the Indus Amber proposed Pipe Outlet

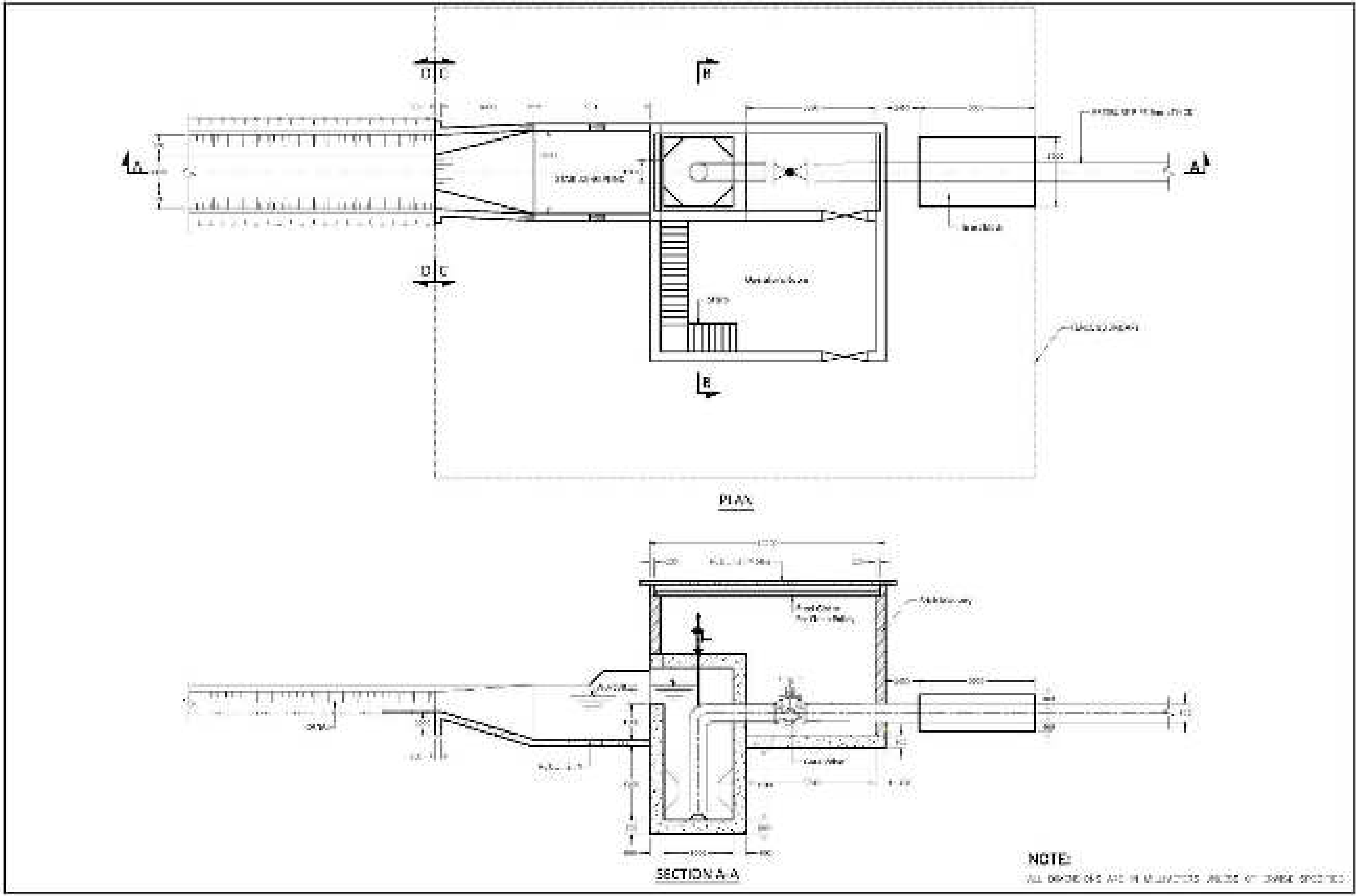


Figure 3-4: Longitudinal Section of the Janda Boka proposed Pipe Outlet

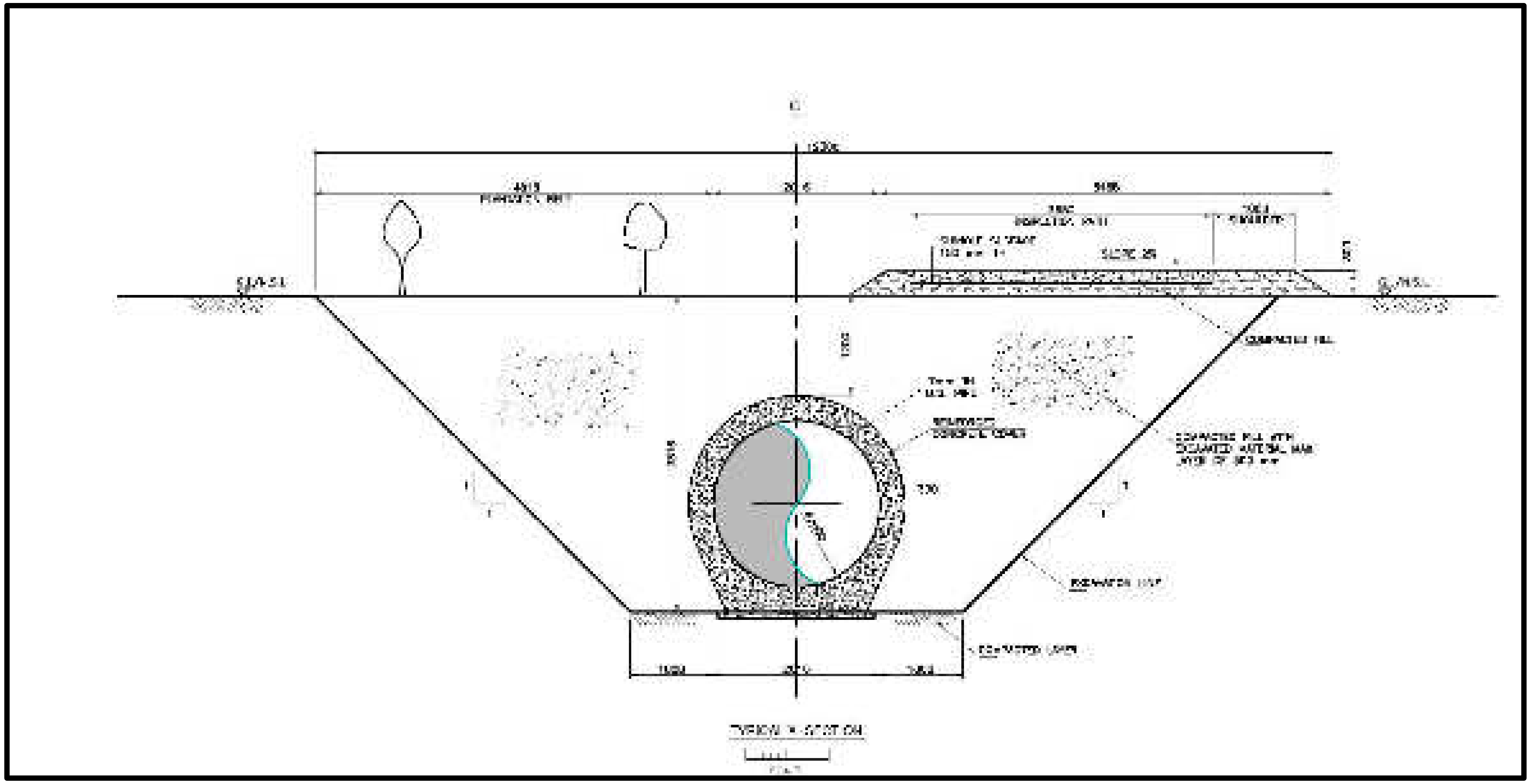


Figure 3-5: Indus Amber Pressure Pipe Typical Cross section

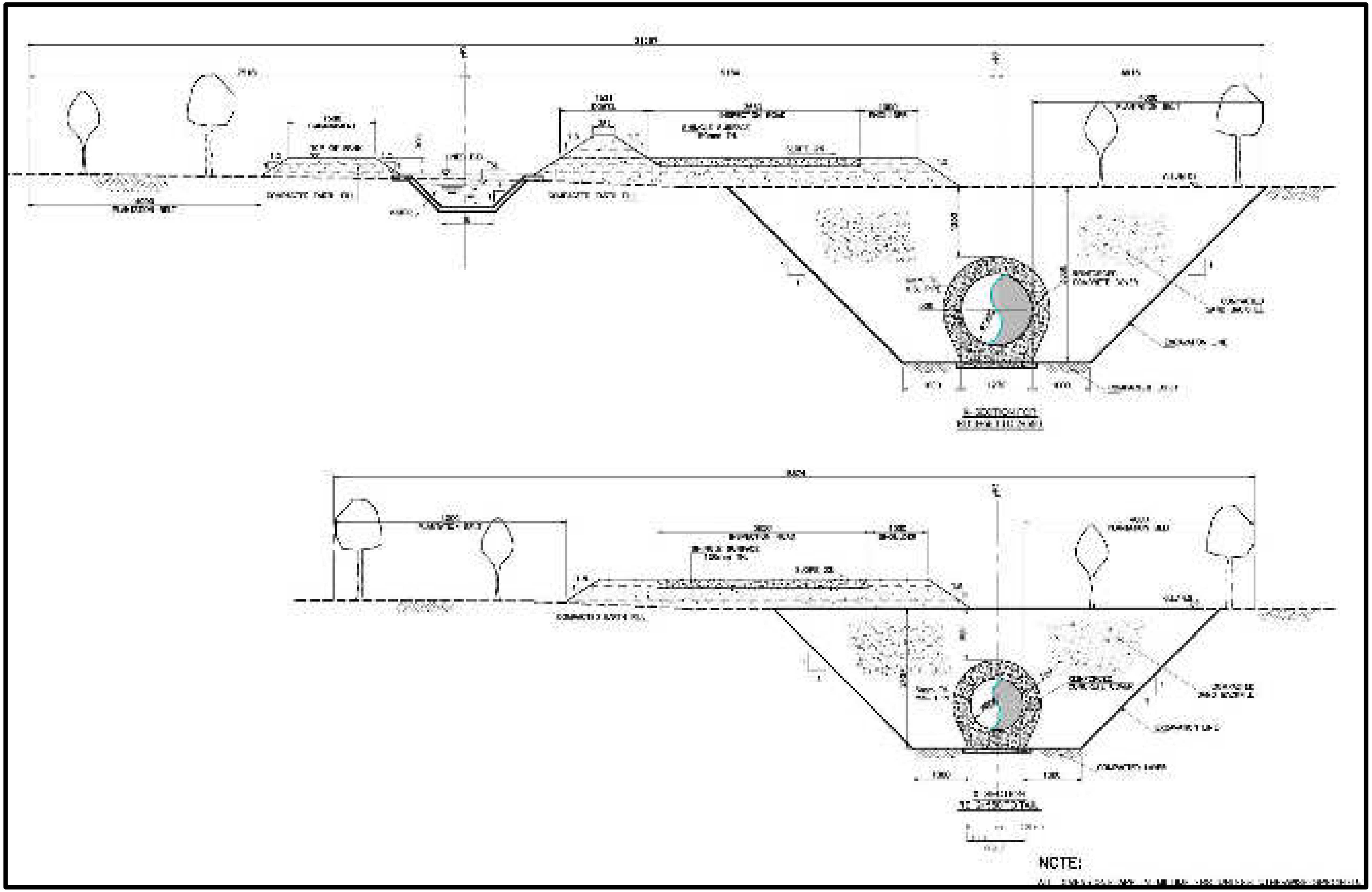


Figure 3-6:Janda Boka Pressure Pipe Typical Cross section

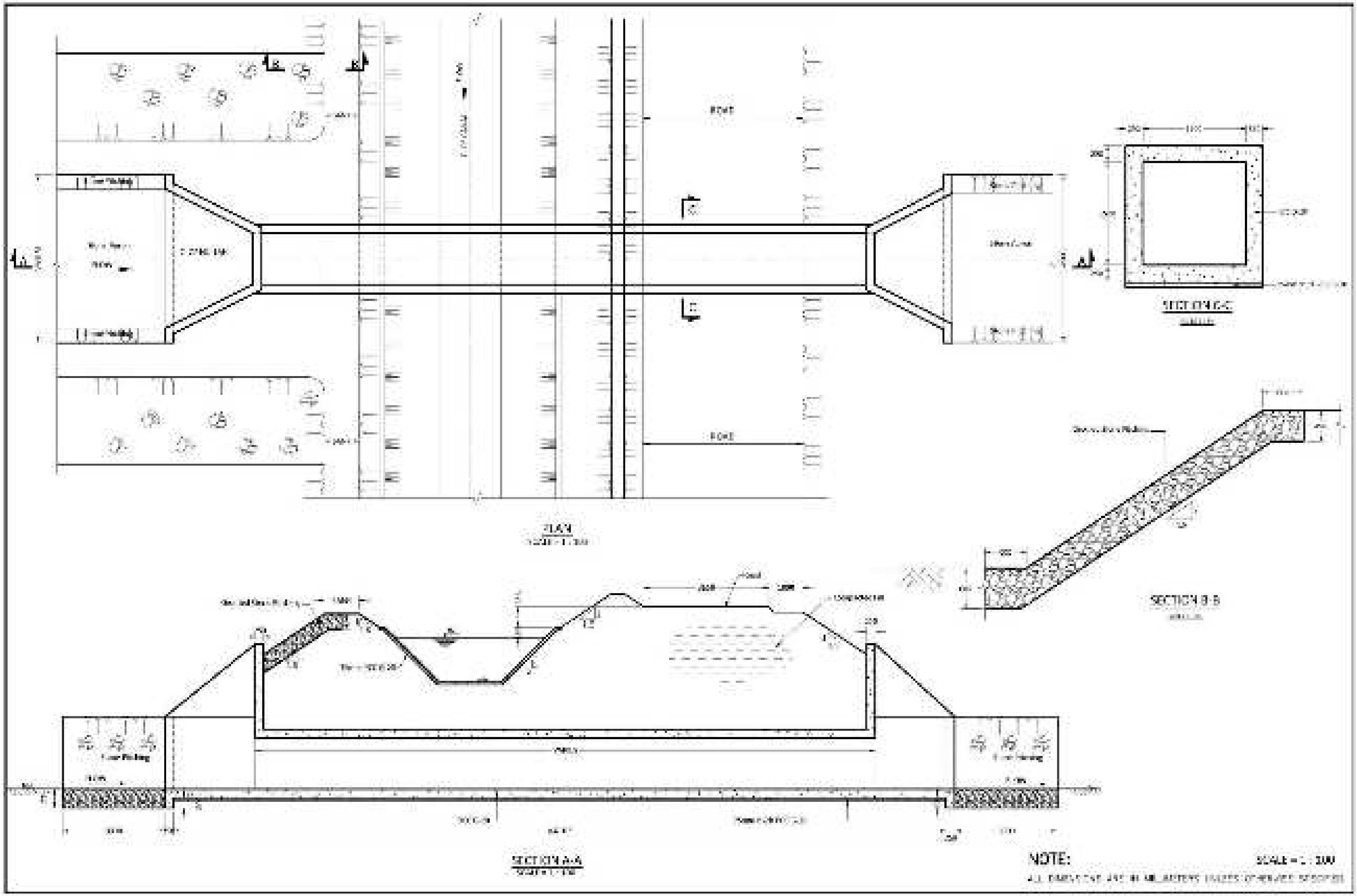


Figure 3-7:Typical Drainage Culvert Plan and Sections

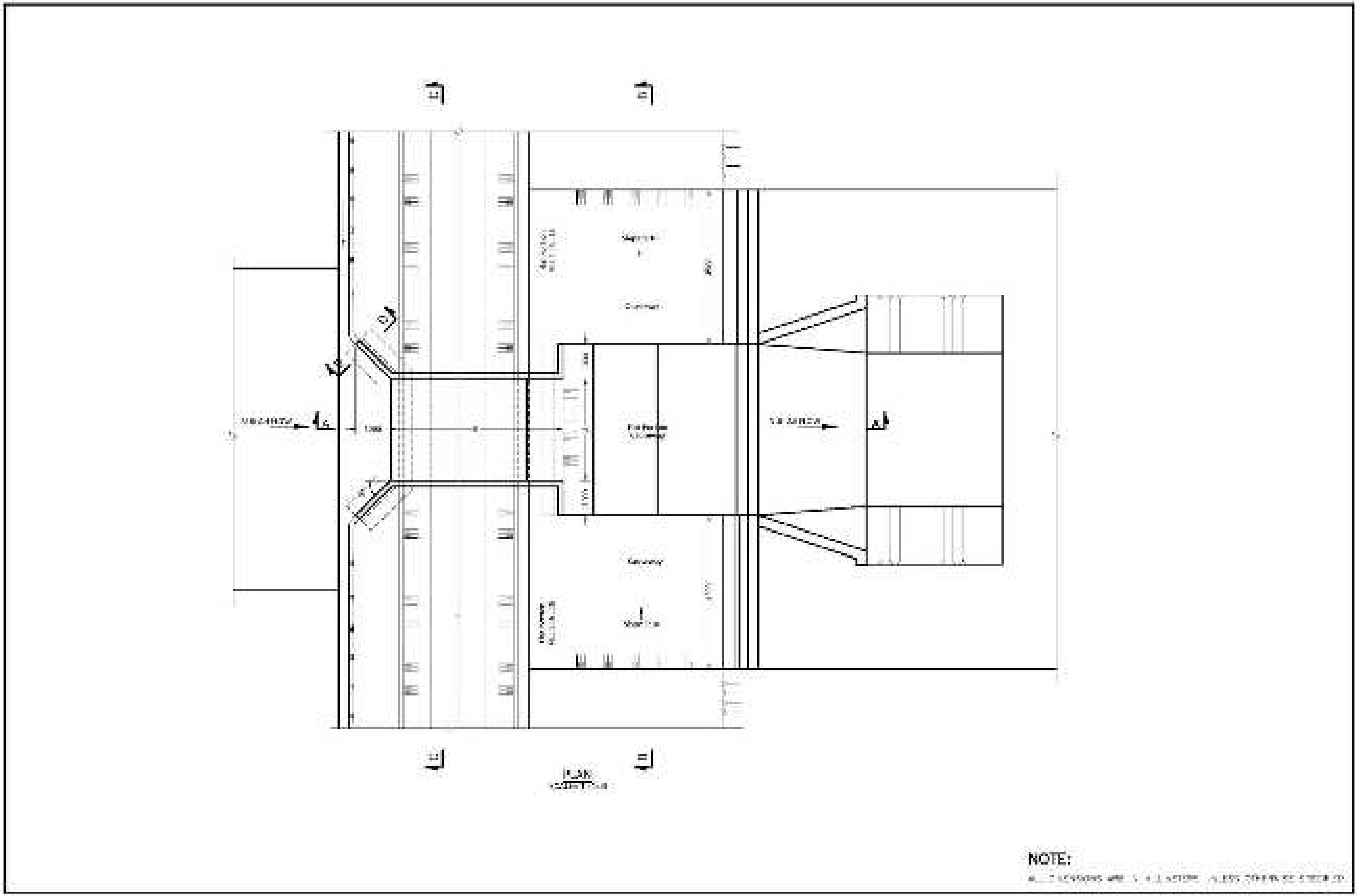


Figure 3-8: Typical Super Passage Type Plan

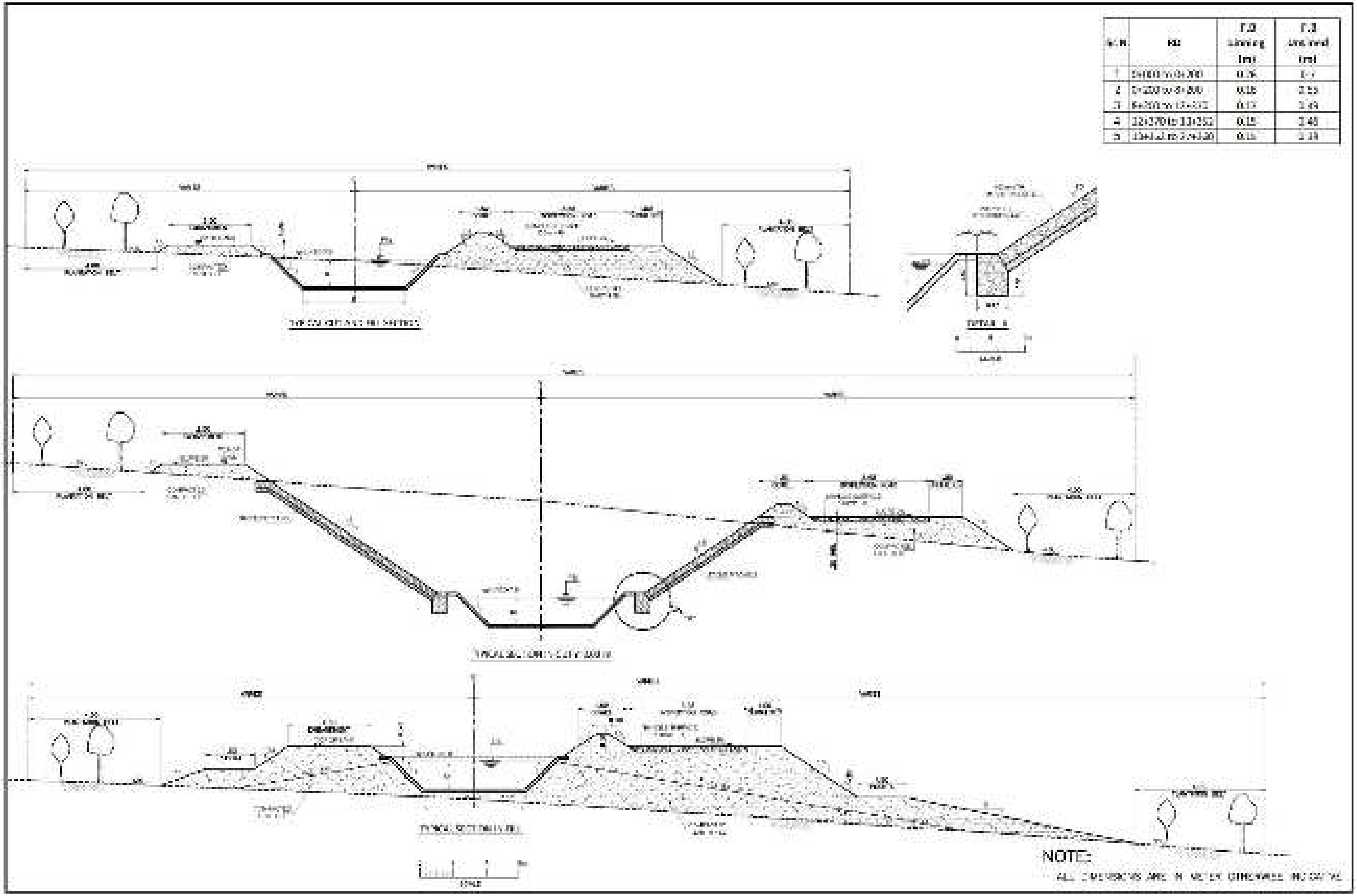


Figure 3-9: Typical Cross Section Indus Amber and Janda Boka

3.6.3 Components of Indus Ambar area

163. As shown in Figure 3-2, the main components of Indus Ambar area include:

- Connection with Gandaf Tunnel
- Pressure pipe and outlet works
- Ambar High Area pressure pipe and outlet works
- Main Indus Ambar Canal
- Distribution Canal System in Ambar Area
- Distribution Canal System in Indus Area
- Distribution Canal System in Ambar High Area

a) **Connection with Gandaf Tunnel:** A brief description of tunnel connection for Janda Boka has been given in the previous section. This is elaborated in detail here taking into account the hydraulics and instrumentation losses of the Gandaf Tunnel to ascertain the level for PHLC Extension off-take for Indus-Ambar areas. There are several locations to connect the pressure tunnel for Indus Ambar. However, the main problem involved is the timing of connection as it will affect the irrigation and power supply for some time. To minimize this risk, it is proposed to connect the new pressure pipe with the existing steel liner of the Gandaf Tunnel at the point of Access Chamber. All the other works will be completed in normal time but the connection will be established in closure period by closing the bulk head and control gates at the head of the Gandaf Tunnel.

b) **Pressure Pipe and Outlet Works:** The proposed pressure pipe starts from the downstream of the control valve and passing through a number of villages to reach the Ambar area where it opens into a discharge basin. Total length of the pipe is about 24.2 km. The pipe diameter for a discharge of 4.19 cumecs (148 cusecs) is 2.00m (10.76 ft) and wall thickness is 8 mm. The pipe is proposed to be buried at a minimum depth of 1.5m to absorb the ground loading and coated with protective material to safe against corrosion. Reinforced concrete cover has been provided and depth of excavation has been increased at the locations where it is crossing vehicular roads to avoid the direct impact of load on the pipe. Similarly it crosses a number of Nullahs and canals including Kundal and Badri. Again the depth is increased and surface is protected by rip rap / stone apron to avoid the chances of exposure due to scour. Necessitated by the variation in ground level along the pressure pipe, a series of drainage and air relief valves are proposed. There are about 19 drainage valves and 17 air-vacuum valves. These valves are protected in RCC chambers which will be projected above the ground to easily identify the location for operation.

c) **Main Indus-Ambar Canal:** Indus-Ambar Main canal serves both the Indus and Ambar areas by gravity. It starts from downstream end of the stabilizing basin. Total length of main canal is 27.36 km. There is a chunk of depression between Indus and Ambar areas. The Ambar area starts descending at about chainage 5 km and the main depression comes between km 14.5 and 16.5 where a siphon has been proposed. At km 7, it crosses the Link Channel at a depressed portion of the area where an aqueduct is proposed. To get the advantage of silt free canal and maximizing the command area, a slope of

1:5,000 to 1:10,000 is followed in the main canal. However, velocity is still above 0.45m/s (1.5 ft/s). Canal starts with a bed width of 2.60 m at the start and gradually decreasing to 0.32 m at the end of trapezoidal section. The last section of a few hundred meters is proposed with pre-cast parabolic section.

d) **Distribution Canals in Indus Area:** Indus Area is divided into two distinct portions i.e. north & south of Motorway M-1. Northern parts will be served directly from the main Indus-Ambar Canal, therefore there is only one minor Indus Minor (IM) -1 proposed to the right of the canal. Main constraint to the southern part is the crossing of the Motorway M-1. To avoid multi crossing of the motorway, one distributary has been proposed to be taken off from the main canal to cross the motorway only at one point. It is proposed to cross the motorway by excavation through micro tunnelling/thrust boring. The second option is to cross the siphon pipe in an existing culvert or underpass. This will reduce the drainage flow area of the culvert to some extent which may however be compromised upon by accepting some additional heading up in front of the culvert. Consultant's experience suggest that thrust boring techniques are now available in Pakistan. Therefore thrust boring underneath motorway has been adopted which will not disrupt the flow of traffic during construction. After crossing the motorway, another minor IM-2 is off-taking at RD 0+340/R (m) from the Indus-distributary (ID). The Indus- distributary is ending at the point where it will be linked with the existing Indus Branch to feed the Nandrak Minor to overcome the shortage in the tail of the system.

e) **Structures on Indus Ambar Pressure Pipe:** About 22.6 km long pressure pipe for Indus-Ambar main canal from Gandaf Tunnel crosses a number of streams, drains, roads, villages and high areas on its way. Because of uneven terrain along the alignment, the slope of pipe may not be kept constant along the entire length. If it is kept one way slopping, this will not only significantly increase the excavation cost but also make it impossible in some of the reaches with populated areas. To avoid this problem, a minimum cover of 1.5m is proposed and pipe has been aligned accordingly. This resulted in requiring a number of drainage / access manholes and air/vacuum valves. Drainage Manholes are proposed in the areas where the pipe is crossing a khawar / depression or there is reverse slope to the high area. Similarly to avoid the air locking in the system, air/vacuum relief valves are proposed at the crown of the pipe in high areas. Apart from these two main types of structures, there are some minor structures along the pipe including road crossings, river bed protection and alignment markers etc. Road crossing is a portion where 300mm thick concrete cover is provided and minimum depth of pipe increased to 2.5 m to cater for the traffic loadings. In the khawar crossing, the depth has been increased for the possible scour and bed to be provided with stones/ gabions to protect the surface scour. A number of markers are proposed on the surface especially at the change point to identify the pipe alignment. This will not only allow the Department to easily identify the route in case of emergency but also alert the locals to avoid construction on the pipe alignment. The proposed structures are listed in the Table 3-3.

Table 3-3: Structures on Main Indus-Ambar Pressure Pipe

Sr. No.	Structure's Type	No of Structures
1	Drainage / Access Manholes	19
2	Air / Vacuum Relief Valves	17
3	Road Crossings	5
4	Bed Protections	4
5	Alignment Markers	100

f) **Structures in Main Indus Ambar Areas**: Main structures in the Indus-Ambar Area includes head regulators, falls, siphons, aqueducts, drainage culverts, super passages, bridges, outlets and its Sumps etc. These structures have been tabulated in the Table 3-4.

Table 3-4: Structures on Indus Ambar Canals

S. No.	Structure's Type	No of Structures
1	Head Regulators	7
2	Cross Regulator	6
3	Escape Regulator	1
4	Aqueducts	1
5	Siphons	2
6	Drainage Culverts	36
7	Super passages	12
8	Road Bridges	44
9	Foot Bridges	50
10	Underpass	3
11	Fall	36
12	Outlets (includes bifurcators and trifurcators as follows)	86

g) **Development of On Farm Works:** In order to ensure irrigation efficiency and conserve water resources, an OFWM component has been developed and agreed with KPID. It is estimated that about 86 water courses will be constructed, land will be levelled, high efficiency irrigation systems will be installed in selected project areas for demonstration purposes, demonstration plots will be set up and capacity building of farmers will be carried out to enable efficient utilization of available water resources. The proposed on farm works are described in Appendix 10: Increased water-use and farm-management capacities in target areas**.**

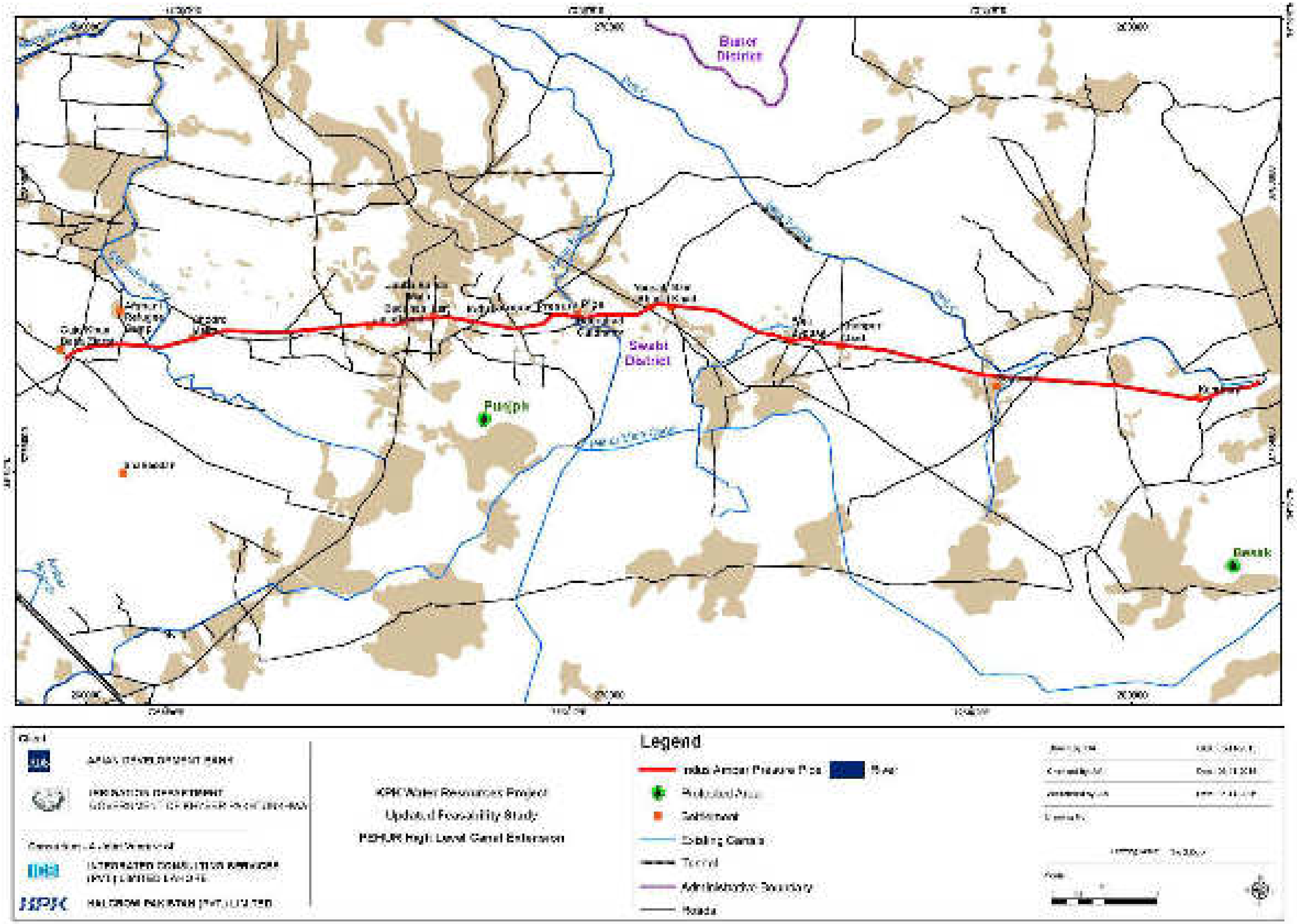


Figure 3-10: Detailed plan of pressure pipe of Indus Ambar area with Settlements

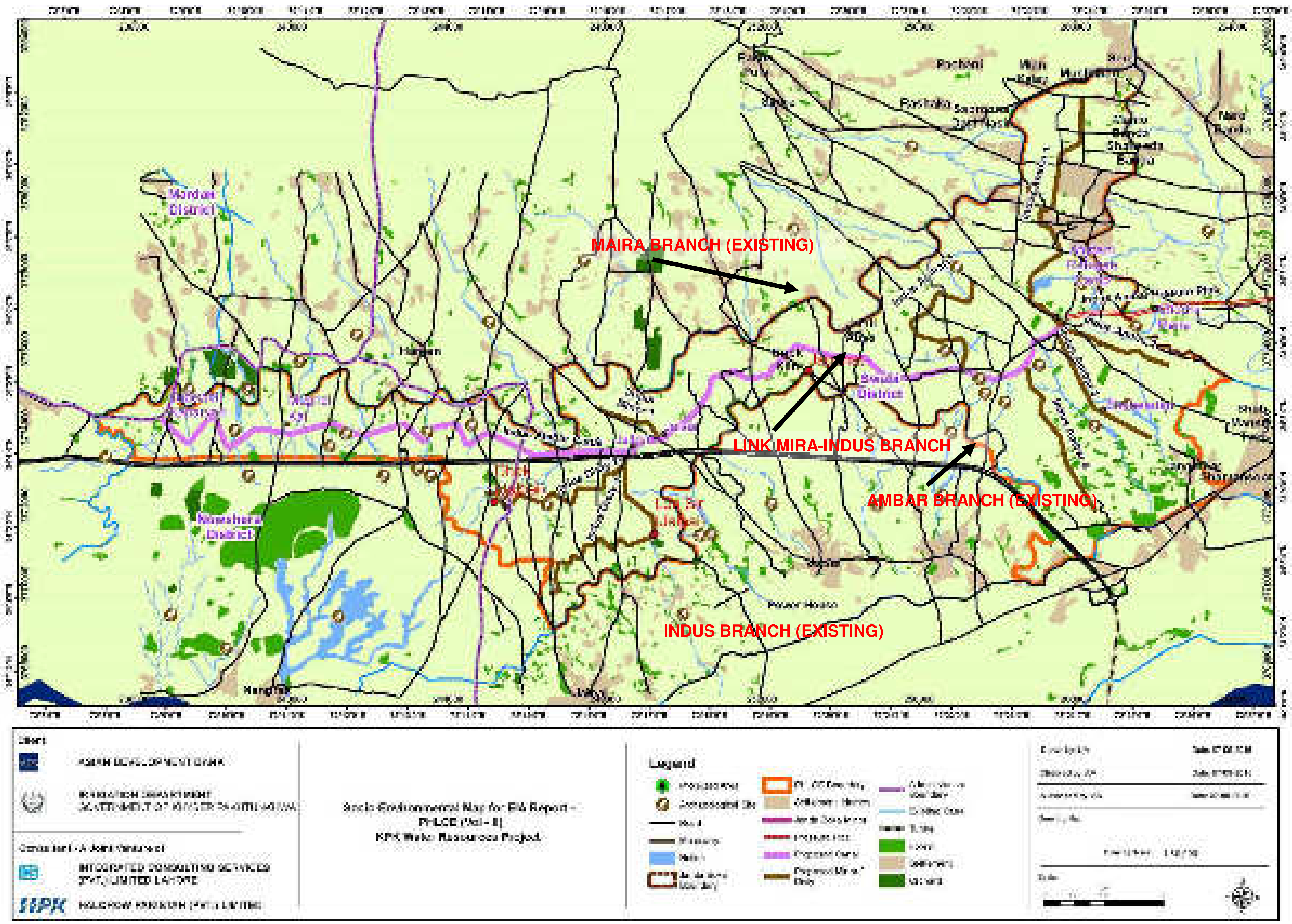


Figure 3-11:Plan of Indus-Ambar Project Area

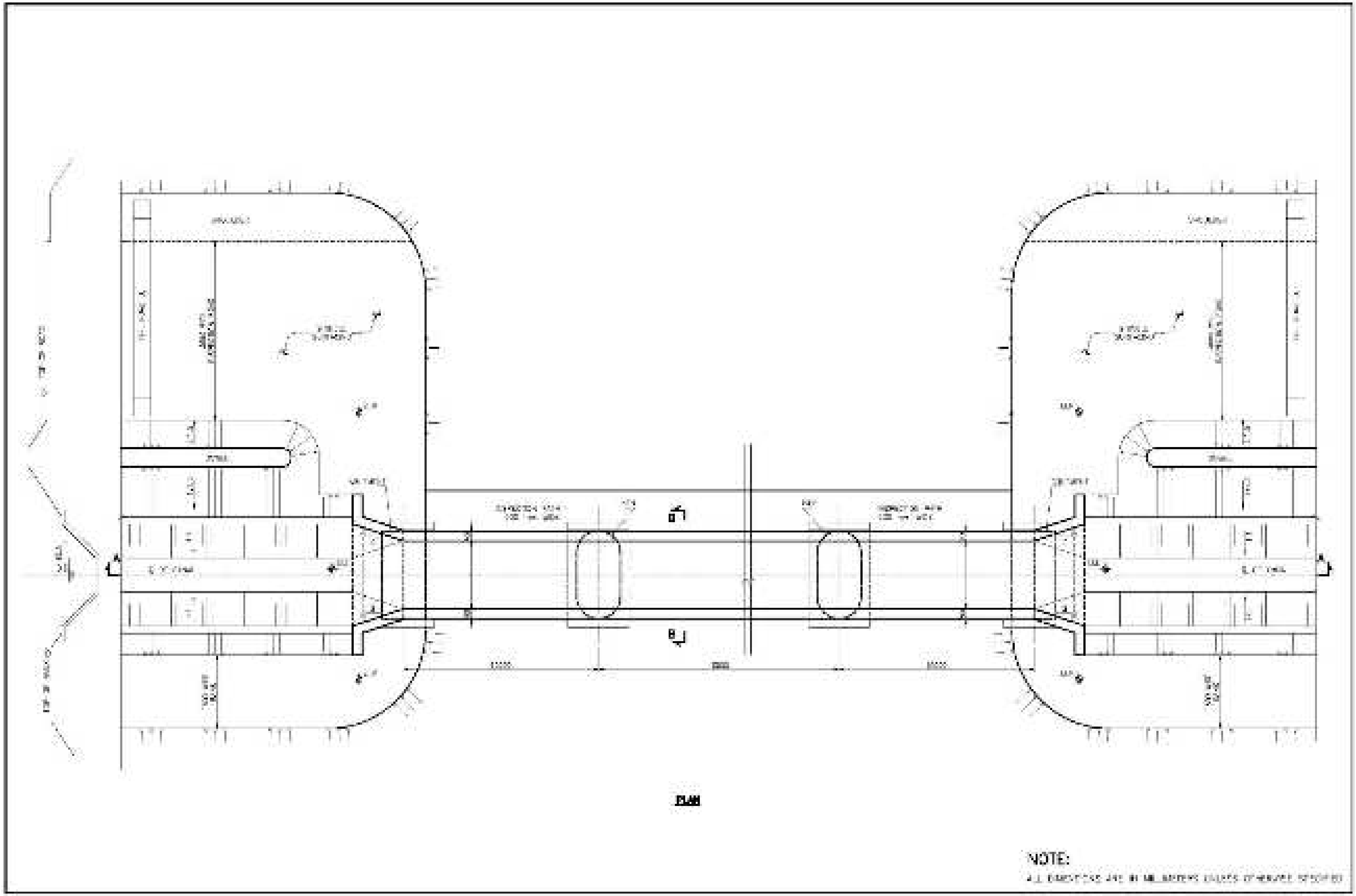


Figure 3-12: Typical Acqueduct plan

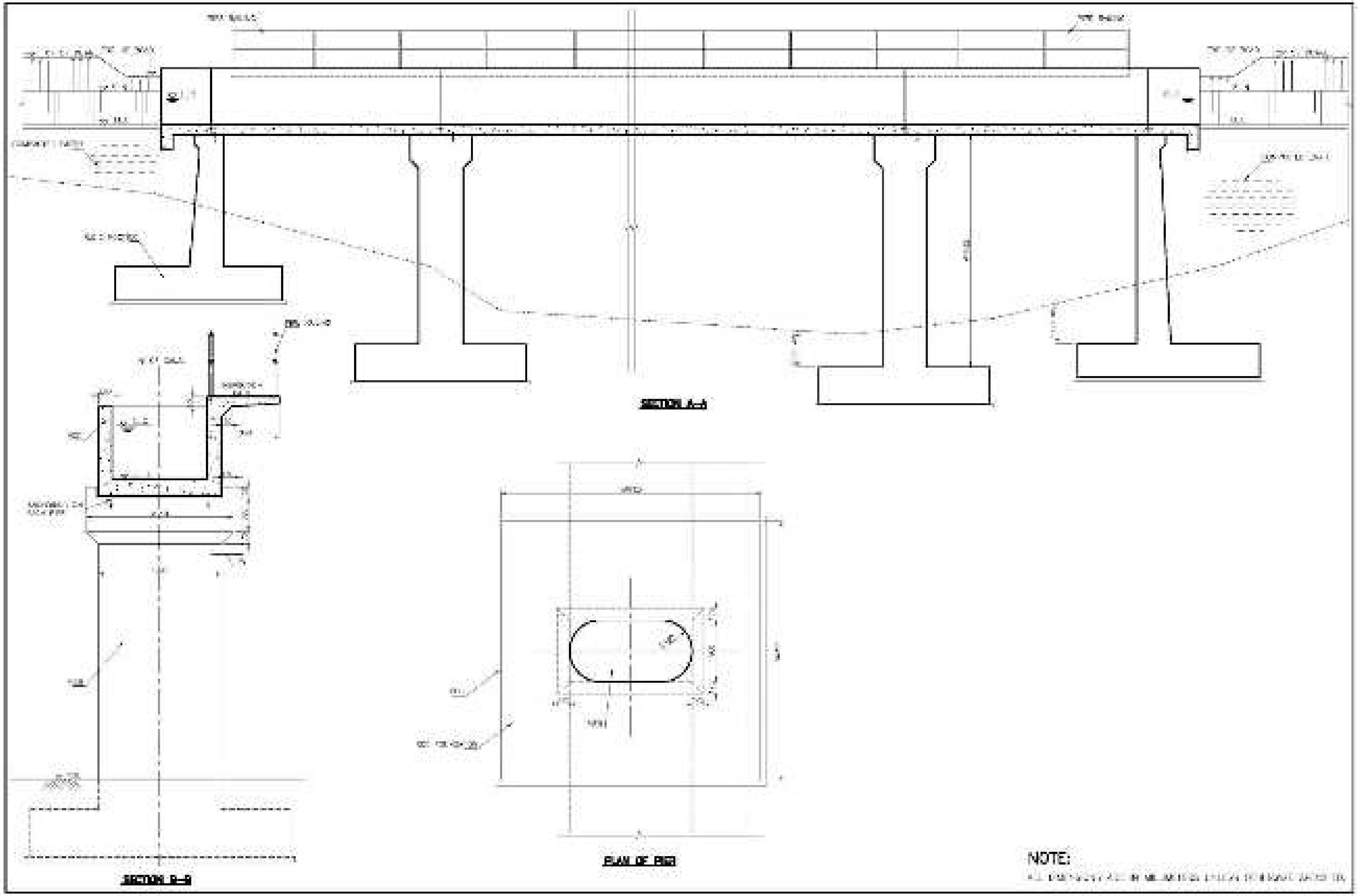


Figure 3-13: Typical Aqueduct Sections

3.7 Pre-Construction Phase Activities

3.7.1 Activities Completed by the Consultants

164. The following activities have already been completed on site prior to the commencement of construction works:

- Topographic survey (carried out during the original feasibility studies in 2012), which has been verified during the present PPTA.
- Preliminary design of canal system and appurtenant structures.
- Proposal for On Farm and introduction of HEIS.
- Environmental baseline and land use survey.
- Preparation of tree inventory.
- Initial Social Assessment.
- Public consultation.

3.7.2 Clearing of the Corridor of Impact

165. Although the corridor of impact includes private property of the local people, damage to houses (partially or completely) and other buildings as well as agriculture activities on the land falling within the COI cannot be avoided during installation of the proposed pressure pipes and construction of open canals. Therefore, a Draft Involuntary Land Acquisition and Resettlement Plan (Draft LARP) has been prepared as a separate document to address Involuntary Resettlement Safeguards (refer Appendix 38 of Draft Final Report).

3.1 Construction Phase Activities

3.1.1 Site Access

166. The PHLCEP construction sites and command area are well connected by roads with other parts of the country through Swabi link road and Motorway to Islamabad, Rawalpindi and Peshawar. The Contractor would use these routes for the transport of the construction material to the site. There are local roads leading to the pressure pipes and canal sites and the contractor will be able to use these roads for mobilization of his staff and labour and machinery, abiding by the safeguard measures in the EMP presented herein.

3.1.2 Construction and Labor Camps

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

168. The proposed site for the Contractor’s camp shall include the following facilities:

- Labour 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
  - Generator(s)
  - Site offices
- Workshop site
  - Workshop
  - Storage area
  - Generator(s)

3.1.3 Site Preparation and Clearance

169. Prior to commencement of civil or earthworks, all structures and surface vegetation (including trees) will be removed from the areas identified for the proposed canals and pressure pipes, site access paths, construction and main contractor's camp and yards. Three tentative sites (02 for Indus Ambar area and 01 for Janda Boka area) for camps have been identified and presented in Figure 3-1 and will be confirmed in consultation with the Contractor.

3.1.4 Borrow Material

170. During the detailed designs the required quantities and potential borrow areas will be established. All required permits will be obtained by the Contractor and shared with KPID.

3.1.5 Water Supply

171. During construction, water will be required for both construction activities and for consumption by the workforce. Water from the existing canals and private tube wells or dug wells shall not be allowed to be used for construction purposes. The Contractor may use the river water of Badri Khawar subject to laboaratory testing of the water to check whether the water is meeting the WHO and NEQS standards, approval of the Engineer and ensuring that any existing uses are not disrupted. It is expected that the Contractor will install his own tube wells and hand pumps where required for the supply of water for construction and consumption. Potable water for the labour will meet the NEQS (2010). After completion of the works, the hand pumps or tubewells will be handed over to the communities.

3.1.6 Equipment

172. Table 3-5 outlines the approximate number of major machinery and vehicles that are envisaged to be required for the project construction works:

Table 3-5: Contractor's Equipment and Machinery

Sr. No.	Machinery / Equipment	Quantity required

Sr. No.	Machinery / Equipment	Quantity required
1	Excavators	6
2	Dumpers	4
3	Batching Plants	1
4	Loaders	2
5	Power Generators	6
6	Rollers	4
7	Tractor Trolly	6
8	Transit Mixer	1
9	Compactor / Roller	2
10	Crane	1
11	Crush Plant	1
12	Concrete Pump	1
13	Vibro Hammer	1
14	Welding Generators	4
15	Watering Tanks (moveable)	3
16	Haulage Trucks	40
17	Cars/Pickups	15

3.1.7 Materials

173. During construction, a large amount of construction materials will be required. This will mainly include cement, aggregates and steel, pipes and valves. The required quantity of cement can be transported from the cement factories in the vicinity of Hasan Abdal and Islamabad.

174. The required supplies of steel will have to be arranged from Rawalpindi / Islamabad or from Lahore. There are a number of ISO certified steel re-rolling mills located in Islamabad producing reinforcing steel according to required standards from which the requirements of the project can be easily met.

175. A summary of the estimated materials quantities required during construction is given in Table 3-6.

Table 3-6: Summary of Materials Required During Construction

Sr. #	Name of Material	units	Quantity
A.	**JANDA BOKA AREA**		
1	Cement	Cu.M	1,243
2	Coarse aggregate	Cu.M	2,485
3	Fine aggregate	Cu.M	4,971
4	Reinforcing Steel	Tonne	55
5	Pressure pipes	meter	4,153
6	Valves	No	3
7	Earthwork Excavation	Cu.M	100,430
8	Earthwork Filling	Cu.M	150,644

Sr. #	Name of Material	units	Quantity
B.	**INDUS AMBAR AREA**		
1	Cement	Cu.M	18,212
2	Coarse aggregate	Cu.M	36,425
3	Fine aggregate	Cu.M	72,849
4	Reinforcing Steel	Tonne	55
5	Pressure pipes	meter	23,514
6	Valves	No	17
7	Earthwork Excavation	Cu.M	756,820
8	Earthwork Filling	Cu.M	,135,230

3.1.8 Personnel

176. Key personnel shall be appointed from within the Contractor's own staff whereas skilled workers (if available) and labourers shall be locally employed. The peak number of total personnel of the Contractor on site (including secondary support staff) is estimated to be about 500. In addition, two separate engineering teams representing the project proponent and project implementation consultants shall be deployed for construction supervision. An environmental safeguard team will also be on board to monitor the implementation of the Environmental Management Plan.

3.1.9 Schedule of works

177. A tentative works schedule and programme revised by the PPTA team is presented in Figure 3-14. This schedule is subject to change depending on the procurement process and following the award of the contract

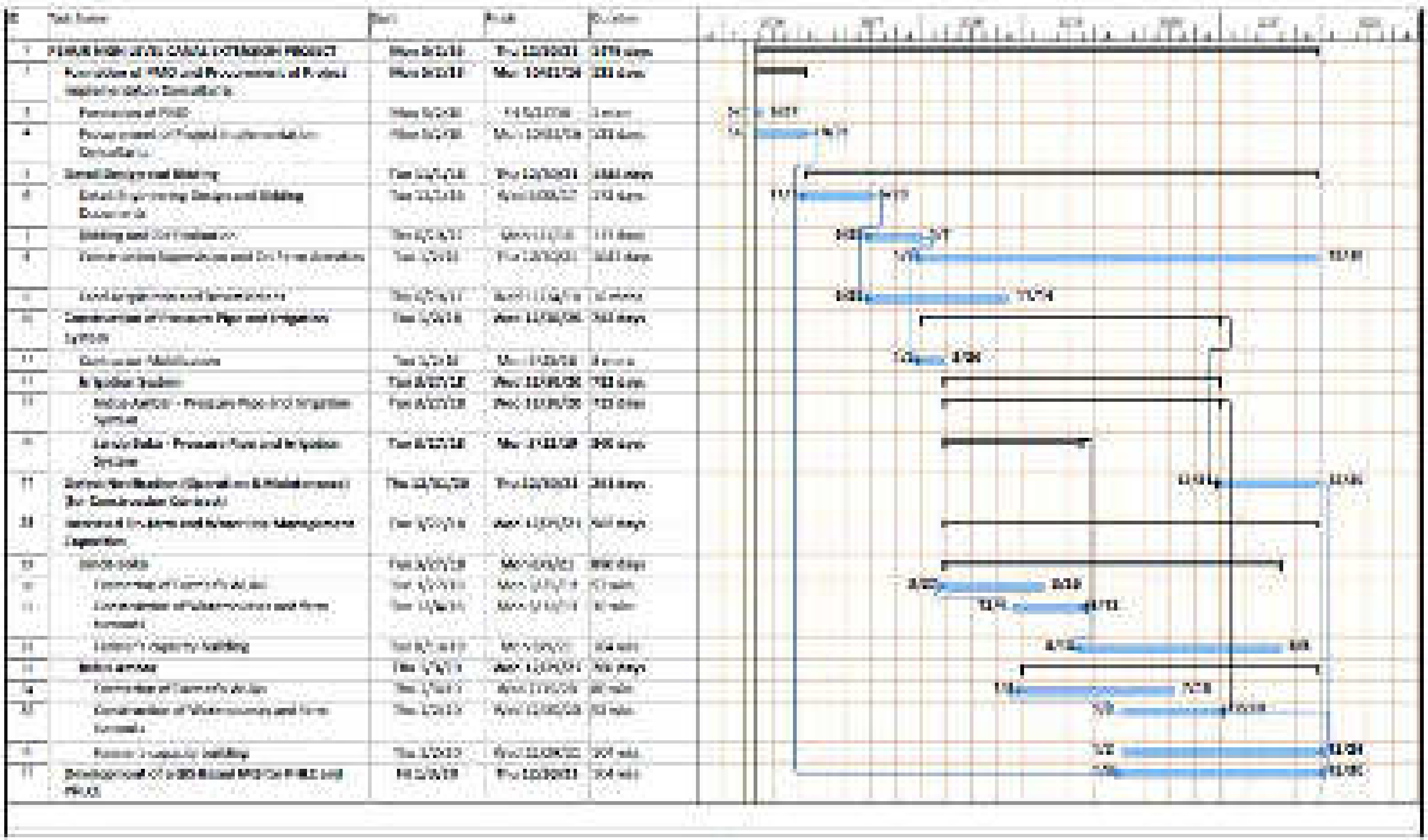


Figure 3-14: Proposed Schedule

4. DESCRIPTION OF THE ENVIRONMENT

4.1 Overview

178. 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.

179. The information provided in this section is both quantitative and qualitative and is based on primary and secondary sources. While primary information was collected through field surveys conducted specifically for this study, secondary information is from desk studies related to the project area and the previous feasibility study carried out for the PHLCE project and other reports and studies.

180. With due regard to baseline environmental conditions, the impact of project interventions are addressed and mitigation measures 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.

4.2 Area of Influence

4.2.1 Primary Impact Zone

181. The primary impact zone (Figure 4-1) can be considered as consisting of the areas where the proposed pressure pipes, irrigation canals and distributaries will be installed/constructed, which action has the potential to significantly impact the communities in relation to their dwellings and/or their agricultural land be it temporarily or permanently. It is expected thate the potential impacts on both these areas will be both adverse and beneficial. For instance, the proposed canal has the potential to negatively impact the small patches of agricultural land and crops falling within right of way (RoW) while positively impacting in the form of water availability throughout the year for irrigating the rain fed areas. The villages through which the pressure pipes traverse are presented in Table 4-1 below.

Table 4-1: Villages falling within RoW of the proposed Pressure pipe

S/No.	Indus Ambar Pressure pipe
1	Village Kambary
2	Village Haji Kheil
3	Village Baja By-Pass
4	Village Sogandi
5	Village Khanpur Abad
6	Village Noorabad (Gulo Dairy)
7	Village Jamal Abad
Janda Boka Pressure pipe	
1	Village Maina

182. This is the area where there will be direct impact, for example, removal of trees, relocation / protection of structures, utilities and other private/public infrastructure. Human habitations and natural resources in this area will be directly affected by project actions; e.g. construction of access roads, haulage routes, movement of vehicles, pollution, and presence of workers.The primary impact zone (project area) is shown in Figure 4-1 below**.**

4.2.2 Secondary Impact Zone

183. The secondary impact zone, which consisits mainly of the settlements benefitting from the enhanced irrigation water supplies and parts of the command areas of the proposed Janda Boka and Indus Ambar irrigation canal, are shown in Table 4-2. These areas are mostly expected to be impacted positively in the medium and long term through availability of the water from the Tarbela reservoir for irrigation and groundwater for domestic use. In addition, the project is also expected to enhance the ground water table in the long run.

Table 4-2: Villages falling in the Secondary Impact Zone of the PHLCEP

S/No.	Indus Ambar Area
1	Village Shaheeda
2	Village Chota Lahor (Shakri)
3	Village Jalsai
4	Village Jalbai
5	Village Mughal Ki
6	Village Tube-well Kabaryan
	Janda Boka
1	Village Maina

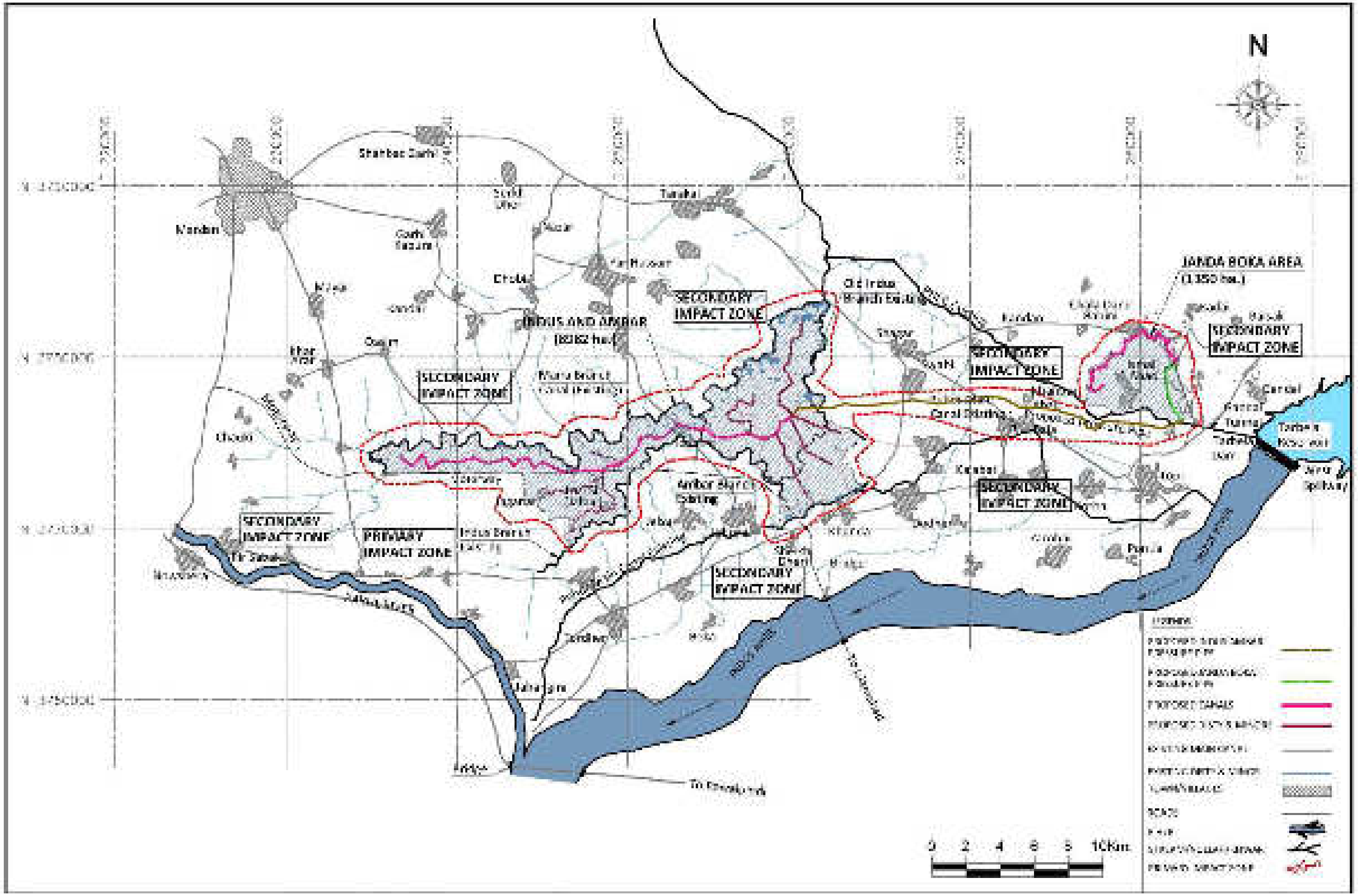
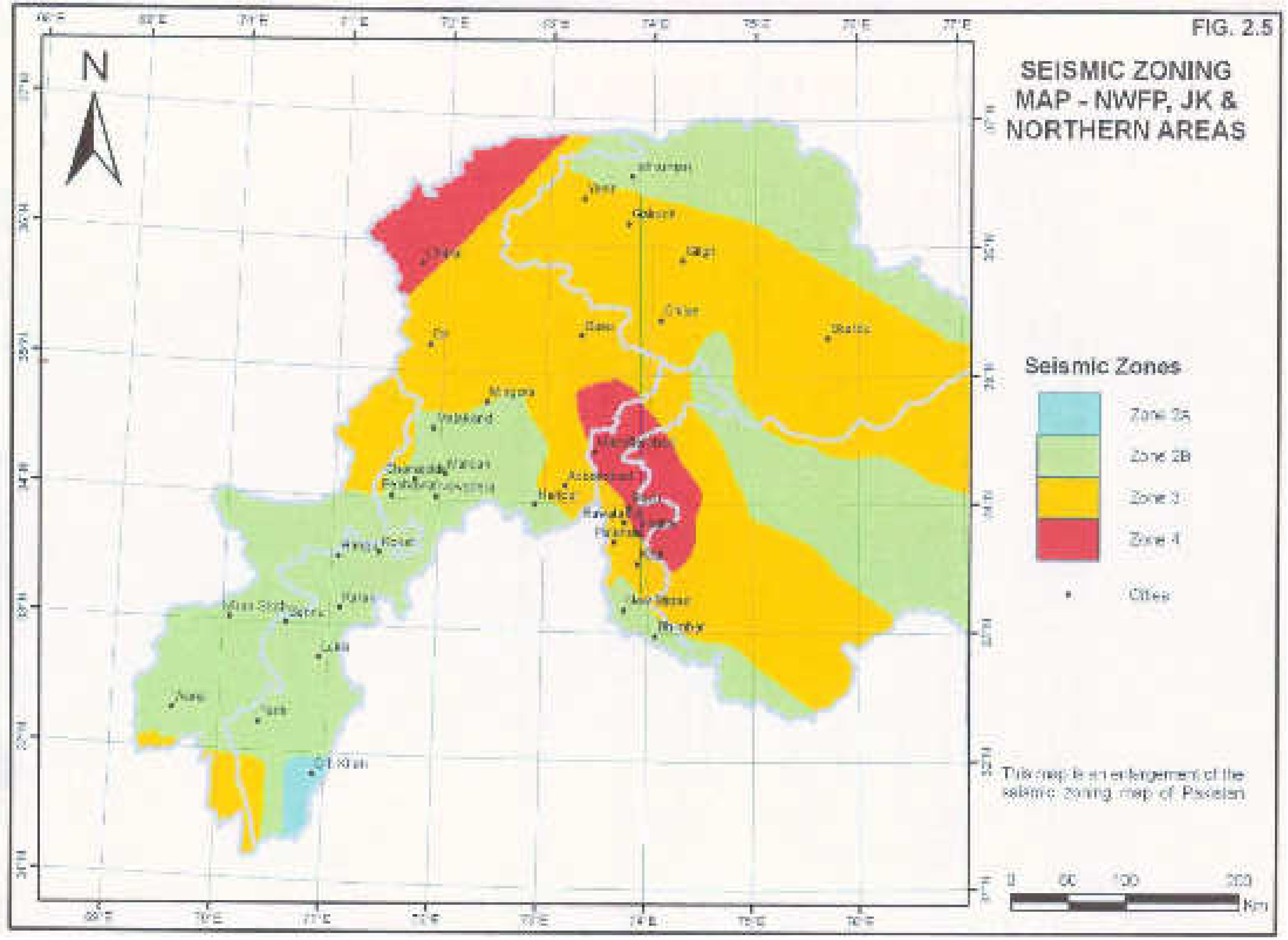


Figure 4-1: Primary and secondary impact zones



(Source:Building Codes of Pakistan – Seismic Provisions 2007)

Figure 4-2: Seismic Zone Map of KP

4.3 Physical Resources

4.3.1 Physiography

184. The project area can be divided into two areas considering the topographical nature; the northern hilly areas and southern plain. The major part of the hilly portion is Gadoon Amanzai to north-west i.e.Babinai, Mainai, Janda-Boka, and Dagai. These are the continuation of Mohaban hills. The other important hills are called Naranji hills. The height of these hills varies between 750 to 1400 meters above sea level. There are also a few other small isolated hills, the most important of which is located south of Swabi town. Other hills are in the South along the border with Nowshehra District, which are part of Khattak hills, north of the Kabul River. From the foot of the hills, the plain runs down at first with a steep slope, and then gently to the lower levels, towards the Kabul River.

185. The lower southern portion of the project area, i.e Ambar and Indus, is somewhat undulating plain with its slope towards the Indus River.The plain area of the project is intersected by numerous streams and smaller rivers. The important stream are Norengi Khwar, Polah Khwar, Kundal Khwar, Nekram nallah, Loe Khwar and Nandak Khwar.

4.3.2 Seismicity

186. Seismic information specifically for the PHLCE Project area is not available and the secondary information available in seismic zoning map of KPK / NWFP is presented as Figure 4-2. PHLCE project area lies in Zone 2B as shown in (Source:Building Codes of Pakistan – Seismic Provisions 2007)

187. Figure 4-2 This region is liable to MSK VI (Medvedev–Sponheuer–Karnik scale) or less and is classified as the Low Damage Risk Zone. The IS code assigns zone factor of 0.10 (maximum horizontal acceleration that can be experienced by a structure in this zone is 10% of gravitational acceleration) for Zone 2B.

4.3.3 Land use

188. Land use in the area is primarily for production of food crops for domestic consumption and is dependent on water availability from canal irrigation, tube wells and barani cultivation. The land use in the command area are:

- General cropping with canal and tube well irrigation;
- Restricted cropping under dry farming;
- Rarely used for restricted cropping;
- Limited area under poor grazing and reserved forests.

189. Ground water is not very deep and good to be used for irrigation. Therefore, tube well irrigation is common in the area. The description of the land use of the Swabi District as per Agricultural statistics record is presented in Table 4-3.

Table 4-3: Land Use in the PHLCE Project Area

Total Reported Area	148,689 ha
Cultivated Area	87,046 ha
Sown	69,543 ha
Current Fallow	17,503 ha
Total Uncultivated Area	61,643 ha
Culturable Wastes	26,630 ha
Forests	26,505 ha
Not available for cultivation	8,508 ha
Total Cropped Area	69,543 ha
One season crop	14,667 ha
Two season crop	54,876 ha

190. The above Table 4-3 reveals that the total area of the Swabi District is 148,689 ha and only 87,046 ha are presently used for cultivation. The current fallow area is 20% of cultivated area. Development of this fertile and plain land will bring in considerable change to the socioeconomic situation of the local population. The land use maps of the area are presented in Annexure – VIII.

4.3.4 Climate

191. No gauging station is available within the Project Area. Nearest available gauging station is at Tarbela Dam, which is managed by SWHP[6]. Average climatic parameters corresponding to temperature and precipitation are discussed below:

4.3.4.1 Temperature

192. Mean maximum and minimum temperature data for the project site is derived from Tarbela. Mean maximum temperature in the project area varies from 21.8 to 46.8^{0}C, while the mean minimum temmperature varies from 12.2 to 13.2^{0}C as shown Table 4-4 below.

Table 4-4: Maximum and Minimum Temperatures

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Maximum	21.8	25.3	31.8	37.9	44.0	46.8	43.1	38.9	37.4	36.3	30.1	24.1
Minimum	3.5	5.0	9.3	12.6	17.9	20.9	20.4	20.7	18.1	14.3	8.7	5.1

193. December to February are the coldest months and the minimum temperatures vary between 3.5 and 5.1°C in these months, whereas the maximum temperature during March to July varies between 43.1 and 46.8°C. Swabi district has extremes in climates, with its summer season being very hot. A steep rise of temperature is observed from May to June; and even July, August and September record quite high temmperatures. There is a rapid fall of temperature from October onwards to the coldest month of January.

[6] Surface Water Hydrology Program – Water and Power Development Authority

4.3.4.2 Rainfall

194. Mean monthly Precipitation records are presented in Figure 4-3.

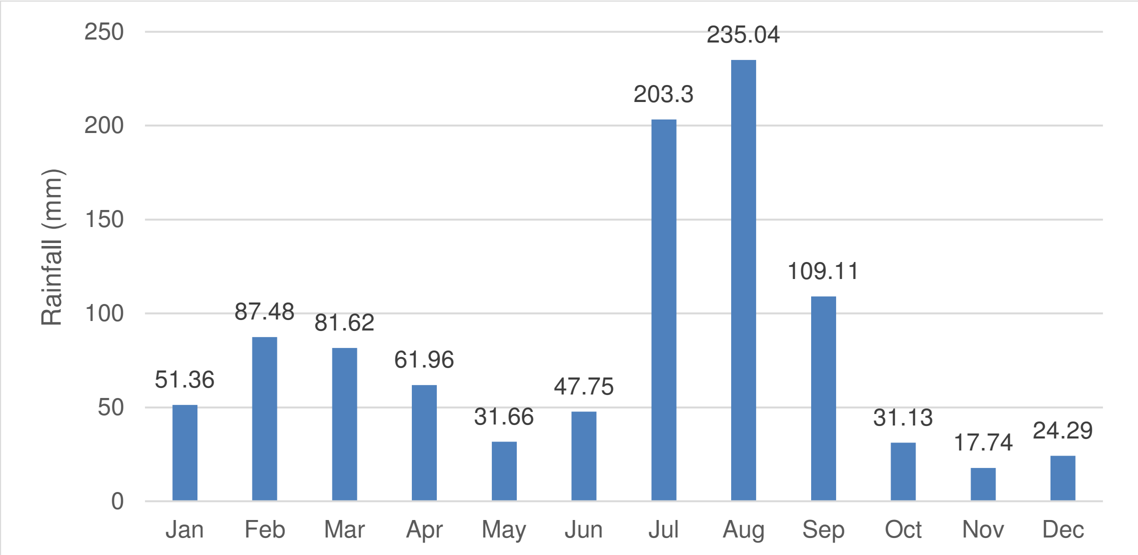


Figure 4-3: Mean Monthly Precipitation

Source: (Surface Water Hydrology Program of WAPDA – Tabela Gauging Station)

4.3.5 Water Resources

195. Water resources of the area can be divided under two categories: i.e. surface and ground water resources. Surface waters are in the form of river flow while groundwater is in the form of tubewells, dugwells and springs as detailed in the following sections:

4.3.5.1 Swat River

196. River Swat is the main source of water for Upper Swat Canal (USC) System. It originates in the form of Ushu and Gabral rivers in the Kohistan range of northern mountains of Khyber Pakhtunkhwa and takes the name of River Swat at Kalam at the confluence of the two above mentioned rivers. From Kalam downwards it proceeds to ultimately join River Kabul with a number of cities, villages and agriculture land lying along its length. Panjkora River from Dir Valley joins the Swat River downstream of Totakan. There are two major offtakes from the River, Upper Swat Canal at Amandara and Lower Swat Canal at Munda. Apart from these two major off takes, hundreds of civil canals are offtaking from the Swat River all along its length.

197. Measurements of flow on River Swat were commenced in 1958 when the Hydrology Division of Irrigation Department installed a staff gauge near Kalam. These gauge recordings were observed by the Directorate of Surface Water Hydrology Program (SWHP) of WAPDA and a record for a few years are available.

198. SWHP (WAPDA) established wire weight automatic gauge recorders on Chakdara Bridge in 1961 and proper measurements are being recorded on this gauge. The position of the creeks where the original gauges were installed has shifted in the past two decades. However, this gauging station still remains to be the most authentic point of measurements.

4.3.5.2 Indus River

199. Indus River is one of the largest rivers in the world. Indus originates from steep mountains in Ladakh covered with snow and enters into flat plains of Punjab and Sindh. The length of the river is more than 2,900 km with steep slopes (1 in 50) in the hilly areas of Skardu and 19 cm per Km in the flat plains of Punjab and Sindh. River Indus and its tributaries are major source of irrigation water in all the provinces. Tarbela Dam was constructed on the Indus River in 1970s. Catchment area of Indus and mean annual inflow at Tarbela Dam are 167,680 sq. km and 78 BCM respectively. During the planning of Tarbela Dam, it was decided to provide a tunnel in right abutment of the dam for future irrigation of the rain-fed areas in district Swabi and to supplement the Upper Swat Canal in its tail reaches. Although the first 500m length of tunnel was constructed along with the Tarbela Dam, further extension was not implemented till 1994, when Government of Pakistan decided to construct Pehur High Level Canal (PHLC) for augmenting Upper Swat Canal system and irrigation of additional land in Topi area.

200. The Pehur High Level Canal (PHLC) is 26 km long, starting from Gandaf tunnel and ends at 242+000 RD of Machai Branch canal of Upper Swat Canal. The design capacity of PHLC is 27.1 cumecs. It provides irrigation supplies to Topi area, and supplements the irrigation demands of Maira Branch downstream of RD 242+000 of Machai Branch canal, when Swat River supplies fall short to meet the crop water requirements of the area.

201. The discharge data for existing Pehur High Level Canal has been collected from WAPDA Tarbela and IRSA and is presented in Annex B.

202. Review of discharge data for the period 2004-05 to 2013-14 shows that irrigation supplies upto 2010 were less. However, from 2010 onwards, the annual water usage of the PHLC varies between 308.37 MCM to 431.72 MCM (0.25 MAF to 0.35 MAF) averaging to 360.18 MCM (0.29 MAF). Maximum discharge supplied to the PHLC during this period is 21.90 cumecs (800 cusecs).

203. From the above discussion it can be concluded that since commissioning, the PHLC never ran to its designed capacity (28.3 cumecs) due to following reasons:

a) Some of the schemes (Ballar and Bazai) considered to be included in PHLC provision are shifted to other canal commands.

b) The presently proposed project areas under PHLCE were proposed to be served through lift-irrigation system. As the system was not yet developed, thus the discharge remains unutilized.

4.3.6 Water Availability for the Present and Proposed Areas

204. The Pehur High Level Canal was developed primarily to augment supplies in the Upper Swat Canal (USC) system. Supplies for the system below RD 242 of Machai Canal of USC (known as Dargai Bifurcator) has been augmented from the PHLC. In addition to augmenting supplies to Machai canal, PHLC also includes additional area in between Gandalf Outlet and Dargai Bifurcator, which has been provided with irrigation supplies through a system of six (6) minors before falling in to the Machai Canal.

205. Another canal system, Pehur Main Canal system run through the south of the area, which offtakes from Ghazi Barotha Barrage.

206. To evaluate water availability, The Consultants (ICS-HPK) collected the ten years actual PHLC withdrawals for period 2004-05 to 2014-15. The data represents that:

a) Average annual volume of water withdrawal for the period 2004-05 to 2014-15 is 243 MCM (0.19 MAF), while maximum withdrawal is 431.72 BCM (0.35 MAF) during year 2011-12.
b) Release pattern in PHLC is consistent from year 2009-10.
c) Allocated volume for the Gandalf Tunnel / Pehur High Level Canal is 654 MCM (0.53 MAF).
d) Thus balance water volume of 222 MCM is available while accounting for maximum water withdrawal during 2011-12 period.
e) In terms of discharge, maximum discharge per year is around 22.6 cumecs (800 cusecs) against sanctioned discharge of 28.3 cumecs (1,000 cusecs). Thus balance discharge of 5.66 cumecs (200 cusecs) is available for further utilization even during peak time.
f) The required water withdrawal of PHLCE project is 4.84 cumecs during peak time, while required water volume is 78 MCM (0.06 MAF), which is well within the sanctioned limits for the Gandalf Tunnel and PHLC.

207. The water demand of PHLCEP is also compared with inflow at Tarbela. The average annual inflow at Tarbela for year 1962 to 2009 varies between 2,005 cumecs to 3,235 cumecs with average of 2,480 cumecs[7]. Thus PHLCEP water demand is only 0.1% of the annual inflow at Tarbela.

4.3.7 Water Saving From Other Miscellaneous Sources

208. In the past many years, new development on Upper Swat Canal System has led to some additional water uses. At the same time, some water saving has also been witnessed/observed due to some small canals/structuresbecoming non-functional.

209. In addition to Bazai, Heroshah Minor is another new development wherein about 0.602 m^3/sec (22 ft^3/sec) of water has been allocated for irrigating about 930.79 ha (2,300 acres) of land lying on the right side of Abazai branch of Upper Swat Canal.

210. On the other hand, a provision of about 12.512 m^3/sec (457 ft^3/sec) was kept for Vortex tube/ Silt Ejector in the main Upper Swat Canal during high flows season. The upstream reach of Upper Swat Canal from the Amandara Headworks to the Vortex tube was accordingly designed for 100.12 m^3/sec (3,657 ft^3/sec) as against its actual design discharge of 87.62 m^3/sec (3,200 ft^3/sec) downstream. Since its construction, the Vortex tube is non-functional and the 12.51 m^3/sec (457 ft^3/sec) of water may be utilized for any downstream irrigation purpose during Kharif.

211. Many stretches of cultivable command area (CCA) under the USC System are no more agriculture land due to conversion into settlements/residential areas in the last 100 years after the system first became operational. These areas, to some extent, are reflected as CCA in the irrigation record. However, this requires a separate comprehensive study of

[7] As per discharge data presented in Design Report of Tarbela 4th Extension Hydropower Project.

the system to assess the actual command on each outlet and ultimately find water saving in the system.

212. Similarly, some small canals rather minors have been partially detached from USC system and put into operation by diverting water from other perennial streams/Khwars. Though not much but still some water has been saved, which needs to be accounted for in future development of irrigable lands.

4.4 Quality of the Environment in the Project Area

213. The quality of the environment in the project area is assessed considering the environmental aspects as soils, water quality, air quality, noise level, and climatic parameters in the project area.

4.4.1 Soils

214. Soil studies have been undertaken to describe, classify and map soils of Janda-Boka, Indus and Ambar areas, covering gross areas of 1,943 ha (4,801 acres), 5,031 ha (12,432 ac) and 5.990 ha (14,801 acres) respectively. Based on the data collected, land capability classification have been carried out and crop suitability ratings determined for optimization of agricultural production.

215. Three textures namely silt loams / loams, sandy loams and sands were identified in all the three segments (Janda-Boka, Indus & Ambar areas

216. For the Project Area the land capability has been assessed keeping in view the ultimate development conditions when adequate quantity of water is made available and the improved agricultural technology is introduced. It is observed that even under these conditions the limitations exist with regard to Sandy Texture and Irrigular Relief that affect the adoption of certain crops.

217. Keeping in view the above limitations, the soils have been grouped into five land capability classes (I, II, III, IV and VI) under potential conditions. Soils in Janda Boka fall in Class I and Class II (Very good to Good) agricultural land, while soils in Indus and Ambar area fall in Class I, III, IVs1 and IVs2. A significant portion of land in this area falls in Class IV category, which shows that particular attention will need to be paid to land preparation and farming practices in these areas to achieve higher yields.

4.4.1.1 Soil Analysis

218. The PPTA consultants conducted soil analyses from samples in the project area. In total, 85 soil samples were collected from the command of both Janda Boka and Indus Ambar canals and mixed together for the preparation of forty (40) composite samples. Soil samples were analysed for the sub-parameters: Soil texture, pH, EC, available phosphorous, and Sodium Adsorption Ratio (SAR).

219. The results reveal that all the soils were loam, silt loam, sandy loam, and loamy sand nature. These soils were medium to loose in texture and facilitated easy water percolation. The samples did not exhibit problems of salinity or sodicity as the pH and salt contents were within safe limits. The soil is deficient in organic matter (OM), Nitrogen (N), Phosphorus (P), and Potassium (K). The report recommends that 15-25 cart load of well digested farm yard manure should be added prior to sowing of crop. Four bags of Single

Super Phosphate (SSP) or two bags of Di Ammonium Phosphate (DAP) and four bags of Urea should be added per acre for cereals crops or according to the requirements of other crops to be sown on these soils

220. The soil conditions prevailing in the area have been discussed with KPID. KPID staff apprised that similar soil conditions existed in the command areas Pehur Main Canal and the Old Indus Branch of Upper Swat Canal however, with time the soil conditions have improved due to irrigated agriculture introduced in the area and field improvements carried out by the farmer following facilitation by Agriculture Department.

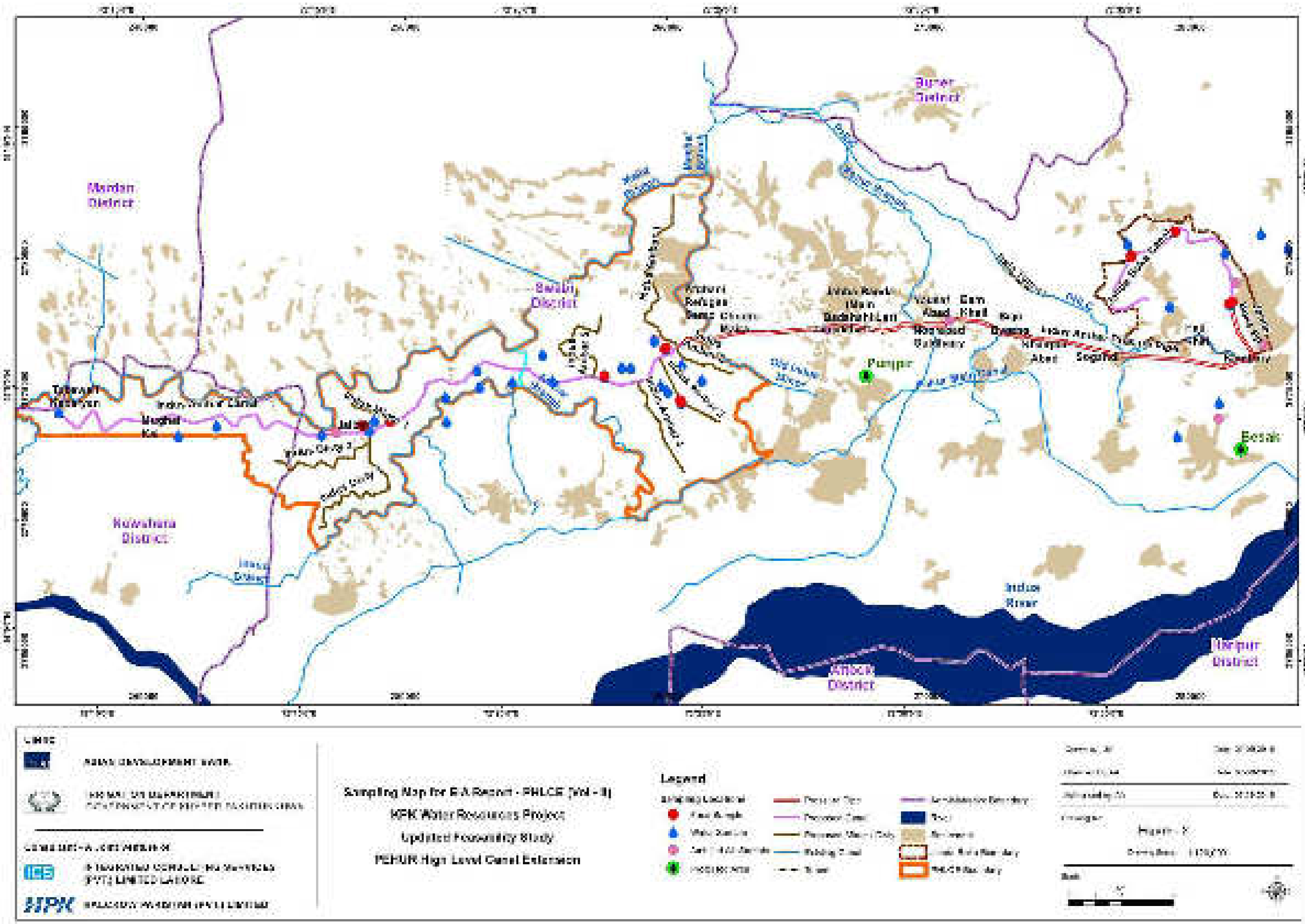


Figure 4-4: Soil, Water, and Pesticide sample Collection Points

4.4.2 Surface Water Quality

221. The Tarbela Dam is the source of water for the proposed PHLCEP. The Tarbela 4[TH] Extension Hydro Power Project monitored the surface water quality parameters as Cs++, Mg++,Na+,K+, CO3, HCO3, Cl, SO4, Total Cations, Anions, SAR, Na2CO and EC x 10^6at the following locations;

- Tarbela Reservoir;
- Ghazi Barrage Pond; and,
- Downstream of the Ghazi Barrage.

222. By comparing surface water quality results with the standards set by WAPDA, the results of all parameters were found to be within the required water quality standards.

4.4.3 Groundwater Resources

223. Ground water is found in ample quantity in the command areas. However, as the population of the project area continues to grow, it is expected that in the future,the availability of groundwater resources would continue to decline as further extractions are made for irrigation and drinking water purposes.

224. In total sixty (60) tube wells were reported by the communities in the command area of PHLCE Project. The existing situation of the groundwater is summarised in the Table 4-5.

Table 4-5: Location of tube wells and Groundwater situation in the Command Area

Year of tube well installation	Depth of Borehole (m)	Depth of Water Table (m)	Diameter (mm)	Quality of water
Village Maina (Janda Boka Canal)				
2003	76.20	36.58	101.60	Sweet
2010	76.20	36.58	101.60	Sweet
The reported total numbers of tube-wells installed in village Maina are 12 but the detailed information was not from public consultation.				
Village Shaheeda (Indus Ambar Minor 3)				
2011	76.20	24.38	101.60	Sweet
2011	76.20	24.38	101.60	Sweet
2011	76.20	24.38	101.60	Sweet
Village Jalsai (Indus Ambar Canal)				
2010	73.15	36.58	101.60	Sweet
2002	73.15	36.58	101.60	Sweet
2014	73.15	36.58	101.60	Sweet
2011	73.15	36.58	101.60	Sweet
2007	73.15	36.58	101.60	Sweet
2014	73.15	36.58	101.60	Sweet
2012	73.15	36.58	101.60	Sweet
Village Jalbai (Indus Ambar Canal)				
Five (05) tube wells were installed by Government of KP and 20 tube wells were installed by the farmers in the village.				

Year of tube well installation	Depth of Borehole (m)	Depth of Water Table (m)	Diameter (mm)	Quality of water
Village Chota Lahor (Sharki) (Indus Ambar Canal)				
2011	85.34	45.72		Sweet
1985	85.34	45.72		Sweet
2010	85.34	45.72		Sweet
2013	85.34	45.72		Sweet
1990	85.34	45.72		Sweet
1990	85.34	45.72		Sweet
Village Mughal Ki (Indus Ambar Canal)				
2014	76.20	39.62	152.40	Sweet
1999	76.20	39.62	152.40	Sweet
2009	76.20	39.62	152.40	Sweet
Village Tube-well Kabaryan (Indus Ambar Canal)				
1980	73.15	45.72	101.60	Sweet
2000	73.15	45.72	101.60	Sweet

225. The depth of water table varies between 36.5 m to 46.7 m and the depth of borehole varies between 61.0 m to 76.2 m respectively. The water quality was reported as good for consumption.

4.4.4 Ground Water Quality

226. In total 35 groundwater samples were collected from the command area. Sample collection was based on availability of water in the area and branch wise sample collection is given in the following Table 4-6;

Table 4-6: Branch wise number of groundwater samples

S#	Branch Name	No of Water Samples
1	Janda Boka Branch	05
2	Indus Ambar Branch	20
3	Besak	02
4	Topi	02
5	Malikabad	01
TOTAL		**35**

227. For water quality, the samples were tsted for twenty one (21) parameters of the National Environmental Quality Standards (NEQS): Physical Parameters; color, odor, taste, ec,ph,turbidity; chemical parameters; calcium, carbonate,hardness, potassium, tds,nitrate, nitrite (as NO2), phosphate, arsenic, COD, DO,TSS; and biological parameters: total coliform, faecal coliform and E. coli.

228. The Coliforms and E Coli in 66% of the ground water samples and the remaining parameters were found to be within the permissible limit of NEQS except turbidity and nitrate levels which exceeded the prescribed limit in 3% samples. The coliforms and Ecoli were high in samples of Malik Abad, Topi, Besak, Janda Boka sample-2, Indus Ambar water samples-1-18 and 20 to 21.

229. The detailed results are given in **Annexure: III.**

4.4.5 Water Rights

230. The PHLCE Project is a new development project and has water rights as delineated in the allocation of PHLC and Gandaf tunnel. The water for these areas was originally proposed to be lifted from PHLC but the lift schemes did not materliase. The same areas are now designed to be served under gravity due to raised dead storage level of Tarbela reservoir due to sediment deposition.

231. The distribution approach adopted for the existing Pehur High Level Canal may be adopted. The entitlement to irrigation water on the existing PHLC is attached to land as with other systems of the Indus basin. The actual water received by a farm is determined by a combination of: a) water allocation, which is 0.7 l/s/ha and 0.63 l/s/ha, respectively, for new and remodelled CCA, b) 10-daily scheduled diversions approved by Indus River System Authority (IRSA) varying from 0.22 l/s/ha to 0.7 l/s/ha, c) physical capacity and operations of the system (PHLC Case study by IPTRID).

4.4.6 Salinity and Water Logging

232. Water logging is one of the major problems of Pakistan's agricultural areas. Over irrigation, runoff water from higher to lower areas, seepage from canals and reservoirs and poor irrigation practices have resulted in wide spread problems of water logging and salinity. Historically, some areas of Swabi and Mardan Districts commanded by the Upper and lower Swat Canals had water logging and salinity problems due to poor drainage system, inadequate application of irrigation water for the high intensity farming practices, high water table in about 26% of the area and frequent flooding.

233. However, at present, the project area has no water logging and salinity problems and the average water table is 39.92 m (129 ft) below the ground level. The existing water table varies ranging from 24.38 m to 45.72 m (80 ft to 150 ft) below the ground surface in the project command area.

4.4.7 Air Quality

234. The sources of air pollution around the Project area are from local traffic movement and the Industrial Estate Gadoon Amazai which is famous for textile production and marble processing. In addition to contaminating the ambient air the Gadoon estate also generates hazardous wastes. The industries in Gadoon are (a) Plastic PVC (b) chemicals (c) textile (d) paper sacks/paper cone (e) steel re-rolling, steel furnace (f) soap (g) Ghee (h) disposable syringes (i) marble (j) beverages (k) foam (l) carpets and (m) chip board.Traffic flow is high though not heavy.

235. The proposed pressure pipe on Indus Ambar Branch runs through Swabi town while the proposed pressure pipe and canal of Janda Boka branch passes through Industrial Estate.

236. The slection of locations for air quality monitoring was done with due consideration to sensitive receptors as settlements along the proposed right of way of the pipeline and canal. Five locations (points 1, 3, 4, 6, and 7 inFigure 4-5) as close as possible to sensitive receptors as settled areas along the project ROW were selected with 02 other locations (points 2 and 5 in Figure 4-5) which were close to the industrial area, a part of which, too, is within the ROW.

237. The level of smoke, metallic substances and oxides of carbon, nitrogen and sulphur in the Project area are also estimated to be below the maximum allowable levels in the NEQS.

238. Ambient air quality monitoring was carried out at Seven (07) locations within the Project area and the results of all parameters are are given in Table 4-7 to Table 4-12 and **Annexure-IV** as charts.

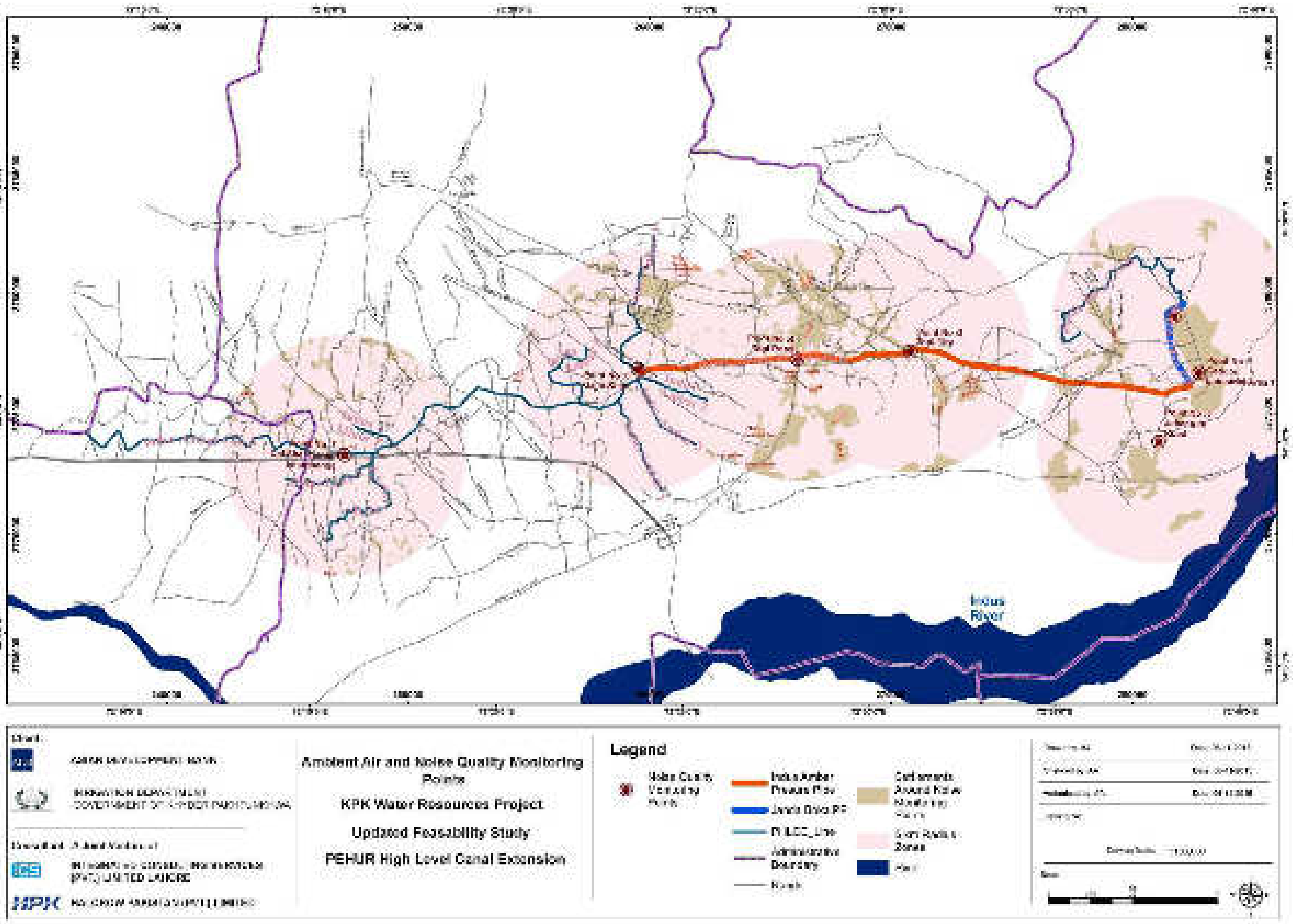


Figure 4-5: Ambient Air and Noise level Monitoring Points

4.4.7.1 Oxides of Nitrogen (NO_X)

239. Nitrogen oxides (NO_X), a mixture of Nitric oxide (NO) and Nitrogen dioxide (NO_2), are produced from natural sources, motor vehicles and other fuel combustion processes. NO is colorless and odorless and is oxidized in the atmosphere to form NO_2. NO_2 is an odorous, brown, acidic, highly corrosive gas that can affect human health and environment. NO_X are critical components of photochemical smog; NO_2 produces the yellowish-brown color of the smog.

240. The measured minimum concentration of NO, 7.8 µg/m^3, in the project area was recorded at Gajju Khan. Similarly the maximum concentration of NO in the project area was recorded at Gadoon Industrial Area–1: 32.8 µg/m^3. The average concentration of NO in Swabi observed at Gadoon Industrial Area 1, Gadoon Industrial Area 2, Gajju Khan, Col. Sher Khan Interchange, Jahangira Road, Topi Road and Topi City (Yousufabad) was 30.1, 17.9, 10.1, 12.5 26.2, 14.4 and 18.1, respectively.

Figure 4-6: Ambient Air Quality Monitoring at Gadoon Industrial Area - 1

241. The measured minimum concentration of NO_2 in the project area was recorded at Gajju Khan 5.5 µg/m^3. Similarly the maximum concentration of NO_2 in the project area was recorded at both Gadoon Industrial Area 1 and Col. Sher Khan Interchange as 25.0 µg/m^3. The average concentration of NO_2 in in the project area was recorded at Gadoon Industrial Area 1, Gadoon Industrial Area 2, Gajju Khan, Col. Sher Khan Interchange, Jahangira Road, Topi Road and Topi City (Yousufabad) as 22.7, 9.0, 6.8, 6.9, 14.6, 7.0 and 8.6, respectively. The results of the seven different locations are illustrated in the following tables.

242. The NO levels in Table 4-7 indicates that there would be no adverse health impacts at the observed concentrations of NO_X and therefore no cautionary measures are required. However, people with asthma or other respiratory diseases, the elderly, and children are the groups that may be sensitive to even this low level of concentration. Epidemiological studies have shown that symptoms of bronchitis in asthmatic children increase in association with long-term exposure to NO_2.

243. The monitoring results in the Table 4-7 reveals that the average levels of NO_X were within the prescribed limits of international and national standards for ambient air quality. The construction and operation of the project will not add to the NOx levels.

Table 4-7: NO_x Monitoring Information in the Project Area

S#	Gadoon Industrial Area-1 6-9-2015		Gadoon Industrial Area-2 6-10-2015		Topi City Yousufabad 6-11-2015		Topi Road 6-10-2015		Jehangir Road 6-13-2015		Gajju Khan 6-14-2015		CoL Sher Khan Interchange 6-15-2015	
	NO (µg/m³)	NO2 (µg/m³)	NO (µg/m³)	NO2 (µg/m³)	NO (µg/m³)	NO2 (µg/m³)	NO (µg/m³)	NO2 (µg/m³)	NO (µg/m³)	NO2 (µg/m³)	NO (µg/m³)	NO2 (µg/m³)	NO (µg/m³)	NO2 (µg/m³)
1	30.9	25	15.8	10.3	17.2	9	16.4	8.1	26.7	14.1	12.7	7.2	12.3	6.7
2	31	24.8	17	9.6	16.6	9.2	15.5	7.7	26.9	14	11.8	7.4	14.3	6.8
3	31	23.9	17.2	8.7	16	8.8	16	7.6	27.2	13.9	11.4	7.4	13.6	6.3
4	31.3	23.3	16.4	9.3	16.9	8.8	16.5	7.4	27.7	14.1	11.3	8.1	13.7	7.4
5	32.7	23.4	16	9.9	16.9	8.6	14.4	7.5	27.5	14.6	10.9	7.6	14.2	7.2
6	32.2	23.3	17.3	9.4	17.2	8.7	14.1	7.1	27.2	14.2	10.7	7.7	13.3	7.5
7	32	23.1	15.6	9.7	17.5	9.4	14.2	7	27.2	14.3	10	7.2	13.4	6.9
8	32	23.9	15.5	8.7	17.8	8.6	13.7	6.6	26.3	14.2	8.7	6.3	13.6	6.3
9	31.6	24.5	17.6	8.9	18.5	8.4	13.4	5.8	26.4	14	8.6	5.8	11.7	6.5
10	28.9	23.9	15.2	9	17.9	8.6	13.4	5.8	26.2	14	8.8	6	11.5	6.3
11	28.4	22.5	17.5	9.2	15.8	8.4	12.5	5.9	26	14.1	8.3	5.7	10.1	6.7
12	28.2	22	16.2	8	17	8	12.5	5.9	26	14	8.1	6	10.6	6.4
13	27.3	21.8	16.5	7.9	16.8	8.1	12.5	6	25.8	13.7	8.1	5.7	10.3	6.3
14	27.6	20.9	16.1	8.1	19.3	8.1	12.3	6.2	26.3	13.6	7.9	5.6	11	6.3
15	27.5	21	16.7	8.1	19.3	8.2	12.1	6.2	25.6	13.9	7.8	5.8	11.3	6.3
16	27.8	21.3	19.4	8.4	20.3	8.3	12.6	6.5	25.6	13.8	8	5.9	10.4	7.1
17	27.9	21.2	21.6	8.9	16.7	8.6	12.2	6.5	25	13.3	9.2	5.5	10.2	7.3

S#	Gadoon Industrial Area-1 6-9-2015		Gadoon Industrial Area-2 6-10-2015		Topi City Yousufabad 6-11-2015		Topi Road 6-10-2015		Jehangir Road 6-13-2015		Gajju Khan 6-14-2015		CoL Sher Khan Interchange 6-15-2015	
	NO (µg/m³)	NO2 (µg/m³)	NO (µg/m³)	NO2 (µg/m³)	NO (µg/m³)	NO2 (µg/m³)	NO (µg/m³)	NO2 (µg/m³)	NO (µg/m³)	NO2 (µg/m³)	NO (µg/m³)	NO2 (µg/m³)	NO (µg/m³)	NO2 (µg/m³)
18	28.6	22.3	21.2	8.9	19.7	8.5	14.7	7.7	25	14.9	11.1	6.4	11.3	7.6
19	28.7	21.4	21.2	9.1	19.2	8	15.1	7.8	25.3	15.6	11.7	6.6	12.9	7.3
20	28.2	21.6	20.6	9.1	18.6	8.8	14.9	8.7	25.6	16.2	11.6	6.8	14.4	7.6
21	30	21.5	20	9.4	18.8	8.8	15.1	7.7	25.4	16.3	11.9	7.7	12.3	7.9
22	32.2	22.8	19.2	9.5	18.4	9	16.6	7	25.9	16.3	12.3	8.3	13.6	7.5
23	32.6	22.9	20.2	9.5	20.3	9.2	17.2	7.1	26.3	16.3	10	8.3	15.1	7.4
24	32.8	23.5	19.4	9.4	20.8	9.1	17.7	7.4	26.5	16.3	10.3	7.2	14.1	6.1
25	27.3	20.9	15.2	7.9	15.8	8	12.1	5.8	25	13.3	7.8	5.5	10.1	6.1
26	30.1	22.7	17.9	9	18.1	8.6	14.4	7	26.2	14.6	10.1	6.8	12.5	6.9
27	32.8	25	21.6	10.3	20.8	9.4	17.7	8.7	27.7	16.3	12.7	8.3	15.1	7.9

4.4.8 Sulfur Dioxide (SO_2)

244. Sulfur dioxide belongs to the family of sulfur oxide gases (SO_X). These gases are formed when fuel containing sulfur (mainly coal and oil) is burned, and during metal smelting and other industrial processes.

245. The major health concerns associated with exposure to high concentrations of SO_2 include effects on breathing, respiratory illness, alterations in pulmonary defences, and aggravation of existing cardiovascular disease. Major subgroups of the population that are most sensitive to SO_2 include asthmatics and individuals with cardiovascular disease or chronic lung diseases (such as bronchitis or Emphysema) as well as children and the elderly. Together, SO_2 and NO_X are the major precursors of acid rain, which is associated with the acidification of lakes and streams, accelerated corrosion of buildings and monuments, and reduced visibility.

246. The measured minimum concentration of SO_2 in the project area was recorded at Gajju Khan 9.8 µg/m^3. Similarly, the maximum concentration of SO_2 was recorded at Jahangira Road as 44..7µg/m3. The average concentration of SO2 recorded at Gadoon Industrial Area 1, Gadoon Industrial Area 2, Gajju Khan, Col. Sher Khan Interchange, Jahangira Road, Topi Road and Topi City (Yousufabad) was 39.1, 22.6, 17.0, 16.7, 41.7, 21.4 and 22.2 µg/m^3, respectively. In 2005 World Health Organization revised its guidelines for 24-hour concentration of SO_2 from 125 to 20 µg/m^3. Table 4-8 indicates that the average levels of SO_2 is within the prescribed limits of NEQS and WHO standards.

Table 4-8: SO_2 Monitoring Information in the Project Area

	Gadoon Industrial Area-1 6-9-2015		Gadoon Industrial Area-2 6-10-2015		Topi City Yousufabad 6-11-2015		Topi Road 6-10-2015		Jehangir Road 6-13-2015		Gajju Khan 6-14-2015		CoL Sher Khan Interchange 6-15-2015	
S. No	Time	SO_2 ($\mu g/m^3$)	Time	SO_2 ($\mu g/m^3$)	Time	SO_2 ($\mu g/m^3$)	Time	SO_2 ($\mu g/m^3$)	Time	SO_2 ($\mu g/m^3$)	Time	SO_2 ($\mu g/m^3$)	Time	SO_2 ($\mu g/m^3$)
1	1200	40.3	1230	24.6	1300	26.1	1330	25.1	1400	43.1	1430	18.6	1500	19.2
2	1300	39.7	1330	28.4	1400	26.2	1430	24	1500	43.6	1530	19.8	1600	18.6
3	1400	40.5	1430	22.9	1500	24.2	1530	25.7	1600	44.7	1630	21.7	1700	18.2
4	1500	39.8	1530	23.8	1600	23.9	1630	23.4	1700	44	1730	22.1	1800	19.4
5	1600	39.7	1630	22.4	1700	23	1730	23.8	1800	44	1830	22.1	1900	18.9
6	1700	40.3	1730	22.2	1800	22.5	1830	24.3	1900	43.7	1930	22	2000	19.1
7	1800	39.9	1830	22.3	1900	22.5	1930	23.2	2000	44.1	2030	20.8	2100	19.3
8	1900	39.8	1930	22.7	2000	21.3	2030	23.1	2100	42.4	2130	20.2	2200	17.8
9	2000	39.7	2030	22	2100	20	2130	20.2	2200	42.8	2230	19.8	2300	17.4
10	2100	38.3	2130	21.7	2200	19.8	2230	18.9	2300	41.1	2330	17.6	0	15.1
11	2200	38	2230	20.2	2300	19.9	2330	18.8	0	40.5	30	13.7	100	15.7
12	2300	38.2	2330	18.9	0	20	30	19.8	100	40.3	130	13.9	200	13.8
13	0	38.1	30	18.4	100	20	130	17.8	200	39.8	230	11.5	300	12.3
14	100	38.1	130	18.9	200	20.1	230	17.8	300	39.5	330	12	400	11.9
15	200	37.7	230	18.5	300	20.5	330	17.6	400	39.4	430	11.3	500	12.6
16	300	37.2	330	18.2	400	21	430	17.4	500	39.3	530	11.6	600	13.6
17	400	37.4	430	21.5	500	22	530	17	600	39.6	630	9.9	700	14.4
18	500	37	530	23.9	600	22.6	630	19.2	700	40.5	730	9.8	800	15.8
19	600	37.3	630	25.7	700	22.2	730	19.6	800	40.1	830	16.1	900	18.3
20	700	40.5	730	25.2	800	22.9	830	19.9	900	40.1	930	18.3	1000	16.3
21	800	40.7	830	23.8	900	22.9	930	23.2	1000	42.3	1030	20.8	1100	17.9

Gadoon Industrial Area-1 6-9-2015			Gadoon Industrial Area-2 6-10-2015		Topi City Yousufabad 6-11-2015		Topi Road 6-10-2015		Jehangir Road 6-13-2015		Gajju Khan 6-14-2015		CoL Sher Khan Interchange 6-15-2015	
S. No	Time	SO_2 (µg/m^3)	Time	SO_2 (µg/m^3)	Time	SO_2 (µg/m^3)	Time	SO_2 (µg/m^3)	Time	SO_2 (µg/m^3)	Time	SO_2 (µg/m^3)	Time	SO_2 (µg/m^3)
22	900	40.9	930	25.4	1000	23.1	1030	24.1	1100	42.1	1130	18.7	1200	16.6
23	1000	39.8	1030	25.5	1100	23.4	1130	24.4	1200	41.7	1230	18.1	1300	17.3
24	1100	40.2	1130	25.6	1200	23	1230	24.4	1300	41.8	1330	18.2	1400	20.1

4.4.9 Carbon Monoxide (CO)

247. Carbon monoxide is a colourless, odourless and poisonous gas formed when carbon in fuels is not burned completely. It is a by product of motor vehicle exhaust, which contributes more than two-thirds of all CO emissions nationwide.

248. Carbon monoxide enters the bloodstream and reduces oxygen delivery to the body's organs and tissues. The health threat from CO is most serious for those who suffer from cardiovascular disease. Healthy individuals are also affected, but only at higher levels of exposure to elevated CO levels which is associated with visual impairment, reduced work capacity, and reduced manual dexterity, poor learning ability, and difficulty in performing complex tasks.

249. The measured minimum concentration of CO in the project area was recorded at Gadoon Industrial Area 2 and Gajju Khan, which was 0.5 mg/m^3. Similarly, the maximum concentration of CO in the project area was recorded at Jahangira Road, which was 3.7 mg/m^3.

250. Average concentration of CO in the project area was recorded at Gadoon Industrial Area 1, Gadoon Industrial Area 2, Gajju Khan, Col. Sher Khan Interchange, Jahangira Road, Topi Road and Topi City (Yousufabad) was 2.8, 1.0, 0.9, 2.3, 3.3, 2.9 and 2.5 mg/m^3, respectively.

251. Table 4-9 indicates that the level of Carbon Monoxide is within the prescribed limits of NEQS and WHO standards.

Table 4-9: CO Monitoring Inofmration in the Ptoject Area

Gadoon Industrial Area-1 6/9/2015	Gadoon Industrial Area-2 6/10/2015	Topi City Yousufabad 6/11/2015	Topi Road 6/10/2015	Jehangir Road 6/13/2015	Gajju Khan 6/14/2015	CoL Sher Khan Interchange 6/15/2015	Gadoon Industrial Area-1 6/9/2015
S#	CO (mg/m^3)	CO (mg/m^3)	CO (mg/m^3)	CO (mg/m^3)	CO (mg/m^3)	CO (mg/m^3)	CO (mg/m^3)
1	3	1.4	2.6	3.1	3.4	1	3
2	3	1.7	2.7	2.9	3.4	0.9	3.2
3	3.1	1.3	2.8	2.9	3.6	1.1	3.1
4	3	1.1	2.8	3	3.5	1.1	2.9
5	3.1	1.1	2.7	2.8	3.7	1.3	3
6	3.2	1.1	2.5	3.2	3.6	1	2.7
7	3	0.9	2.5	3	3.6	0.8	2.5
8	2.8	0.9	2.4	2.9	3.4	0.9	2.3
9	2.7	0.9	2.4	3	3.5	0.9	2.1
10	2.5	0.8	2.2	2.9	3.2	0.9	2
11	2.6	0.9	2.3	2.7	3.1	0.8	1.7
12	2.7	0.9	2	2.6	3	0.7	2
13	2.5	0.8	2.1	2.6	2.7	0.7	1.9

Gadoon Industrial Area-1 6/9/2015	Gadoon Industrial Area-2 6/10/2015	Topi City Yousufabad 6/11/2015	Topi Road 6/10/2015	Jehangir Road 6/13/2015	Gajju Khan 6/14/2015	CoL Sher Khan Interchange 6/15/2015	Gadoon Industrial Area-1 6/9/2015
S#	CO (mg/m³)	CO (mg/m³)	CO (mg/m³)	CO (mg/m³)	CO (mg/m³)	CO (mg/m³)	CO (mg/m³)
14	2.5	0.5	2.3	2.7	2.9	0.6	2.1
15	2.6	0.5	2.3	2.6	3	0.5	2
16	2.7	0.7	2.1	2.6	3.1	0.5	2.1
17	2.6	1	2.3	2.7	3.2	1.5	2
18	2.8	1.2	2.5	3.1	3.2	0.9	2.1
19	2.8	1.1	2.6	3.1	3.4	1	2.1
20	2.9	1.3	2.7	2.8	3.4	1.1	1.9
21	3	1.2	2.6	2.8	3.4	1	2
22	2.9	1.3	2.6	2.8	3.3	1.1	2.5
23	2.8	1.1	2.7	2.7	3.4	1	2.7
24	2.8	1.1	2.7	2.9	3.4	0.9	1.6
25	2.5	0.5	2	2.6	2.7	0.5	1.6
26	2.8	1	2.5	2.9	3.3	0.9	2.3

4.4.10 Ozone (O_3)

252. Ground-level ozone (the primary constituent of smog) is the most complex, difficult to control, and pervasive of the six principal pollutants. Unlike other pollutants, ozone is not emitted directly into the air by specific sources. Ozone is created by sunlight acting on nitrogren oxides (NOx) and volatile organic compound (VOC) emissions in the air. Some of the more common sources include gasoline vapours, chemical solvents, combustion products of various fuels, and consumer products. Combined emissions from motor vehicles and stationary sources can be carried hundreds of miles from their origins, forming high ozone concentrations over very large regions.

253. Studies indicated that ground-level ozone not only affects people with impaired respiratory systems (such as asthmatics), but healthy adults and children as well. Exposure to ozone for 6 to 7 hours, even at relatively low concentrations, significantly reduces lung function and induces respiratory inflammation in normal, healthy people during periods of moderate exercise.

254. The measured minimum concentration of Ozone (O_3) (µg/m^3) in the project area was recorded at Gajju Khan as 6 µg/m^3. Similarly, the maximum concentration of O_3 (µg/m^3) in the project area was recorded at Topi City (Yousufabad) as 27µg/m^3.

255. Average concentration of O_3 at Gadoon Industrial Area 1, Gadoon Industrial Area 2, Gajju Khan, Col. Sher Khan Interchange, Jahangira Road, Topi Road and Topi City (Yousufabad) was 15.8, 13.1, 10.9, 14.3, 19.7, 14.5 and 16.0 µg/m^3, respectively.

256. The above Table 4-10 indicates that the average levels of Ozone is within the prescribed limit of NEQS and WHO standards.

Table 4-10: Ozone Monitoring Infomation in the Project Area

S #	Gadoon Industrial Area- O_3 (µg /	Gadoon Industrial Area- O_3 (µg /	Topi City Yousufabad 6-11-2015 O_3 (µg / m³)	Topi Road O_3 (µg	Jehangir Road 6-13- O_3 (µg /	Gajju Khan O_3 (µg	CoL Sher Khan Interchange O_3 (µg / m³)	Gadoon Industrial Area- NO (µg/m³)	Gadoon Industrial Area- NO2 (µg/m³)	Topi City Yousufabad 6-11-2015 CO (mg/m³)	Topi Road 6- Noise	Jehangira Road 6-13-2015 O_3 (µg / m³)
1	17	19	23	17	22	16	21	30.9	25	3	59	17
2	16	19	20	19	19	14	21	31	24.8	3	62	16
3	18	15	27	21	21	13	21	31	23.9	3.1	53	18
4	20	15	22	20	23	13	16	31.3	23.3	3	51	20
5	21	12	20	17	23	12	18	32.7	23.4	3.1	55	21
6	22	13	14	13	21	13	16	32.2	23.3	3.2	58	22
7	22	12	14	14	20	14	12	32	23.1	3	60	22
8	19	12	13	15	20	12	13	32	23.9	2.8	61	19
9	16	11	15	11	20	10	10	31.6	24.5	2.7	63	16
10	11	9	11	15	16	8	11	28.9	23.9	2.5	55	11
11	10	10	11	11	16	8	10	28.4	22.5	2.6	51	10
12	10	9	12	10	14	8	9	28.2	22	2.7	45	10
13	10	10	11	10	15	8	10	27.3	21.8	2.5	43	10
14	10	10	11	9	16	6	9	27.6	20.9	2.5	42	10
15	10	10	12	9	13	7	11	27.5	21	2.6	43	10
16	11	11	12	9	16	7	13	27.8	21.3	2.7	42	11
17	13	12	11	11	17	7	14	27.9	21.2	2.6	43	13
18	16	11	11	14	18	9	13	28.6	22.3	2.8	50	16
19	16	13	16	17	19	10	12	28.7	21.4	2.8	57	16
20	14	15	18	17	22	10	16	28.2	21.6	2.9	62	14
21	17	16	20	17	26	13	16	30	21.5	3	61	17
22	20	17	19	17	26	14	17	32.2	22.8	2.9	61	20
23	20	17	20	17	25	15	19	32.6	22.9	2.8	60	20
24	21	17	20	17	25	15	15	32.8	23.5	2.8	56	21
25	10	9	11	9	13	6	9	27.3	20.9	2.5	42	10
26	15.8	13.1	16	14.5	19.7	10.9	14.3	30.1	22.7	2.8	53.9	15.8
27	22	19	27	21	26	16	21	32.8	25	3.2	63	22

4.4.11 Particulate Matter (PM_{10}, $PM_{2.5}$ and TSP)

257. Particulate matter comprises solid or liquid particles found in the air. Some particles are large or dark enough to be seen as soot or smoke. Others are so small they can be detected only with an electron microscope. Because particles originate from a variety of mobile and stationary sources (diesel trucks, wood stoves, power plants, etc.), their chemical and physical compositions vary widely. Particulate matter (PM) is a complex mixture consisting of varying combinations of dry solid fragments, solid cores with liquid coatings and small droplets of liquid. These tiny particles vary greatly in shape, size and chemical composition, and can be made up of different materials such as metals, soot, soil and dust. PM may also contain sulphate particles. PM may be divided into many size fractions, measured in microns (a micron is one-millionth of a meter). Pak EPA regulates three classes of particles - particles up to 10 microns (PM_{10}), particles up to 2.5 microns in size ($PM_{2.5}$) and Total Suspended Particulates (TSP).

258. $PM_{2.5}$ particles are a subset of PM_{10}, which directly relate to vehicular emissions.

259. PM_{10} particles are subset of TSP. Major sources of PM_{10} are fuel combustion, construction, mining and quarrying are the major sources of particulate emissions.

260. Major concerns for human health from exposure to particulate matter are: effects on breathing and respiratory systems, damage to lung tissue, cancer, and premature death. The elderly, children, and people with chronic lung disease, influenza, or asthma, tend to be especially sensitive to the effects of particulate matter. Acidic particulate matter can also damage manmade materials and is a major cause of reduced visibility.

261. The average minimum concentration of $PM_{2.5}$ (µg/m^3) in the project area was recorded at Col. Sher Khan Interchange as 17 µg/m^3. Similarly, the average maximum concentration of $PM_{2.5}$ (µg/m^3) was recorded at three sites including Col. Sher Khan Interchange, Jahangira Road and Topi Road as 29µg/m^3. Daily average concentrations of $PM_{2.5}$ (µg/m3) at Gadoon Industrial Area 1,Gadoon Industrial Area 2, Gajju Khan, Col. Sher Khan Interchange, Jahangira Road, Topi Road and Topi City (Yousufabad) was 23µg/m^3, 19µg/m^3 22µg/m^3, 17µg/m^3, 28µg/m^3, 29µg/m^3 and 24µg/m^3, respectively.

262. Table 4-11 indicates that the average levels of $PM_{2.5}$ is within the prescribed limits of NEQS standards.

263. The average minimum and maximum concentration of PM_{10} (µg/m^3) in the project area was recorded at Topi City (Yousufabad) and Jahangira Road, which were 66µg/m^3 and 127µg/m^3, respectively, indicating vehicular movement on unpaved or poorly paved tracks generating dust as the main contributor to elevated PM10 cocentrations in the area.While $PM_{2.5}$ is direcly from the emission of vehicles. Average concentrations of PM_{10} (µg/m^3) at Gadoon Industrial Area 1, Gadoon Industrial Area 2, Gajju Khan, Col. Sher Khan Interchange, Jahangira Road, Topi Road and Topi City (Yousufabad) was 89µg/m^3, 71µg/m^3, 97µg/m^3, 73µg/m^3, 127µg/m^3, 112µg/m^3 and 66µg/m^3, respectively.

264. Table 4-11 shows that the average levels of PM_{10} is within the prescribed limits of NEQS and US EPA standards; however it does not comply with the WHO guideline value of 50 µg/m^3 for ambient air quality. The comparatively elevated PM_{10} levels are mainly due to dust due to vehicular movement on unpaved roads.

Table 4-11: Particulate Matter (PM_{10}, $PM_{2.5}$ and TSP) Monitoring Infomation in the Project Area

Location	Monitoring Date	$PM_{2.5}$ (µg / m³)	PM_{10} (µg / m³)	SPM (µg / m³)
Gadoon Industrial Area-1	9-Jun-2015	23	66	377
Gadoon Industrial Area-2	10-Jun-2015	89	197	17
Topi Road	10-Jun-2015	19	112	143
Topi City Yousufabad	11-Jun-2015	276	29	73
Jehangira Road	13-Jun-2015	71	296	22
Gajju Khan	14-Jun-2015	115	28	97
Colonel Sher Khan Interchange	15-Jun-2015	24	127	235

4.4.12 Monitoring Results of Suspended Particulate Matter

265. Table 4-11 above indicates that the measured concentration of Suspended Particulate Matter (SPM) was within the prescribed limits of NEQS and there are no WHO ambient air quality guideline for SPM.

4.4.13 Noise Level

266. Noise is unwanted or harmful sound created by human activities, including noise emitted by transport - road traffic, rail traffic, air traffic and from sites of industrial activity. It is monitored to prevent and reduce its impact on the environment, including human health.

267. This pre-project noise monitoring was required in order to establish the baseline (day & night time) for evaluation during construction to measure difference between pre-project noise levels and noise levels during consturuction period and also during operation. Noise measurements at 07 selected points which were representative of the closest sensitive receptors (settlements) were carried out to determine the existing baseline ambient and background noise levels. The identification of appropriate monitoring locations was finalized during the baseline survey and site walkover and visit to the surrounding areas. First and foremost, proximity to sensitive receptors was the criteria considered in the selection of locations for noise level monitoring. Therefore, noise level was monitored along the proposed pipe line and canals at 05 locations (points 1, 3, 4, 6, and 7 in Figure 4-5) which were close to settlements and 02 points (points 2 and 5) where the noise level would be already elevated due to industries in the vicinity. However, as the selected 05 locations were close to settelements and also close to roads.

268. The locations and receptors sensitivity is given in the following Table 4-12 and Figure 4-5.

Table 4-12: Ambient Air and Noise Quality Monitoring Locations in the Project Area

S#	Location of Noise and Amabient Air Quality Monitoring	Sensitive Receptors
1	Gadoon Industrial Area-1	Population of the Gadoon Industrial Area
2	Gadoon Industrial Area-2	Population of the Gadoon Industrial Area
3	Jehangira Road	Villages
4	Topi-1 Close to City	Population of the Topi city and villages
5	Topi-2 Road	Population of the reported villages
6	Gajju Khan	Afghan Refugees Camp and other villages
7	Col.Sher Khan Interchange	Villages

269. The measured minimum noise level in the project area during day time was recorded at Gajju Khan as 36 dBA. Similarly, the maximum noise level was at Topi Road as 79 dBA. Average noise level at Gajju Khan, Col. Sher Khan Interchange, Jahangira Road, Topi Road and Topi City (Yousufabad) were 50.6 dBA, 67.5 dBA, 67.6 dBA, 74.3 dBA and 61.9 dBA, respectively. These high average noise levels and the highest at Topi road is probably due to vehicular traffic. Similarly, noise level at Gadoon Industrial Area 1, Gadoon Industrial Area 2 were also high; 58.5 dBA and 44.8 dBA respectively. Further, the night time average noise levels were low even at locations in the industrial area except at busy interchanges and roads indicating traffic as the main source of high noise levels.

270. The above table reveals that the baseline noise level is within the permissible limit of NEQS and WHO standards. The noise level monitoring results are given in Table 4-13.

Table 4-13: Noise Level Monitoring Data

S#	Gadoon Industrial Area-1 6-9-2015	Gadoon Industrial Area-2 6-10-2015	Topi City Yousufabad 6-11-2015	Topi Road 6-10-2015	Jehangir Road 6-13-2015	Gajju Khan 6-14-2015	CoL Sher Khan Interchange 6-15-2015
	Noise (dBA)	Noise (dBA)	Noise (dBA)	Noise (dBA)	Noise (dBA)	Noise (dBA)	Noise (dBA)
1	59	48	60	73	70	54	71
2	62	45	63	79	67	52	70
3	53	49	60	77	66	55	70
4	51	44	66	76	66	55	70
5	55	43	64	74	72	54	71
6	58	48	66	71	73	54	71
7	60	42	68	76	67	51	70
8	61	46	65	74	72	52	69
9	63	48	62	72	72	46	68
10	55	43	60	77	69	44	68
11	51	41	61	70	64	44	65
12	45	36	56	69	63	43	65
13	43	37	58	64	63	44	59
14	42	38	55	61	58	44	57

S#	Gadoon Industrial Area-1 6-9-2015	Gadoon Industrial Area-2 6-10-2015	Topi City Yousufabad 6-11-2015	Topi Road 6-10-2015	Jehangir Road 6-13-2015	Gajju Khan 6-14-2015	CoL Sher Khan Interchange 6-15-2015
	Noise (dBA)	Noise (dBA)	Noise (dBA)	Noise (dBA)	Noise (dBA)	Noise (dBA)	Noise (dBA)
15	43	34	55	61	57	41	56
16	42	37	54	59	61	36	57
17	43	43	55	68	56	37	68
18	50	42	53	71	57	36	62
19	57	46	52	71	58	44	68
20	62	40	57	72	61	52	64
21	61	44	65	77	67	50	62
22	61	43	61	79	69	55	64
23	60	45	62	73	74	54	67
24	56	43	58	74	75	55	64
25	42	34	52	59	56	36	56
26	53.9	42.7	59.8	71.6	65.7	48	65.7

Col: Abbreviation for Colonel, a military rank

4.4.14 Meteorological parameters

271. In this study, meteorological parameters including wind speed, wind direction, ambient temperature and relative humidity were measured in the project area. The monitoring locations, were similar to air and noise monitoring as sensitive receptors were the primary criteria considered in location selection. The prevailing wind speed and wind direction at each site is produced as wind roses.

272. The minimum average value of temperature and minimum average value of humidity was 28.2°C and 31.9%, respectively as recorded at Topi City (Yousufabad) and minimum average value of wind speed was 1.5m/s recorded at Gadoon Industrial Area 1 in Swabi. While, maximum average value of temperature was 34.5°C recorded at Topi Road, maximum average value of humidity was 40.9%, recorded at Gajju Khan and maximum average value of wind speed was recorded as 5.7m/s at Gajju Khan in Swabi. The results are presented in the following tables.

273. The Table 4-14 shows Minimum, Average and Maximum Values (24hrs) values of temperature, measured at different locations of PHLCE Project area.

Table 4-14: Air Temperature in the Project Area

S#	Gadoon Industrial Area-1 6-9-2015	Gadoon Industrial Area-2 6-10-2015	Topi City Yousufabad 6-11-2015	Topi Road 6-10-2015	Jehangira Road 6-13-2015	Gajju Khan 6-14-2015	Col Sher Khan Interchange 6-15-2015
	Air Temp.(°C)	Air Temp.(°C)	Air Temp.(°C)	Air Temp.(°C)	Air Temp.(°C)	Air Temp.(°C)	Air Temp.(°C)
1	37	37	38	40	39	40	35
2	38	37	37	41	40	39	34
3	38	36	36	40	40	38	34
4	39	37	36	39	41	36	34
5	40	38	35	38	40	33	33

S#	Gadoon Industrial Area-1 6-9-2015	Gadoon Industrial Area-2 6-10-2015	Topi City Yousufabad 6-11-2015	Topi Road 6-10-2015	Jehangira Road 6-13-2015	Gajju Khan 6-14-2015	Col Sher Khan Interchange 6-15-2015
	Air Temp.(°C)	Air Temp.(°C)	Air Temp.(°C)	Air Temp.(°C)	Air Temp.(°C)	Air Temp.(°C)	Air Temp.(°C)
6	38	33	33	36	38	31	33
7	37	33	32	34	36	30	32
8	35	31	30	33	33	29	30
9	34	31	29	31	32	28	29
10	32	30	28	30	32	27	29
11	31	29	27	30	31	27	28
12	30	28	27	30	30	26	27
13	29	27	27	29	29	25	26
14	28	26	26	28	29	24	25
15	28	25	27	28	28	25	25
16	27	25	29	29	28	26	24
17	26	27	32	31	27	27	25
18	25	29	34	33	27	30	26
19	26	32	35	34	29	30	29
20	28	34	36	37	30	31	32
21	31	35	37	38	32	32	33
22	34	35	38	39	33	34	34
23	35	36	39	39	34	36	35
24	36	36	39	40	35	37	36
25	25	25	26	28	27	24	24
26	32.6	32	32.8	34.5	33	30.9	30.3
27	40	38	39	41	41	40	36

274. The Table 4-15 is showing minimum, average and maximum values (24hrs) of humidity at different locations of PHLCE Project area.

Table 4-15: Humidity in the Project Area

S#	Gadoon Industrial Area-1 6-9-2015	Gadoon Industrial Area-2 6-10-2015	Topi City Yousufabad 6-11-2015	Topi Road 6-10-2015	Jehangira Road 6-13-2015	Gajju Khan 6-14-2015	Col Sher Khan Interchange 6-15-2015
	Hum. (%)	Hum. (%)	Hum. (%)	Hum. (%)	Hum. (%)	Hum. (%)	Hum. (%)
1	33	27	27	26	31	27	34
2	31	29	29	26	29	29	34
3	29	32	32	24	29	31	34
4	26	30	30	26	30	30	28
5	26	29	30	27	29	31	29
6	27	41	31	30	31	35	29
7	31	41	36	32	37	35	33
8	34	43	40	31	29	37	43
9	36	43	40	35	40	42	45
10	41	45	45	35	40	48	45
11	40	45	51	35	40	48	48
12	43	48	58	37	45	51	48

S#	Gadoon Industrial Area-1 6-9-2015	Gadoon Industrial Area-2 6-10-2015	Topi City Yousufabad 6-11-2015	Topi Road 6-10-2015	Jehangira Road 6-13-2015	Gajju Khan 6-14-2015	Col Sher Khan Interchange 6-15-2015
	Hum. (%)	Hum. (%)	Hum. (%)	Hum. (%)	Hum. (%)	Hum. (%)	Hum. (%)
13	45	51	58	37	45	54	47
14	48	54	57	39	45	57	50
15	45	57	58	39	48	54	50
16	48	57	51	37	48	51	53
17	51	54	43	33	51	51	47
18	51	48	38	36	51	45	51
19	51	36	34	34	45	43	45
20	45	30	34	35	45	40	36
21	38	29	30	33	40	38	36
22	34	26	27	31	38	36	32
23	30	26	27	30	36	36	28
24	29	26	27	28	32	33	27
25	26	26	27	24	29	27	27
26	38	39.5	38.9	32.3	38.9	40.9	39.7
27	51	57	58	39	51	57	53

275. The Table 4-16 and Table 4-17 show average values of Wind Speed and wind directions at different locations of PHLCE Project area.

Table 4-16: Wind Speed in the Project Area

S#	Gadoon Industrial Area-1 6-9-2015	Gadoon Industrial Area-2 6-10-2015	Topi City Yousufabad 6-11-2015	Topi Road 6-10-2015	Jehangir Road 6-13-2015	Gajju Khan 6-14-2015	CoL Sher Khan Interchange 6-15-2015
	Wind Speed (m/s)	Wind Speed (m/s)	Wind Speed (m/s)	Wind Speed (m/s)	Wind Speed (m/s)	Wind Speed (m/s)	Wind Speed (m/s)
1	3.1	7.2	4.1	4.4	5.3	4.1	8.2
2	2.1	6.2	6.2	5.4	2.5	5.1	7.2
3	1.5	10.3	5.8	2.3	2.9	8.2	6.2
4	1.2	4.1	7.2	3.4	4.5	7.9	5.1
5	0.9	4.1	2.7	3.9	5.4	7.8	7.9
6	1.3	10.3	4.1	2.5	5.8	8.6	8.1
7	1.5	8.2	3.4	3.1	3.6	7.2	4.3
8	1.4	5.1	2.1	3.7	2.5	6.8	4.8
9	1.1	4.1	0.9	5.9	3.6	5.1	5.1
10	1.9	4.1	3.1	2.7	3.9	7.2	1.9
11	1	3.1	2.1	2.1	7.4	5.1	6.2
12	0.8	3.1	Calm	4.2	1.5	4.9	6.2
13	0.9	3.1	Calm	1.8	1.4	8.7	5.1
14	1.2	2.1	Calm	2.9	2.8	6.9	4.6
15	1.3	5.6	Calm	2.5	4.1	3.1	5.8
16	1.7	2.8	Calm	4.8	3.1	4.6	2.4

S#	Gadoon Industrial Area-1 6-9-2015 Wind Speed (m/s)	Gadoon Industrial Area-2 6-10-2015 Wind Speed (m/s)	Topi City Yousufabad 6-11-2015 Wind Speed (m/s)	Topi Road 6-10-2015 Wind Speed (m/s)	Jehangir Road 6-13-2015 Wind Speed (m/s)	Gajju Khan 6-14-2015 Wind Speed (m/s)	CoL Sher Khan Interchange 6-15-2015 Wind Speed (m/s)
17	0.9	2.4	2.3	7.6	3.1	3.1	3.1
18	0.2	3.1	3.1	2.1	4.1	3.1	2.8
19	0.6	2.9	3.1	3.3	3.1	3.1	2.4
20	0.9	3.8	3.5	2.3	4.9	5.1	3.1
21	1.6	2.2	3.1	2.1	1.8	7.2	3.1
22	2.8	2.9	5.1	5.4	1.5	8.2	3.1
23	3.9	5.7	4.1	2.9	1.7	3.8	4.3
24	2.4	1.8	4.8	2.7	2.8	2.9	5.1
25	0.2	1.8	0.9	1.8	1.4	2.9	1.9
26	1.5	4.4	3.7	3.5	3.5	5.7	4.8
27	3.9	10.3	7.2	7.6	7.4	8.7	8.2

Table 4-17: Wind Direction in the Project Area

S#	Gadoon Industrial Area-1 6-9-2015 Wind Dir (Deg)	Gadoon Industrial Area-2 6-10-2015 Wind Dir (Deg)	Topi City Yousufabad 6-11-2015 Wind Dir (Deg)	Topi Road 6-10-2015 Wind Dir (Deg)	Jehangir Road 6-13-2015 Wind Dir (Deg)	Gajju Khan 6-14-2015 Wind Dir (Deg)	CoL Sher Khan Interchange 6-15-2015 Wind Dir (Deg)
1	41	41	142	41	133	142	41
2	44	44	41	41	148	157	42
3	142	41	41	142	145	142	142
4	41	142	41	157	146	164	142
5	41	142	41	149	142	41	57
6	43	233	319	176	41	47	41
7	41	211	319	41	41	319	157
8	41	233	278	45	319	11	142
9	41	241	319	44	11	17	41
10	319	41	289	46	27	41	51
11	319	192	233	41	39	11	54
12	319	197	48	319	34	49	49
13	233	192	49	318	22	47	105
14	237	41	47	311	39	55	107
15	233	319	38	142	38	319	95
16	233	11	98	41	142	58	46
17	142	319	41	41	12	61	48
18	233	319	46	41	17	64	42
19	142	48	42	233	41	41	43
20	258	41	41	142	11	66	41

S#	Gadoon Industrial Area-1 6-9-2015 Wind Dir (Deg)	Gadoon Industrial Area-2 6-10-2015 Wind Dir (Deg)	Topi City Yousufabad 6-11-2015 Wind Dir (Deg)	Topi Road 6-10-2015 Wind Dir (Deg)	Jehangir Road 6-13-2015 Wind Dir (Deg)	Gajju Khan 6-14-2015 Wind Dir (Deg)	CoL Sher Khan Interchange 6-15-2015 Wind Dir (Deg)
21	142	233	47	148	41	41	319
22	211	214	41	142	33	49	149
23	142	142	192	319	48	319	142
24	291	256	41	322	41	11	41
25	41	11	38	41	11	11	41
26	163.7	162.2	118.1	143.4	71.3	94.7	89
27	319	319	319	322	319	319	319

4.4.15 Pesticide Residue Analysis

276. Different studies reveal that the use of pesticides/insecticides is common in the project area and is detected in groundwater. As the command area is rain fed, for the last two decades the culture of tube wells as a supplementary irrigation source has been introduced. After the project implementation, it is anticipated, that due to water availability, the cropping pattern and cropping intensity will increase which would proportionally increase the use of pesticides. These pesticides/insecticides can find their way into groundwater through leaching, channelling (downward percolation), direct spillage, and wind drift and uptake in the farm products. The baseline is etablidhed for future project's impacts evaluation.

277. Therefore, food products and groundwater were analysed for groups of chlorinated hydro carbons and organophosphates of pesticides to establish a baseline in the project area. The food samples included chillies, okra, onions, pumpkins, sun flowers, tomatoes, water melons and wheat. The food products results are for the overall projectarea while the results of groundwater is separately for Indus Ambar, Janda Boka and Besik areas.

278. Five (05) composite samples of ground water were prepared from thirty five (35) grab samples collected for analysis. Eight food product varieties[8] were collected and the analyses were also done on composite samples. The samples in Table 4-18 were collected in accordance with the required preservative protocols;

[8] Keeping in view the availability of the crops at the time of sample collection in the project area

Table 4-18: Varieties of Food Samples

S#	Name of Food Product	No of Samples Collected
1	Okra	04
2	Tomato	07
3	Chillies	02
4	Sunflower	02
5	Wheat	08
6	Pumpkin	02
7	Water Mellon	03
8	Onion	05

279. Some of the sub-parameters of pesticide residue were detected in the food products and the detected parameters are presented in the following Figure 4-7 while the details are given in **Annexure-V.**

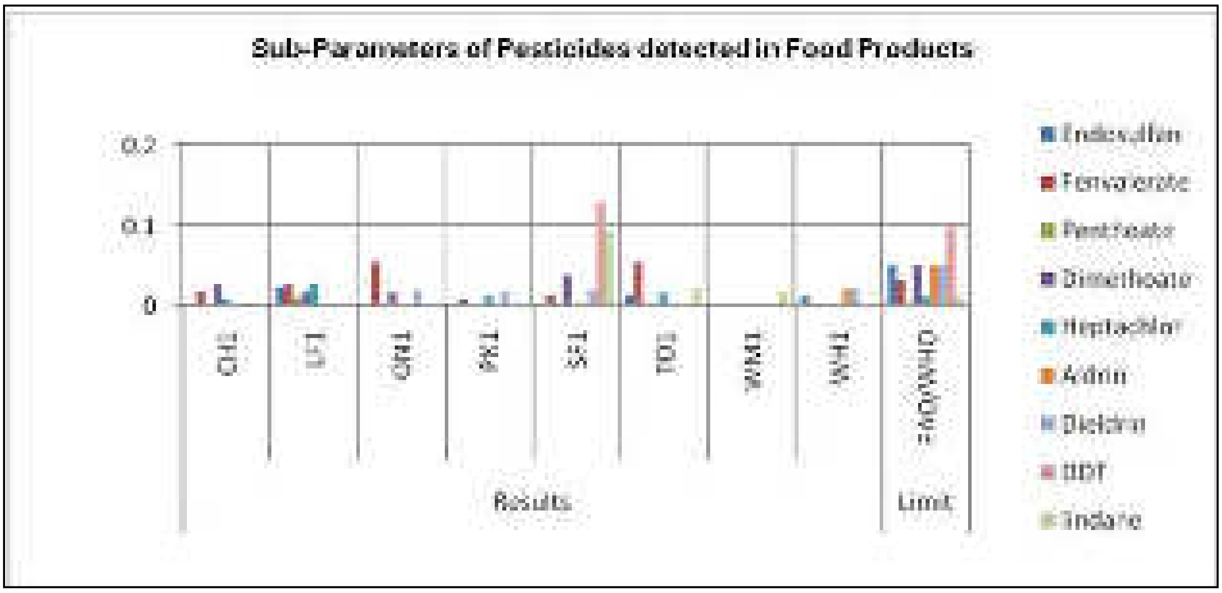


Figure 4-7: Sub-parameters of Pesticide Detected

280. The pesticides residues were within the permissible limits of FAO-WHO standards for food and ground water except on Besik and Janda Boka where the limit of Dimethoate was found to exceed the standards. The IPM of KPID will address these issues during the operation stage.

4.5 Biodiversity

4.5.1 Protected Areas in Swabi

281. Protected areas are important tools of wildlife and nature conservation. The number of protected areas notified in KP province include, 6 national parks, 3 wildlife sanctuaries, 38 game reserves, 16 private game reserves, 2 wildlife refuges and 8 wildlife

parks. The combined area of all protected areas is 666,340.368 ha. Of the above-mentioned protected areas, the following are located in Swabi District.

Table 4-19: Protected Areas in District Swabi

S#	Name	District	Key wildlife	Area (in hectares)	GPS Coordinates
1	Baga Hills	Swabi	Hare, Wolf, Fox, Black partridge, Grey partridge, Starling, Snipe Mallard, Wigeon	61	34°16'33.4" 72°26'44.2"
2	Shewa Karmar	Swabi	Hare, Wolf, Fox, Black partridge, Grey partridge, Starling, Snipe Mallard, Wigeon	627	34°15'15.7" 72°17'00.3"
3	Naranji	Swabi	Hare, wolf, Fox, Black partridge, Grey partridge, Starling, Snipe mallard wigeon	2189	34°18'49.5" 72°25'29.0"
4	Besak	Swabi	Jackal, Fox, Hare, Mongoose, Black partridge, Grey partridge, see-see partridge, Owl, Quail	530	34°04'20.3" 72°38'12.5"
5	Punjpir	Swabi	Black partridge, Grey partridge, Myna, Owl, Tit, lark, Dove	55	34°05'40.2" 72°28'51.9"

Source: Wildlife Department Govt of KP Peshawar, 2012

282. The above Table 4-19 shows that all the protected areas are game reserves managed by the government or local communities. As per the findings of the baseline surveys the above mentioned game reserve areas were not within the potential impact zone of the PHLCEP.

4.5.2 Forest Areas in Swabi

283. There are three major categories of forests in the province of KP i.e. (i) Reserve Forest (ii) Protected Forest and (iii) Guzara Forest. The area of the above mentioned categories are summarised in the following Table 4-20.

Table 4-20: Forest Types in KP

Legal Categories	Area (Million in Ha)	%age
Reserve Forest	0.097	6
Protected Forest	0.512	29
Guzara Forest	0.549	31
Others Forests Including Village Forest (Plantation/ Trees on Farmland etc)	0.612	34
Grand Total	**1.770**	**100**

284. Although the ratio of Forest in District Swabi is negligible, there are some forest areas in Gadoon such as Mahaban, which is protected by the Government as well as local people. The project area does not include any forests.

4.5.3 Tree Inventory

285. At the first round of the baseline survey, 6,415 trees were recorded within the RoW of the proposed pressure pipes, main and minor canals. Out of the 6,415 trees, it is anticipated that approximately 800-1200 trees will have to be removed and the exact number will be confirmed after the detailed design. The following Table 4-21 provides the inventory of trees existing on the RoW of PHLCE Project.

Table 4-21: Tree Inventory along the RoW of the Pressure pipes, Main and Branch Canals

S#	Location	No of Trees
1	Janda Boka Pressure Pipe	114
2	Janda Boka Canal	566
3	Indus Ambar Pressure Pipe	3,415
4	Indus Ambar Main Canal	1,560
5	Indus Ambar Minor-2	122
6	Indus Ambar Minor-4	299
7	Indus Ambar Minor-5	20
8	Indus Minor-1	52
9	Indus Minor-2	44
10	Indus Distributary 1	223
TOTAL		**6,415**

286. PP- The names of trees, number and location with reference to RDs are given in **Annexure-VI**.

4.5.4 Flora

287. The 5 dominant flora consists of Zizyphus nummelaria, Justacia adhatoda, Dodonaea viscosa and Gymnosporia royleana which are mainly shrubs, while Saccharrum spontanum, Cenchrus ciliarus and Cymbopogon jawarancusa etc are common grasses. The tree flora related to the project specific area is illustrated in Table 4-22.

Table 4-22: Life Forms of Identified Species in the Project Area

S/No	Name of Trees	Use for
1	Eucalyptus globulus	Timber, fuel wood
2	Dalbergia sissoo	Timber, fuel wood
3	Melia azedarach	Timber, fuel wood
4	Morus alba	Timber, fuel wood, edible fruit, medicinal uses, Fodder
5	Ficus carica	Timber, fuel wood, edible fruit, medicinal uses
6	Zizipus jujuba	Timber, fuel wood, edible fruit, medicinal uses, Fodder
7	Acacia modesta	Fuel wood
8	*Platanus orientalis* Linn (Chinar)	Timber, fuel wood,
9	Ghaz (local name)	Fuel wood
10	Albizia lebbeck	Fuel wood


Eucalyptus globulus, Melia azedarach & White poplar.


Melia azedarach & Morus alba.


White poplar


Melia azedarach


Morus alba


Eucalyptus globulus

Ficus carica

Acacia modesta

4.5.5 Wetlands

288. Wetlands cover approximately 9.7% or 7,800,000 ha of the total area of Pakistan. Wetlands in the country are mainly found along the Indus River and other rivers and in the floodplains. The Indus valley forms the main wetland artery in the country. These include the Tarbela Reservoir, the Ghazi Barotha pond, the Chashma barrage pond, and further downstream other water bodies and reedlands along the Indus River towards the Indus Delta.

289. Wetlands are characterized by high biodiversity. Their significance is attributable to the wide diversity of species that they support. In all, eighteen threatened species of wetland dependent mammals are found in the country: twenty threatened bird species are supported by Pakistan's wetlands in addition to twelve reptiles and two endemic species of amphibians. Pakistan's wetlands also support between 191-198 indigenous freshwater fish species, including fifteen endemics and a total of 788 marine and estuarine fish species. Out of the 12 habitats identified in the KP (Roberts, 1977), none are located in Swabi District and therefore no impacts in this regards are assoicated with the project activities.

4.5.6 Fauna

290. The generl area where the project is loacted provides a variety of habitats for fauna; thus, data for fauna was collected at different sampling locations within this area and also from local people and the Wildlife Department at Peshawar. The results of this survey, supplemented with secondary data sources where appropriate, are detailed in the following sections.

4.5.6.1 Avifauna

291. The information on avifauna was collected during the baseline survey through direct observation and collecting information during public consultation. The avifauna reported and classified in accordance to the IUCN Redlist and NWFP Wildlife Act 1975 in the area surrounding the project area are presented below in Table 4-23.

Table 4-23: Avifauna in the Project Area

Crow	Scientific Name	Migratory/Sedentary	Status according to IUCN Red List	Status according to NWFP Wildlife Act 1975
Little Bustard	*Tetrax tetrax*	Migratory	Near Threatened	Protected
Jungle Pigeon	Avian	Sedentary	Common	
Quail	*Coturnix*	Sedentary	Least Concern	Protected
Black Partridges	*Melanoperdix niger*	Sedentary	Vulnerable	Protected
Grey Partridge	*Perdix perdix*	Sedentary	Least Concern	
Chukar Partridge	*Avian*	Sedentary	Edible	Protected
Mynah (Mina)	*Acridotheres tristis*	Sedentary	Least Concern	Not protected
House Sparrow	*Passeridae*	Sedentary	Common	Not protected
Vulture	*Aegypius Monachus*	Sedentary	Near Threatened	Not protected
Eagle	*Hieraatus Spilogaster*	Sedentary	Not known	Protected
Falcon	*Falco*	Sedentary	Least Concern	Protected
Capercaillie (Jungle Fowl)	*Gallus*	Sedentary	Least Concern	Protected
Long Tailed Grass Warbler	*Locustella caudatus*	Sedentary	No information	Protected

292. In addition to these birds, a number of species are reported in literature (TJ Roberts, Birds of Pakistan, Vol.1 and 2.1991, 1992) which are expected to be found in the surrounding area and mainly in the Indus River passage for migration.

293. The common birds include the House Crow, Common Myna and Bank Myna. Other species such as Little Owlet, Common Cuckoo, Black Winged Kite, Black Kite, Red Vented Bulbul, White Cheeked Bulbul, Hoopoe, Collard Dove, Little Brown Dove, Red Turtle Dove and Common Starling are also reported in the area.

4.5.6.2 Migratory Birds

294. Different studies indicate that the famous route for migratory birds from Siberia to various destinations in Pakistan over Karakorum, Hindu Kush, and Suleiman Ranges along Indus River down to the delta is known as International Migratory Bird Route Number 7; it is known as the Indus Flyway and is one of the busiest routes in the world. According to estimates based on regular counts between 700,000 and 1,200,000 birds arrive in Pakistan through Indus Flyway every year. This route is also called “The Green Route”. The birds start their migration alongn this route in November; February is the peak time and by March they start to fly back home. These periods may vary depending upon weather conditions in Siberia and/or Pakistan. Some rare species as white headed duck, houbara bustard and Siberian crane also travel on this route. The other migrating birds include, pelicans, cormorants, herons, egrets, bitterns, cranes, flamingo, teals, mallards, gadwalls and

pigeons. However, there are no landing zones in or around the the project area for migratory brids.

4.5.6.3 Mammals

295. Five (5) species of mammals were recorded during the field visit. Out of these, one is common, two are of least concern and the status of remaining three is unknown according to IUCN Red list. A complete list of the mammalian species observed or reported in the project area is provided as Table 4-24 below.

Table 4-24: List of Mammalian Fauna Observed/Reported in the Project Area

S#	Name of Wild Animals	Scientific Name	Status According to IUCN Redlist	Status according to NWFP Wildlife Act 1975
1	Swine	*Sus*	Common	Not Protected
2	Rabbit	*Lepus curpaeums*	Unknown	Not Protected
3	Asiatic Jackal	*Canis aureus*	Least Concern	Not Protected
4	Squirrel	*Sciuridae*	Least Concern	Protected
5	Common Red Fox	*Vulpes vulpes*	Least Concern	Protected
6	Long-eared Hedgehog	*Hemiechinus auritus*	Least Concern	
7	Grey mongoose	*Herpestes edwardsii*	Least Concern	Not protected
8	Jungle Cat	*Felis chaus*	Least Concern	Protected
9	northern palm squirrel	*Funambulus pennantii*	Least Concern	Not protected

296. In addition, small animals including Indus Valley toad, common tree lizard, spotted barn gecko, common house gecko, Agrore Valley agama, rugose spectacled lacerta are reported from this area.

4.5.7 Reptiles

297. The KP supports a rich biological diversity spreading throughout the province. According to Wildlife Department, Government of KP, 48 species of reptiles are found in the province.

4.5.8 Fish Hotspots in Area

298. Several consultative meetings were arranged with the representatives of Fisheries Department Government of KPK in Peshawaer. It was concluded that there are no fish production/hotspots in the project corridor except a fish hatchery which is under planing in Malik Abad Area. When the alignment of the proposed pressure pipe and canal was shared with the Department it ws revealed tha the the said area was not falling within the RoW of the PHLCE project.

299. In addition, WAPDA developed fish cultivations in the Tarbela Reservoir produce fish protein to meet the increasing demands of the growing population. The fishery is now managed by the fisheries department of KP. The principle of reservoir fishery management at Tarbela was to stock fish seed hatcheries in order to rear fish up to a marketable size. Presently fishing rights for the Tarbela Reservoir lie with the KP Province and revenue generated from the fisheries sector is about PKR 0.5 million per year. Furthermore, there are hundreds of fishermen being employed by fishing contractors in the fishery business. Around 13,000 anglers visit these reservoirs for recreation, per annum. In July 1997 the WAPDA Fisheries Department introduced Chinese Carp into the Tarbela Reservoir. The Tarbela Reservoir is away from the PHLCE project area. However; Tarbela reservoir does not fall in the primary impact zone of the project. The water demand of PHLCEP is negligible as compared with inflow at Tarbela. The average annual inflow at Tarbela for year 1962 to 2009 varies between 2,005 cumecs to 3,235 cumecs with average of 2,480 cumecs[9]. Thus PHLCEP water demand is only 0.1% of the annual inflow at Tarbela. As such the withdrawal of water for PHLCEP will have no material effect on fisheries in the Tarbela reservoir.

4.6 Physical Cultural Resources

300. Saints and shrines are respected highly by the local communities and a list of monuments and archaeological sites in Khyber Pakhtunkhwa, is presented below as Table 4-25. A total 85 sites in the province are under the protection of the Federal Government. The list includes the only UNESCO World Heritage Site in Khyber Pakhtunkhwa, the Buddhist Ruins of Takht-i-Bahi.

Table 4-25: Archaeological/Historical Sites in District Swabi

S#	Name of Archaeological Site	Location
1	Stone Circle	Asota Swabi
2	Chanaka Dheri	Shahbaz Garhi
3	Ruined fort wall	Hund
4	Maida Ghundai or Maida Dheri	Shahbaz Garhi
5	Hussai Dheri	Shahbaz Garhi
6	Takhta (Takhta Band) Taakhta Band	Swabi
7	Fourteen rock edicts of Ashoka inscribed on two rocks in Shahbaz garhi	Shahbaz Garhi

301. Sites of importance in respect to cultural heritage have not been reported from the specific area of the project.However,some of the historical sites located in the close vicinity of the RoW of the proposed pressure pipes, main and branch canals are described below:

[9] As per discharge data presented in Design Report of Tarbela 4th Extension Hydropower Project.

4.6.1 Tomb of Gajoo Khan

302. The tomb of Gajoo Khan Figure 4-8 is situated at a distance of almost 500 m from the proposed Indus Ambar Main Canal at RD:0+000. It has been estimated that the total value of the tomb is Rs 86.738 million. The tomb has been renovated by the Government of KP. The tomb will not be affected by the construction of the PHLCEP.

Figure 4-8: Tomb of Gajoo Khan

4.6.2 Hund

303. Hund (Swabi), which was the capital city of Hindu Shahi till 1008 AD and an important city of Gandhara, is now a small village of District Swabi. Hund lies on the west bank of the Indus River (Abbaseen), about half way between Jehangira and Tarbela Dam. The famous Hund Fort is now reduced to a few walls and gates Figure 4-9 while the rest of the Fort is now occupied by the people.The rest of the antiques are now gathered in Hund Museaum which is situated on the bank of River Indus River and is also visible from the Indus Bridge on the Motorway from Islamabad to Peshawar.

Figure 4-9: Hund site

4.7 Socio-Economic Environment

304. 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 on socio-economic conditions including social and physical infrastructure in the project area.

4.7.1 Administrative Setup

305. The administrative setup of the Swabi district is similar to the other districts of the province. District administration is headed by the Deputy Commissioner (DC) who is assisted by district heads of departments. The main district departments include: administration; judiciary; police; education; health; communication and works; agriculture; forest; irrigation; telecommunication; and livestock and fisheries. 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.

4.7.2 Demography and Population

306. The total population of the Swabi District is 1,026,804 as per Census of 1998 but with an intercensal percentage increase of 64.3% since March 1981 when it was 625,035 persons. The average annual growth rate was 3% during this period.The total area of the District is 1,543 km^2.

4.7.3 Religion

307. According to the Population Census of 1998, about 97% of the population of the Swabi and Haripur districts is Muslim, while the remaining 3% of the population consist of minorities such as “Ahmadis”, Christians, Hindus and other scheduled castes. Scheduled castes are the depressed and low rank classes as declared by the Scheduled Castes (Declaration) Ordinance, 1957.

308. All people belong to the Muslim “Sunni “school of thought. There are many religious institutions in Swabi where students from all over the province seek religious education.

4.7.4 Tribal Structure in Swabi

309. The Major tribes in the district are as follows:

(a) Razzar
(b) Utman
(c) Jadoon
(d) Umar Khel
(e) Aba Khel
(f) Khattak (in small numbers)

310. All members of the above tribes belong to Muslim Sunni school of thought and in general are staunch followers of the religion.

4.7.5 Ethnicity and Population in the Project Area

311. The primary data collected by the PPTA team during environmental baseline survey and public consultation shows the following ethnic diversity and population in the project area (Table 4-26);

Table 4-26: Ethnicity and Population in the Project Area

Name of the Village	Name of the Main Caste		Name of the Clan*	Estimated Household of Respective Caste	Gender wise Estimated Population	
					Male	Female
Chota Lahore Sharki	1	Yousafzai		1000	60%	40%
	2	Lohar		2000	55%	45%
	3	Malyar		1500	55%	45%
	4	Awan		1000	55%	45%
	5	Jola		1500	50%	50%
	6	Gair kom		5000	55%	45%
Mughal Ki	1	Turab Shah Khail		150	50%	50%
	2	Lohaar		70	50%	50%
	3	Chamyaar		80	50%	50%
	4	Baghban		150	50%	50%
	5	Nayyan		80	50%	50%
	6	Tarkan		250	50%	50%
	7	Khan Khail		350	50%	50%
	8	Molyan		100	50%	50%
	9	Zikarya Khail		370	50%	50%
	10	Hassan Khail		400	50%	50%
Tube-well Kabaryan	1	Mohmand		30	200	150
Jalbai	1	Yousaf Zai				
			Ghar zai	10	45%	55%
			Mehmoodyan	9	45%	55%
			Awan	8	50%	50%
			Mohmand	6	45%	55%
			Asori	9	50%	50%
			Khurgari	8	50%	50%
			Adam Zai	7	45%	55%
Jalsai	1	Dangarzai		40		
	2	Momandi		75		
	3	Dumba Khail		70		
	4	Isori		45		
	5	Adamzai		55		
	6	Jolagan		140		
	7	Chamyaran		40		
	8	Kumbaran		35		
Maina	1	Ibrahimzail	Ismail khail	160	55%	45%
			Niki khail	320	50%	50%
			Khwaidad khail	400	50%	50%

Name of the Village	Name of the Main Caste		Name of the Clan*	Estimated Household of Respective Caste	Gender wise Estimated Population	
					Male	Female
			Balar khail	130	45%	55%
			Khadar khan khail	400	45%	55%
	2	Charsada	Habib khail	50	45%	55%
			Juna khail	110	45%	55%
			Sayed Ali khail	50	45%	55%
			Hbib khail	60	45%	55%
			Mani khail	300	45%	55%
			Arabzai	50	45%	55%
			Shaikhmali khail	80	45%	55%
			Awan	100	45%	55%
			Swatian	50	50%	50%
			Dalazak	30	45%	55%

* Clan information as per field consultation is presented in this table. Note that some groups of people did not have record of Clans and have there not been reflected in the table.

4.7.6 Language and Dialects

312. Pushto is the main language of the district. However, Hindko is also spoken in few villages i.e. Jehangira, Tordher, Manki and Jangidher etc.

4.7.7 Dress/Clothing

313. People wear the traditional pakhtoon dress of Shalwar Kameez, turban and Chaddar with Peshawari Chappal as footwear. The women wear Shalwar Kameez and Dopatta in their houses while outside their homes, they use Chaddar for “Purdah”. In upper class women, the use of gold ornaments is popular. Ornaments made of silver (Chandi) are used by the women folk of lower classes.

4.7.8 Marriages – Deaths

314. Marriages are arranged according to the traditions of Pakhtun society. The parents of the boys and girls usually arrange the majority of the marriages when they reach the age of 20/25 years. The engagement is followed by Rukhsati (departure) in a year or two. During this period girls strictly observe Purdah and avoid appearing before her fiancé or other close relatives. A marriage procession called Janj carrying Doli (Palanquin) visits the girl’s house on the fixed date. A religious cleric holds Nikah on the following night A meal, called Walima, is served by bridegroom at his place a day or two after marriage.

315. The deaths ceremony is performed in sorrowful but respectable manner. The villagers jointly prepare the grave and men and women assemble in the house of the deceased for Taziat (mourning). Nemaz-e-Janaza (Funeral prayers) is offered at the time fixed by family of the deceased, and is attended by large number of men of the society. The men / women visit the hujra / house of the deceased for offering Fatiha (prayers) up to three days. The family of the deceased gives food to the poor and relatives as Khairat (charity).

4.7.9 Dwelling

316. Most of the houses are made of bricks and stones. The house generally consists of 2 / 3 rooms with veranda. The joint family system is prevalent. Each cluster of houses has a hujra where all male members gather for socializing. It is also used as a guest house. A Huqa (Huble – Bubble) is a permanent feature of Hujra. The youngsters spend their winter nights in Hujra and arrange music programmes. It is an important part of Pakhtoon culture but due to modernization, people now prefer to have their personal guest rooms and the use of Hujra as a centre of social activities is declining.

4.7.10 Occupation

317. In general, the literacy rate is not very high; most of the people earn their livelihood as tenants on lands owned by the Khowaneen (Land-lords). However, large numbers of educated people are employed in agriculture or work abroad and thus are adding to the prosperity of the area by sending their returns to the area. The occupation levels in the project area are given in Table 4-27 below.

Table 4-27: Occupation of the People in the Project Area

Name of the Village	Agriculturist	Shopkeepers	Transporters	Livestock Farmers	Employment (Public)	Employment (Private)	Daily wage Earners/ Laborers	Poultry Farmers
Chota Lahor Sharki	45%	8%	4%	13%	9%	10%	9%	2%
Mughal Ki	75%	4%	3%	8%	1%	3%	4%	2%
Tube-well	90%	1%	Nil	4%	Nil	Nil	5%	Nil
Jalbai	55%	10%	2%	16%	3%	3%	10%	1%
Jalsai	60%	7%	2%	20%	3%	3%	4%	1%
Maina	55%	6%	3%	21%	5%	5%	4%	1%

4.7.11 Education Facilities in Swabi

318. The following are the main Educational Institutions in the District.

- Govt; Post Graduate College Gohati (Swabi).
- Govt; Degree College Kotha.
- Govt; Degree College Lahore.
- Govt: Degree College Shewa.
- Govt Degree College, Yar Hussain.
- Govt Degree College, Zarobi.
- Govt Degree College, Gandaf (Gadoon).
- Govt; Girls College Maneri (Swabi)
- Govt Girls College Marghuz

- Govt Girls College Manki
- FEF Girls Degree College, Topi.
- FEF Girls Degree College, Zaida.
- Govt Girls College, Shewa.
- Govt; Commerce College Bamkhel.
- Govt College of Technology, Swabi at Shahmansoor.
- Vocational College Anbar.

Table 4-28: Primary, Middle and Higher Secondary Students in Swabi District

S.No.	Nomenclature of School	Male	Female
1.	Government Primary Schools	590	422
2.	Government Middle Schools	78	41
3.	Government High Schools	65	35
4.	Higher Secondary Schools	08	06

Source: Elementary and Secondary Education Department Govt: of KP, 2008.

319. The Ghulam Ishaq Khan Institute for Science and Technology in Swabi provides higher education in the disciplines of Science and Technology.

320. In recognition of sacrifices rendered by the Kargil Hero, Karnal Sher Khan Shaheed (NH) Cadet College has been established in Swabi.

4.7.12 Education Facilities in Project Area

321. Information up to 2014 of school education in and around the project command area was obtained from the Education Department office at Swabi and are summarized in Table 4-29 as follows;

Table 4-29: Education Facilities and Enrolment in the Project Area

School Level	No of Schools	Enrollment
Girl's Primary Scools	41	5,140
Boy's Primary School	52	9,586
Girl's Middle Schools	1	1,828
Boy's Middle School	4	3,018
Girl's High School	5	663
Boy's High School	4	1,082
Girl's College	N/A	1,727
Boy's College	N/A	1,414

Source: Elementary and Secondary Education Department Govt: of KP, 2014.

322. The number of male and female teachers are 314 and 180, respectively. For college and higher studies, the boys and girls have to enroll in institutions outside the project area, in Swabi town and Peshawar.

4.7.13 Literacy

323. The literacy ratio in Swabi District for males is 54.0% as against 18.3% for females. The ratio is much higher in urban areas when compared with rural areas, both for males and females.

4.7.14 Public Health

324. There are five (05) health facilities in the project area and details are as given in Table 4-30 below;

Table 4-30: Health Facilities in the Project Area

Name of the Village	Facility Within Village	No	Whether Functioning Yes=1 No=2	Medical Staff Available (Nos.)	Nearby Similar facility (near of place)
Chota Lahor Sharki	Hospital	1	1	4	Village: Kaonda
	Basic Health Unit	1	1	3	Village: Kaonda
	Mother Child Care Centre	0	0	0	
	Child Immunization Centre	0	0	0	
Mughal Ki	Hospital	0	0	0	Akora Khattak 5 KM
	Basic Health Unit	1	1	1	Misri Banda 4 KM
	Mother Child Care Centre	0	0	0	
	Child Immunization Centre	0	0	0	

Name of the Village	Facility Within Village	No	Whether Functioning Yes=1 No=2	Medical Staff Available (Nos.)	Nearby Similar facility (near of place)
Tube-wellan	Hospital	0	0	0	Wali Interchange 4 KM
	Basic Health Unit	0	0	0	Wali Interchange 4 KM
	Mother Child Care Centre	0	0	0	
	Child Immunization Centre	0	0	0	
Jalbai	Hospital	0	0	0	Village: Shaheedan (Private)
	Basic Health Unit	0	0	0	Village: Shaheedan (Private)
	Mother Child Care Centre	0	0	0	
	Child Immunization Centre	0	0	0	
Jalsai	Hospital	0	0	0	Jaga Naat
	Basic Health Unit	1	1	6	
	Mother Child Care Centre	0	0	0	
	Child Immunization Centre	0	0	0	
Maina	Hospital	0	0	0	Topi
	Basic Health Unit	1	1	9	Janda
	Mother Child Care Centre	0	0	0	
	Child Immunization Centre	0	0	0	

4.7.15 Sanitation

325. Drinking water is provided to the local populace by water extracted from 106 Tube Wells. These are operated as follows:

- Under Village Develpment Organization (VDO) Operation 03
- Under Public Health Engineering Department: Operation 103

326. Three tube wells which had been providing drinking water have now been abandoned.

4.7.16 Electricity

327. The local Electricity Department has been divided into two divisions. Each division is headed by a Deputy Manager, Operation (DMO,PESCO). Both DMOs are assisted by Assistant Managers Operation (PESCO) and other Technical Staff. Each division is responsible for electrification / service facilities in their respective domain.

4.7.17 Telephone

328. As per the official website of Government of KP, the total number of telephone connections in the district in December, 2014, were 25,404. There are 23 Exchanges functioning in the district and the main Exchange is at Swabi.

4.7.18 Places of Tourists Interest / Historical Places

329. Mahaban is a famous mountain, which according to Dr. Stein has been mentioned in the Alexander campaign. It is about 2,182 above sea level. On the top of the ridge that stretches towards the Indus, known as SHAH KOT, old ruins of a fortress are still present. It is partly located in District Buner and the greater portion is in District Swabi. From here it extends into Haripur District.

330. It is a potential hill resort for the people of the area due to its close proximity to Tarbela Dam, Topi, Gadoon Industrial Estate and Mardan; but infrastructure facilities are barely available.

4.7.19 Livestock

331. There are 7 veterinary hospitals, 24 dispensaries and 11 veterinary centers in the District. They provide health cover to 70% of the animals of different species for different diseases. Vaccination is done by the departmental staff as well as Live Stock Extension workers in different villages who are trained by the Department with foreign financial assistance.

4.7.20 Industries

332. Industrial Estate Gadoon Amazai was approved by the Federal Government to create job opportunities for the local people in order to stop poppy cultivation in the area. Initially 83 ha land was developed with a Provincial Government grant of Rs.24.800 Million for purchase of land and Rs.20 Million by USAID for construction of infrastructure.

333. . The present status of the estate is given below: -

- Operational units 74
- Closed units 133
- Near operation/abandoned 22
- Under construction 29
- Vacant plots/abandoned 67
- Total: - 325

4.7.21 Mega Projects

4.7.21.1 Tarbela dam project

334. The power house of Tarbela Dam Project, which is one of the largest Dams in the World, is situated in the territorial limits of Swabi District. Tarbela Dam has been a big boost to the economy of Pakistan and has assisted in enhancing economic activities in the country and will provide water to PHLCEP.

4.7.21.2 Ghazi Barotha hydropower project

335. 1,450 MW run-of-the-river hydropower project connected to the Indus River About 1,600 cubic meter per second of water is diverted from the Indus River near Ghazi about 7 km downstream of Tarbela Dam. It then runs through a 100 metre wide and 9 metre deep open power channel down to the village of Barotha where the power complex is located.This project plays an important role in up-lifting the society by providing electricity and water for irrigation purposes to various parts of the country. Pehur Main canal offtakes from Ghazi Barrage.

4.7.21.3 Pehur high level canal project

336. The Pehur High Level Canal is located at the tail end of the Upper Swat Canal (USC). One of the objectives of PHLC was to reduce the shortages at the tail of USC and bring additional area under irrigation. The canal was designed for 28.3 m^3/s and has a water allocation of 654 MCM. The actual water use of PHLC varies between 308.37 MCM to 431.72 MCM (0.25 MAF to 0.35 MAF) averaging to 370.05 MCM (0.299 MAF). Maximum discharge supplied to the PHLC during this period is 22.65 cumecs (800 cusecs).

5. ANALYSIS OF ALTERNATIVES

5.1 Introduction

337. The aim of this section is to analyse the alternatives as part of the EIA to review and assess different ways of meeting the project objectives that might have fewer environmental and/or socio- economic impacts.

338. This section is based on a systematic comparison of feasible alternatives for the proposed project site, technology and operational alternatives. The project interventions have also been assessed against the without project scenario.

339. When examining the alternatives, the following key parameters were considered;

- What are the alternatives?
- What are the impacts associated with each alternatives?
- What is the rationale for selecting the preferred alternative?

340. Different project alternatives were evaluated keeping in view the above mentioned questions and with due consideration to environmental, socio-economic and engineering perspectives during the feasibility sstudy.

5.2 Alternatives to the Project

5.2.1 The do-nothing scenario

341. The do nothing scenario involves no intervention for provision of water supply for irrigation. Under the no action scenario the area will continue to remain dependant on sporadic rainfall and limited quantity of groundwater.

342. Existing cropping intensity in project command area is estimated at a meagre 52.4% (14.08% in Kharif and 38.32% in Rabi). The principal Kharif crop is maize (10.36%) and the principal Rabi crop is wheat (36.92%). It is evident that with such a low cropping intensity, farming in the command area is below subsistence level and is unsustainable. The yield level is quite low due to erratic and inadequate rainfall resulting in shortage of required moisture. The analyses of primary and secondary data indicate that the existing agriculture situation in the command area would continue if not decline further, under the rain fed conditions without provision of regulated irrigation. The current cropping pattern and intensities would remain more or less unchanged if not declining further. Therefore, without regulated irrigation supplies (i.e. without project) the existing agriculture output will not change for the better and the land will become drier and less productive.

343. After provision of irrigation supplies to the existing un-irrigated command area, there would be enormous improvement in the cropping pattern and cropping intensity with additional land coming under cultivtion. The “with project” cropping intensity is calculated as 165.75%. Besides wheat and maize high value crops including fruit and vegetables will be grown, which will result in good land use practises and increased farm incomes which will contribute to improved environmental conditions particularly in the primary impact are and enhanced living standards in the project area, especially in the secondary impact area.

344. In the scenario of without project, there will be no adverse social and environmental impacts as no land will be acquired from the local people for installing the

pressure pipes and constructing main and branch canals and tube wells. While ‘with’ the project option, there will be some land acquisition and temporary adverse environmental impacts during construction which could be reversed to the baseline situation after completion of the project. For adverse social impacts of land acquisition for installation of pressure pipes, main and branch canals, the people will be compensated in accordance to the LAA Act, 1894 and ADB SPS. A draft LARP for the Project has been prepared (Appendix 38 of draft Final Report)

345. Therefore, while the community income and environmental conditions would increase with the proposed project which also would have easily mitigated adverse impacts, the ‘do-nothing" option would not contribute to environmental enhancement and increased income levels of the people and would neither have adverse environmental impacts nor positive impacts. Therefore, the do nothing scenario is not a viable alternative.

5.2.2 Technological Options

346. Once the “do-nothing alternative has been rejected as an alternative to the project interventions should be examined for alterntives that are of least cost and enhanced benefits including environmental enhancement. Thus, when project boundaries are defined and water availability is confirmed, the second most important aspect is to explore the possible options to link the area to the water sources to facilitate water provision. There are usually different possible ways to link the source to the command area. The optimum way is the one that not only provide the shortest route but which can command the maximum area with minimum environmental impacts and O&M cost.

347. In the case of PHLCE Project, the project implementation area is divided into two major chunks i.e. Indus-Ambar and Janda Boka. Both the areas are not only far from each other by more than 30 km but also their soil characteristics and cropping patterns are different from each other. Therefore, the options for connecting both command areas to the source have been discussed separately.

348. The following alternative interventions were considered to fulfil the project objectives in the two command areas:

5.2.3 Possible Options for Indus Ambar Branch

349. The following three possibilities were considered for irrigating the command area of Indus and Ambar:

5.2.3.1 Pumping (Lifting) from Maira Branch

350. Lifting water to the command areas using pumps was the initial concept proposed in the PHLC Project feasibility report for the purpose of irrigating Indus and Ambar areas.

351. These lift schemes, however, were not considered for implementation due to economic and environmental constraints. While the main economic constraints were the high cost of the electro-mechanical components and high O&M costs the environmental concerns were use of energy for pumping and emission of green house gases. In addition, the decision to use pumping has become more difficult under the prevailing energy crisis in the

country where electricity could hardly be provided to even the domestic users. Similarly, the diesel operated pumps are also expensive due to the high cost of the oil prices[10] in the international market. Therefore, all efforts were made during the present assignment to find gravity options as substitute for the proposed lift schemes and bring maximum area under gravity mode of gravity irrigation instead of opting for lift.

5.2.3.2 Connection from Pehur High Level Canal

352. PHLC joins the Machai Branch at about RD 242+000 with zero level difference. Therefore, there is no additional head available to get any advantage for irrigating high lands. However, the two siphons, Kundal and Badri, on the main PHLC have drops of about 4-5m (13.12 -16.40 ft) each. The question was if a canal from the upstream of Badri siphon was taken-off at a higher elevation, could it provide an opportunity to serve some of the areas in Ambar by gravity. However, after studying contour maps and water levels in the PHLC in more details, it was revealed that the 5 m available head was not enough to irrigate the entire Ambar area. Rather a very small chunk (about 10% only) of the proposed area could be supplied by gravity flow from the proposed canal. Following this option, lift irrigation was also to be adopted as the garvitional flow in the command area is not feasibile. The environemtnal effects of lift irrigation are already detailed in the preceding section (5.2.3.1). Thus this option too has not been recommended.

5.2.3.3 Gravity Option - Pressure pipe from Gandaf Tunnel

353. This is an entirely new concept for irrigating the proposed Indus-Ambar areas. The estimated minimum operating level of Tarbela reservoir for year 2020 is 423.1 m which is about 20.77 m higher than the original level used for the design of Gandaf Tunnel. Under the presently proposed concept, this additional head has been utilized to carry the water in a pressure pipe from the Gandaf Tunnel outlet to the Ambar area. This provides an opportunity to irrigate more than 8,870 ha (21,918 Acres) of Indus-Ambar area by gravity upto a command level of 390 m (1,279.53 ft). The water will be delivered to head of the canal through a pressure pipe.

354. This option has some environmental impacts only during construction period but have no significant adverse or irreversible impacts. The major impacts are cutting of trees. Therefore a compensatory tree plantation is proposed in this EIA and the impacts are anticipated to be achieved within 5 years period. However; in the long run this option is sustainable with minimal environmental impacts. Although the capital cost of this option may be higher than the pumping option the nominal O&M cost and minimum environmental impacts makes the option very attractive. Hence, the option was selected and considered for further study.

5.2.4 Possibilities of Feeding Janda Boka Area

355. The following possibilities were considered for irrigating the command area of Janda Boka;

[10] The oil prices have dropped recently but may rise again.

5.2.4.1 Pumping / Lift from PHLC

356. Pumping from PHLC was the initial concept of irrigating the Janda-Boka area. Here again the same constraints were valid for the lift scheme as in the Indus-Ambar. In the presence of gravity option, this idea was not worth pursuing. As discussed earlier in Section 5.2.3.1 above, the option has long term environmental impacts besides requiring high O&M costs.

5.2.4.2 Gravity Option - Pressure pipe from Gandaf Tunnel (Janda Boka)

357. The availability of additional head in the Gandaf Tunnel Outlet portion due to raising of the minimum operating level of Tarbela Reservoir makes it possible to irrigate part of the high lands of the Janda-Boka by gravity. An outlet for the Janda Boka scheme was kept in the design of PHLC. A pressure pipe of about 3.94 km length and 1.22 m (4.00 ft) diameter will be connected with this outlet to convey the discharge to the high lands of the Janda Boka from where a gravity canal of 10.5 km would irrigate the command area of about 1,371 ha). This option has a great advantage in terms of O&M costs and environmental impacts as compared to the pumping scheme. As discussed earlier for the Ambar area, this option is also environmentally sustainable for Janda Boka area.

6. Environmental Impacts and Mitigation

6.1 General

358. Potential environmental impacts and issues arising during various stages of the project development along with the proposed mitigation measures are discussed in this chapter. The general impacts on physical environment, environmental quality, terrestrial and aquatic ecology, and social impacts associated with the project activities, such as land acquisition and resettlement are presented herein.

359. The area of impact of the PHLCEP includes the Primary Impact Zone comprising the areas traversed by the proposed pressure pipes and canals and distributaries and also the command area where water courses will be constructed; and secondary impact zone which is the settlement area and parts of the commnd area.

6.2 Methodology

360. Determining the significance of environmental impacts and their effects enables the identification of necessary mitigation and benefit enhancement measures as well as an estimation of the related financial costs associated with the impacts of a project. An impact can be either beneficial or adverse and is assessed by comparing the quality of the baseline conditions with the predicted quality once the project is under implementation or in place.

361. In order to describe the significance of an impact it is important to distinguish between two concepts, magnitude (of impact) and sensitivity (of receptors). The use of these two concepts for this EIA is outlined below.

362. The mitigation measures have been devised in accordance with the ADB SPS and recommended World Bank Pollution Prevention and Abatement Handbook 1998 towards cleaner production and the globally recognised IFC guidelines. In developing mitigation ction frequent reference has been made to the IFC Performance Standards, the IFC General EHS Guidelines and the IFC EHS Guidelines for Construction Materials Extractions

6.3 Environmental Impacts

363. Mitigation principally consists of careful iterative design whereby the engineer and the project environmentalists tailor the scheme and adopt available options so that minimum adverse impacts are achieved. These are discussed in the relevant sections below.

364. Impacts can be both adverse and beneficial and the methodology defined below has been applied to define both beneficial and adverse impacts of the project. The criteria for assessing the impact significance are based on a combination of the sensitivity of the receptors and the magnitude of the impact. Impacts have been considered for the design, construction and operation phases of this project.

365. The assessment of the environmental impacts has been carried out adopting a risk based approach and considering the engineering proposals prepared during the previous feasibility study and revised in the current PPTA.

6.3.1 Impact Magnitude

366. The assessment of impact magnitude was undertaken considering the following:

- Duration of the impact;
- Spatial extent of the impact;
- Reversibility;
- Likelihood; and
- Legal standards and established professional criteria.

367. Accordingly, the magnitude of impacts was identified according to parameters outlined in Table 6-1 below.

Table 6-1: Parameters for Determining Magnitude of Environmental Impact

Parameter	Major	Moderate	Minor	Negligible
Duration of impact	Long term (more than 35 years)	Medium term Life span (5-15 Years)	Confined only to project construction period (less than 5 years)	Temporary with no detectable impact
Spatial extent of the impact	Widespread far beyond project component site boundaries	Beyond immediate project components, site boundaries or local area	Within project components and site boundary	Specific location within project component or site boundaries with no detectable impact
Reversibility of Impacts	Impact is effectively Legal standards and established professional criteria Likelihood of impacts occurring permanent, requiring considerable intervention to return to baseline	Requires a year or so with some interventions to return to baselin	Baseline returns naturally or with limited intervention within a few months	Baseline remains constant

Source: Handbookof EnvironmentalImpact Assessment, VolumeII, Judith Petts, 1999.BlackwellScienceltd.

6.3.2 Impact Sensitivity

368. The sensitivity of a receptor is determined based on review of the receptor of the impact (population, habitat or wildlife etc.) and considering proximity, numbers and vulnerability. The criteria for determining sensitivity of receptors are outlined in Table 6-2. Each assessment will define sensitivity in relation to its topic.

Table 6-2: Criteria for Determining Sensitivity of Environmental Receptor

Sensitivity Determination	Determination	Example
Very High	Extremely vulnerable receptor (human, terrestrial or aquatic) with little or no capacity to absorb proposed changes or minimal opportunities for mitigation.	Endangered species or habitat which is unique to the area
High	Vulnerable receptor (human, terrestrial or aquatic) with little or no capacity to absorb proposed changes or limited opportunities for mitigation.	Endangered species or habitat, hospitals and clinics
Medium	Moderately vulnerable receptor (human, terrestrial or aquatic) with some capacity to absorb proposed changes or moderate opportunities for mitigation	Natural habitats, schools, residential areas, areas of cultural value

Sensitivity Determination	Determination	Example
Low	Non-vulnerable receptor (human, terrestrial or aquatic) with good capacity to absorb proposed changes or/and good opportunities for mitigation	Agricultural land, light and heavy industry, outdoor storage

Source: Handbookof EnvironmentalImpact Assessment, VolumeII, JudithPetts, 1999.BlackwellScienceltd.

6.3.3 Impact Significance

369. The assessment of significance is based on the combination of magnitude of impact and sensitivity of receptor using the impact significance matrix in the following Table 6-3.

Table 6-3: Assessment of Environmental Impact Significance

Magnitude of Impacts	Very High	High	Medium	Low
Major	Critical	Major	Moderate	Minor
Moderate	Major	Major	Moderate	Minor
Minor	Moderate	Moderate	Minor	Negligible
Negligible	Negligible	Negligible	Negligible	Negligible

6.3.4 Mitigation and Enhancement Measures

370. Mitigation measures are identified to address negative impacts. The following hierarchy of mitigation will be applied:

- Elimination/mitigation through design (embedded mitigation);
- Site / technology choice; and,
- Application of best practice.

371. In identifying the mitigation action using the above methodology the relevant guidelines from the IFC and World Bank Pollution Prevention and Abatement Handbook[11] was followed.

372. Where appropriate, enhancement measures were also identified to create new positive impacts or benefits, increase the reach of positive impacts or benefits, or distribute them more equitably.

6.4 Physical Environment

373. The impacts of project interventions on the physical environment are considered under the following environmental aspects.

[11] 1998 IFC Pollution Prevention and Abatement Handbook. Washington

6.4.1 Changes in Natural Topography

6.4.1.1 Impact

374. Topography in the Janda Boka area would pose a challenging work environment during construction as the available flat land for construction yards and equipment are limited. As a result, some areas will have to be leveled in terrace form. Changes to natural topography will impair the natural landscape and induce a series of impacts related to changes in slopes such as soil erosion, landslides and changes in drainage pattern. Soil erosion from the disturbed areas and excavated soil and rock stock piles will increase the sediment load of surface water in the vicinity.

6.4.1.2 Impact Significance

375. Following the criteria for assessing environmental impacts, the impact is assessed to be Short Term Minor Adverse.

6.4.1.3 Mitigation

376. Required land excavation and levelling will be carried out only in the designated areas, and alternative excavation methods as cutting with excavator, will be used wherever possible.

377. The topography of the final surface of the levelled land will be conducive to enhance the natural draining of rainwater and floodwater.

378. The contractor shall prepare landscaping and re-vegetation plans which shall include (i) restoration of cleared areas which are no longer in use, spoil areas, and any areas temporarily occupied during construction work; (ii) all areas disturbed by construction activity, including temporary access roads shall be landscaped to reflect natural contours, restore suitable drainage paths and encourage re-establishment of vegetation; and (iii) spoil heaps and excavated slopes shall be compacted and protected to prevent erosion.

6.4.2 Landslides

6.4.2.1 Impact

379. Although landslides are not common phenomena in the project area, natural landslides and slope failures may occur due to lubrication of rock support structure by rainfall or water seepage. During construction, excavations could have the capacity to generate localized vibrations which can potentially trigger landslides.

6.4.2.2 Impact Significance

380. Following the criteria for assessing environmental impacts, the impact is assessed to be Long Term Minor Adverse.

6.4.2.3 Mitigation

381. Excavation activities in these areas will be controlled and contained within defined limits. During excavations the slopes will be stabilized where needed.

6.4.3 Spoil

6.4.3.1 Impact

382. Spoils will be generated from the excavation activities for pressure pipe and potable water pipe installation and construction of main and distribution canals. Potential impacts from spoils and its disposal are (i) land for disposal of spoil, (ii) conversion of those land areas in to a permanent dumping area, (iii) potential erosion from the spoil areas and spoil material reaching the river/waterways, and (iv) aesthetic impacts.

6.4.3.2 Impact Significance

383. Following the criteria for assessing environmental impacts, the impact is assessed to be Short Term Moderate Adverse

6.4.3.3 Mitigation

384. The first step towards addressing the impacts of spoil is to minimize the generation of spoils by recycling the excavated material to the maximum extent possible by using them as aggregate or fill material works.

385. An analysis of spoils will be carried out to assess its usability of the spoil by the contractor. Surface excavations consisting loose soil material are not expected to meet the requirement of aggregates and much of it will have to be either used as fill material or disposed of in approved sites.

6.5 Environmental Quality

6.5.1 Air Quality

6.5.1.1 Impact

386. The activities that could contribute to air pollution and enhanced noise levels are installation of pressure pipes having total length of about 27,649 m and wall thickness is 6 to 8 mm. The pipe will be buried in ground at a minimum depth of 1.5 m. The installation of the proposed pressure pipes, earthwork and lining of main canals forJanda Boka and Indus Ambar, construction of minor canals in the command areas of Janda Boka and Indus Ambar and construction of canal roads are all expected to generate air and noise impacts. The laying of pumping mains will also contribute to air quality deterioration and noise level increases.

387. Air quality of the area may degenerate during construction as a result of the above project interventions. Construction machinery, diesel generators and project vehicles will release exhaust emissions containing carbon monoxide (CO), sulfur dioxide (SO_2), oxides of nitrogen (NO_X), and particulate matter (PM). These emissions can deteriorate the ambient air quality at the project site and along the haulage roads leading to the sites.

388. Noise generated by the construction machinery is likely to affect the project area particularly sensitive receptors like schools, health care centers and wildlife. However, since, construction activities of main and distributary canal would be mostly outside major towns and settlements the number of sensitive receptors would be less. Noise may also pose a hazard to workers at the construction site.

6.5.1.2 Impact Magnitude

389. As discussed above, the duration of the impact associated with the earthwork, lining of canal, construction of canal road and installation of the pressure pipe shall be up to 3 years following which all sources of emissions will all be removed from the project area.

390. An increase in carbon monoxide, sulfur dioxide, oxides of nitrogen, and particulate matter, should be expected throughout the project area, however, this increase shall be mainly focused at the work sites and in the vicinity of the following villages;

Indus Ambar Pressure pipe

- Village Kambary
- Village Baja By-pass
- SMKM College Kotha
- Village Sogandi
- Village Khanpur Abad
- Village Yousuf Abad
- Village Noorabad (Gullo Dairy)
- Village Jamal Abad

Janda Boka Branch

- Village Maina

Indus Ambar Branch Canals

- Village Jalsai
- Village Jalbai
- Village Mughal Kai
- Village Tubewell Kabarayan

6.5.1.3 Impact Significance

391. Following the criteria for assessing environmental impacts, the impact is assessed to be Short Term Moderate Adverse.

6.5.1.4 Mitigation

392. The relevant guidelines from the IFC and the project specific construction stage mitigations are given in the following Table 6-4.

Table 6-4: IFC Guidelines and Project Specific Mitigations for Air Quality

S#	IFC Guidelines	Mitigation Measures for PHLCE Project
1	Managing emissions from mobile sources (such as on-road and off-road vehicles) including: Implementation of manufacturer recommended engine maintenance programs, Training of drivers on driving practices to reduce fuel consumption, including measured acceleration	All project plant (including generators & batching plant) and vehicles must be serviced as per manufacturer's guidelines. Emissions from vehicles not to exceed limits stated in Table 6-5.

		The contractors staff training programme, shall include driver training for fuel efficient driving
2	Avoid open burning of solids	Incineration of any solids which may release toxic chemicals on combustions, such as plastics, shall be prohibited. Burn pits shall be visually monitored and the quantity of burning waste and incineration temperature controlled to minimise smoke emissions.
3	Ensure emissions resulting from the project do not result in pollutant concentrations that reach or exceed relevant ambient quality guidelines, including annual stack testing at generators and batching plant for NOx, SO2, and PM against NEQS. Where emissions are found to exceed national standards, point source air emissions prevention and control techniques detailed in Annexure-VIIIof the IFC General EHS Guidelines should be considered	Quarterly effects monitoring of ambient air against NEQS and WB Guidelines is proposed in the monitoring plan. Where NEQS / WB Guidelines are exceeded at generators or batching plant, control technologies as defined in Table 6-6 shall be required to reduce emissions to within acceptable levels.
3	Stack height for all point source emissions, whether ‘significant’ or not, should be design according to Annexure-VIIIof the General EHS Guidelines	Minimum generator stack height and distance from existing structures as defined in Figure 6-1.
4	No new systems or processes should be introduced to the project area which use CFCs, halons, 1,1,1-trichloroethance, carbon tetrachloride, methyl bromide or HBFCs.	The contractors methodology must not include CFCs, halons, 1,1,1- trichloroethance, carbon tetrachloride, methyl bromide or HBFCs.

393. The emissions from vehicles used in the project area shall not exceed the values given in Table 6-5.

Table 6-5: WHO Ambient Air Quality Guidelines Emission Limits for Vehicles on PHLCE Project

	Averaging Period	Guideline value in mg/m3
Sulfur dioxide (SO2)	24-hour 10 minute	125 (Interim target-1) 50 (Interim target-2) 20 (guideline) 500 (guideline)
Nitrogen dioxide (NO2)	1-year 1-hour	40 (guideline) 200 (guideline)
Particulate Matter PM10	1-year 24-hour	70 (Interim target-1) 50 (Interim target-2) 30 (Interim target-3) 20 (guideline) 150 (Interim target-1) 100 (Interim target-2) 75 (Interim target-3) 50 (guideline)
Particulate Matter PM2.5	1-year 24-hour	35 (Interim target-1) 25 (Interim target-2) 15 (Interim target-3) 10 (guideline) 75 (Interim target-1) 50 (Interim target-2) 37.5 (Interim target-3) 25 (guideline)
Ozone	8-hour daily maximum	160 (Interim target-1) 100 (guideline)

394. The contractor shall be required to provide the following relevant modifications to generators and/or batching plants where ambient airquality shows NEQS and WB (WHO) guidelines are exceeded:

Table 6-6: Point Source Air Emissions Control Technologies

Emission	Maximum Permissible (from NEQS)	Control Options	Reduction Efficiency	Comments
Particulate Matter (PM) from batching plants Generators and blowing dust (most prevalent in dry and semiarid climates) contribute to background levels.	500 mg/Nm³ at batching plants, 300 mg/Nm³ at generators – measured at source	Fabric Filters	99-99.7%	Applicability depends on flue gas properties including temperature, chemical properties abrasion and load. Typical air to cloth ratio range of 2.0 to 3.5 cfm/ft². Achievable outlet concentrations of 23 mg/Nm³
		Cyclone	74-95%	Most efficient for large particles. Achievable outlet concentrations of 30 – 40 mg/Nm³
		Wet Scrubber	93-95%	Achievable outlet concentrations of 30 - 40 mg/Nm³
Sulphur Dioxide(SO2) from generators	120µg/m³ - average in ambient air measured over 24 hours	Selection of Fuel	>90%	Use of light diesel or natural gas
		Sorbent Injection	30-70%	Calcium or lime is injected into the flue gas and the SO2 is adsorbed onto the sorbent
Oxides of Nitrogen (NOx) from fuel	80µg/m³ - average in ambient air measured over 24 hours	Selective Catalytic Reduction	60-90%	Involves the injection of ammonia as a reducing agent to convert NOx to nitrogen in the presence of a catalyst
		Selective Non-Catalytic Reduction	30-70%	Involves the injection of ammonia or urea as a reducing agent to convert NOx to nitrogen without the presence of a catalyst

The minimum generator stackheight and clearance from existing structures shall be as defined in the following figure 6-1.

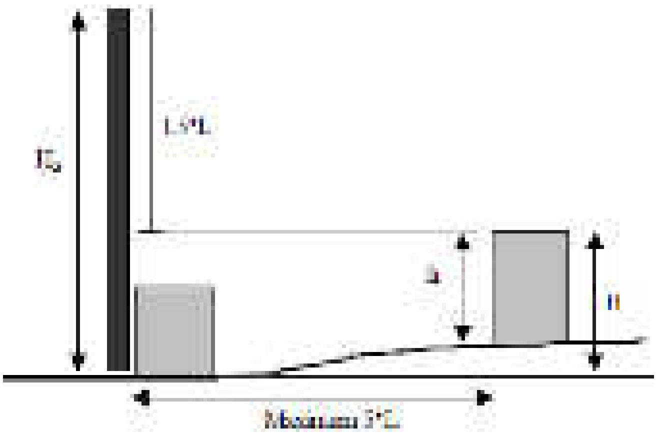
395. In addition, the project specific construction stage mitigation actions are as follows:

(a) The works along the SMKM College shall be carried out during off days of the college. If the works required more time, the sound/noise barriers shall be installed by the Contractor to avoid any disturbance to the students.
(b) The emissions from vehicles used in the project area shall not exceed the values given in Table 6-7.
(c) Generators will only be operated on standby basis for short periods. Electricity from WAPDA will be used where a connection is available.

Table 6-7: Emission Limits for Vehicles on PHLCE Project

Emission	Limit
Particulate Matter	100 mg/Nm³
Sulphur Dioxide	3% Sulphur
Nitrogen Oxides	1,460 mg/Nm³

(d) *Source: IFC General Environmental, Health and Safety Guidelines.*



Where:
H_G=H + 1.5L
H_G=Stackheightmeasuredfrom groundlevel
H =Height ofexistingnearbystructures above groundlevel at stack
L=Lesser dimensionofhorw
h = Heightof existingnearbystructures
w=Widthofexistingnearbystructures

Source: IFC GeneralEnvironmental,Healthand Safety Guidelines

Figure 6-1: Minimum Generator Stack Height and Clearance

396. The contractor shall be required to provide the following relevant modifications to generators and/or batching plant where ambient air quality shows NEQS are exceeded:

Table 6-8: Point Source Air Emissions Control Technologies

Emission	Maximum Permissible (from NEQS)	Control Options	Reduction Efficiency	Comments
Particulate Matter (PM) from batching plants	500 mg/Nm³ at batching plants, 300 mg/Nm³ at	Fabric Filters	99-99.7%	Applicability depends on flue gas properties including temperature, chemical properties abrasion and load. Typical air to cloth ratio range

Emission	Maximum Permissible (from NEQS)	Control Options	Reduction Efficiency	Comments
and generators	generators – measured at source			of 2.0 to 3.5 cfm/ft². Achievable outlet concentrations of 23 mg/Nm³
		Cyclone Windstorm	74-95%	Most efficient for large particles. Achievable outlet concentrations of 30 – 40 mg/Nm³
		Wet Scrubber	93-95%	Achievable outlet concentrations of 30 - 40 mg/Nm³
Sulphur Dioxide(SO2) from generators	120µg/m³ - average in ambient air measured over 24 hours	Selection of Fuel	>90%	Use of light diesel or natural gas
		Sorbent Injection	30-70%	Calcium or lime is injected into the flue gas and the SO_2 is adsorbed onto the sorbent
Oxides of Nitrogen (NOx) from fuel	80µg/m³ - average in ambient air measured over 24 hours	Selective Catalytic Reduction	60-90%	Involves the injection of ammonia as a reducing agent to convert NOx to nitrogen in the presence of a catalyst
		Selective Non-Catalytic Reduction	30-70%	Involves the injection of ammonia or urea as a reducing agent to convert NOx to nitrogen without the presence of a catalyst

Source: Based on IFC General Environmental, Health and Safety Guidelines, Annex 1.1.2

397. The post mitigation residual impact is assessed to be of minor adverse in the short term. Recommended monitoring in EMP would assist in confirming the residual impact during construction.

6.5.2 Noise

6.5.2.1 Impact

398. Noise will be generated from vehicular movement, excavation machinery, concrete mixing, and construction activities during the construction phase. The sources of noise during construction will be excavators, generators, concrete batching plant and other construction machinery and vehicles. Increased noise and vibration levels during construction activities can be a source of nuisance for locals and a source of disturbance to wildlife.

399. The equipment to be used for the construction of PHLCE is mostly powered by internal combustion engines including earth moving equipment, handling materials and stationary equipment. An outline of major machinery and vehicles that are envisaged to be required for the project construction works along with its maximum noise level are given in the following Table 6-9:

400. Construction machinery and vehicle numbers and anticipated noise level from the machinery and vehicles are presented in Table 6-9 below.

Table 6-9: Noise pollution sources and Relative Range of Noise

S#.	Machinery / Equipment	Noise level, dBA at 15m				
		60	70	80	90	100

		60	65	70	75	80	85	90	95	100	105
1	*Excavators	**6**						92			
2	Dumpers	**4**									
3	Batching Plants	**1**									
4	Loaders	**2**						92			
5	Power Generators	**6**									
6	Rollers	**4**									
7	Tractor Trolly	**6**									
8	Transit Mixer	**1**									
9	Compactor / Roller	**2**									
10	Crane	**1**									
11	**Crush Plant	**1**						92			
12	Concrete Pump	**1**				82					
13	Vibro Hammer	**1**									
14	Welding Generators	**4**									
15	Watering Tanks (moveable)	**3**									
16	Haulage Trucks	**40**									
17	Cars/Pickups	**15**									

Range of sound levels from various types of construction equipments to be used for PHLCE (Sources: Analysis in the light of US-EPA 1972).

**The tabulated noise level is calculated on single construction machinery basis and as per requirement of the contractor, more than one specific machinery or equipement, does not work together on a single section of the canal or pressure pipe. These machineries will be distributed on different sections of the pressure pipes and canals as per requirement of the works.*

***Based on the limited available data samples, the excavators, loaders and crush plants are grouped in the same class.*

401. The EPA has set 75 decibels (day time) and 65 decibels (at night time) as the maximum exposure limit in the workplace. Above this level, hearing protection should be worn. The IFC adopted the WHO standards for noise level as presented in the following Table 6-10 must be followed;

Table 6-10: IFC Noise Level Guidelines

Receptor	**One Hour L_{Aeq} (dBA)**	
	Day Time 07:00-22:000	**Night Time 22:00-07:00**
Residential; institutional; educationa	55	45
Residential; institutional; educationa	70	70

6.5.2.2 Impact Significance

402. Following the criteria for assessing environmental impacts, the impact is assessed to be Short Term Minor Adverse.

6.5.2.3 Mitigation

403. The relevant guidelines from the IFC and the project specific construction stage mitigations are given in the following Table 6-11.

Table 6-11: IFC Guidelines and Project Specific Mitigations for Noise & Vibration

S#	IFC Guidelines	Mitigation Measures for PHLCE Project
	Selection of equipment with lower sound power levels	The Contractor shall provide latest equipment required for completion of each task.
	Installation of silencers & suitable mufflers on engine exhausts	The contactor shall provide acoustic guards, covers and doors.
	Limiting hours of operation	The contractor shall plan his operations to be completed based on a six day working week from 6am to 6pm. Should the Contractor require additional working hours, or weekend working, he shall submit a request to the Engineer for permission to work extended hours, giving full reasons for the requests..
	Develop a mechanism to record and respond to complaints	A complaints register shall be placed at the Contractors and Engineers Offices to address complaints. The register shall record measures taken in response to the complaints. The contractor shall be required to employ a full time, qualified Community Liaison Officer for the project who is conversant with the World Bank's social safeguardpolicies and can address grievances and other community liaison issues.

404. The monitoring results during the baseline survey indicate that noise levels at the monitoring locations are generally on the high side but within the permissible limit of NEQS and WHO/IFC standards. The enhanced noise levels along the pressure pipe and canal are due mainly to traffic on the roads close to monitoring locations. The high noise levels at Gadoon industrial area are caused by industries in the area.

405. The impact of noise is determined in the PHLCE project area as “minor” in term of duration (three years along a linear project which means about less than 1 year at a particular location) and the situation will return to the baseline after completion of the construction activities. For the construction of PHLCE blasting or large quarries are not required. In comparison of the pre-project (baseline) noise levels at seven locations close to receptors with noise levels during construction noise level enhancement will be monitored. However, given the limited use of heavy machinery to be used and very limited excavation and filling required and also the distance of the settlements from the construction works impact of noise on the receptors are not expected to be a significant.

406. The cumulative noise from construction activities are not expected to exceed NEQS, WHO/IFC standards. However, the following mitigation actions are recommended as precautionary measures.

407. The project specific construction stage mitigation measures are:

(a) The contractor shall provide equipment only of the size/power required to complete each task

(b) The contactor shall ensure provision of acoustic guards, covers and doors on plants and vehicles

(c) The contractor shall plan his operations to be completed preferably based on a six day working week from 6am to 6pm. Should the contractor require additional working hours, or weekend working, he shall submit a request to the Engineer and Environmentalist for permission to work extended hours, giving full reasons for the requests. Approval to such requests will not be granted for works close to the populated areas

(d) The contractor will monitor the noise levels regularly at the nearby villages and other sensitive receptors to ensure that these do not exceed NEQS, WHO/IFC standards. Contractors will adopt appropriate noise attenuation measures to reduce the noise generation from construction activities. The noise attenuation measures will include, (i) fitting of high efficiency mufflers to the noise generating equipment; and (ii) keeping acoustic enclosures around drilling equipment.

(e) Construction activities that are close to settlements will be stopped during night times if high noise values are observed.

(f) All vehicles used in the construction activities will comply with NEQS, WHO/IFC standards exhaust and noise standards (85 dBA at 7.5m from the source)

(g) Generators, vehicles and other potentially noisy equipment used during construction should be in good condition and maintained as per manufacturer’s guidelines.

(h) Speed of the project vehicles will be kept low and horns will be restricted while passing through or near the communities.

(i) Movement of all project vehicles and personnel will be restricted to within work areas, as far as possible.

(j) The Community Liaison Officer shall notify affected people and communities prior to undertaking especially noisy work activities;

(k) Construction activities close to SMKM College will be timed to coincide with school vacation or long holidays

408. The residual impact post mitigation is assessed to be insignificant but will have to be confirmed through monitoring as specified in the EMP.

6.5.3 Dust Emission

6.5.3.1 Impact

409. Potential sources of dust are construction material stockpiling and loading, transportation and unloading, areas cleared for installation of pressure pipes, construction of main and branch canals, preparation of camp sites and access tracks for operations, off road vehicular traffic on unpaved roads during construction, open storage of solid materials, exposed soil surfaces and excavation and placement of fill material for raising irrigation canal.

410. Generation of dust from these activities is likely to be significant if not mitigated, and given the prevailing wind direction from the north to north-east.

411. Following the completion of the preparatory works, the generation of dust from construction sites may reduce, but will be elevated above the baseline due to removal of ground vegetation and unused material including aggregates.

412. Within the wider project area, an increase in particulate matter is expected in the vicinity of haulage routes. Dust generation on embankments is only likely during the works to place and compact the fill material. Following the works to each section, the material shall be compacted, reducing any dust generation.

6.5.3.2 Impact Significance

413. Following the criteria for assessing environmental impacts, the impact is assessed to be Short Term Moderate Adverse.

6.5.3.3 Mitigation

414. The relevant guidelines from the IFC and the project specific construction stage mitigations are given in the following Table 6-12.

Table 6-12: IFC Guidelines and Project Specific Mitigations for Soil Erosion & Dust Emissions

S#	IFC Guidelines	Mitigation Measures for PHLCE Project
1	Simple, linear layout for materials-handling operations should be designed and implemented to reduce the need for multiple transfer points	The contractor shall be required to minimise double handling of material during earthworks operations. This shall also be in the interest of the contractor as this shall reduce his costs.
2	Dust emissions from processing equipment shall be controlled through dust collectors, wet processing or water spraying	Water sprinkling at batching plants shall be required as a dust suppression method. Wet scrubbers for batching plants can also be used.
3	Procedures to limit the drop height of falling materials should be adopted.	The training programme for excavator operators shall include the need to reduce drop height when loading trucks in order to reduce dust emissions (& noise)
4	Internal roads should be adequately compacted	Access roads shall be adequately compacted and/or regularly sprinkled with water as a dust suppression measure.
5	Use of water suppression for control of loose materials on paved and unpaved road surfaces	As above
6	Use of dust control methods such as covers or water suppression for open materials storage piles	Covered storage of materials shall be preferred. Where not possible, water sprinkling shall be carried out at material stockpiles where dust is generated.

415. In addition, the project specific construction stage mitigation measures are:

(a) Clearing of vegetation for site clearance will be kept to a minimum
(b) Vegetation clearance for camps and access roads will be kept to the minimum required
(c) Clearing of vegetation beyond the CoI/RoW shall be avoided
(d) Existing tracks shall be favoured for haulage of material.
(e) Access tracks will follow natural contours to minimize disturbance to natural topography and soils; cutting along the sides of the slopes will be minimized.
(f) During construction the preparation of new access tracks will be minimized. Where improvement of existing tracks or development of short lengths of new tracks is unavoidable the width of the access track will not exceed 3 m.
(g) The establishment of temporary haul roads shall not be permitted within 150 m of any settlements without approval from the Engineer
(h) Vehicle speeds will be regulated and monitored to avoid soil erosion.
(i) Off-road travel will be minimised observance of this restriction will be monitored during the operation.
(j) Periodic trainings will be provided to drivers on mitigation measures related to off-road travel and speeds limits.
(k) During construction movement of construction equipment will be restricted to work areas and established access tracks to avoid unnecessary disturbance to soils in the project area.
(l) Spoil heaps (whether temporary or permanent) will be protected from erosion by trimming and grading
(m) In addition to the above, the slopes of permanent spoil heaps shall be compacted and stabilised
(n) Earthworks shall be rescheduled, where practical, to avoid periods of high wind
(o) At mobilization, the contractor shall be required to submit a Traffic Management Plan to the Engineer. This plan shall define all the access and haul routes to be established as part of the project and their position relevant to existing settlements. Within this plan, the contractor shall be required to demonstrate no practicable alternative haulage routes where a haulage route is required within 150 m of a settlement.

6.5.3.4 Monitoring

416. Photographs will be taken before any activity to record the conditions of campsite, roads and other construction activities at locations that are likely to undergo soil erosion. Similar photographs will be taken at intervals throughout the construction to monitor any changes and soil conditions.

417. After adopting the above mentioned mitigation measures, the residual impacts are expected to be minor adverse in the short term.

6.5.4 Surface Water Quality

6.5.4.1 Impact

418. The proposed pressure pipes, main and branch canals are crossing a number of tributaries and rivers. These streams and nullahs originating from the Buner and Swabi Hills, cross the Pehur High Level Canal, are the sources of surface water. Kundal Khwar, is a perennial river with its tributaries Polah Khwar, Bada Khwar, Gajai Khwar, and Wuch Khwar etc. crosses PHLC in upper reaches near Janda-Boka areas. While Badri Khwar, which is also a perennial river, originating as Loe Khwar, crosses PHLC at Badri Siphon. Loe Khwar is a perennial channel, and about 0.06 to 0.14 cumecs of base flow exit throughout the year. Two other nallahs i.e. Wuch Khwar (another Khwar with same name) and Naranji Khwar cross Machai Branch canal in Totalai and Naranji areas respectively.

419. During installation of the pressure pipes, two perennial rivers i.e. Kundal Khwar and Loe Khwar would be within the primary impact zone and the turbidity level of the perennial flow of both rivers may increase, though temporarily.

420. Improper disposal of solid waste or washout from concrete batching plants may contaminate the said perennial sources of water. Additionally, other contaminants such as oil and fuel spills from operational equipment may contaminate surrounding surface water including canals, ponds and the rivers, which may affect aquatic organisms and the surrounding ecosystem. Contaminated surface water also holds potential health hazards if the water is used for drinking purposes.

421. Domestic wastes generated from construction camps includes sewage or black water, grey water (from kitchen, laundry, and showers), kitchen wastes, combustible wastes, non-combustible wastes (such as glass and plastic) and recyclable wastes. Inappropriate disposal of this waste may cause contamination of water bodies.

6.5.4.2 Impact Significance

422. Following the criteria for assessing environmental impacts, the impact is assessed to be Short Term and Major Adverse.

6.5.4.3 Mitigation

423. The relevant guidelines from the IFC and the project specific construction stage mitigations are given in the following Table 6-13. Guidelines relating to sewerage systems are included in this section due to the risk to surface water quality posed by overloading of these systems.

Table 6-13: IFC Guidelines and Project Specific Mitigations for Surface Water Quality

S#	IFC Guidelines	Mitigation Measures for PHLCE Project
1	Discharge of process wastewater or sanitary wastewater to surface water should not result in contaminant concentrations in excess of local and WB ambient water quality criteria (NEQS – Annexure-I)	Quarterly monitoring of surface water and treated wastewater against NEQS and WB guidelines
2	Discharge to existing sewerage systems must meet the pre-treatment requirements for municipal and liquid industrial effluents	Mitigating the O & M impacts of the project Contractor’s Camp and Prject staff Office to be facilitated with a standardised gravity sanitary sewerage system along with drainage plan and septic tank to treat the water before disposal in

S#	IFC Guidelines	Mitigation Measures for PHLCE Project
		the river or other areas
3	Discharge to existing sewerage systems must not interfere, directly or indirectly, with the operation and maintenance of the collection and treatment systems or adversely impact the characteristic of residuals from wastewater treatment operations.	If waste is to be discharged from the Contractor's camp into the existing sewerage systems, the operator of the system (Swabi Municipal Corporation) must be notified of the nature of the waste and consent, in writing, to receiving this discharge
4	Existing sewerage systems must only be used where they have adequate capacity to meet the local standards	Only Swabi Municipal Corporation approved sewerage systems may be used.
5	Septic systems must only be used for treatment of sanitary waste	Disposal of construction waste water to septic systems shall be prohibited
6	Septic systems must be properly designed and installed to prevent any hazard to public health, or contamination of land, surface or groundwater and be installed inareas with sufficient soil percolation for the design wastewater loading rate.	If septic systems are to be used, the contractor must submit a plan for treatment using septic systems to the Engineer for approval. The plan must include designs or specifications demonstrating that the treatment rate of the system exceeds the loading rate
7	Septic systems must be installed in areas of stable soils that are approximately level, well drained and permeable, with enough separation between drain field and the groundwater table and surface water	A location plan of the septic system must be included in the treatment plan to be submitted to the Engineer for approval. The location should ensure that in the event of surcharge of the system, sewage shall not flow to the rivers/tributaries, canals, wetlands or ponds.
8	Septic systems must be well maintained to allow effective operation	A maintenance programme must be included in the treatment plant to be submitted to the Engineer.
9	Sludge from septic systems should be disposed in compliance with local regulatory requirements	A plan for treatment and disposal of sludge from septic systems must be included in the treatment plan
10	Transfer of pollutants from process wastewater to another phase should be avoided	Washout from concrete batching plant should be treated to meet NEQS, WHO/IFC guidelines. Treatment may include, as necessary, flow and load equalization with pH adjustment and sedimentation of suspended solids using settling basins or clarifiers
11	Stormwater at campsites should be separated from process and sanitary wastewater streams	Camps site should be provide all necessary drainage of storm water away from the camp & construction areas and community settlements
12	Surface runoff from potential sources of contamination should be prevented, or if not possible, segregated from less contaminated runoff	Hazardous material storage sites should be covered and runoff from refuelling and plant wash down sites should be treated before being disposed. Drainage shall be provided to divert natural rainfall runoff around the site location

424. In addition, the project specific construction stage mitigation measures are:

(a) Discharge of untreated sanitary wastewater into flowing water will not be allowed.

(a) Vehicles will not be washed in the perennial and non-perennial rives and will only be washed in designated areas within campsites.

(b) The fuel shall be carried out in leak proof drums with a platform mounted with impervious (iron or plastic) sheet overlain by absorbent foam or sand.

(c) The platform as well as boat shall be fixed to the vessel carrying the plant to be refuelled

425. The residual impact post mitigation is assessed to be low adverse.

6.5.5 Soil Contamination and Ground Water Quality

6.5.5.1 Impact

426. Fuel or oil stains, leakage or spills can result in contamination of soil and water. From a management perspective these have been generally categorised as minor, moderate or major and detailed below along with the recommended mitigation measures.

427. When water is available throughout the year, ultimately the cropping intensity and cropping pattern will change and there is a risk of over use of pesticides in the project area. There is a danger that farmers may start cultivating rice and cotton, which will result in increased use of pesticides. Review of cropping pattern in PHLC shows that rice is grown on only 0.93% of the area under PHLC command and no cotton is grown over there, thus the likelihood of impact is negligible.

428. **Minor Spills**: Leaks from vehicles, equipment, or storage containers at camp sites or work areas outside the camp site or oil or fuel stains produced during handling and transfer operations such that the area and depth of soil contaminated is less than 1 square meter and 0.3 m, respectively.

429. **Moderate Spills**: Oil spills during transfer or handling operations resulting in spillage of no more than 200 litres of fuel or oil.

430. **Major Spills**: These may occur during transportation of oil to the camp sites or failure of the oil containment arrangement at the camp sites resulting in spillage of oil significantly more than 200 litres in volume. The contaminated soil may require specialised treatment such as incineration or bioremediation.

431. The risk of leaks or spills is especially high at the contractor’s labour and construction camp. Contaminated ground water holds potential health hazards if the contaminant reaches ground water aquifers which are exploited for drinking purposes.

432. Risks of soil and ground water contamination may also result from wastewater as well as wastewater treatment facilities.

433. The impact of soil and ground water contamination will be felt most severely by those nearby to any spill as the overall population settled in the primary impact zone or

secondary impact zone are dependent on spring/ground water as their source of drinking water.

434. While the risk of a major spill occurring due to some accident during the transport of fuel around site cannot be discounted, the possibility of a major spill within the wider project area during the installation of pressure pipes is low, except at re-fuelling locations. Any ground water resource serving villages adjacent to the pressure pipe or canals should be considered at risk.

6.5.5.2 Impact Significance

435. Following the criteria for assessing environmental impacts, the impact is assessed to be Short Term Moderate Adverse.

6.5.5.3 Mitigation

436. The relevant guidelines from the IFC and the project specific construction stage mitigations are given in the following Table 6-14.

Table 6-14: IFC Guidelines and Project Specific Mitigations for Soil Contamination and Ground Water Quality

S#	IFC Guidelines	Mitigation Measures for PHLCE Project
1	Septic systems as per details in Table 6-13	As per Table 6-13
2	Process wastewater as per details in Table 6-13	As per Table 6-13.

437. In addition, the project specific construction stage mitigations are:

(a) All fuel tanks and other hazardous material storage containers will be properly marked to highlight their contents.

(b) The Contractor in consultation with the EA, will identify the sites for disposal of oil contaminated soil etc.

(c) An integrated Pest Management (IPM) Plan is being prepared by the Agriculture Department of KP and Pakistan Forest Institute. The website of KP Finance Department indicates that development budget was allocated for the implementation of IPM during the financial year 2014-15. As Agriculture Department KP is one of the implementing agency of the PHLCEP, therefore; the implementation of the IPM will be extended to the project area and the impact mitigated.

(d) Fuel storage areas and generators will have secondary containment in the form of concrete or brick masonry bunds. The volume of the containment area should be equal to 120% of the total volume of fuel stored.

(e) Fuel and hazardous material storage points must be included in camp layout plan to be submitted to Engineer 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.

(f) Designated vehicles/plant wash down and refuelling points must be included in camp layout plan to be submitted to the Engineer for approval

(g) Run-off from wash down and refuelling points shall be treated in a separation tank – oil shall be collected and treated as hazardous waste.

(h) Washdown points will have a concrete pad underneath to prevent soil contamination in case of leaks or spills

(i) Refuelling points shall be provided with a concrete pad and bund, or drip trays shall be used to prevent soil contamination in the event of leaks or spills.

(j) Vehicles will be checked daily for fuel or oil leaks. Vehicles with leaks will not be operated until repaired.

Treatment following spills

(a) The soil contaminated from minor and moderate spills will be removed and burnt in the burn pit.

(b) The soil contaminated from major spills may require specialised treatment such as incineration or bioremediation.

(c) Shovels, plastic bags, and absorbent material shall be present near fuel and oil storage or handling areas to attend to spills and leaks.

438. The residual impact post mitigation is assessed to be low adverse.

6.5.6 Water Logging and Salinity

6.5.6.1 Impacts

439. One of the expected impacts of an irrigation project is water logging and salinity..

440. The command area of the PHLCE Project is rain fed and is currently supplemented by tube well irrigation in part of the area. It is anticipated in the long run, after the completion of the proposed project, the water will be available throughout the year, resulting in changes to the cropping pattern and cropping intensity and use of agro-chemicals. This increase in the intensity of production can contribute to reduced soil fertility and salinity.

441. Freely available irrigation water leads to the inefficient use of this scarce and expensive resource, inequities between head and tail users and water logging and salinity problems.

442. However, as discussed in Section 4.4.4, Groundwater table in the entire project area is significantly deep (more than 45m). In addition, the project area comprises well-drained soils. A number of natural streams also occur in and around the Project Area which act to drain any excess surface and subsoil water in the near vicinity of the streams. Therefore potential of water logging and salinity can be safely ruled out for the Project Area.

443. Impact Significance

444. Water logging and Salinity are not likely impacts of the projects.

6.5.6.2 Mitigation

445. No specific mitigation measures are required as this is not a likely impact. However, following measures proposed within the project will be additional protection against water logging and salinity.

(a) Canal Lining**:** In the main canal system, distributaries and minors and watercourses provision of concrete lining over well compacted ground would minimise water leakages and therefore minimize potential for water logging. The overall irrigation system efficiency is 60.6% which is much higher than the irrigation system efficiency of 35 to 40% in unlined systems.

(b) On-Farm Water Management**:** Use of resource conservation technologies such as zero tillage, bed and furrow, rough and precise land leveling, and introduction of High Efficiency Irrigation Sysytems (HEISs) will be encouraged as part of interventions for minimizing water loss and potential for water logging and result in efficient water use. The proposed on farm works are described in Appendix 10: Increased water-use and farm-management capacities in target areas.

(c) Canal Bank Afforestation**:** The canal network that comes within the command area will have to be considered for afforestation. A 4m wide plantation belt has been provided for this purpose.

6.5.7 Waste Management

6.5.7.1 Impact

446. It is expected that large quantities of solid waste will be generated at the site camps, main camp and other construction waste. The types of waste generated will include domestic waste, food waste, sewage (waste water), workshop waste (oils, mechanical parts) chemical waste, medical waste, packing waste, demolition material (concrete, masonry, etc), debris from construction sites (excess aggregate, sand etc.) and excavation for the pressure pipes, main and branch canals.

447. Improper disposal of waste can result in contamination by leachate or runoff reaching the ground or surface water resources. Proper management of solid waste is also important because of the risk to human health and the environmental degradation. Careless and indiscriminate open dumping of wastes can create unsightly and unsanitary conditions within the project area. Delay in delivery of solid wastes to landfills results in nuisance and unpleasant odours, which attract flies and other disease vectors. Direct contact with them can be dangerous and unsafe to the workers and local public, as infectious diseases such as cholera and dysentery can spread through contact with these wastes. Open solid waste dumps can also provide breeding places for vermin and flies and other disease vectors, and can also contain pathogenic micro-organisms.

6.5.7.2 Impact Significance

448. Following the criteria for assessing environmental impacts, the impact is assessed to be Short Term Moderate Adverse.

6.5.7.3 Mitigation

449. The relevant guidelines from the IFC and the project specific construction stage mitigations are given in the following Table 6-15.

Table 6-15: IFC Guidelines and Project Specific Mitigations for Waste Generation

S#	IFC Guidelines	Mitigation Measures for PHLCE Project
1	Topsoil, overburden, and low quality materials should be properly removed, stockpiled near the site and reused during site rehabilitation	IFC Guideline shall be adopted
2	Waste management should be addressed through a waste management system that addresses issues linked to waste minimization, generation, transport, disposal & monitoring and	Waste management plans from hazardous and non- hazardous wastes have been developed

	includes: Characterisation of waste according to composition, source, types and volumes in waste management planningMinimise hazardous waste generation by implementing stringent waste segregation to prevent commingling of non-hazardous and hazardous waste to be managed	
3	Establishment of a waste management hierarchy that considers prevention, reduction, reuse, recovery, recycling, removal and finally disposal of wastes.	IFC guideline adopted
4	Avoid or minimise generation of waste as far as practicable	Excess construction material shall be returned to suppliers or sold for use locally
5	Where waste generation cannot be avoided but has been minimised: recovering and reusing waste Evaluation of waste production processes and identification of potentially recyclable materialsIdentification and recycling of products that can be reintroduced to the activity on site	Non-combustible recyclable waste including plastic or glass bottles and cans will be temporarily stored on site and sold/handed over to a waste/recycling contractor who will utilise these wastes for recycling purposes. If no contractor is available, waste shall be disposed of. The scrap steel (existing gates) shall be sold to local contractors or for recycling using approved facilities.
6	Investigation of external markets for recyclingProviding training to employees in order to meet objectives	Demolition waste shall be reused in construction activities such as for aggregate, landscaping and road formation such as for aggregate, landscaping and road formation
7	Where waste cannot be recovered or reused: treating, destroying, and disposing of it in an environmentally sound mannerOn- or off-site treatment of waste material to render it non-hazardous prior to final disposalTreatment or disposal at permitted facilities specially designed to receive the waste	IFC guideline adopted Biodegradable domestic waste shall be disposed of inlandfills established in the project area or disposed of at municipal waste facilities where available Sanitary waste shall be transferred to local sewerage treatment system or treated using septic tanks (see Table 6-13). Packaging paper and card shall be incinerated in burn pit if recycling is not possible. Fire extinguishers to be provided at burn pitsMedical wastes will be temporarily stored onsite.
8	Hazardous waste materials shall be disposed of through reputable and legitimate enterprises, licensed by the relevant regulatory agencies. In the absence of qualified waste disposal operators, facilities for long- term storage of wastes in site or at an alternative location shall be constructed until external commercial options are available	The contractor shall prepare a plan for treatment of hazardous waste including details of a licensed contractor to be used (including relevant certification) ordetails of long-term storage facilities of hazardous waste if licensed contractor is not available. The plan shall besubmitted to the Engineer for approval prior to commencement of works.
9	Hazardous waste storage should: Be separate to non-hazardous waste. Prevent or control accidental releases to air, soil, and water resources. Be in closed containers away from direct sunlight, wind and rain. Be clearly identified and demarked both on site and on a	Areas for storage for hazardous materials (including hazardous waste) shall be identified on the camp layout to be submitted to the

	site plan	Engineer for approval. Hazardous material storage areas shall be covered, secured and include a concrete floor to prevent infiltration of contaminants to ground or ground water. Hazardous storage areas must not be situated adjacent to surface water or in areas at risk of flooding Hazardous material storage a
10	Hazardous waste storage area should allow for inspection between containers to monitor leaks and spills Be inspected periodically and findings documented	Space must be maintained between hazardous storage containers in the storage area to allow personnel to inspect each container. Hazardous storage areas should be inspected weekly by the contractor and the findings documented by the contractor and made available to the Engineer on request.
11	Hazardous storage areas should be subject to special management actions, conducted by employees who have received specific training and limiting access to employees who have received training	Hazardous areas must be secure, and access only permitted to those who have received specific training. Training on handling, use and disposal of hazardous material must be included in the contractors training plan for specified personnel.
12	A spill response and emergency plan should address accidental releases of hazardous waste	Spill kits, including sand buckets (or other absorbent material) and shovels must be provided at each.
13	Providing training to employees in order to meet objectives of waste management strategy	Waste management for all site staff to be included inContractor's training plan.

450. The project specific construction stage mitigation measures are:

(a) Topsoil, overburden, and low quality materials should be properly removed, stockpiled near the site and reused during site construction

(b) While biodegradable domestic waste shall be disposed of in landfills established in the project area or disposed of at municipal waste facilities where available; sanitary waste shall be transferred to local sewerage treatment system or treated using septic tanks

(c) Training on handling, use and disposal of hazardous material must be included in the contractors training plan for specified personnel;

(d) Minimise hazardous waste generation by implementing stringent waste segregation to prevent mixing of non-hazardous and hazardous waste to be managed;

(e) Hazardous areas must be secure, and access only permitted to those who have received specific training

(f) Spill kits, including sand buckets (or other absorbent material) and shovels must be provided at each designated location

(g) Waste management training for all site staff to be included in Contractor's training plan;

(h) A separate waste management plan will be prepared by Contractor which includes a plan for treatment of hazardous waste including details of a licensed contractor to be used (including relevant certification) or details of long-term storage facilities of hazardous waste if licensed contractor is not available. The plan shall be submitted to the Engineer for approval prior to commencement of works.

451. Land **Fill for Wate:** Measures for mitigating impacts from Land-fill are:

(a) Landfills shall be sited in an area where groundwater is low and, where the base of the landfill is highly permeable, the base shall be lined with an impervious layer (such as clay) to prevent ground water contamination from leachate.

(b) Provide fences and secure landfills to prevent unauthorised access.

(c) Inert waste/demolition debris shall be disposed of in burial sites away from settlements in the large barren area(s).

(d) The waste will be transported to disposal points in well maintained, designated and covered vehicles.

(e) Any excess excavated material will be dumped in vast plain area with the permission of Project Environmentalist and the Engineer.

(f) Within the camp areas all solid wastes will be stored in waste bins provided within the camp area and waste disposed of regularly.

(g) It will be ensured that after restoration activities the campsites are clean and that no refuse has been left behind.

(h) Guidelines in the solid waste management plan should be strictly followed.

452. After adopting the above mentioned mitigation measures, the residual impact will be minor adverse.

6.6 Land Use Changes

453. The potential activities which will change land use of the project area include excavation of borrow areas and access routes. The contractor shall select borrow areas best suited to his chosen methodology and work programme, and submit this selection to the Engineer for approval, following soil testing in the selected areas to confirm suitability. The existing land use in the area where borrow areas may be established is as follows:

- Agricultural land
- Barren land
- Hilly areas
- Forest
- Streams and creeks
- Settlements

454. Of the above land uses, it is clearly not possible for agriculture, forest and settlements to be used as borrow areas or to establish access routes, however, the use of all other areas may be possible with prior permission.

6.6.1.1 Impact Significance

455. Following the criteria for assessing environmental impacts, the impact is assessed to be Short Term Moderate Adverse.

6.6.1.2 Mitigation

456. The requirement for borrow material would be very limited for the construction activities planned. However, the following mitigation measures are proposed when borrow materials are to be extracted.

(a) Excavation for borrow material will be minimised by reuse of cut material and will be carried out only in the designated areas;

(b) The topography of the final surface of the levelled land will be made conducive to enhance natural drainage of rainwater and floodwater

(c) The contractor will prepare landscaping and re-vegetation plans which will include (i) restoration of cleared areas which are no longer in use, spoil areas, and any areas temporarily occupied during construction work; (ii) all areas disturbed by construction activity, including temporary access roads will be landscaped to reflect natural contours, restore suitable drainage paths and encourage re-establishment of vegetation; and (iii) spoil heaps and excavated slopes shall be compacted and protected to prevent erosion.

(d) During construction phase of the project, the contractor in consultation with the EA will identify suitable places for disposal of surplus excavated materials. These sites will be assessed environmenallly and socially before disposal of material.

(e) The borrow pits would be located in the uncultivated land and shall not be in the areas which are permanently flooded. Preferably, the borrow material shall be obtained from the areas which are owned by the KPID and currently uncultivable. The borrow areas will not be selected within or in the immediate vicinity of any settlements. The location of borrow areas will be at least 150m away from the existing canals and will not jeopardize the stability of the embankments fo the canals or any other structur, settlements, civil works or natural habitats. The borrow areas shall not be close to the settlement and wherever the settlement exist and the establishment of borrow pit is unavoidable, the Contractor will be responsible to backfill the borrow pit with rejected /surplus excavated/cut material and will be given a vegetative cover. In addition, the contractor will submit and implement a traffic management plan. Community consultations will be carried out while selecting borrow areas particularly near the settlements. GRM will be established to address any related complaints.

6.6.2 Biodiversity

6.6.2.1 Habitat

457. In terms of magnitude of impact, the most serious impacts are those which are likely to cause permanent adverse impact on the integrity of an ecological system and those which affect a major proportion of vulnerable habitats or species within the wider study area. The potential magnitude of impact to the habitat is the most significant in terms of

biodiversity as its effects shall be felt long after construction is complete and this in turn could affect the fauna which the habitat supports.

458. The primary impact to existing habitats will be during the implementation of the proposed works. The most notable impact shall be due to the establishment of borrow areas and camps and yards, involving the clearing of vegetation– this will result in a permanent change in the habitat of these areas.

459. In addition, vegetation will be stripped and trees felled along the foot print of the proposed pressure pipes and irrigation canals.

460. The majority of the habitat to be cleared along the alignment of the proposed pressure pipes, main and branch canals can be classified as agriculture land, river bed and toes of hilly areas. This could result in a negative impact on the long-tailed grass warbler which is known to prefer low lying habitats and is a sensitive receptor in the project area. In total 800-1,200 trees are likely to be cut/ uprooted during construction works.

461. The cutting of trees shall result in the loss of habitat for the avifauna. Where acacia trees are to be felled, this will again represent a negative impact to the long-tailed grass warbler which is known to prefer this tree.

6.6.2.2 Impact Significance

462. The impact to the different habitats is shown in the following Table 6-16.

Table 6-16: Habitat Impact Significance (without mitigations)

Habitat	Impact Significance	Comment
Wetland	Major Beneficial in the long term	The PHLCE project will further increase the wetland area.
River forests	Major Adverse in the long term	See mitigation below

6.6.2.3 Mitigation

463. Mitigations proposed during the design and planning stage of the project include:

(a) The selection of potential camp sites to avoid areas of dense vegetation.

464. In addition, the following mitigation measures are proposed to be implemented during the construction stage:

(a) The establishment of borrow areas or access tracks in forest land shall be strictly prohibited;
(b) The area required for camp sites, borrow sites (if required), and dumping sites will be kept to the minimum required.
(c) Approval from the Engineer shall be required before clearance of vegetation

(d) Clearing of vegetation will be kept to a minimum and will not extend beyond the area required for works.

Tree cutting

(a) The cutting of trees shall be minimized – a tree management plan shall be prepared during implementation of the project. Every tree removed will be compensated with the planting of 05 seedlings to ensure at least 02 mature trees.

(b) An inventory of trees to be cut shall be maintained by the contractor

(c) Compensatory tree plantation plan will be in place and implemented before cutting the trees. This will be prepared as part of the site-specific EMP (SSEMP) by the Contractor. The local species will be preferred during replantation. The plantation in consultation with the local forest department and communities is recommended.

(d) Selective and careful pruning of trees shall be made where possible to reduce need of tree removal.

(e) Supply appropriate fuel in the work camps to prevent fuel wood collection.

(f) The felling of a tree which houses an active nest or eggs shall be prohibited. The felling of such trees will be carried out in non-breeding seasons.

(g) Dumping of construction materials should be avoided where large number of terrestrial trees, shrubs, herbs, grasses and fruit trees are found.

465. Following the adoption of these mitigation measures, the impact on the different habitats shall be as follows Table 6-17:

Table 6-17: Habitat Impact Significance (with mitigation)

Habitats	Impacts Significance
Wetland	Negligible
River forests	Negligible

466. With mitigations, the impact is judged to be minor adverse in the short term due mainly to the cutting of trees and loss of vegetation. However, overall this shall improve to moderate beneficial in the long term when newly planted trees reach maturity.

6.6.3 Terrestrial Fauna

6.6.3.1 Impact

467. The key terrestrial species in the project area, which are considered as sensitive receptors, are:

- Asiatic Jackal
- Fox
- Squirrel
- Rabbit

468. The accidental striking of all terrestrial fauna by project vehicles on access routes is a considerable risk during the project, although this is easier to mitigate during establishment of borrow areas.

6.6.3.2 Impact Significance

469. Following the criteria for assessing environmental impacts, impact is assessed to be Short Term Major Adverse.

6.6.3.3 Mitigation Measures

470. The following construction stage mitigation measures are proposed:

(a) The establishment of borrow areas (if required) within earlier identified habitat margins of the project area shall be prohibited to mitigate the impact to the key species.

(b) Borrow areas (if required) shall only be approved where these are proposed in converted habitat or barren land.

(c) Hunting or harassment of wildlife will be strictly prohibited.

(d) The speed of project vehicles shall be limited to 30 km/hr.

(e) Vehicles will be maintained in good condition and provided with mufflers to reduce noise.

(f) Development of new access tracks will be minimised, and where they are prepared their width will be kept to the minimum required width as approved by the Enginer.

(g) The construction camp site(s) to be selected in an area non-sensitive to wildlife so as to minimise any impacts of its operation.

471. After adopting the above mentioned mitigation measures, the residual impact will be minor negative due only to the risk of striking fauna on access routes.

6.6.4 Avifauna

6.6.4.1 Impact

472. The presence of migratory and sedentary birds is considered likely throughout the area surrounding the project footprint. Avifauna prefers undisturbed marshy habitats, such as that surrounding the river and away from agricultural land. However, they are also observed within cultivated lands and around settlements of the project area. The presence of avifauna will increase during the winter months, with the arrival of migratory birds. However, there are no landing zones used by migratory birds in the immediate project area.

473. The key avifauna species in the project area, which are considered as sensitive receptors, are as follows:

- Black Partridge
- Common Pheasant
- Jungle fowl

- Jungle Pigeon and
- Quail

474. During construction, avifauna may be disturbed due to sensory disturbance from construction; movement of vehicles and crew personnel; location and operation of camps; operation of large plant; and site restoration. This will be a temporary disturbance within the project area. Following construction, there will also be an impact on avifauna due to the loss of habitat but this would be compensated by tree planting and availability of wetland areas.

6.6.4.2 Impact Significance

475. Following the criteria for assessing environmental impacts, impact is assessed to be Short Term Major Adverse.

6.6.4.3 Mitigation Measures

476. The following construction stage mitigation measures are proposed:

(a) The establishment of borrow areas (if required) within river bed forests will be prohibited to mitigate the impact to the key species of avifauna.

(b) Borrow areas (if required) shall only be approved where these are on barren land.

(c) The development of borrow areas or access tracks through strands of vegetation including identified tree species shall be prohibited

(d) Development of new access tracks will be minimised, and where they are prepared their width will be kept to 3 m.

(e) Biodiversity monitoring is proposed quarterly within the project area to monitor the status of avifauna in the project area and the impacts of habitat loss.

(f) Hunting or harassment of wildlife will be strictly prohibited.

(g) Vehicles will be maintained in good condition and provided with mufflers to reduce noise.

(h) The construction camp site(s) need to be selected in an area non-sensitive to wildlife so as to minimise any impacts of its operation on the wildlife.

477. After adopting the above mentioned mitigation measures, the residual impact will be minor negative.

6.7 Traffic

6.7.1.1 Impacts

478. The construction of PHLCE Project will take approximately 3 years to complete and during this time there will be increased traffic within the project area as well as on the roads approaching the project area due to movement of personnel, plant and materials around site as well as delivery to the site. A large volume of construction material as well as construction debris will be transported to and from the construction areas.

479. Traffic movement will interrupt the local traffic and pedestrian traffic and school children on some routes during some specific periods of peak activities. Due to increased use of trucks and other vehicles on the narrow roads in the project area elderly people, women and children will be more exposed to dangerous situations, which may lead to traffic accidents and unrest.

6.7.1.2 Impact Significance

480. Following the criteria for assessing environmental impacts, impact is assessed to be Short Term Major Adverse.

6.7.1.3 Mitigation

481. The relevant guidelines from the IFC and the project specific construction stage mitigations are given in the following Table 6-18.

Table 6-18: IFC Guidelines and Project Specific Mitigations for Traffic

S#	IFC Guidelines	Mitigation Measures for PHLCE
1	Emphasize safety aspects amongst drivers and improve driving skills	Training of drivers to be included in the Contractor's training plan. A speed limit of 30km/hr on site roads shall be enforced.
2	Require licensing of drivers	All drivers engaged by Contractors must hold a valid license for the vehicle they are operating.
3	Regular maintenance of vehicles to minimise accidents caused by equipment malfunction or premature failure	Maintenance of all vehicles as per manufactures guidelines.
4	Using locally sourced materials whenever possible to minimise transport distances	The surplus material would be used for filling
5	Locating associated facilities close to project sites	As above
6	Minimize pedestrian interaction with construction vehicles	Construction camp layout plan to be submitted to the Engineer for approval must include details of segregation of plant/vehicles and pedestrians.
7	Collaboration with local communities and responsible authorities to improve signage, visibility and safety of roads, particularly near schools or where children may be present	Contractor must provide warning signage where access routes pass adjacent to settlements or schools. The Contractor's Community Liaison Office shall be required to collaborate with local communities to identify sensitive areas.
8	Employing safe traffic control measures, including road signs and flag persons to warn of dangerous conditions	Contractor to provide flag persons where construction plant and vehicles meet the main road to ensure project traffic merges safely with public traffic. Signage and flag men to be provided to direct public traffic whenever necessary to partially close any public road (i.e. close one of two carriage ways).
9	Ensure moving equipment with restricted rear visibility is outfitted with audible back-up alarms	Plant or vehicles with restricted rear visibility shall be fitted with audible back-up alarms or banksmen provided when reversing.
10	Restricting the circulation of delivery and private vehicles to defined routes and areas, giving preference to 'one- way' circulation where appropriate	The camp layout plan to be submitted to the Engineer for approval shall include routes for delivery vehicles.

482. The project is located in an area where only the village road to the PHLCE Project serves as a connection between the two river banks.

(a) The project area can be accessed via existing different link roads (approaching each section of the pressure pipe and canal) and the same roads will be used during construction phase of the project.

(b) The Contractor will prepare a traffic management plan before commencement of physical works.

Road Closure:

(a) Blockage of local roads and routes will be minimized. If unavoidable, consultation with the affected communities will be carried out and alternate routes identified.

(b) Requests for closure of public roads must be made in advance to the relevant authority (highways department or local authority)

Disturbance to local communities

(c) The Contractor's Community Liaison Officer will notify affected people and communities prior to movement of any major plant or equipment which may cause disruption.

Use of public highways

(d) Speed and weight restrictions will be enforced.

(e) Ruts and scars resulting from project operations will be repaired by the Contractor at his own cost.

483. The residual impact post mitigation is assessed to be low adverse.

6.7.2 Occupational Health and Safety

6.7.2.1 Impact

484. The construction activities will involve operations which pose risks to health and safety of the contractor's staff as well as the surrounding communities. Table 6-19, below details the main construction activities and impacts which may result in ill health, injury, or in extreme cases death.

Table 6-19: Health and Safety Impacts of construction activities

Activity	Potential Impact
Working at height	Injury/death from fall
Working near water	Death by drowning (only during flood season)
Operation of heavy construction plant/machinery	Injury/death
Movement of vehicles and plant	Injury/death from traffic accident
Excavation works	Injury/death from slip of earth material
Earthworks	Ill health due to dust or injury/death following accident caused due to poor visibility
Use of hazardous substances	Ill health/injury/death from improper handling
Manual handling	Injury from improper lifting
Working in vicinity of heavy plant	Injury/ill health due to high noise or emissions
Inhabitation of construction camp	Ill health due to poor quality or unhygienic camps

General site works	Injury from slips and trips

6.7.2.2 Impact Significance

485. The impact is assessed to be Short Term Major Adverse.

6.7.2.3 Mitigation

486. The relevant guidelines from the IFC and the project specific mitigations regarding the staff welfare & Health and safety at the Contractor's facilities are given in the following Table 6-20.

Table 6-20: IFC Guidelines and Project Specific Mitigations for Site Facilities

S#	IFC Guidelines	Mitigation Measures for PHLCE Project
1	Structures, surfaces & installations should be easy to clean and maintain, and not allow for accumulation of hazardous compounds.	Surfaces (including flooring and work surfaces) in camps, kitchens, dining areas and workshops should be solid and easy to clean. Flooring for work camps must be float finished concrete or better.
2	Buildings should be structurally safe, provide appropriate protection against the climate, and have acceptable light and noise conditions.	All drivers engaged by Contractors must hold a valid license for the vehicle they are operating.
3	Contractor's staff accommodation must be structurally sound and provided with lighting and ventilation. Accommodation must be situated at least 25m from the nearest generator.	As for #1
4	Work place structures should be designed and constructed to withstand the expected elements for the region and have an area designated for safe refuge, if appropriate.	Contractor's staff accommodation must be located such that it is not at risk from flooding.
5	Standard Operating Procedures (SOPs) should be developed for project or process shut-down, including an evacuation plan. Drills to practice the procedure and plan should be undertaken annually.	The Contractor shall submit to the Engineer for approval a shut-down procedure, identifying indicators which shall prompt the shut-down of various works activities, The Contractor shall submit to the Engineer for approval an emergency evacuation plan and practice the procedure annually.
6	The work space provided for each worker, and in total, should be adequate for safe execution of all activities, including transport and interim storage of materials and products	The Contractor shall submit to the Engineer 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.
7	Passages to emergency exits should be unobstructed at all times. There should be a minimum of two exits from any work area	Evacuation routes to be unobstructed at all times. At least two emergency exits to be provided from each building and the camp itself.

S#	IFC Guidelines	Mitigation Measures for PHLCE Project
8	Equipping facilities with fire detectors, alarm systems and fire-fighting equipment. The equipment should be maintained in good working order and be readily accessible.	Fire extinguishers should be provided throughout camps and work sites. Fire extinguishers should be inspected monthly and maintained as necessary.
9	Adequate lavatory facilities (toilets and washing areas) should be provided for the number of people expected to work. Allowances should be made for segregated facilities, or indicating whether the toilet facility is “In Use” or “Vacant”	Separate latrines and washing facilities for males and females with total isolation by wall or by location shall be provided. Female toilets should be clearly marked in language understood by those using them to avoid miscommunication. Suitable and sufficient washing facilities, including showers, shall be provided or made available at readily accessible places within the immediate vicinity of every sanitary facility. Washing facilities shall include a supply of clean running water, soap or other suitable means of cleaning and towelsor other suitable means of drying. Rooms containing washing facilities shall be sufficiently ventilated and lit and kept in aclean and orderly condition.
10	Where workers may be exposed to substances poisonous by ingestion and skin contamination may occur, facilities for showering and changing into and out of street and work clothes should be provided	As for #9
11	Adequate supplies of potable drinking water should be provided from a fountain with an upward jet or with a sanitary means of collecting the water for the purposes of drinking. Water supplied to areas of food preparation or for the purpose of personal hygiene (washing or bathing) should meet drinking water quality standards	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 these to be samples to be tested at a licenced laboratory prior to its use by the Contractor’s staff. The results of these tests for each supply must be submitted to the Engineer and must demonstrate that each water supply meets national and World Health Organisation standards for drinking water.
12	Where there is potential for exposure to substances poisonous by ingestion, suitable arrangements areto be made for provision of clean eating areas where workers are not exposed to the hazardous or noxious substances.	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.
13	Workplaces should, to the degree feasible, receive natural light and be supplemented with sufficient artificial illumination to promote workers’ safety and health, and enable safe equipment operation. Supplemental ‘task lighting’ may berequired where specific visual	Work places and camps should be provided with both natural& artificial light. Artificial lighting should be powered by generator in the event of

S#	IFC Guidelines	Mitigation Measures for PHLCE Project
	acuity requirements should be met. Emergency lighting of adequate intensity should be installed and automatically activated upon failure of the principal artificial light source to ensure safe shut-down, evacuation, etc.	power cuts.
14	Passageways for pedestrians and vehicles within and outside buildings should be segregated and provide for easy, safe, and appropriate access	Pedestrian and vehicle routes are to be included in site layout plans to be submitted to the Engineer for approval.
15	The employer should ensure that qualified first-aid can be provided at all times. Appropriately equipped first-aid stations should be easily accessible throughout the place of work.	A qualified doctor shall be appointed on site and adequately equipped and properly staffed portable first aid stations or dispensaries shall be provided by the Contractor at camps and other strategic locations, to administer first aid treatment at any time required and free of charge to all persons on the Site, including personnel of the Engineer and the Employer. The nature, number and location of facilities furnished and the Contractor's staff for administering first-aid treatment shall, as a minimum, meet the requirements of the Health Service of the Government of Pakistan. Dispensaries should be adequately stocked with medicines. The doctor shall be registered to practice in Pakistan with the PMDC (Pakistan Medical and Dental Council).

6.7.3 Physical Cultural Resources

6.7.3.1 Impact

487. The tomb of Gajoo Khan Baba and graveyard exists on the connecting point of pressure pipe and Indus Ambar canal. It is anticipated that as a result of the works, the location of the graveyard could be adversely impacted during the works.

6.7.3.2 Impact Significance

488. According to the criteria for social impacts, the impact on the graveyards is judged to be moderate adverse in the long term.

6.7.3.3 Mitigation

(a) As the tomb and graveyard is situated in the primary impact zone (close to the pressure pipe and Indus Ambar canal connecting point), it is possible to avoid any adverse impacts to the graveyards by restricting the movement of contractor's crews, machinery and project staff in this area and the access path to the construction site will be planned away from the tomb..

(b) The environmental survey did not identify any other tombs or graves within the primary impact zone; however, if any are found during the works, consultation with family members of the deceased will be required by the contractor in order to identify a mutually acceptable solution.

6.7.3.4 Chance Find Procedure

489. The following procedure shall be initiated in the event of the discovery of a previously unidentified archaeological or culturally important site during construction:

- In the event of discovery of grave yards or any architectural assets which have not been identified, the contractor will immediately cease all works in that area and report the find to the Engineer. Works may not recommence until approval is given by the Engineer.
- Upon receiving a report of a chance find of a graveyard or archaeological feature, the Engineer will immediately mobilise his environmental team to the site to make recommendations. These recommendations shall be forwarded to the Client for approval. Approval for the contractor to continue shall be given by the Engineer once the Client has agreed to the proposed measures to be implemented and once these measures are included within the social or environmental management plan.

490. Following the implementation of these mitigation measures, the impact is judged to be minor adverse in the short term.

6.7.4 Social Impacts

6.7.4.1 Land acquisition and relocation of project affected persons impact

491. In order to install the pressure pipes and construct main and branch canals, the construction foot print will have to be cleared prior to commencement of the works. This area of land is reportedly privately owned. As a result, acquisition of the land from those likely PAPs living within the area will be required.

6.7.4.2 Impact Magnitude

492. Permanent acquisition of up to ***218.88 ha*** (540.9 acres) of privately owned land shall be required and temporary acquisition of land may also be required for the contractor’s construction and accommodation facilities.

6.7.4.3 Impact Mitigation

493. All temporary and Permanent Land Acquisition will follow the procedures as outlined in the Draft LARP, which has been prepared under the PPTA.

6.7.5 Disruption of Water Supply to Population

494. Groundwater for drinking and domestic use is common in the project area. The water is commonly supplied to the communities through buried pipe lines. There is a likelihood of drinking water supply pipes passing into the proposed RoW which may be negatively affected during the construction.

6.7.5.1 Impact Significance

495. According to the criteria for assessing social impacts, the impact to the command area is major adverse in the short term, reducing to negligible following completion of the construction phase.

6.7.5.2 Mitigation

496. The contractor and the project engineer will need to investigate the presence of such supply pipes in the project area before commencement of the physical works of the pressure pipes and irrigation canals. If any pipe lines are detected the contractor needs to re-align the water supply pipe on alternate feasible routes without impacting/disrupting the water supply to concerned village during construction work. The Contractor shall submit a construction programme to the Engineer for approval on mobilisation. This programme shall only be approved if it is shown that alignment of the pipes will not be impacted during construction period.

497. As a result of the proposed mitigations, the impact is unlikely to occur. As such the significance of the impact shall reduce to minor adverse in the short term.

6.7.6 Impact on Agriculture

6.7.6.1 Impacts

498. The following activities shall result in the loss of land during the installation of pressure pipes, irrigation canals and water courses mostly in the primary impact zones which is currently under cultivation:

- Construction of haul routes;
- Construction of sub-camps (small camps to serve remote project areas) in the project area,
- Increase use of pesticides which will leach into the ground and may have a chance of uptaking by the crops.

499. The impact is temporary as the land is not permanently acquired; therefore there shall be no loss of investment to the famers, other than where standing crops will be lost. In such cases the impact will be severe, and its magnitude will depend upon the level of inputs (such as seed, fertilisers and pesticides) applied to the land as these all represent a cost to the farmer to be recovered following harvest and sale of the crop. The resettlement action plan will include compensation provisions for such losses.

500. The areas used for the construction of haul routes and sub-camps will result only in temporary loss of cultivatable land, as the land can be again brought under cultivation following completion of the construction works.

6.7.6.2 Impact Significance

501. According to the criteria for assessing social impacts, the impact on agriculture in the project area is major adverse in the short term.

6.7.6.3 Mitigation

(a) The Resettlement Action Plan includes provision for payment of compensation to farmers for the loss of any standing crops, or crops already sowed. The compensation value shall be calculated based on market value of the crops and average yields in the project area.

(b) An integrated Pest Management (IPM) Plan implementation is underway through Agriculture Department of KP and Pakistan Forest Institute. The website of KP Finance Department reveals that development budget was allocated for the implementation of IPM during the financial year 2014-15. As Agriculture Department

KP is the implementing agency of the ADB KPWRSP, therefore; the implementation of the IPM implementation may be extended to the project area.

(c) Before disposal of excavated material/spoil, the pesticides residue will be tested in the soil sample by the project proponent and Contractor to ascertain the persistency of pesticide residue. If in case, the pesticides rediue detected in the soil sample, the soil will be disposed off to an appropriate site to be approved by the project proponent and provincial EPA.

(d) In order to reduce the loss of agricultural land during the construction stage, existing haul routes will be preferred by the contractor, and the width of any new haul route shall be limited to the bare minimum required and approved by the Engineer.

(e) Removal of all contractors' facilities from the project area shall be a contractual requirement, and as such the land used for the sub-camps can be restored to facilitate agriculture and the land used for the construction camp shall become cultivatable.

502. Following these mitigations in particular payment of compensation for standing crops, the receptor sensitivity shall reduce to minor adverse.

6.7.7 Risks of Community Disturbance, Health, Safety and Wellbeing

6.7.7.1 Impact

503. During construction there will be a number of activities which, if not mitigated, are likely to cause disturbance to communities in the project area; these are:

- Movement of plant and vehicles throughout the project area, especially along haulage routes passing alongside private land during the installation of pressure pipes, main and branch canals, disrupting local movement and posing traffic safety issues.
- Increased traffic on public routes.
- Health and safety risk will also be posed to the community due to the existence of a construction site(s) and the storage and use of hazardous chemicals.

504. In addition, local communities rely on groundwater for their drinking water needs, and excessive use of these resources by the contractor shall adversely impact upon the availability of local drinking water.

6.7.7.2 Impact Significance

505. According to the criteria for assessing social impacts, the impact on community health is moderate adverse in the short and long term.

6.7.7.3 Mitigation

506. Mitigations proposed in this section include guidance given in the IFC General Environmental, Health and Safety (EHS) Guidelines.

Table 6-21: IFC Guidelines and Project Specific Mitigations for Community Health, Safety & Wellbeing

S#	IFC Guidelines	Mitigation Measures for PHLCE

1	Inclusion of buffer strips or other methods of physical separation around project sites to protect the public from major hazards associated with hazardous materials incidents or process failure, as well as nuisance related to noise, odours, or other emissions.	Contractor's camp to situated at least 300m from the nearest Settlement
2	Reducing off-site impacts of releases through measures intended to contain explosions and fires, alert the public, provide for evacuation of surrounding areas, establish safety zones around a site, and ensure the provision of emergency medical services to the public	The contractor is to identify zones within public areas that shall be impacted as a result of the outbreak of fire at the contractors camp and include measures for evacuation of the public in these areas within their emergency plan. The Contractor's Health and Safety Plan should include plans for the emergency transfer of members of the public to suitable medical facilities in the event of a serious accident resulting from the construction works. Details of transport and medical treatment en-route are to be included. See following chapter for further details of the Health and Safety Plan.
3	Communicable diseases: Provide surveillance and active screening and treatment of workers; Prevent illness among workers in local communities; Providing treatment through standard case management in on-site or community health facilities. Ensuring access to medical treatment, confidentiality and appropriate care.	Include information about HIV/AIDS and the spread of sexually transmitted diseases within the workers code of conduct. Include proposals for awareness raising on HIV/AIDS and thespread of sexually transmitted diseases in Contractor's trainingplan, to be undertaken in a culturally sensitive manner.
4	Vector-borne diseases: Prevention of larval and adult propagation throughsanitary improvements and elimination of breeding habitats close to human settlementsElimination of unusable impounded waterEducating project personnel and area residents to risks, prevention, and available treatment; Distributing appropriate education materials.	Contractor to provide effective drainage at and around camp to prevent accumulation of surface water near to camp or existing settlementsInclude proposals for awareness raising on risks, prevention and available treatment of vector-borne diseases within Contractor's training plan.
5	Water availabilityProject activities should not compromise the availability of water for personal hygiene needs and should take account of future increases in demand. The overall target should be the availability of 100 litres per person per day.	The use of community water pumps shall not be permitted by the Contractor. The use of groundwater for construction works shall be strictly prohibited. The contractor shall ensure that his use of groundwater for health requirements of his staff shall not result in the availability of water within local communities dropping below 100 litres per person per day or baseline availability, whichever is lower. Independent monitoring of groundwater availability in the communities shall be carried out to verify this. Where local drinking water resources are compromised by the contractor's activities, the contractor shall provide temporary drinking water supplies to the

		effected households until such a time as natural drinking water resources are recovered.

507.

508. In addition, the following mitigation measures are proposed:

(a) Complaints register shall be set up at the Contractor's and Engineer's offices to record any complaints received during the implementation of the works.

(b) Fencing shall be provided around all construction sites where there is a risk to community health and safety, including excavations, construction camp and storage locations.

(c) Access to construction camps shall be controlled by fences, gates and security guards

509. Following the implementation of these mitigation measures as well as relevant mitigations relating to traffic, dust and noise discussed earlier in this chapter, the impact shall reduce to minor adverse in the short term.

6.7.8 Employment Generation

6.7.8.1 Impact

510. During the peak of works, it is estimated that approximately 500 personnel shall be engaged on site. The majority of the personnel shall be unskilled labourers, drivers, plant operators and secondary support staff and it will be possible to draw part of this labour force from communities within the project area, many of whom currently work as labourers on an intermittent basis.

511. While it is anticipated that the project will draw a large unskilled workforce from within the project area, this shall depend in part on the extent to which the contractors bring external workers with them.

512. Temporary employment within the area has the potential to contribute to reduction in the local poverty level, especially if vulnerable groups (such as landless farmer's etc. living in the project area and those living below the poverty line) are engaged. Such emmployment will also result in an increase in the skills base of those engaged on the project.

6.7.8.2 Impact Significance

513. According to the criteria for assessing social impacts, the impact of employment generation is major beneficial in the short term. There are minor beneficial impacts in the long term due to an increase in the skills base of the local population.

6.7.8.3 Enhancement Measures

(a) The requirement for provision of employment opportunities to residents of the project, and surrounding area, shall be included in the contract documents.

(b) The Contractor shall comply with all Pakistani national, regional and local government labour and employment laws. In addition, the Contractor shall comply with the IFC and EHS guidelines.

6.7.9 Local Conflicts and Security

6.7.9.1 Impact

514. Ethno-religious conflicts are common in the Janda Boka area and although the situation has improved since 2014, a general feeling of distrust exists towards outsiders.

6.7.9.2 Impact Significance

515. According to the criteria for assessing social impacts, the impact on conflicts and security is moderate adverse in the short term.

6.7.9.3 Mitigation

516. The main mitigation for this impact is the preparation and implementation of the contractor's Communication Strategy. This strategy shall focus on early and continued consultation by the contractor with influential figures within the project area, especially those within Maina village.

517. The Communication Strategy shall also include plans for continual consultation in local languages within project affected communities. As for the landlord consultations, the aim of these meetings should be to raise awareness amongst the local community of upcoming activities, and for community members to raise any concerns or suggestions.

518. The Communication Strategy should define a process for receiving, recording and responding to complaints and also monitoring of the success of any responsive action taken to prevent the escalation of any conflicts.

519. All contractors' staff will be required to carry identification cards issued by the contractor which clearly state the staff member's identification details and affiliation with the contractor and the project. Cards shall also be issued to all sub-contracted staff and the Engineers' staff active in the project area. The issue of identity cards shall be strictly controlled by the contractor, and following termination/completion of staff contract the identity card shall be destroyed.

520. Pashto speaking staff must be available at all active work sites at all times in order to communicate with the local community.

521. All camp sites must be secured with perimeter fences preventing any unauthorized access to the camp(s). Access to the camps must be controlled through gated entrances and entrance and exit logs shall be maintained at each gate. Access will be restricted to project staff holding valid identity cards only. The ID should provide support to the contractor and Engineer in arranging government security personnel for their camps and the project site.

522. Should the contractor choose to engage his own security companies, the contractor shall be responsible to ensure such companies or personnel do not have a history of past abuse and that personnel are trained in the use of force and in the applicable laws so that no contravention of national legislation takes place. The contractor shall provide training to security personnel using the guiding principle that force shall not be used except in defence and in proportion with the nature and extent of the threat.

523. Finally, the contractor's emergency response plan will include details of emergency evacuation of the camp site in the event of an emergency and be supplemented by annual drills.

524. As a result of the proposed mitigations the likelihood of the impact occurring will be reduced and the capacity of the staff to absorb the impact of such an event shall be increased by the provision of security and an emergency evacuation plan. Therefore, the impact will reduce to minor adverse in the short term.

6.7.10 Relocation of Structures

525. The project will result in the displacement/relocation of public and 31 individually owned structures. The Land Acquisition and Resettlement Plan (LARP) will address this issue in detail but available information of displacement/ relocation of structures are given below in Table 6-22:

Table 6-22: Inventory of Structures that comes in PCHLCE P.P and Canals RoW referenced with R.Ds

S/No.			
1	Village Kambary, Houses in Indus Ambar P.P RoW at R.D 1+300	2	House at R.D 2+150 in RoW of Indus Ambar Pressure pipe
3	Village Sharki Road at R.D 2+900 in RoW of Indus Ambar Pressure pipe	4	Village Maina Road at R.D 4+500 in RoW of Indus Ambar Pressure pipe
5	Indus Ambar P.P crossing Channel at RD 4+900	6	SMKM College Kotha Road R.D 5+100
7	Drinking water pipeline of SMKM College Kotha at R.D 5+100 in RoW of Indus Ambar Pressure pipe	8	Baja Maina Road at R.D 6+600 in RoW of Indus Ambar Pressure pipe
9	House in Khanpur abad at R.D 8+100 in RoW of Indus Ambar Pressure pipe	10	Graveyard at R.D 8+550 in RoW of Indus Ambar Pressure pipe
11	Village Bamkheil Road at R.D 11+500 in RoW of Indus Ambar Pressure pipe	12	Swabi –Topi Road at R.D 12+100 in RoW of Indus Ambar Pressure pipe
13	Gullo Daira Road at R.D 13+530 in RoW of Indus Ambar Pressure pipe	14	Rehat at R.D 16+300 in RoW of Indus Ambar Pressure pipe
15 and 16	Swabi – Jehangira Road at R.D 16+850 in RoW of Indus Ambar Pressure pipe		
17	Swabi Grid Station at R.D 16+850	18	Ambar Minor 2 is passing near graveyard at R.D 2+050
19	Indus Ambar Canal is passing through poultry farm at R.D 5+600	20	Indus Ambar Canal passing existing PHLC at R.D 7+000
21	Indus Ambar Canal is passing through Chota Lahor Road at R.D 9+000 near Brick Kilns	22	Indus Ambar Canal is passing through Jalsai-Jaganaath Road at R.D 10+150
23	Indus Ambar Canal is passing through Village Jalbai at R.D 14+250	24	Indus Ambar Canal is passing through Karnal Sher Khan - Dobian Road R.D 21+000
25	Indus Ambar Canal is passing through houses of village Tube-well Kabaryan at R.D 28+200.	26	Indus Disty- 1 is passing through Islamabad-Peshawar Motorway at R.D14+250 of Indus Ambar Canal.
27	Indus Minor 2 is passing through Jalbai Road at R.D 2+350.	28	Janda Boka Pressure pipe is passing through village Maina Road at R.D 1+900
29	Janda Boka Canal is passing through Saeed abad Road at R.D 2+000	30	Janda Boka canal at R.D 5+000 is passing through Siphon
31	Janda Boka Canal is passing through Janda Boka – Maina Road at R.D 6+500		

6.7.11 Cumulative Impacts

526. The PHLCE project environmental impacts/effects were evaluated in section 4.3.5.3 in the context of the combined effect of all past, present, and reasonably foreseeable future projects that may have or have had an impact on the resources in project area. The future irrigation/water resources projects in the area were evaluated to assess whether any of the planned project is falling in the PHLCE project area or sharing command area. All the planned projects were out of the PHLCE project area except Kundal Dam which is located in the area of Janda Boka. However; it is confirmed by KPID staff that there is no overlap in CCA of Kundal Dam and Janda Boka Canal Command.

527. In addition, the anticipated environemtnal impacts and recommended best practices to mitigate the impacts are presented Table 6-23 below.

Table 6-23: Risk of Potential Cumulative and Induced impacts and Mitigation

Risk of Potential Impacts	Recommended Best Practices and Risk Analysis
1. Water Use	
Irrigation water supply to the Indus Ambar and Janda Boka area may reach other agricultural land at lower elevations where irrigated agriculture is already practiced which could result in salinity and sodicity increases in these areas.	Schemes should be designed and water allowance for the new schemes should be kept within permissible limits. When evaluating any scheme, necessity for drainage should be ascertained keeping in view soil texture, nearby natural drains and whether additional drains are required. Planning of schemes should also ensure no-overlap of the CCA with the current CCA of existing systems except in case of remodelling, wherein a scheme is meant to augment the supplies of an existing irrigation system.
Potable water supplies may burden the drainage system.	A system for wastewater disposal will have to be considered with the potable water distribution network.
2. Forestry and Biodiversity	
There is a potential for intrusion in to natural habitat and exploitation of flora and fauna. Canals are expected to increase the population of migratory birds as they serve as artificial staging grounds. Canals will also provide habitats for aquatic fauna as fish species.	Principles of responsible environmental stewardship; Institutional strengthening and capacity of resource agencies, such as forest and fisheries departments to meet expectations of integrated resource management along with responsible energy development. Consistent involvement and interest of all sectors of local communities/ stakeholders.
3. Agriculture and Land Use	
Additional land in Indus Ambar and Janda Boka will add to land under agriculture in the district. This may warrant enhanced demands on other agricultural inputs as fertilizer and pesticides etc resulting in water and soil contamination. Further, farm gate prices of agricultural produce may become lower.	Introduce Integrated Pest management and organic fertilizer use. Engage stakeholders directly in the broadly affected areas in an inclusive and participatory manner with thorough and timely feedback on agriculture input and contamination issues.
4. In-migration Growth	
After completion of the proposed PHLCE	The project will attract workforce only during

Risk of Potential Impacts	Recommended Best Practices and Risk Analysis
Project, it is anticipated that the project may attract in-migrants to the project area once irrigation canals and distributaries are commissioned and water becomes available. They may overwhelm the local population, infrastructure, create political tension and adversely influence the local culture and social fabric, services and utilities and may convert the productive agriculture land into settlements, contaminate the water resources and may occupy the legally entitled land and allocated water share.	construction phase when the requirement of workfoce is high. Over the course of construction period, the ADB Core Labor Standards shall be followed by the PMO and Contractor. There are no indigenouse people in the area and all the pople are belonging to Pashtun ethenic group and the risk of political tension or adverse influence on local culture and social fabric is not anticipated in the project area. There is traditionally and legaly recognized entitled land. All the legally entitled land owners have the rights of water on the proposed PHLCE project. Accordingly; the water shall be allocated on the basis of land size or KPID will follow the approach adopted for exsiting PHLC. Therefore; the risk of dispossession through in-migration is not expected. However; the project may attract the tenants and sharecropper for whom the command area of PHLCE had the capacity for settlement.

7. STAKEHOLDERS CONSULTATION AND INFORMATION DISCLOSURE

7.1 Introduction

528. Public consultation is a necessary process to ascertain public views and opinions of the Project and to provide an opportunity for the people to participate in the project design and development.

529. Public consultation involves actively seeking the opinions of those interested or affected by a project. It is a two-way flow of information, which may occur at any stage of development from project identification through planning, design, construction and operation. It may be a process or a continuing dialogue between project implementation authority and the affectees. Consultation is increasingly concerned with the objective of gathering information and finding the acceptable solution.

530. The Government of Pakistan (GOP) as well as international financiers (e.g. ADB and World Bank) place great importance on involving primary and secondary stakeholders for determining the environmental and social impacts associated with project implementation. Therefore; the public consultation for PHLCE Project was carried out in accordance with the ADB principles of information dissemination, information solicitation, integration, coordination and engaging people in dialogue. The process included the participation of project affected persons (PAPs).

531. Two rounds of comprehensive stakeholders' consultations were organised for the EIA of PHLCEP. The first round of public consultation was carried out in the month of March, 2015, while the second round of public consultation was completed in the month of July, 2015. Information on positive and negative impacts associated with constructional and operational stage and proper mitigation of adverse impacts were shared at these consultations.

7.2 Objectives

532. The purpose of consultation was to disseminate project information among the project stakeholders and obtain their feedback regarding local knowledge of baseline environmental conditions, mitigation measures, perception of stakeholders with regard to impact significance, and their views on project interventions.

533. The consultation with various stakeholders was carried out to:

- Provide those who will be impacted by the PHLCEP with balanced and objective information, including the issues, alternatives, opportunities and/or solutions;
- Solicit community concerns and recommendations regarding the proposed project to be addressed/incorporated into the project design to the extent possible;
- Work directly with stakeholders throughout the process to ensure their concerns and aspirations are consistently understood and considered when making decisions.
- Share with the local communities the mitigation measures included in the project design to address the potential impacts;
- Partner with stakeholders in developing solutions of issues;

- Give stakeholders opportunities to inform and influence decision-making on the project interventions;
- Promote good will towards the project among these communities; and,
- Begin establishing communication and an evolving mechanism for resolution of social and environmental problems.

7.3 Stakeholder's Analysis

534. Prior to commencing the public consultation, a stakeholder analysis was carried out to identify the primary and secondary stakeholders. Stakeholders are people, groups, non-governmental organisations (NGOs), community based organisations (CBOs), or institutions that may be affected by the Project who can significantly influence, or are important to the achievement of the stated purpose of a proposed intervention. Generally, stakeholders can be classified into three groups:

7.3.1 Primary Stakeholders

535. People or groups who are directly affected (positively or negatively) by the Project are called Primary Stakeholders. In the case of PHLCEP, the Primary Stakeholders may include;

- Potential PAPs i.e. inhabitants of villages who may be subject to direct or indirect impact on their residences or access to their workplaces during the construction period, or by any kind of project action, or who may have other interests in the project are given in Table 7-1 and Table 7-2;
- Farmers who will be potentially impacted by this project, positively in the long term through water availability from the proposed canal, and also, potentially, negatively due to the minor risk of disruption due to construction of irrigation supply canal as presented in Table 7-3 and Table 7-4.

Table 7-1: Potentially affected villages along the Indus Ambar Pressure pipe and Indus Ambar Canal

S/No.	Indus Ambar Pressure pipe
1	Village Kambary
2	Village Haji Kheil
3	Village Baja By-Pass
4	Smkm College Kotha
5	Village Sogandi
6	Village Khanpur Abad
7	Village Noorabad (Gulo Dairy)
8	Village Jamal Abad

Table 7-2: Potentially affected villages along the Janda BokaPressure pipe

S/No.	Indus Ambar Pressure pipe
1	Village Maina

Table 7-3: Villages in the Secondary Impact Zone of Indus Ambar Canal

S/No.	Indus Ambar Canal
1	Village Shaheeda
2	Village Chota Lahor (Shakri)
3	Village Jalsai
4	Village Jalbai (Sher Ullah Abad)
5	Village Mughal Ki
6	Village Tube-well Kabaryan

Table 7-4: Villages in the Secondary Impact Zone ofJanda Boka Canal

S/No.	Indus Janda Boka Canal
1	Village Maina

7.3.2 Secondary Stakeholders

536. People, groups, or institutions that are important intermediaries in the Project delivery process or those who influence or are indirectly affected by the project. Secondary Stakeholders identified for PHLCEP Project are:

- Irrigation, Agriculture and PHE Departments, Government of KP (the project proponent).
- The ADB (The Financing Agency)
- Forest and Wildlife Departments, Government of KP
- Representatives of local communities
- Fisheries Department, Government of KP
- WWF
- IUCN
- Public at large

7.3.3 Key stakeholders

537. Those who can significantly influence a project, or who are critical to the success of a project are considered key stakeholders. Key stakeholders may be from both primary and secondary stakeholders. Key stakeholders in PHLCEP may be local leaders, influential community members and other local representatives including Imams of mosques and teachers of local schools.

7.4 Stakeholder Consultations

7.4.1 Methodology

538. The public consultation process was carried out by the PPTA Consultant from 1st March 2015 to 23rd April, 2015 and during 8th June, 2015 to 14th June, 2015. 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.

539. Consultations were carried out and recorded by Mr. Zaheer Ahmad (Sociologist) and Mr.Sibghatullah Khan (Environmentalist). The stakeholders were also briefed by Environmental Specialist, Senior Irrigation Engineer as well as KPID representatives based in Swabi District. During these consultations, the primary and secondary stakeholders were briefed on the project components in details and one by one and their concerns and feedback recorded. The environmental team obtained the signatures of the participants where possible; signature sheets and pictorial views of these consultations are attached as **Annexure-VII**.

540. The details of opinions and views of the participants are presented in **Annexure-VII** while a summary of the views and opinions which were considered in the project planning and assessment are given below.

7.4.2 First Round Public Consultation with Primary Stakeholders: Primary and Secondary Impact Zone

541. The PPTA team carried out the 1st round of public consultation in the primary and secondary impact zones and the summary of consultations are presented below. Details of the consultations as date, location and names of participants and the issues discussed with participants views are presented in **Annexure-VII**.

542. Public consultations in the primary impact zone of the proposed pressure pipe on the Indus Ambar branch-Primary Stakeholders

7.4.2.1 SMKM Government College, Kotha:

543. The Principal of SMKM Government College Kotha, said that at this stage, he could not give any suggestions with regard to installation of pressure pipe which is proposed to pass through the college boundary, because after some months, Benazir Women University will be shifted to the college building and SMKM College will be relocated to a new place.

544. However, he was concerned that during installation of pressure pipe, the studies of the students may be affected due to heavy traffic movement and noise; therefore, it would be preferable to undertake the works during off days of the week.

545. According to the participants, the drinking water supply pipeline from the source to the college falls within the RoW of the proposed pressure pipe and therefore, may be affected.

546. The college play ground may be disturbed during excavation works.

547. The stakeholders requested for rehabilitation/restoration of infrastructure if damaged due to proposed project work.

548. They also felt that the passage/main entrance of the college may be disturbed due to the excavation/installation of pressure pipe and requested remedial measures.

549. Following the discussion, the pressure pipe pipe alignment was shifted away from the SMKM Government College.

7.4.2.2 Indus Ambar Pressure pipe- Public Consultation Meeting In Haji Khail Village:

550. During the consultation, it was reported that most of the land in the village was owned by the residents of Maini village.

551. Stakeholders requested for outlets from pressure pipe for Haji Khail village and surrounding areas for irrigation purposes. According to the participants, two outlets from PHLC (local name Stepa) are already provided, but are not completely functional.

552. The participants expressed concerns that if they provide land for pressure pipe then the given land will become property of the Irrigation Department and they will not be able cultivate or construct houses in future; therefore, they would not benefit from this project.

553. According to the participants, they had already lost 71 ha (176 acres) of land due to various projects as road construction, PHLC and Transmission lines etc. The participants stated that the key issues regarding installation of pressure pipe in their land will be discussed in the 'reforming assembly' (ISLAHI JIRGA) in Maini village. Accordingly a separate meeting was arranged and the decision of the reforming assembly is provided in the following sections.

7.4.2.3 Indus Ambar Pressure pipe- Public Consultation Meeting in Village Baja By-Pass:

554. The participants were willing to provide their agricultural land for installation of pressure pipe.

555. The participants requested that the land located near "by-pass", which is rainfed, to be provided with outlets from pressure pipe to irrigate the land.

556. Compensation for land acquisition may be given in accordance with the current land rate.

557. The house of Mr. Hanif will be affected by the installation of pressure pipe and he requested to change the alignment of proposed pressure pipe at RD 09+200.

7.4.2.4 Indus Ambar Pressure pipe- Public Consultation Meeting in Jamal Abad:

558. The participants agreed with the installation of the pressure pipe.

559. The participants requested for provision of outlets from pressure pipe; the land is mostly rain-fed and irrigation water from the existing outlets of PHLC (commonly known as Stepa) does not reach their fields.

560. Compensation for land required for the pressure pipe should be given according to present market rates.

561. The participants requested for reconstruction of infrastructure falling within the RoW of the proposed pressure pipe.

562. Most of the participants agreed to the pressure pipe passing through their agricultural land. However, the land-owners Haji Akbar, Ghulam Akbar, Muhammad Akbar and Kareem Akbar expressed concern as they have planned to construct houses in their agricultural land which is falling within the RoW of pressure pipe. They had borne high cost

to purchase access path to their fields and houses. After installation of the pressure pipe, the land will not be of any use to them as it will be the property of Irrigation Department.

563. The participants requested for rehabilitation of road falling within the ROW of proposed pressure pipe in Jamal Abad village.

7.4.2.5 Indus Ambar Pressure pipe- Public Consultation Meeting in Village Khanpur abad:

564. The participants requested for a change of the proposed alignment of pressure pipe: away from the populated areas and re-aligned in nearby agricultural land where settlements do not exist. The house of Javid Ahmad (Rtd Pak Army) will be affected which falls within RoW of the proposed pressure pipe.

565. According to the participants, their economic status is not very good; therefore, they were partially willing for the installation of pressure pipe in their agricultural land. They wanted to know whether the land falling within right of way of pressure pipe; would be considered as property of Irrigation Department or the existing ownership will remain?

566. The participants requested that the land falling within the RoW of proposed pressure pipe must be compensated according to the rate in village Khanpur Abad, at the time of project implementation.

7.4.2.6 Indus Ambar Pressure pipe- Public Consultation Meeting in Village Kambary:

567. The participants expressed concern that a number of houses may be affected due to installation of the proposed pressure pipe.

568. Participants requested to re-align the pressure pipe from the populated areas to government property which is located near the settlements and the site for realignment of the pressure pipe as proposed by the participants was referenced with GPS Co-ordinates:

N=34°06’06.0” E=072°37’46.1”

569. The participants reported that constructions of more houses are in progress within the RoW of proposed pressure pipe From R.D 1+200 to 1+400; a settlement is located in the RoW of pressure pipe.

7.4.2.7 Indus Ambar Pressure pipe- Public Consultation Meeting in Village Noor Abad

570. The participants did not completely agree with the alignment of the proposed pressure pipe which is passing through their agricultural lands. They requested that, the width (ROW) for the proposed Pressure pipe may be decreased from 10m to 5m (32.81 to 16.40 ft).

571. The participants enquired about the land which falls within the RoW of the propose pressure pipe; will it be considered as Government property or existing ownership will remain? The inhabitants of Noor Abad village wanted to know whether they will be allowed to cultivate crops after completion of works on the land which falls within the RoW of the proposed pressure pipe.

572. The participants requested for compensation for the land falling in the RoW according to the latest market rates. They informed PPTA team that current rate of their land has increased after the establishment of Women University in the area.

573. The participants requested that excavation for the pressure pipe should not be done in sowing and harvesting seasons.

574. The stakeholders requested that pressure pipe should pass along the edge of their agricultural land. They requested realignment of the pressure pipe.

7.4.2.8 Indus Ambar Pressure pipe- Public Consultation Meeting in Village Sogandi:

575. The participants were completely willing to provide their land for pressure pipe installation. The villagers requested that during excavation for the pressure pipe, diversion of the Ghareeb Abad Sogandi track should be made.

576. Participants requested that compensation against land acquisition should be given according to the latest market rates.

577. During the consultative meeting, the stakeholders highlighted that the reconstruction of the community structures should be ensured.

578. The participants requested to change the alignment of the proposed pressure pipe from dwelling areas and if not compensation should be given to the affected house owners.

579. The participants requested that the labourers should be hired from village Sogandi, during installation of the pressure pipe. They also requested that the Gareeb Abad Sogandi track be rehabilitated immediately after the installation of pressure pipe.

580. According to Javid Zaman (influential person), the existing outlet from PHLC (stepa canal) may be damaged during installation of the pressure pipe.

7.4.2.9 Indus Ambar- Minor-3- Public Consultation Meeting in Village Shaheeda:

581. Land owner Mr. Zahid was not agreeable with the construction of the proposed Indus Ambar Minor 3 which is likely to pass within his agriculture land. He requested to change the alignment of Ambar Minor 3 to protect his land. According to him he had his own tube-well for irrigation purposes and has no interest to allow passage of Ambar Minor 3 through his land. He reported that he had only 15 to 20 kanal of agricultural lands, which will be adversely affected due to the alignment of the proposed minor. According to him he invested about Rupees 1,000,000 on levelling and filling of land.

582. An orchard is also within RoW for Ambar Minor 3.

7.4.2.10 Indus Ambar Canal- Public Consultation Meeting in village Chota Lahor (Sharki):

583. Inhabitants of Chota Lahore (Sharki) were completely willing to provide their land in Maira, for the construction of PHLCEP. They considered the proposed project a gift because land in Maira is completely rain fed and perennial water would become available for their crops after construction of PHLCEP. They will fully cooperate during construction of the proposed PHLCEP.

584. The land owner Tilawat s/o Miradad requested for the provision of outlets from the proposed Indus Ambar minor 5 on both sides to irrigate about 1756 ha which is the property of the inhabitants of Chota Lahore.

585. The land owners requested for compensation against land falling within the RoW which should be in accordance with the latest market rate. The participants requested that compensation should be given under the supervision of ADB, and patwari should not be involved in the payment process, because they do not trust the patwari system.

7.4.2.11 Indus Ambar Canal and Indus Minor-1- Public Consultation Meeting in village Jalsai:

586. The inhabitants of village Jalsai showed concern regarding the land falling within the RoW.

587. They requested for the provision of outlets from the main canal to irrigate all land falling within the command of the canal.

588. The villagers requested for the realignment of proposed Indus Minor 1 which is currently passing through their land.

589. They requested for a minor canal across the motorway towards Nowshera where the fertile rainfed land could be irrigated by perennial source through this project.

7.4.2.12 Indus Ambar Canal- Public Consultation Meeting in village Jalbai:

590. Inhabitants of village Shair Ullah Abad (Jalbai) were supportive of the construction of the proposed Canal within their land.

591. The villagers requested for provision of outlets from proposed Indus Ambar Canal for the village Jalbai, because village Jalbai has vast areas of rain fed agricultural land.

592. Land owners demanded compensation against land to be acquired for the canal should be in accordance with the latest market rates. The participants expressed concern that the Government land rates are not acceptable and patwari should not be involved in the payment process because stakeholders of Jalbai did not place trust in the patwari system.

593. Some structures including a mosque may be affected due to construction of canal at R.D=14+250 which need to be protected by realigning the canal. House owners Mr. Kaleem Ullah and Sadeeq Ullah requested to change the alignment of the proposed canal.

594. According to villagers of Jalbai, the track will be affected due to construction activities at R.D= 14+250. They requested remedial measures.

7.4.2.13 Indus Ambar Canal- Public Consultation Meeting in village Mughal Kai:

595. Inhabitants of the village Mughalki were supportive of the proposed canal construction. The land is completely rain-fed; the villagers requested for provision of outlets on both sides of the proposed PHLCE.

596. The villagers requested for compensation for the land falling within the RoW in accordance with the latest market rates.

597. The villagers were willing to provide security to the workers during the construction phase.

7.4.2.14 Indus Ambar Canal- Public Consultation Meeting in village, Kabaryan:

598. The participants reported that the land which falls in the command area of proposed PHLCE is likely to be acquired for the China Zone project (China Industrial Zone). However, they were not keen to sell their land to the China Zone project.

599. The villagers were supportive of canal construction within their land. The villagers requested to realign the canal to protect the settlements.

600. The villagers requested compensation for land falling within the RoW in accordance with the latest market rates.

601. An influential person requested for provision of drinking water supply to the Kabaryan village.

7.4.2.15 Public consultation in the primary impact zone of the proposed pressure pipe on the Indus Ambar branch: Secondary Stakeholders – Institutional Stakeholders

602. Meetings with institutional stakeholders including government departments and NGOs were organised to discuss project interventions and their potential impacts. In these meetings, stakeholders were informed of the salient features of the project, its location and activities. The following is a summary of institutional stakeholder's suggestions / recommendations.

a.) Cosultative Meeting with KP Forest Department, Mardan Division:

603. The plantation if proposed under the PHLCEP needs to be formally handed over to the Forest Department for standardised plantation and after care. The plants will be under the ownership of the Forest Department in the long run.

b.) Meeting with KPID, Forest, Wildlife and Fisheries Departments:

604. Meetings were conducted with KP Irrigation Department and Forest, Wildlife and Fisheries Departments on 15th Dec, 2014 in Peshawar and the participants list is given below in Table 7-5.

605. The representatives of the said departments were briefed about the proposed project interventions and later they provided information required by the PPTA Team.

Table 7-5: List of Participants

S#	Name	Designation
1	Mr.Amjad	Technical Officer to Chief Engineer North KPID
2	Mr.Syed Mubarak Ali Shah	Chief Conservator Wildlife Department Govt of KP
3	Mr.Jan Nissar	Assistant Director Fisheries Haripur
4	Mr. Hashim Ali Khan	Chief Conservator Forest Govt of KP
5	Mr. Kifayat	DFO

7.4.3 Second Round of Public Consultation with Primary Stakeholders: Primary and Secondary Impact Zone

7.4.3.1 SMKM Government College, Kotha

606. The alignment of the canal is shifted to backside of the SMKM .

7.4.3.2 Village Haji Khail

607. The villages are not the actual owners of the land; therefore; not consulted during the second round of public consultation.

7.4.3.3 Village Baja (By pass)

608. The stakeholders stated that they have no objection to provide their land for installation of the pressure pipe.

609. Giving reasons, the PPTA team members explained to the participants that provision of outlets from the pressure pipe was not possible as requested by them in the early round of consultation.

610. Participants were informed by PPTA team that a social and resettlement survey is planned and a resettlement framework is being prepared which will outline the procedure for compensation of the land to be acquired.

611. The participants were also informed that Mr. Hanif's house would not be affected by installation of the pressure pipe. PPTA team members convinced Mr.Hanif by showing engineering drawings.

7.4.3.4 Village Jamal Abad

612. Participants of village Jamal Abad indicated that they have no objection for pressure pipe installation.

613. PPTA team members explained to the participants why provision of outlets from the pressure pipe was not possible: the flow through pressure pipe will be governed by irrigation requirements and corresponding canal operation. The canals and hence the pressure pipes may be closed in case of heavy rainfalls and during maintenance. As such supplies from pressure pipes cannot be guaranteed throughout the year.

614. Participants were informed by PPTA team that a social and resettlement survey is planned and a resettlement framework is being prepared which will outline the procedure for compensation of the land to be acquired.

615. Participants requested for the provision of drinking water supply from the pressure pipe.

616. PPTA team members informed that contractors will be responsible for the rehabilitation of any infrastructure damaged during construction.

7.4.3.5 Village Khanpur Abad

617. The participants completely agreed to the proposed change in alignment of proposed pressure pipe. Mr. Javid's house will not be affected by the changed alignment of pressure pipe. PPTA team informed the participants that the land where the pressure pipe is to be installed and its RoW will be the property of KPID.

618. The participants requested that payment for cultivated crops be given during installation of pressure pipe.

619. PPTA team members informed the participants that a social and resettlement survey is planned and a resettlement framework is being prepared which will outline the procedure for compensation of the land to be acquired.

620. The participants of village Khanpur abad requested for the supply of drinking water from the pressure pipe.

7.4.3.6 Village Kambary

621. The participants completely agreed with the change in alignment of the pressure pipe. According to the participants most houses will not be disturbed during installation of the pressure pipe.

622. Although tube wells are present, they have tested the quality of drinking water and test results shows that the water is not suitable for drinking. They requested for drinking water supply from the pressure pipe.

7.4.3.7 Village Noor Abad

623. Participants of village Noor Abad requested to change the alignment of the proposed pressure pipe, towards the barren land of village Kala Khoro, or along the road of Kala Khoro. They felt that the pressure pipe should not pass through their agricultural land as they are not benefited.

7.4.3.8 Village Sogandi

624. The participants were completely willing to provide their land for pressure pipe installation.

625. PPTA team members informed that the contractors will be responsible for the rehabilitation of affected infrastructure in accordance with provisions in the contract.

626. Participants were informed by PPTA team that a social and resettlement survey is planned and a resettlement framework is being prepared which will outline the procedure for compensation of the land to be acquired.

627. PPTA team members informed the stakeholders that PPTA team is trying to change the alignment of pressure pipe away from dwelling areas towards the path near existing PHLC and Swabi Model School, Kotha.

628. The participants requested that labour should be hired from village Sogandi. PPTA members responded that although it is the responsibility of the contractor the EIA would recommend it.

629. According to the participants, construction activities will disturb the people by noise pollution and dust. PPTA team responded saying that remedial measures will be adopted to minimise the adverse effects during construction.

7.4.3.9 Village Shaheeda

630. During the Public Consultation meeting PPTA team informed Mr. Zahid that request for change in alignment was noted during the 1st Round meeting. PPTA team was requested to change the alignment from agricultural land to kacha track.

7.4.3.10 Chota Lahore (Sharki)

631. Land owners of Chota Lahore (Sharki) were willing to provide their land in Maira, for the construction of PHLCE. They will cooperate fully during the construction phase for the proposed PHLCEP.

632. PPTA team informed the participants that the provision/request of outlets from the proposed Indus Ambar minor 5 on both sides has been noted for action.

633. Participants were informed by PPTA team that a social and resettlement survey is planned and a resettlement framework is being prepared which will outline the procedure for compensation of the land to be acquired.

7.4.3.11 Village Jalsai

634. PPTA team informed the participants that the provision/request of outlets from the proposed Indus Ambar Canal on both sides has been noted for action.

635. The participants requested that road bridges may be constructed on the canal in village Jalsai. PPTA team replied that provision of bridges is also included in the project. The provision for realignment of Indus Minor 1 is not required. The canal is passing through agricultural land.

636. PPTA team explained that provision of minor across the motorway towards Nowshehra is not possible because the available water is not enough to irrigate additional land.

7.4.3.12 Village Shair Ullah Abad (Jalbai)

637. Participants of Village Shair Ullah Abad (Jalbai) agreed to the construction of the proposed canal within their land. PPTA team informed the participants that the provision/request of outlets from the proposed Indus Ambar Canal has been noted for suitable action.

638. Participants were informed by PPTA team that a social and resettlement survey is planned and a resettlement framework is being prepared which will outline the procedure for compensation of the land to be acquired.

639. PPTA team informed the participants that settlements including mosque are protected. Change in alignment is not required.

640. PPTA team informed the participants that rehabilitation of any damaged infrastructure will be the responsibility of the contractor and will be monitored by the Engineer.

641. Participants of village Jalbai requested for drinking water supply.

7.4.3.13 Mughal Koi

642. Participants of the village Mughal Koi were completely supportive of the proposed canal construction. They assured the PPTA team that they will provide all kinds of support to the project during implementation phase.

643. Participants were informed by PPTA team that a social and resettlement survey is planned and a resettlement framework is being prepared which will outline the procedure for compensation of the land to be acquired...

644. During 2nd Round meeting the participants requested for provision of Minors from PHLCE to Villages Raj Muhammad, Village Meshak, Village Nandarak and Village Mian Essa. PPTA team explained that provision of minor across the motorway towards Nowshehra is not possible because the water is not available to irrigate additional land.

7.4.3.14 Village Kabaryan

645. Participants of the village tube-well Kabaryan were completely supportive of the construction of proposed canal. According to the participants it is a gift for them.

646. PPTA team informed the participants that settlements are not affected and change in alignment is not required.

647. Participants were informed by PPTA team that a social and resettlement survey is planned and a resettlement framework is being prepared which will outline the procedure for compensation of the land to be acquired.

7.4.3.15 Second Round of Public Consultation with Secondary Stakeholders: KP Fisheries Department

648. The second round of public consultation was carried out by PPTA team on 5th November, 2015 with the representatives of Fisheries Department Government of KPK to assess presence of any fisheries hotspot in the project corridor. PPTA team briefed the representatives of the Fisheries Department about the proposed project interventions and they ensured that there is no existing fisheries production site in the project corridor. However; they are planning to establish fish hatchery in Malik Abad-Janda Boka area. The officials requested for provision of fresh water to the proposed hatchery through propsoed Janda Boka branch.

7.4.4 Consultative Discussions with Women along the Project Alignment

649. The feedback regarding the consultations with the women resided in the villages/ settlements along the proposed alignment of PHLCE reveals that most of the women were helping their male members in performing their activities relating to the farming and livestock raising. Moreover, the women pointed out the following main concerns/ feedback associated with this project:

- Livelihood assistance to restore their economic activity.
- Women routine activities/jobs should not be affected due to the implementation of the Project.
- Passage/ crossing at different locations along the canal should not be stopped during implementation of civil works.
- Health and education facilities especially for women should be improved as a benefit to the local population of the project area.

- Organize some vocational training for income generating activities for women to increase the overall household income.
- The relocation of affected business structures will have a negative effect for their owners, if proper compensation and relocation/ shifting assistance are not provided.
- Male household members should be employed in the project related jobs so that they can stay in their own community, rather than seeking employment outside the project area. In this way their social safety could be enhanced.

650. A list of public consultations with the Government officials and DPs/local population is presented below in Table 8-1. A summary of overall concerns/ feedback of the potential DPs have been discussed above, while the proposed action to be taken or arrangements is presented in Table 7-6.

Table 7-6: Summary of Public/ Stakeholder Consultations

Sr No	Date	Location	Category of Participants	Name of Main Respondent
1	October 29, 2015	Bam Khel, Tehsil & District Swabi.	DPs /Local Communities	- Ms. Rafida - Ms. Husan Huda W/o Noor Muhammad - Ms. BakhtZaiba D/o PirMuahammad - Ms. Farhana w/o FazalWahab - Ms. Wazira W/o Nazar Muhammad - Ms. Norhaaz W/o Hameed Sultan - Ms. Taaj Bibi W/o Nazeer Muhammad - Ms. Omerkhela W/o Meer Bahadar - Ms. Rameem D/o Sheraj
2	October 29, 2015	Baja, Tehsil & District Swabi.	DPs /Local Communities	- Ms. Shazia - Ms. Nabia - Ms. Iqra - Ms. Shaheen - Ms. Saina
8	October 28, 2015	Ambar, Tehsil Lahore, District Swabi.	DPs /Local Communities	- Ms. Rehana D/o Nadeem - Ms. Nusrat - Ms. Shehnaz D/o Riaz - Ms. Haseena D/o Muhammad Afzal - Ms. Kalsoom W/o Ayaz Khan - Ms. Danish W/o Qasim - Ms. Nasrata W/o Ahmed - Ms. Saukata D/o Nushad Khan - Ms. Fozia D/o Riaz Khan

7.5 Incorporation of Stakeholder Views and Opinions

651. Above mentioned views, opinions and requests of the stakeholders were taken into consideration not only in environmental assessment and management but also in the project designs. For example observations on the impact of noise and air pollution during construction was considered in the EIA preparation and the EMP contains required mitigation. And on the other hand, to avoid adverse impacts of the pressure pipe passing through the SMKM College the alignment of the pressure pipe was amended so that it would be installed outside the premises of the college.

652. The responses of the PPTA Team to stakeholder views and requests was made known to stakeholders themselves at the second round of consultations and action on views and opinions expressed during the second round have been considered for necessary action.

7.6 Incorporation of Stakeholder Views and Opinions

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8. Grievance Redress Mechanism

8.1 Overview

655. In order to receive and facilitate the resolution of affected peoples' concerns, complaints, and grievances about the project's environmental performance an Environmental Grievance Redress Mechanism (GRM) will be established for the PHLCE project. The mechanism will be used for addressing any complaints that arise during the implementation of projects. In addition, the GRM will include a proactive component whereby at the commencement of construction of project (prior to mobilization) the community will be formally advised of project implementation details by the PMO, the Project Implementation Consultants (PIC) and the contractor (designs, scheduled activities, access constraints etc) so that all necessary project information is communicated effectively to the community and their immediate concerns can be addressed. This proactive approach with communities will be pursued throughout the implementation of the project.

656. The GRM will address affected people's concerns and complaints proactively and promptly, using an understandable and transparent process that is gender responsive, culturally appropriate, and readily accessible to all segments of the affected people at no costs and without retribution. The mechanism will not impede access to the Country's judicial or administrative remedies.

8.2 Redress Committee, Focal Points, Complaints Reporting, Recording and Monitoring

657. The Grievance Redress Mechanism, which will be established at PHLCE project is described below:

658. The Project Director PMO will facilitate the establishment of a Grievance Redress Committee (GRC) and Grievance Focal Points (GFPs) in PHLCE project location prior to the Contractor's mobilization to site.The functions of the GRC and GFPs are to address concerns and grievances of the local communities and affected parties as necessary.

659. The GRC will comprise representatives from local authorities, affected parties, and other well-reputed community persons from health or education sectors, as mutually agreed with the local authorities and affected persons. It will also comprise the Contractor's Environmental Expert, PIC's Environmental Specialist and PMO's Environmental specialist. The role of the GRC is to address the Project related grievances of the affected parties that are unable to be resolved satisfactorily through the initial stages of the Grievance Redress Mechanism (GRM).

660. The PMO will assist affected communities/villages identify local representatives to act as Grievance Focal Points (GFP) for each community/village.

661. GFPs are designated personnel from within the community who will be responsible for i) acting as community representatives in formal meetings between the project team (contractor, PIC, PMO) and the local community he/she represents and ii) communicating community members' grievances and concerns to the contractor during project implementation. The number of GFPs to be identified for PHLCE project will depend on the number and distribution of affected communities. It is anticipated that for PHLCE project GFPs for villages on the proposed pressure pipe of Indus Ambar and Janda Boka is required.

662. A pre-mobilization public consultation meeting will be convened by the Project Director PMO Environment Specialist for PHLCE and attended by GFPs, contractor, PIC, PMO representative and other interested parties (eg. District level representatives, NGOs). The objectives of the meeting will be as follows:

(i) Introduction of key personnel of each stakeholder including roles and responsibilities,
(ii) Presentation of project information of immediate concern to the communities by the contractor (timing and location of specific construction activities, design issues, access constraints etc.) This will include a brief summary of the EMP - its purpose and implementation arrangements;
(iii) Establishment and clarification of the GRM to be implemented during project implementation including routine (proactive) public relations activities proposed by the project team (contractor, PIC, PMO) to ensure communities are continually advised of project progress and associated constraints throughout project implementation;
(iv) Identification of members of the Grievance Redress Committee (GRC)
(v) Elicit and address the immediate concerns of the community based on information provided above

663. Following the pre-mobilization public consultation meeting, environmental complaints associated with the construction activity will be routinely handled through the GRM as explained below and shown on Figure 8-1.

(i) Individuals will lodge their environmental complaint/grievance with their respective community's nominated GFP.
(ii) The GFP will bring the individual's complaint to the attention of the Contractor.
(iii) The Contractor will record the complaint in the onsite Environmental Complaints Register (ECR) in the presence of the GFP.
(iv) The GFP will discuss the complaint with the Contractor and have it resolved;
(v) If the Contractor does not resolve the complaint within one week, then the GFP will bring the complaint to the attention of the PIC's Environmental Specialist. The PIC's Environment Specialist will then be responsible for coordinating with the Contractor in solving the issue.
(vi) If the Complaint is not resolved within 2 weeks the GFP will present the complaint to the Grievance Redress Committee (GRC).
(vii) The GRC will have to resolve the complaint within a period of 2 weeks and the resolved complaint will have to be communicated back to the community. The Contractor will then record the complaint as resolved and closed in the Environmental Complaints Register.
(viii) Should the complaint not be resolved through the GRC, the issue will be adjudicated through local legal processes.
(ix) In parallel to the ECR placed with the Contractor, each GFP will maintain a record of the complaints received and will follow up on their rapid resolution.
(x) PMO will also keep track of the status of all complaints through the Monthly Environmental Monitoring Report submitted by the Contractor to the PIC and will ensure that they are resolved in a timely manner.

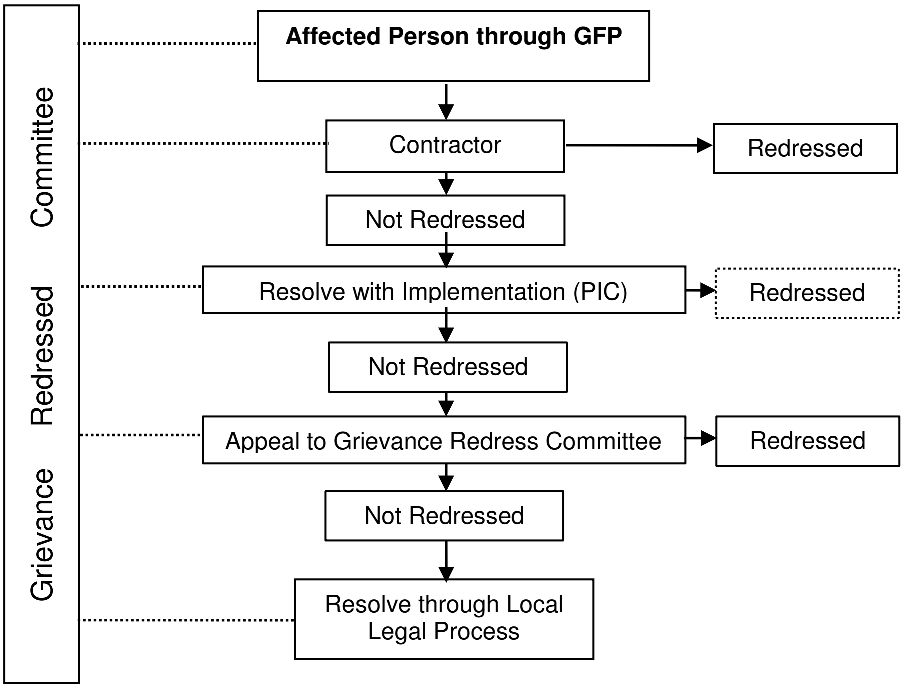

Figure 8-1: Grievance Redressal Mechanism

9. Environment Management Plan

9.1 Introduction

664. The Environmental Management Plan (EMP) for PHLCE Project has been prepared keeping in view the anticipated environmental impacts during pre-construction, construction and operational stages of the project, on the existing environmental conditions including air, soil, water, bio diversity and wildlife and socio economics of the project area and suggests appropriate measures to mitigate the potential adverse impacts and enhance the positive impacts.

665. The compliance monitoring of mitigation measures would be ensured through the implementation of the EMP and recording of feedback for identifying the necessary corrective actions.

9.2 Objectives of the EMP

666. To facilitate the implementation of the mitigation measures, the EMP has been prepared to manage probable adverse environmental impacts due to the project interventions in a way which minimises these adverse impacts on the environment and socio-economic conditions of the project area. The specific objectives of the EMP are to:

- Mitigate the impacts identified during the present EIA and discussed in Chapter 6;
- Maximise potential project benefits and control negative impacts;
- Draw responsibilities for project proponent, contractors, and other members of the project team for the environmental and social management of the Project;
- Define a monitoring mechanism to ensure that the EMP achieves its desired objectives;
- Ensure the complete implementation of all mitigation measures;
- Ensure the effectiveness of the mitigation measures;
- Maintain essential ecological process through preservation of Biodiversity; and,
- Assess training requirements for different stakeholders at various levels.

667. The detailed EMP is provided in Table 9-1.

668. Table 9-2 describes the respective sets of mitigation measures, monitoring and institutional arrangements to be followed during design, construction and operational stages of PHLCEP. The EMP also identifies the responsible parties to implement the various activities falling under EMP and to monitor its compliance.

669. The EMP includes the information regarding establishment of construction camps, placing and operational schedule for equipment, use of borrow and dumping sites, procurement, excavation methodology and construction measures after completion of works. The issues related to water usage by the Contractor either for construction, or other purposes have been properly addressed to avoid any conflict with local water users. Various waste management techniques are duly highlighted.

670. Health and Safety measures have been given due priority in the EMP, which consists of appropriate design solutions, traffic plan and special protective measures for

labour force. Environmental enhancement measures such as tree planting have been proposed for multiple functions such as soil erosion control, protection of embankments and landscape aesthetics.

671. The EMP ensures that cultural and religious sensitivities and the quality of life of the project area residents will be fully preserved to avoid any social severance and conflicts between the workers and host communities.

672. The EMP shall be an integral part of the Tender, Bidding and Contract documents. Any violation of/non- compliance with EMP shall be considered as a violation/non-compliance to the overall contract and shall be punishable as per degree of violation/non-compliance.

673. The Contractor shall appoint a full time Environmental Coordinator for the project who is conversant with national legislations related to the environment and with the ADB's environmental safeguard policies. The Environmental Coordinator shall ensure affective implementation of EMP and be responsible for the reporting requirements of the project.

9.3 Components of the EMP

674. The EMP has the following components.

- Organizational structure; roles and responsibilities
- Mitigation Plan
- Environmental monitoring plan
- Communication and documentation
- Traffic management
- Waste disposal
- Environmental training
- Restoration and Construction

9.4 Institutional Arrangements for EIA/EMP Implementation

9.4.1 Management Responsibilities

9.4.1.1 Project Director

675. Overall responsibility for environmental management and environmental monitoring will rest with the Project Director (PD), Government of KP. An Environmental Management Unit (EMU) is proposed to be set up within the office of the PD, with direct reporting line to the PD. An Environment Specialist and a Social Development Specialist will be a part of the PD office so as to ensure compliance to both EMP and LARP. The responsibilities of EMU will be, but not limited to the following:

- Ensure effective compliance of EMP and LARP as per ADB Safeguard Policy requirements.
- Provide technical assistance to the project team, in matters related to EMP in particular, and to environmental and social safeguards as a whole.

- Put in place reporting mechanism and monitoring regimes for project staff as well as contractors.
- Ensure that EMP related clauses specifically, and environment related clauses in general, are part of all the tender/bid/RFP documents.
- Provide technical input to the various training programs proposed as a part of the EMP.
- Ensuring that all regulatory clearances from the KP EPA are obtained before starting civil works for the Project.
- Conduct on site spot checks to check the compliance level, as well as for any outstanding issue not being covered by the EMP - Regularly report to PD as well as ADB on progress related to EMP Compliance.
- For effective compliance of an EMP, roles and responsibilities need to be defined at the onset, with relevant professionals hired as project team members at the executing agency (EA) levels. Moreover, these professionals are to be placed in the project hierarchy in such a way whereby they cannot be influenced by the operational teams (engineers, procurement, contractors, etc.) in order to lessen their compliance monitoring responsibilities.
- Approve the site-specific EMP (SSEMP) prepared by the Contractor and also monitor the implementation of the SSEMP.

9.4.1.2 Project Implementation Consultants

676. The PD will be supported during implementation of the Project by Project Implementation Consultants (PICs). The Environmental Team of the Consultant shall include:

- An International Environmental Specialist for intermittent inputs and
- A National Environmental Specialist.

677. The PICs to be engaged by the project proponent shall be responsible for day to day monitoring of the EMP on behalf of the Client (KPID) during the execution of the Civil Works of the Project and shall submit periodic reports to the PD and ADB regarding the EMP implementation status. In general, the PICs will have the following responsibilities pertaining to the environmental aspects of the project:

- Review all relevant documents, particularly the Environmental Impact Assessment study and update these as may be required to bring it in compliance with ADB's SPS.
- Prepare/update a cost effective environmental management and monitoring plan for the Project in line with EIA/EMP recommendations so as to ensure minimal environmental effects both during and following the construction period.
- Review the site specific environmental management plan (SSEMP) for the project prepared by the contractors.
- Monitor the implementation of EMP and LARP on a regular basis during execution of civil works by the Contractor.

- Prepare and execute required appropriate actions to mitigate any negative environmental impacts associated with construction activities in collaboration with all concerned stakeholders.

- Develop training materials for KPID, and OFWM Directorate staff to support environmental protection measures and to monitor and mitigate potential environmental impacts.

- Ensure that any environmental impact assessments, if required, fully comply with ADB SPS and ensure, that all required mitigation measures are identified and acceptable environmental management and monitoring plans reflecting full details regarding the estimated mitigation costs are in place through the SSEMMP.

- Prepare internal monitoring reports on implementation of environmental safeguards and EMP during project implementation.

9.4.1.3 The Contractor

678. The Contractor will be responsible for the implementation of the EMP as well as maintaining responsibility for environmental protection liabilities under KP Environmental Protection Act 2014, ADB's Environmental Safeguard Policies, and relevant EMP provisions for the Project. The Contractor will also be responsible for training his crew in all aspects and implementation of the EMP. The contractwould include an environmental and social mitigation budget as part of the engineering costs of the respective works.

679. The contractor will prepare a site specific Environmental Management Plan (SSEMP) which would include the contractor's plan to implement environmental management and monitoring requirements specified in the EMP. The SSEMP will be prepared in line with ADB SSEMP guidelines and an SSEMP framework given as **Annexure:IX** and the SSEMP shall be approved by the PIC/PD Office KPWRSP and sent to ADB for review before construction commence. The Contractor will also prepare a compensatory tree planting plan as part of the SSEMP and will undertake replantation. The Contractor will also be responsible for site restoration.

680. The key positions to be filled within the contractor's staff for implementation of the EMP include:

- An Environmental Coordinator.
- Two (02) Environmental Inspectors.
- A Health and Safety Officer, and
- A Community Liaison Officer for the Project.

9.5 Environmental Management and Monitoring Plan

681. Environmental management plan and environmental monitoring plan is prepared for the PHLCE project based on the findings of this EIA and is given in Table 9-1 and Table 9-2 respectively.

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Table 9-1: Environmental Management Plan

S#	Project Activities	S#	Environmental Impacts	Mitigation Measures	Responsibility		Key Performance Indicators	Time Frame
					Execution	Monitoring		
A. DESIGN PHASE								
A.1	Alignment of works	A.1.1	Damage to private and government buildings, orchards and trees	Aligning the RoW to avoid or mitigate impact	PPTA/ Design Consultant	PMO KPWRSP	Design of the alignment to avoid damage as much as possible	PPTA/ Design Stage
			Impact on trees falling within the RoW	Preparing a tree inventory	PPTA/ Design Consultant	PMO KPWRSP	Tree inventory prepared(see **Annexure-VI**)	PPTA/ Design Stage
		A.1.2	Impact on cultivated land, houses, private and government structures within RoW of the project	Involuntary Land Acquisition and Resettlement Plan (LARP) Preparation	PPTA/ Design Consultant	PMO KPWRSP	LARP Prepared	PPTA/ Design Stage
		A.1.3	Loss of flora and disturbance to fauna within COI	Tree inventory preparation and avoidance of tree cutting to the possible extent (see table 7.38)	PPTA/ Design Consultant	PMO KPWRSP	Tree inventory prepared	PPTA/ Design Stage
B. CONSTRUCTION PHASE								
B.1. SITE PREPARATION AND CLEARANCE								
B.1.1	Vegetation clearance	B.1.1.1	Loss of habitat at the location of Contractor's camp , proposed Pressure pipes, Main and Branch Canals and access routes	Controlled clearing of vegetation	Contractor	PIC and PMO KPWRSP	Vegetation clearance shall be limited to the extent required for execution of the works	Site preparation
				Use of existing access tracks	Contractor	PIC and PMOKP WRSP	Minimal use of new tracks are used	Throughout construction period
				Photographs of pre-construction state of camp areas	Contractor	PIC and PMO KPWRSP	Photographs taken	Site preparation
				Biodiversity monitoring	Contractor	PIC and PMO KPWRSP	Moitoring status of terrestrial and avifauna	Throughput construction period

S#	Project Activities	S#	Environmental Impacts	Mitigation Measures	Responsibility		Key Performance Indicators	Time Frame
					Execution	Monitoring		
B.1.2	Tree cutting	B.1.2.1	Loss of habitats and natural resources	Tree cutting to be marked in advance and approved by Site Engineer	Contractor	PIC and PMO KPWRSP	Written approval from Site Engineer for cutting of marked trees prior to cutting	Prior to excavation for pressure pipes, canals and site preparation
				Cutting only of trees approved by Site Engineer	Contractor	PIC and PMO KPWRSP	Cutting only of marked trees	As above
				Tree cutting and clearance of dense vegetations for establishment of temporary haul routes avoided	Contractor	PIC and PMO KPWRSP	Damage to trees minimised on temporary haul routes	During site clearance
				Contractor shall prepare an inventory of cut trees including details of grith, species, height and ownership	Contractor	PIC and PMO KPWRSP	Maintenance of inventory and Ownership	Throughput construction period
				Compensatory planting and afercare of saplings of native trees at a ratio of 5 trees for each 1 tree cut	KPID	PIC and PMO KPWRSP	Planting of trees and survival rate of trees	From commencement of tree plantation to end of defects liability period
				Compensation to the owners of the cut down trees	KPID	PIC and PMO KPWRSP	Status of terrestrial and avifauna	Throughput construction period
B.2. CONSTRUCTION AND LABOUR CAMPS								
B.2.1	Locating Camps	B.2.1.1	Community disturbance	Locate camp at least 300m away from the communities	Contractor	PIC and PMO KPWRSP	Review of Camp layout plan	Before camp construction
				Employment of Community Liaison Officer	Contractor	PIC and PMO KPWRSP	Community Liaison Officer EMMPloyed	After mobilization of the Contractor
B.2.2	Supply of drinking water	B.2.2.1	Depletion of local drinking water resources	Contractor shall make his own arrangements for supply of water ensuring water supply and availability to local communities is unaffected	Contractor	PIC and PMO KPWRSP	Contractor is not using public water resources	Through out construction phase

S#	Project Activities	S#	Environmental Impacts	Mitigation Measures	Responsibility		Key Performance Indicators	Time Frame
					Execution	Monitoring		
		B.2.2.2	Spread of disease through unsuitable water supply	Provision of safe drinking water and annual testing according to the NEQS	Contractor	PIC and PMO KPWRSP	Water Supply provided at Camp and test results are within the permissible limit of NEQS	Following the camp construction
B.2.3	Siting and planning of construction camps	B.2.3.1	Flood risk within Camp	Drainage will be provided and maintained to convey storm water away from camp and settlement	Contractor	PIC and PMO KPWRSP	Drainage provided in camps	Following the camp construction
				Camp shall be located above or beyond flood plain	Contractor	PIC and PMO KPWRSP	Review of Camp layot plan	Before camp construction
		B.2.3.2	Surface run-off through camp and pollution of surface water	Drainage provided to divert surface run-off from surrounding	Contractor	PIC and PMO KPWRSP	Drainage provided in camps	Through out construction phase
				Camp shall be located above or beyond flood plain	Contractor	PIC and PMO KPWRSP	Review of Camp layout plan	Before camp construction
				Hazardous material storage area shall be covered	Contractor	PIC and PMO KPWRSP	Covered storage of hazardous materials	Following the camp construction
				Run-off from refueling and wash down areas collected from treatment	Contractor	PIC and PMO KPWRSP	Measures are in place to collect the run-off from refueling and wash down areas	Following the camp construction
		B.2.3.3	Spread of disease due to unhygienic looking/cooking/eating/ sanitary quarters	Provision of solid flooring and work surfaces which are easily to clean	Contractor	PIC and PMO KPWRSP	Solid flooring and surfaces are provided	Following the camp construction
				Contractor shall regularly clean camps	Contractor	PIC and PMO KPWRSP	Regular cleaning in all areas of camps	Throughout construction phase
				Suitable latrines and washing facilities provided in vicinity of camps	Contractor	PIC and PMO KPWRSP	Latrines are provided at each camp	Following the camp construction

S#	Project Activities	S#	Environmental Impacts	Mitigation Measures	Responsibility		Key Performance Indicators	Time Frame
					Execution	Monitoring		
				Lined washing facilities including shower, available near each latrine , including clean running water, soap and drying facilities	Contractor	PIC and PMO KPWRSP	Suitable washing facilities provided at each camp	Following the camp construction
				Treatment and disposal of sanitary wastes	Contractor	PIC and PMO KPWRSP	The waste management plan is prepared by Contractor	
		B.2.3.4	Well being of staff	Provision of electricity and lighting	Contractor	PIC and PMO KPWRSP	Lighting and electrical supply provided with generator back-up	Through out construction phase
				Provision of sheltered kitchens, separated from living quarters with raised washable preparation surfaces	Contractor	PIC and PMO KPWRSP	Provision of adequate kitchen	Following the camp construction
				Provision of Medical Officer	Contractor	PIC and PMO KPWRSP	Doctor visiting camp site regularly	Throughout construction phase
				Adequately stocked dispensary shall be provided	Contractor	PIC and PMO KPWRSP	Adequately stocked dispensary available to all site staff	Throughout construction phase
		B.2.3.5	Tree cutting	Contractor shall supply staff with cooking fuel	Contractor	PIC and PMO KPWRSP	Tree wood not used in kitchen	Throughout construction phase
		B.2.3.6	Safety of staff	Segregated pedestrian and vehicle routes provided	Contractor	PIC and PMO KPWRSP	Review of Camp layout plan	Before camp construction

S#	Project Activities	S#	Environmental Impacts	Mitigation Measures	Responsibility		Key Performance Indicators	Time Frame
					Execution	Monitoring		
		B.2.3.7	Spread of communicable and vector borne diseases	Include information on HIV/AIDS and sexually transmitted diseases to be included within Code of Conduct[12] for workers	Contractor	PIC and PMO KPWRSP	Information on HIV/AIDS and sexually transmitted disease included in the Code of Conduct	At mobilization
							Code of conduct signed by all staff	Throughout construction phase
				Include awareness raising on HIV/AIDS and sexually transmitted disease and prevention and treatment of vector borne disease in Contractor training plan	Contractor	PIC and PMO KPWRSP	Approval of Contractor training plan	At mobilization
						PIC and PMO KPWRSP	Training as per approved plan	Throughout construction phase
		B.2.3.8	Community Conflicts	Set up a public comlaints receiving center (vide GRM in previous section) register at Contractor and Engineer's office	Contractor	PIC and PMO KPWRSP	Complaint register maintained	Throughout construction phase
				Contractor shall develop a code of conduct to govern behavior of workers	Contractor	PIC and PMO KPWRSP	Code of conduct approved by Engineer	At mobilization
				Contractor shall deliver training on cultural sensitivity to migrant workforce during induction	Contractor	PIC and PMO KPWRSP	Code of conduct signed by all staff	Throughout construction phase

12 To be prepared by Contractor and approved by PIC

S#	Project Activities	S#	Environmental Impacts	Mitigation Measures	Responsibility		Key Performance Indicators	Time Frame
					Execution	Monitoring		
				Contractor's Community Liaison Officer to consult local communities and focus on impacts to women and girls	Contractor	PIC and PMO KPWRSP	No complaint received regarding mobility of women and girls	Throughout construction phase
				Migrant construction staff visits to nearby villages to be controlled	Contractor	PIC and PMO KPWRSP	No complaint received regarding migrant staff	Throughout construction phase
		B.2.3.9	Hunting and loss of Fauna	Ban on hunting, poaching and trapping of all fauna by all project personnel	Contractor	PIC and PMO KPWRSP	No hunting reported/observed	Throughout construction phase
				Biodiversity monitoring of impacts of fauna	Contractor	PIC and PMO KPWRSP	Status and behavior of terrestrial and avi-fauna	Throughout construction phase
		B.2.3.10	Threats to life	Contractor shall prepare a shut down procedure and evacuation plan	Contractor	PIC and PMO KPWRSP	Plan submitted to Engineer	Throughout construction phase
							Annual evacuation drill	Throughout construction phase
				Emergency access routes shall be signed and maintained	Contractor	PIC and PMO KPWRSP	Emergency access routes clear and signed	Throughout construction phase
				Fire extinguishers to be provided through out camp	Contractor	PIC and PMO KPWRSP	Fire extinguishers provided	Through out construction phase
				Public areas at risk from fire in camp identified in emergency plan with evacuation measures	Contractor	PIC and PMO KPWRSP	Plan submitted to Engineer include evacuation procedure of public in event of major fire	At mobilization
B.2.4	Camp Planning	B.2.4.1	All of the above issues	Camp layout plan to be submitted to Engineer	Contractor	PIC and PMO KPWRSP	Review of Camp layout plan	Before camp construction

S#	Project Activities	S#	Environmental Impacts	Mitigation Measures	Responsibility		Key Performance Indicators	Time Frame
					Execution	Monitoring		
							Commencement of works not before approval of plan	Before camp construction
					Contractor	PIC	Construction of camp as per plan	During construction
B.2.5	Security	B.2.5.1	Conflict with local communities, attack on staff	Security for avoiding any conflict with local communities	Contractor	PIC and PMO KPWRSP	Fencing and security shall be provide by Contractor at all campsa. Entrance to camp shall be monitored and restricted	Throughout construction phase
				Contractor shall provide all staff with Identity Cards showing their association with the project	Contractor	PIC and PMO KPWRSP	All staff issued with identity cards	
				Staff speaking local dialect to be available to all active work sites to communicate with local community	Contractor	PIC and PMO KPWRSP	Staff speaking local dialect available at all active work sites	
				The Contractor shall include in the Emergency Plan, a procedure for emergency evacuation of camp and practice this procedure	Contractor	PIC and PMO KPWRSP	Plan submitted and approved	At mobilization
						PIC and PMO KPWRSP	Annual evacuation drill	Throughout construction period
		B.2.5.2	Change in Landscape after closure of works	All temporary facilities shall be removed by Contractor after completion of the works	Contractor	PIC and PMO KPWRSP	Temporary facilities are removed on completion of works	at completion of works
B.3	**STORAGE OF MATERIALS**							
B.3.1	Stockpile storage of materials	B.3.1.1	Increase in particulate matter	Proper covered storage; Water sprinkling of any uncovered stockpile where dust is generated	Contractor	PIC and PMO KPWRSP	Generation of dust from stockpiles minimised	Throughout construction period

S#	Project Activities	S#	Environmental Impacts	Mitigation Measures	Responsibility		Key Performance Indicators	Time Frame
					Execution	Monitoring		
				Reduce distance between storage of aggregates, cement and sand to batching plant	Contractor	PIC and PMO KPWRSP	Review of camp layout plan	Before camp construction
		B.3.1.2	Soil, ground and surface water pollution	Locate storage area away from water courses, drain and transport routes	Contractor	PIC and PMO KPWRSP	Review of camp layout plan	Before camp construction
				Locate storage area above or beyond the flood plain	Contractor	PIC and PMO KPWRSP	Review of camp layout plan	Before camp construction
				Use only designated storage areas	Contractor	PIC and PMO KPWRSP	Stockpile only in storage areas identified in camp layout plan	Throughout construction period
B.3.2	Storage of hazardous materials	B.3.2.1	Health and safety issues due to improper use of hazardous material	Fuel tanks and other hazardous material storage containers will be properly marked to highlight their contents	Contractor	PIC and PMO KPWRSP	Hazardous material storage containers adequately labeled	Throughout construction period
				Hazardous areas to be secure and access limited to trained personnel only	Contractor	PIC and PMO KPWRSP	Untrained personnel's are not accessing hazardous storage areas	Throughout construction period
				Hazardous material sites identified on site	Contractor	PIC and PMO KPWRSP	Signs provided to identify hazardous material storage area	Following camp construction
				Provide fire extinguishers	Contractor	PIC and PMO KPWRSP	Fire extinguishers are provided	Throughout construction period
				Provide and enforce use of PPEs as per Contractor Health and Safety Plan	Contractor	PIC and PMO KPWRSP	PPEs used	Throughout construction period

S#	Project Activities	S#	Environmental Impacts	Mitigation Measures	Responsibility		Key Performance Indicators	Time Frame
					Execution	Monitoring		
		B.3.2.2	Ground or surface water pollution	Fuel storage areas shall have masonry or concrete secondary containment area with 120% capacity of fuel stored	Contractor	PIC and PMO KPWRSP	Bunding provided at fuel bowsers	Following camp construction
				Hazardous material storage areas shall be covered and provided with concrete floor	Contractor	PIC and PMO KPWRSP	Concrete flood and cover to hazardous material storage areas and generators	Following camp construction
				Concrete or masonary bunds provided at perimeter of hazardous material storage area	Contractor	PIC and PMO KPWRSP	Enclosures provided for hazardous material areas and generators	Following camp construction
				Daily check of fuel tanks and immediate plugging of leaks	Contractor	PIC and PMO KPWRSP	No leakage observed at fuel tanks	Throughout construction period
				Shovels, plastic bags and sand provided at fuel tanks and hazardous material storage area	Contractor	PIC and PMO KPWRSP	Spill kits provided	Throughout construction period
				Spill prevention and contigency plan prepared by Contractor	Contractor	PIC and PMO KPWRSP	Approval of Plan	At mobilization
				Hazardous material storage area or fuel tank not to be situated adjacent to watercourse	Contractor	PIC and PMO KPWRSP	Review of camp layout plan	Before construction camp
				Space maintained between containers to allow inspection	Contractor	PIC and PMO KPWRSP	Containers spaced to allow inspection	Throughout construction period
				Weekly inspection of containers and documentation of findings	Contractor	PIC and PMO KPWRSP	Weekly record of inspection of inspection available and up to date	Throughout construction period

S#	Project Activities	S#	Environmental Impacts	Mitigation Measures	Responsibility		Key Performance Indicators	Time Frame
					Execution	Monitoring		
		B.3.2.3	Health safety and Pollution	Designated oil storage area used	Contractor	PIC and PMO KPWRSP	Stockpiles only in storage areas identified in camp layout plan	Throughout construction period
				Training on handling, use and disposal of hazardous material shall be provided to all those with access to hazardous material area	Contractor	PIC and PMO KPWRSP	Training as per Contractor's approved training plan	Throughout construction period
				Covered transporation of hazardous material	Contractor	PIC and PMO KPWRSP	Hazardous material covered during transport to site	at completion of works
		B.3.2.4	Ground and surface water pollution after closure of works	All excess materials (other than earth stockpiles) shall be removed on completion of works	Contractor	PIC and PMO KPWRSP	Excess construction material removed	at completion of works
B.4	**WASTE MANAGEMENT**							
B.4.1	Generation of Sanitary Wastes	B.4.1.2	Surface and groundwater pollution and health of staff	All excess materials (other than earth stockpiles) shall be removed on completion of works	Contractor	PIC and PIC and PMO KPWRSP	Excess construction material removed	at completion of works
B.4.2	Disposal of sanitary wastes using municipal system (if available)	B.4.2.1	Introduction of inappropriate contaminants or waste volume to municipal system	Quarterly testing of wastes and submission of results to Engineer	Contractor	PIC and PMO KPWRSP	Test results show wastes is within NEQS limit for pre-treatment	Throughout construction period
				Written consent from the operator of the municipal system submitted to Engineer	Contractor	PIC and PMO KPWRSP	Consent submitted	At mobilisation
		B.4.2.2	Use of municipal system	Only government approved system to be approved	Contractor	PIC and PMO KPWRSP	Government approved system used	At mobilisation
B.4.3	Treatment of sanitary wastes using septic tank	B.4.3.1	Introduction of inappropriate contaminants into the septic system	Only sanitary wastes treated in septic tank	Contractor	PIC and PMO KPWRSP	No construction waste water entering septic tank	

S#	Project Activities	S#	Environmental Impacts	Mitigation Measures	Responsibility		Key Performance Indicators	Time Frame
					Execution	Monitoring		
		B.4.3.2	Ineffective treatment of waste leading to ground or surface water pollution	Regular maintenance of the system by Contractor	Contractor	PIC and PMO KPWRSP	Monitoring of effluents against NEQs	Throughout construction period
				Submit pollution plan to Engineer including design or specifications of system to show treatment rate exceeds loading rate and include plan for treatment/disposal of sludge	Contractor	PIC and PMO KPWRSP	Plan submitted and approved	Throughout construction period
							treatment as per approved plan	
		B.4.3.3	Surcharge of septic system surface	Location of system to ensure surcharge shall not reach surface water bodies	Contractor	PIC and PMO KPWRSP	Review of camp layout plan	Before construciton camp
B.4.4	Collection of domestic wastes	B.4.4.1	Surface and groundwater pollution	Provide garbage bins within all camps for domestic wastes	Contractor	PIC and PMO KPWRSP	Provision of bins	Throughout construction period
		B.4.4.2	Regular collection and disposal of wastes	Regular and disposal of wastes	Contractor	PIC and PMO KPWRSP	Bins are not full	Throughout construction period
B.4.5	Generation of wastes	B.4.5.1	Air, ground and surface water pollution	Return excess construction material to supplier	Contractor	PIC and PMO KPWRSP	Used construction material not disposed of	Throughout construction period
				Use of recycling Contractor	Contractor	PIC and PMO KPWRSP	Recyclable material not disposed of	Throughout construction period
				Reuse of domestic wastes (if applicable)	Contractor	PIC and PMO KPWRSP	Domestic waste included in Loacal authority reuse programs	Throughout construction period
B.4.6	Landfill of domestic wastes	B.4.6.1	Ground and groundwater pollution, spread of disease	Landfill shall be located where groundwater is low. If base of landfill is permeable, clay/geotextile lining is required	Contractor	PIC and PMO KPWRSP	Groundwater should not be observed in landfill	Throughout construction period

S#	Project Activities	S#	Environmental Impacts	Mitigation Measures	Responsibility		Key Performance Indicators	Time Frame
					Execution	Monitoring		
				Inert wastes only to be disposed of in landfills	Contractor	PIC and PMO KPWRSP	No hazardous waste, medical waste or sanitary in landfills	Throughout construction period
		B.4.6.2	Health and safety of community and fauna	Fencing around landfill	Contractor	PIC and PMO KPWRSP	Fencing provided	Throughout construction period
		B.4.6.3	Landscape change	Landfill shall be covered with top soil to original ground level following use	Contractor	PIC and PMO KPWRSP	Landfill capped	Decommissioning
		B.4.6.4	Social conflicts, odor, community health and safety	Landfill to be situated at least 100m away from the settlement	Contractor	PIC and PMO KPWRSP	Review of camp layout plan	Before camp construction
B.4.7	Fuel emissions	B.4.7.1	Air pollution	Fuel of any material resulting in release of toxic emissions should not be allowed	Contractor	PIC and PMO KPWRSP	Permitted fuel used	Throughout construction period
		B.4.7.2	Fire	Contractor shall provide fire extinguishers at burn sites	Contractor	PIC and PMO KPWRSP	Fire extinguishers are provided	Throughout construction period
B.4.8	Disposal of medical wastes	B.4.8.1	Ground, groundwater and surface water pollution, health and safety	Medical wastes stored on site and ultimately disposed of at medical incinerator	Contractor	PIC and PMO KPWRSP	No medical wastes in landfill or burn pits	Throughout construction period
B.4.9	Disposal of hazardous wastes	B.4.9.1	Ground, groundwater and surface water pollution, health and safety	Hazardous wastes to be passed to licensed contractor, or , ir available wastes to be stored in long term storage facilties meeting requirement of hazardous material storage area to be taken on client following construction. Details to be provided in pollution plan to the Engineer.	Contractor	PIC and PMO KPWRSP	Approval of Plan	At mobilisation
B.4.10	Transport of wastes	B.4.10.1	Littering, pollution	Wastes shall be covered (e.g. with a tarpaulin) during transport	Contractor	PIC and PMO KPWRSP	No wastes littering the project area	Throughout construction period

S#	Project Activities	S#	Environmental Impacts	Mitigation Measures	Responsibility		Key Performance Indicators	Time Frame
					Execution	Monitoring		
B.4.11	Disposal of Batching Plant washing	B.4.11.1	Ground, groundwater and surface water pollution, health and safety	Washout to be treated to NEQS for industrial effluents	Contractor	PIC and PMO KPWRSP	treatment as per approved plan	Throughout construction period
B.4.12	Disposal of excess excavated materials	B.4.12.1	Loss of habitat, loss of productive land and defacing of landscape	Resue excavated material	Contractor	PIC and PMO KPWRSP	Use of excavated material construction of embankment	During Excavation for pressure pipe and canal
				Dispose the excavated material in stockpiles on barren land	Contractor	PIC and PMO KPWRSP	Disposal of the excavated material along outer toes of embankment	After completion of the works
B.4.13	General wastes management	B.4.13.1	All above	Wastes management for all sites to be included in Contractor's training plan	Contractor	PIC and PMO KPWRSP	Submittal and approval of plan	At mobilisation
							Training as per approved plan	Throughout construction period
B.4.14	Closure of works	B.4.14.1	Ground, groundwater and surface water pollution, health and safety	All solid wastes not within the landfill shall be removed from the project area on completion of works	Contractor	PIC and PMO KPWRSP	All solid wastes landfill or removed from the site	On completion of works
B.5	**CONSTRUCTION PLANTS AND VEHICLES**							
	Movement/ operation of vehicles/ plant and equipment on site	B.5.1.1	Air pollution	All plants and vehicles are regularly services as per manufacturers requirements	Contractor	PIC and PMO KPWRSP	Black smoke not observed emitting from Vehicles/plant	Throughout construction period
						PIC and PMO KPWRSP	Monitoring of ambient air quality as per NEQS	Throughout construction period
				Efficient driving practices included in Contractor's training plan	Contractor	PIC and PMO KPWRSP	Submittal and approval of plan	At mobilisation
						PIC and PMO KPWRSP	Training as per approved plan	Throughout construction period

S#	Project Activities	S#	Environmental Impacts	Mitigation Measures	Responsibility		Key Performance Indicators	Time Frame
					Execution	Monitoring		
		B.5.1.2	Generation of dust	Access road to be adequately compacted or regularly sprinkled to prevent dust generation during use	Contractor	PIC and PMO KPWRSP	Dust not reaching the settlements in the project area	Throughout construction period
				Construction traffic limited to work area and established tracks	Contractor	PIC and PMO KPWRSP	Construction traffic use only established tracks	Throughout construction period
B.5.1		B.5.1.2	Soil and Groundwater pollution	Vehicles/plants will be checked daily for fuel oils and leaks and fixed as required	Contractor	PIC and PMO KPWRSP	No fuel oil leaks observed form plant/vehicel	Throughout construction period
		B.5.1.3	Community disturbance increase in traffic	Project vehicles in plant parked in designated areas as per camp layout plan	Contractor	PIC and PMO KPWRSP	No vehicle observed parked outside the approved areas	Throughout construction period
				Movement of vehicles/plant restricted to work hours	Contractor	PIC and PMO KPWRSP	No movement of vehicles/plant beyond works hours	Throughout construction period
				Warning signs must be provided where access routes pass adjacent to settlements	Contractor	PIC and PMO KPWRSP	Warning signs provided near settlement	Throughout construction period
		B.5.1.4	Safety of community, other road users, fauna and staff	Heavy vehicle speed limited to 30 km/hr in access roads and camp area	Contractor	PIC and PMO KPWRSP	Submittal and approval of plan	At mobilisation
				Safe driving practices included in Contractor's training plan	Contractor	PIC and PMO KPWRSP	Training as per approved plan	Throughout construction period
				All Drivers hold a valid license	Contractor	PIC and PMO KPWRSP	Drivers able to show valid license	Throughout construction period
				Flag persons to be provided where access roads cross/meet main road	Contractor	PIC and PMO KPWRSP	Flag persons provided	Throughout construction period

S#	Project Activities	S#	Environmental Impacts	Mitigation Measures	Responsibility		Key Performance Indicators	Time Frame
					Execution	Monitoring		
				Contractor's Community Liaison Officer to collaborate with communities to identify sensitive areas and inform communities prior to movment of large plant	Contractor	PIC and PMO KPWRSP	No complaint received from communities	Throughout construction period
				Plant/vehicles with restricted rear visibility to be fitted with audible back-up alarm or provided with banks men	Contractor	PIC and PMO KPWRSP	Back-up alarms or banks men provided	Throughout construction period
				Mud shall be cleared from vehicle before entering public roads, or else public roads shall be cleared of mud regularly	Contractor	PIC and PMO KPWRSP	No mud on public roads	Throughout construction period
				Driving in project area after nightfall is prohibited except on public highways	Contractor	PIC and PMO KPWRSP	No driving after dark	Throughout construction period
			Damage to public infrastructure	Damage to roads, infrastructure and property immediately repaired/compensated by Contractor	Contractor	PIC and PMO KPWRSP	Damages to roads/infrastructure rectified/compensated	Throughout construction period
				Use of horns is prohibited near settlements	Contractor	PIC and PMO KPWRSP	Noise level within NEQS near settlements	Throughout construction period
				Acoustic guards, cover and doors provided on plant and vehicles shall be left in place	Contractor	PIC and PMO KPWRSP	Acoustic guards, silencers, cover and doors provided on plant and vehicles left in place	Throughout construction period
				Plants and vehicles to adhere to noise standard specified in NEQS	Contractor	PIC and PMO KPWRSP	Monitor with noise meter	Throughout construction period

S#	Project Activities	S#	Environmental Impacts	Mitigation Measures	Responsibility		Key Performance Indicators	Time Frame
					Execution	Monitoring		
				Plants/vehicles shall be restricted from playing radio/taps audible beyond the plant	Contractor	PIC and PMO KPWRSP	Radio/taps are not audible at 50m or further from plant	Throughout construction period
			Disturbance to Fauna	Biodiversity monitoring of impacts on fauna	Contractor	PIC and PMO KPWRSP	Status and behavior of terrestrial and avi-fauna	Throughout construction period
			Restriction of access to women and girls	Avoid routes use by women and girls as far as possible, if unavoidable, identify alternate routes for women and girls	Contractor	PIC and PMO KPWRSP	No complaint received from women and girls	Throughout construction period
B.5.2	Deliveries to Site	B.5.2.1	Air pollution	Delivery vehicles engines should be off when queuing	Contractor	PIC and PMO KPWRSP	Queuing vehicles engines are not idling	Throughout construction period
		B.5.2.2	Dust	Covered transportation of loose materials	Contractor	PIC and PMO KPWRSP	No dust generation from delivered materials	Throughout construction period
		B.5.2.3	Community disturbance and increase in traffic	Traffic management plan to be submitted to Engineer for approval; and to include routes for delivery vehicles	Contractor	PIC and PMO KPWRSP	Submittal and approval of plan	At mobilisation
						PIC and PMO KPWRSP	Delivery vehicles are following designated routes	Throughout construction period
				Deliveries should aim to avoid peak traffic hours (9-11am and 2-5pm)	Contractor	PIC and PMO KPWRSP	No deliveries between 9-11am and 2-5pm)	Throughout construction period
				Delivery vehicles are prohibited from queuing on public roads	Contractor	PIC and PMO KPWRSP	No queuing delivery vehicles on public roads	Throughout construction period
				Vehicles to be unloaded at designated locations	Contractor	PIC and PMO KPWRSP	No unloading on public roads	Throughout construction period
B.5.3	Road Closure	B.5.3.1	Community disturbance increase in traffic	Flag persons ot be provided where plant cross/meet road over the proposed RoW	Contractor	PIC and PMO KPWRSP	Flag persons provided	During partial road closure

S#	Project Activities	S#	Environmental Impacts	Mitigation Measures	Responsibility		Key Performance Indicators	Time Frame
					Execution	Monitoring		
				Contractor's Community Liaison Officer to collaborate with communities to identify sensitive areas and inform communities prior to movement of large plant	Contractor	PIC and PMO KPWRSP	No complaint received	Throughout construction period
				Traffic by-pass should be provided and signed	Contractor	PIC and PMO KPWRSP	By-pass provided and signed	During road closure
				Request for road closure must be approved by relevant authority	Contractor	PIC and PMO KPWRSP	Approval for road closure submitted to Engineer	Throughout construction period
B.5.4	Refueling of vehicles and plant on land or filling of fuel drums	B.5.4.1	Ground, ground and surface water pollution	Refueling points to be provided with a concrete pad and bund or drip trays used. Spill fuel disposed of as hazardous waste	Contractor	PIC and PMO KPWRSP	No fuel spillage from refueling operations	Throughout construction period
B.5.5	Wash down of plants and vehicles	B.5.5.1	Ground, ground and surface water pollution	Wash down of plants only in designated areas as per site layout plan	Contractor	PIC and PMO KPWRSP	Vehicles not washed down outside designated area	Throughout construction period
				Wash down areas have concrete pad foundations	Contractor	PIC and PMO KPWRSP	Concrete pad foundation provide	Throughout construction period
				Run-off from wash down areas to be collected and treated in separation tank. Oil to be disposed of as for hazardous wastes or reused as lubricants	Contractor	PIC and PMO KPWRSP	Wash down water is treated	Throughout construction period
		B.5.5.2	Depletion of local water resources	Use of groundwater by the contractor will be monitored and controlled by Engineer	Contractor	PIC and PMO KPWRSP	Contractors use of Groundwater monitored by Engineer	Throughout construction period
B.6	**GENERATORS and BATCHING PLANT OPERATION**							

S#	Project Activities	S#	Environmental Impacts	Mitigation Measures	Responsibility		Key Performance Indicators	Time Frame
					Execution	Monitoring		
B.6.1	Operation of Batching Plan	B.6.1.2	Air pollution	Plant regularly services as per manufacturers requirement	Contractor	PIC and PMO KPWRSP	Black smoke not observed emitting from the plant	Throuhgout contract period
				Use batching plant with low emission	Contractor	PIC and PMO KPWRSP	Low emission batching plant in use	Throuhgout contract period
		B.6.1.3	Dust	Water sprinkling at batching plant as dust suppression method	Contractor	PIC and PMO KPWRSP	Minimal dust generation from the batching plant	Throughout contract period
				program work to be completed between 6am and 6pm	Contractor	PIC and PMO KPWRSP	No operation of batching plant between 6am and 6pm	Throughout contract period
		B.6.1.4	Noise	Acoustic guards and doors kept in place and plant regularly serviced	Contractor	PIC and PMO KPWRSP	Noise at settlement below NEQS	Throughout contract period
		B.6.1.5	Depletion of local water resources	Contractor is prohibited from using groundwater for wash down of plant and vehicles	Contractor	PIC and PMO KPWRSP	Groundwater is not used for construction purposes	Throuhgout contract period
B.6.2	Operation of power generators	B.6.2.1	Air pollution	Generators to be required of Table:7.17 of IFC EHS Guidelines	Contractor	PIC and PMO KPWRSP	Monitoring ambient air quality against NEQS	Throughout contract period
				Generators regularly services as per manufacturers requirements	Contractor	PIC and PMO KPWRSP	Black smoke not observed emitting from generators	Throughout contract period
				Generators stack height to be in accordance with Annex1.1.3 of IFC General EH Guidelines	Contractor	PIC and PMO KPWRSP	Stack height as per Annex-1.1.3 of IFC general EHS Guidelines	Following cap construction
				Generators to be operated on standby basis when WAPDA electricity is unavailable	Contractor	PIC and PMO KPWRSP	Connection to WAPDA network made where possible	Following cap construction
		B.6.2.2	Noise	Acoustic guards and doors kept in place and plant regularly serviced	Contractor	PIC and PMO KPWRSP	Noise at settlement below NEQS	Throughout contract period

S#	Project Activities	S#	Environmental Impacts	Mitigation Measures	Responsibility		Key Performance Indicators	Time Frame
					Execution	Monitoring		
B.7	**HEALTH AND SAFETY OF WORKFORCE**							
B.7.1	General construction works	B.7.1.1	Health and safety of staff	Contractor shall prepare and submit health and safety plan	Contractor	PIC and PMO KPWRSP	Submittal and approval of plan	At mobilisation
						PIC and PMO KPWRSP	Implementation of approved plan	Through out contract period
				Inclusion of training of all staff in health and safety best practices within the Contractor training plan	Contractor	PIC and PMO KPWRSP	Submittal and approval of plan	At mobilisation
				Provision and enforcement in use of all necessary PPEs as per approved health and safety plan	Contractor	PIC and PMO KPWRSP	Use of all necessary PPEs by staff at work ing site	Through out contract period
				Contractor will submit accident report to the Engineer following any accident on site. Report must details actions to be taken to reduce risk of occurrence	Contractor	PIC and PMO KPWRSP	Submittal of accident report	Throughout contract period
				Qualified health and safety manager will be appointed by Contractor	Contractor	PIC and PMO KPWRSP	Qualified health and safety manager present on site	Through out contract period
				Contractor shall engage a full time Doctor on site who is registered with PMDC	Contractor	PIC and PMO KPWRSP	On site Presence of qualifide Doctor	Through out contract period
				Provision of dispensary for treatment of staff. Dispensary to be stocked with appropriate medicines for likely incidents, diseases and ailments to be occurred on site. Stock to be replenished as necessary.	Contractor	PIC and PMO KPWRSP	Dispensary available on site and regularly restocked	Through out contract period

S#	Project Activities	S#	Environmental Impacts	Mitigation Measures	Responsibility		Key Performance Indicators	Time Frame
					Execution	Monitoring		
				First aid facility shall be provided at each work site in the project area	Contractor	PIC and PMO KPWRSP	First aid facilities provided at each work site	Through out contract period
				The Contractor shall include in the health and safety plan a procedure for the transfer of injured staff from the site to medical facilities including transport and provision of medical treatment in en-route.	Contractor	PIC and PMO KPWRSP	Submittal and approval of plan	At mobilisation
						PIC and PMO KPWRSP	Provision of resources required for implementation	Through out contract period
C.1	Water logging in areas prone to water logging	C.1.1	Seepage from canal	Canal lining is provided in required area	Contractor	PIC and PMO KPWRSP	Lining of main and branch canals	Continuous
				Lining of water courses in required area	Contractor	PIC and PMO KPWRSP	Water courses are lined	Throughout construction period
				Maintenance of water courses	Farmers	KPID	Water courses are well maintained	Continuous
				On Farm Water Management	KPAD / OFWM Deptt	KPID	Training of farmers in On Farm Water Management techniques.	Through out contract period and periodically during operation period
C.2	Aftercare of planted saplings	C.2.1	Depletion of natural resources and Habitats	Regular watering and after care	KPID	KPID	Saplings are properly cared	Continuous

Table 9-2: Environmental Monitoring Plan

Environment Component	Parameters	Standards / Guidelines	Locations	Monitoring Period/ Frequency/ Sampling, No/year	Responsibility	
					Implementation	Monitoring
PRE-CONSTRUCTION STAGE						
Trees cutting	Monitoring to check that the required minimum of trees are cut. Check whether proper compensation as mentioned in LARP is received by PAPs	Inspection	Throughout the project areas	During tree felling and site clearing operations	Contractor	PIC and PMO KPWRSP
CONSTRUCTION STAGE						
Air Quality	SO_2, NOx, CO, O_3, SPM, PM_{10}, $PM_{2.5}$,Humidity, Wind direction, Wind speed, Temperature	Air quality standard by NEQS, Pakistan	Throughout the project areas	Quarterly	Contractor	PIC and PMO KPWRSP
Dust	Dust control	Air quality standard by NEQS Pakistan	Throughout the project areas	Quarterly	Contractor	PIC and PMO KPWRSP
Noise Level	dB(A)	Noise Pollution Control NEQS, Pakistan	Throughout the project areas	Quarterly	Contractor	PIC and PMO KPWRSP
Water Quality	Surface water: Temperature, Turbidity, pH, TDS, EC, TSS, DO, COD, BOD_5,	Water quality standard by WAPDA and NEQS Pakistan	Surface water near project corridor	Quarterly	Contractor	PIC and PMO KPWRSP
	Groundwater: Color,odor, Taste,Temperature, Turbidity, pH, TDS, EC, TSS, CaCo3,hardness,Potassium, Nitrate, Nitrite (as NO2), Phosphate, Arsenic, COD, DO, TSS, Total Coliform, Faecal Coliform and E.Coli.	Water quality standard by NEQS Pakistan	Groundwater near project corridor	Quarterly	Contractor	PIC and PMO KPWRSP

Environment Component	Parameters	Standards / Guidelines	Locations	Monitoring Period/ Frequency/ Sampling, No/year	Responsibility	
					Implementation	Monitoring
Soil Pollution	• Soil texture, pH, EC, Available Phosphorpus and SAR. Check on liquid waste to be carried out by experienced personnel and using proper procedures. • Careful and proper handling of oil and other hazardous liquids.	WAPDA Standards Government of Pakistan	At all project sites	Twice a year	Contractor	PIC and PMO KPWRSP
Soil Erosion	Visual check for soil erosion and siltation. Visual inspection of erosion prevention measures and occurrence of erosion.	Non specific	Material storage sites and all the water bodies near the project corridor	Monthly	Contractor	PIC and PMO KPWRSP
Drainage congestion	Check drainage plan implemented correctly; Conduct regular inspection	Monitoring	Throughout the project areas	Weekly during monsoon	Contractor	PIC and PMO KPWRSP
Wildlife	Wildlife habitat and movement	None Specific	Areas alongside corridor	Quarterly	Contractor	PIC and PMO KPWRSP
Fisheries	Construction phase impact on fish breeding and spawning areas as a site is proposed for hatchery in Malik Area by Fisheries Department Government of KPK.	None Specific	All major water bodies	Quarterly	Contractor	PIC and PMO KPWRSP

Environment Component	Parameters	Standards / Guidelines	Locations	Monitoring Period/ Frequency/ Sampling, No/year	Responsibility	
					Implementation	Monitoring
Waste Management	Check storage, transportation, disposal, handling of hazardous waste; Waste and effluents to be collected and disposed safely from all camps; Waste and garbage from bridge construction site to be disposed safely.	Monitoring	Throughout the project areas	Weekly	Contractor	PIC and PMO KPWRSP
Health and Safety	Check quality of food and accommodation at construction camp. Check safe water supply, hygienic toilet at camps and construction of drain at camp sites. Check toilets are close to construction site and separate toilet for female workers; First-Aid kit with required tools and medicine; The heavy construction material to handled and stored safely putting due care on public safety; Heavy construction materials at bridge construction site to be stored and handled safely; and Check of personal protective	Monitoring	Construction sites, labour camps	Regularly	Contractor	PIC and PMO KPWRSP

Environment Component	Parameters	Standards / Guidelines	Locations	Monitoring Period/ Frequency/ Sampling, No/year	Responsibility	
					Implementation	Monitoring
	equipment (PPE) for worker at the sites.					
Traffic Safety	Record of accidents, and implementation of the traffic management plan to be prepared and implemented by the Contractor.	None Specific	Throughout the project section	Full operation period	PMO KPWRSP	KPID
OPERATION STAGE						
Tree Plantation	Check the plantation method and number of tree species	Inspection to ensure proper plantation with proper species	Throughout the project areas	During June/ July	Contractor	PIC and PMO KPWRSP
Water Quality	Surface water: Temperature, Turbidity, pH, TDS, EC, TSS, DO, COD, BOD_5,	Water quality standard by DOE, Bangladesh	Surface water near project corridor	Twice a year for 3 years	PMO KPWRSP	KPID
	Groundwater: Color,odor, Taste,Temperature, Turbidity, pH, TDS, EC, TSS, CaCo3,hardness,Potassium,Nitrate,Nitrite (as NO2),Phosphate,Arsenic,COD,DO,TSS,Total Coliform,Faecal Coliform and E.Coli.	Water quality standard by NEQS Pakistan	Surface water near project corridor	Twice a year for 3 years	PMO KPWRSP	KPID
Soil Quality	• Soil texture,pH,EC, Available Phosphorpus and SAR.Check liquid waste is carried out by experienced personnel and in proper way. • Careful and proper handling of oil and other hazardous liquids.	WAPDA Standards Government of Pakistan and applicable International Standard	At each construction camp post restoration of construction camp site	Yearly	PMO KPWRSP	KPID

Environment Component	Parameters	Standards / Guidelines	Locations	Monitoring Period/ Frequency/ Sampling, No/year	Responsibility	
					Implementation	Monitoring
Wildlife	Wildlife habitat and movement	None Specific	CoI	Quarterly	PMO KPWRSP	KPID
Fisheries	Impact on fish productivity, breeding and spawning	Malik Abad and other areas	All major water bodies	End of first year of operation	PMO KPWRSP	KPID

10. ENVIRONMENTAL MANAGEMENT and MONITORING COST

10.1 Environmental Plan Implementation and Management Cost

682. Costs have been estimated for implementing EMP for the proposed project. The estimates for the key EMP components are detailed below and summarised in the Table 10-1 below. Appropriate clauses will be added to the Construction Contract(s) to ensure a mechanism for compliance and payment.

10.2 Effects Monitoring Cost

683. Perennial surface and groundwater water at designated locations will be tested as per NEQS on quarterly basis during construction. The approximate cost of monitoring for 3 years during construction phase include noise monitoring, Dissolved Oxygen, pH and Electric Conductivity (EC) of the water (perennial tributaries/Khwar falling within in project area)to be monitored on monthly basis; the estimated cost of the equipment is Rs. 495,000 as given in Table 10-2.

Table 10-1: Surface and Ground Water Monitoring Equipment's

Equipment	Cost (PKR)
DO meter	40,000
EC meter	35,000
pH meter	30,000
Noise meter	65,000
Other expenditures (miscellaneous)	325,000
Total	**495,000**

684. Groundwater quality should be tested on quarterly basis. Testing is also required at the start of the project before using the groundwater as drinking water. The samples should be collected from all the sources of groundwater use for the water supply system on site i.e. dug wells, tube well etc this includes 3 samples every three months from 4 sources and their analysis as per NEQS.

685. Air quality should be monitored on the proposed alignment during earthwork and movement of the construction machinery and noise should be monitored at potential noise prone areas on a weekly basis. The approximate cost of ambient air monitoring during the construction phase is given in Table 10-1.

10.3 Training Cost

686. Training is considered to be an important part of environment and social awareness and all site management and work supervisors should undertake periodic training given by the Contractor's HSE staff.

687. The Contractor will arrange to run a proper campaign among his personnel and workers to make people aware of the causes, mode of transmission and consequences of HIV/AIDS.

688. Briefing will be given to all workers regarding the biological resources and protected areas (in particular the private protected area in the command area). It will be

communicated to the worker that unnecessary and out of bound activities / movements are strictly prohibited in the construction area. No weapon will be carried by any of the worker.

689. All forest and fisheries laws should be explained to the workers. The approximate cost of training carried out by the contractor of his own site staff is Rs. 2500,000. The cost includes the cost from the trainings to be imparted to the environmental and social staff of the project staff (PICs andPD).

10.4 Tree Plantation Cost

690. It is proposed to plant and care up to approximately 4,800 compensatory trees including woody and fruit trees at different places in the project area. The total estimated cost of plantation is Rs.480,000

10.5 Waste Disposal Cost

691. Daily domestic waste will be produced by skilled and non-skilled workers on site. The approximate cost of disposal of domestic waste for the construction phase including the preparation and maintenance of the temporary storage area and landfill pit is Rs. 150,000.

10.6 Water Supply and Wastewater Treatment Cost

692. It is the Contractor's obligation to provide clean drinking water, to do this he may install a new tube well with overhead water tank to supply drinking water to the site workers at appropriate pressure. The approximate cost for installing water supply system is Rs. 1,400,000.

693. In addition to complying with the appropriate legislation the Contractor may have to treat the domestic wastewater generated from the labour camp by provision of one chamber septic tank to be connected in series. The capacity of chamber should have minimum one day waste water discharge which would be about 150,000 litres. The approximate construction and maintenance cost of the septic tank is Rs. 500,000.

694. Effluent will be tested and confirmed that the treatment meets with NEQS standard before disposal. The quarterly testing is recommended of the treated wastewater. The cost of testing is Rs.150,000.

10.7 Traffic Management Cost

695. The flow of traffic during construction works may be interrupted. To avoid traffic blockage, traffic management plan will be prepared by the Contractor, and an amount of Rs.700,000 is allocated for its implementation.

10.8 Restoration Cost

696. The area under the use of Contractor during construction time will be restored at the completion of the project to the original level without any additional cost. However any additional improvement will be paid to the Contractor for example converting unpaved path into metal road.

10.9 Staffing

697. The cost including the salaries of the staff and logistics for the Environmental Management Unit of the PD office (PMO) to be set up with direct reporting line to the PD. An Environment Specialist and a Social Development Specialist will need to be a part of the EMU so as to ensure compliance to both parts of the EMMP. It is estimated as Rs. 24,000,000 would be required. The estimated cost Rs. 12,000,000 is estimated for staffing of the Environmental Unit of the PICs. An Environmental Unit (EU) of the Consultant shall hire the services of an Environmental Specialist for the overall project.

698. The cost to provide the Contractor's Environmental Coordinator and two (02) Environmental Inspectors andOne Health and Safety Officer and one Community Liaison Officer for the for PHLCE Project is Rs. 24,000,000.

10.10 Dispensary at Labour Camp

699. The Contractor has to establish a dispensary at the camp site and provide the first aid facilities at each working site. The cost for the establishment of the dispensary excluding the building (that has to be built by the Contractor as a part of the camp) would be Rs. 3,500,000. It would include the provision of a well- equipped ambulance, medicines, first aid boxes, salaries of the medical professionals etc.

10.11 Relocation Costs

700. The cost associated with assistance offered to for the acquisition of the land for the installation of pressure pipes, main and branch canals is not included in this cost estimate. The total cost shall be provided in the Resettlement Action Plan for the Project.

10.12 Total Cost

701. The total cost for environmental and social management and monitoring is estimated as PKR 70 Million as given in the Table 10-2.

Table 10-2: Environmental Management and Monitoring Cost

Component	Activity	Cost (PKR)
Effects Monitoring Cost	Miscellaneous	325,000.00
	Purchasing of required instruments	170,000.00
Training Cost		2,500,000.00
Compensatory Plantation Cost	1200*4*300	1,440,000.00
Waste Disposal Cost	Disposal of wastes	150,000.00
	Treatment of waste	1,400,000.00
	Maintenance of equipment	150,000.00
	Testing of effluents	500,000.00
Dispensary for Contractor's crews and Project Staff		2,500,000.00
Traffic Management		700,000.00
Environmental Staffing	PD	24,000,000.00
	PICs	12,000,000.00
	Contractor	24,000,000.00
Total Cost		**69,835,000 (Say PKR 70 Million)**

11. CONCLUSIONS

11.1 Impacts and Mitigations

702. The implementation of the PHLCE project would result in both beneficial and adverse impacts on the environment and community, both. The beneficial impacts are as follows:

11.2 Beneficial Impacts

11.2.1 Income Generation

703. The income level of the communities in Janda Boka and Indus Ambar will be enhanced susbtatially when they are able to use the irrigation water from the PHLCE. This would not only elevate their living conditions but also develop the area.

11.2.2 Employment Generation

704. During the peak of the civil works it is estimated that approximately 500 personnel shall be engaged on site and the majority of these personnel shall be unskilled labourers, drivers, plant operators and secondary support staff (domestic staff, such as cooks and cleaners). As the skills required for these personnel are not very high persons from the local communities could be employed for these positions. The EMP specifies that local community be given preference when filling such vacancies and it is anticipated that the contractor shall be able to source much of the workforce from within the project area, which shall result in a major short term positive impact to a, largely vulnerable, population.

11.3 Adverse Impacts

705. The main potential adverse impacts are associated with the construction phase of the project which would result mainly from the construction and operation of of temporary accommodation and construction facilities by the contractor, installation of pressure pipes and construction of irrigation canals works. The following significant potential impacts have been identified and described in Chapter 6 with proposed mitigation.

- Noise and air quality issues;
- Waste and wastewater disposal;
- Occupational Health and Safety problems;

706. Main Opoerational Health and Safety problems are:

a. Generation of Traffic issues in the Project Area;
b. Loss of Agricultural Land in the Project Area;
c. Removal of Trees along the alignment;

707. All the above adverse impacts and other adverse impacts considered in Chapter 6 can be mitigated through implementation of the mitigatory measures proposed in the same Chapter and Chapter 9, EMP.

708. Socio-economic impacts as displacement and loss of property and income have been addressed and adequate compensation recommended in the Resettlement Plan.

11.4 Conclusion

709. Therefore, assuming the effective implementation of the mitigation measures and monitoring plan as outlined in the Environmental Management Plan (Chapter 9), the Project is not expected to have significant adverse environmental impacts.

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ANNEXURE-I NATIONAL ENVIRONMENTAL QUALITY STANDARDS

Table 1: Selected NEQS for Waste Effluents

Parameter	**Unit**	**Standards (maximum allowable limit)**
Temperature increase	^{o}C	<3
pH value (acidity / basicity)	pH	6-9
5-day biochemical oxygen demand (BOD) AT 20 ^{O}C	mg/l	80
Chemical oxygen demand (COD)	mg/l	150
Total dissolved solids	mg/l	200
Total dissolved solids	mg/l	3,500
Grease and oil	mg/l	10
Phenolic compounds (as phenol)	mg/l	0.1
Chloride (as Cl)	mg/l	1.0
Fluoride (as F)	mg/l	10
Sulfate (SO_4)	mg/l	600
Ammonia (NH_3)	mg/l	40
Cadmium	mg/l	0.1
Chromium (trivalent and hexavalent)	mg/l	1.0
Copper	mg/l	1.0
Lead	mg/l	0.5
Mercury	mg/l	0.01
Selenium	mg/l	0.5
Nickel	mg/l	1.0
Silver	mg/l	1.0
Total toxic metals	mg/l	2.0
Zinc	mg/l	5
Arsenic	mg/l	1.0
Barium	mg/l	1.5
Iron	mg/l	8.0
Manganese	mg/l	1.5
Boron	mg/l	6.0
Chlorine	mg/l	1.0

Notes:

1. The standard assumes that dilution of 1:10 on discharge is available. That is, for each cubic meter of treated effluent, the recipient water body should have 10 m^3 of water for dilution of this effluent.

2. Toxic metals include cadmium, chromium, copper, lead, mercury, selenium, nickel and silver. The effluent should meet the individual standards for these metals as well as the standard for total toxic metal concentration.

Source: Government of Pakistan (2000) (SRO 549(I)/2000).

Table 2: NEQS for Industrial Gaseous Emissions

mg/Nm^3 unless otherwise stated

Parameter	Source of Emission	Standards (maximum allowable limit)
Smoke	Smoke opacity not to exceed	40% or 2 Ringlemann Scale or equivalent smoke number
natter [1]	(a) Boilers and furnaces: i. Oil fired ii. Coal fired iii. Cement Kilns	 300 500 300
	(b) Grinding, crushing, clinker coolers and related processes, metallurgical processes, converters, blast furnaces and cupolas.	500
hloride	Any	400
Chlorine	Any	150
uoride	Any	150
ulphide	Any	10
Sulphur Oxides [2,3]	Sulfuric acid/Sulphonic acid plants	5,000
	Other Plants except power Plants operating on oil and coal	1,700
noxide	Any	800
Lead	Any	50
Mercury	Any	10
Cadmium	Any	20
Arsenic	Any	20
Copper	Any	50
Antimony	Any	20
Zinc	Any	200
itrogen [3]	Nitric acid manufacturing unit	3,000
	Other plants except power plants operating on oil or coal: i. Gas fired ii. Oil fired coal fired	400 600 1,200

Explanations:

1. Based on the assumption that the size of the particulate is 10 micron or more.
2. Based on 1% sulphur content in fuel oil. Higher content of sulphur will cause standards to be pro-rated.
3. In respect of emissions of sulphur dioxide and nitrogen oxides, the power plants operating on oil and coal as fuel shall in addition to NEQS specified above, comply with the standards provided separately.

Source: Government of Pakistan (2000) (SRO 549 (I)/2000).

Table 3: National Environmental Quality Standards for Ambient Air [7]

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).

Table 4: NEQS for Motor Vehicles Exhaust and Noise [8]

(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.		

(b) For Heavy Duty Diesel Engines and Large Goods Vehicles (g/Kwh)

Type of Vehicle	Category/Class	Tiers	CO	HC	NOX	**PM**	Measuring Method	Applicability
Heavy Duty Diesel Engines	Trucks and Buses		4.0	1.1	7.0	0.15	ECE-R-49	Pak-II
Large goods Vehicles	N2 (2000 and up	Pak-II	4.0	7.0	1.10	0.15	EDC	
Parameter	Standard (maximum permissible limit)					Measuring Method		
Noise	85 db (A)					Sound meter at 7.5 meters from the source.		

(ii) Emission Standards for Petrol Vehicles (g/km)

Type of Vehicle	Category/Class	Tiers	CO	HC+ NOX	Measuring Method	Applicability
Passenger	M 1: with reference mass (RW) upto 2500 kg. Cars with RW over 2500 kg to meets NI category standards.	Pak-II	2.20	0.50	NEDC (ECE 15+ EUDCL)	All imported and new models* locally manufactured petrol vehicles with effect from 1st July, 2009**
Light Commercial Vehicles	NI-I (RW<1250 kg)	Pak-II	2.20	0.50		
	NI-I (1250 kg> RW< 1700 kg0	Pak-II	4.00	0.65		
	NI-III (RW>1700 kg)	Pak-II	5.00	0.80		
Motor Rickshaws and motor Cycles	2.4 strokes < 150 cc	Pak-II	5.50	1.50	ECER 40	
	2.4 strokes < 150 cc	Pak-II	5.50	1.30		
Parameter	**Standard (maximum** permissible **limit**				Measuring Method	
Noise	85 db (A)				Sound meter at 7.5 meters from the source.	

Explantations:

DI: Direct Injection
IDI: Indirect Injection
EUDCL: Extra Urban Driving Cycle
NEDC: New Urban Driving Cycle
M: Vehicles designed and constructed for the carriage of passengers and comprising no more than eight seats in addition to the driver's seat.
N: Motor vehicles with at least four wheels designed and constructed for the carriages of goods.
* New model means both model and engine type change
** The existing models of petrol driven vehicles locally manufactured will immediately switch ever to Pak-II emission standards but not later than 30th June, 2012.

Source: Government of Pakistan (2009) (SRO 72 (KE)/ 2009).

Table 5: National Standards for Drinking Water Quality[9]

Properties/Parameters	Standard Values for Pakistan

Properties/Parameters	Standard Values for Pakistan
Bacterial	
All water intended for drinking (E.Coli or Thermo tolerant Coliform bacteria)	Must not be detectable in any 100 ml samples
Treated water entering the distribution system (E.Coli or thermo tolerant coliform and total coliform bacteria)	Must not be detectable in any 100 ml samples
Treated water in the distribution system (E.Coli or thermo tolerant coliform and total coliform bacteria)	Must not be detectable in any 100 ml samples In case of large supplies, where sufficient samples are examined, must not be present in 95% of the samples taken throughout any 12-month period.
Physical	
Color	≤ 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).

Table 6: National Environmental Quality Standards for Noise [10]
Limit in Db(A) Leq*

Category of	**Effective from 1st July 2010**	**Effective from 1st July 2012**

Area/Zone	Day time	Night time	Day time	Night time
Residential area	65	50	55	45
Commercial area	70	60	65	55
Industrial area	80	75	75	65
Silence zone	65	45	50	45

Notes:

1. Day time hours: 6:00 a.m to 10:00 p.m.
2. Night time hours: 10:00 p.m to 6:00 a.m.
3. Silence zone:: Zones that are declared as such by the competent authority. An area comprising not less than 100 m around the hospitals, educational, and courts.
4. Mixed categories of areas may be declared as one of the four above-listed categories by the competent authority.

* dB(A) Leq: time weighted average of the level of sound in decibels on Scale A which is relatable to human hearing.

Source: Governments of Pakistan (2010) (SRO 1064(I)/ 2010).

ANNEXURE – II SOIL SAMPLES RESULTS

Sample#	Source	ECx10³ dsm⁻¹	pH	OM	N	P	K	TSS	$CaCO_3$	Texture(%)			Class
										Clay	Silt	Sand	
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*13*	*14*
427	Indus Minor 1, R.D 1+100	0.1	8.2	0.34	0.017	1.4	40	0.032	10	11.8	64	24.2	Silt Loam
428	Janda Boka Canal, R.D 0+020	0.08	8.5	0.34	0.017	1.1	50	0.026	5	15.8	46	38.2	Loam
429		0.07	8.1	0.4	0.02	1.7	40	0.023	17.5	21.8	74	4.2	Silt Loam
430	Indus Ambar Main Canal, R.D 1+900. Indus Ambar Minor 4, R.D 0+000	0.05	8.3	0.37	0.018	1.1	60	0.016	5	5.8	8	86.2	Loamy Sand
431	Indus Ambar Minor 2, R.D 5+600	0.06	7.5	0.34	0.017	2	40	0.019	5.75	23.8	62	14.2	Silt Loam
432	Indus Ambar Minor 3, R.D 3+500	0.05	8.1	0.51	0.025	9.1	50	0.016	4.75	9.8	8	82.2	Loamy Sand
433	Indus Ambar Main Canal, R.D 10+100	0.06	8.3	0.48	0.024	1.1	30	0.019	16.25	21.8	44	34.2	Loam
434	Indus Ambar Main Canal, R.D 19+200	0.05	8.1	0.51	0.025	1.7	50	0.016	6	7.8	38	54.2	Sandy Loam
435	Indus Minor 1, R.D 0+150	0.12	8.4	0.48	0.024	2	40	0.38	16.75	13.8	83	3.2	Silt Loam
436	Indus Minor 2, R.D 2+300	0.05	8.3	0.58	0.029	1.4	70	0.016	6	11.8	8	80.2	Sandy Loam
437	Indus Ambar Main Canal, R.D 14+200	0.08	8.3	0.4	0.02	4.8	40	0.026	13.25	15.8	62	22.2	Silt Loam
438	Indus Ambar Minor 2, R.D 3+000	0.1	8.2	0.75	0.037	2	50	0.032	13.5	23.8	42	34.2	Loam

Sample#	Source	$ECx10^3$ dsm^{-1}	pH	OM	N	P	K	TSS	$CaCO_3$	Texture(%)			Class
										Clay	Silt	Sand	
439	Indus Disty 1, R.D 5+350	0.19	8	0.13	0.006	2.8	40	0.06	4.5	9.2	14	76.8	Sandy Loam
440	Indus Disty 1, R.D 3+750	0.12	8	0.37	0.018	2.2	40	0.038	3.73	13.2	10	76.8	Sandy Loam
441	Indus Ambar Minor 5, R.D 4+400	0.07	7.8	0.17	0.008	5.7	50	0.023	6	17.2	60	22.8	Silt Loam
442	Indus Disty 1, R.D 1+100	0.066	8	0.13	0.006	7.1	40	0.019	4.25	11.2	10	78.8	Sandy Loam
443	Indus Ambar Main Canal, R.D 0+050	0.09	7.9	0.27	0.013	4	30	0.029	12.5	27.2	56	16.8	Silt Loam
444	Indus Minor 2, R.D 4+400	0.06	7.8	0.27	0.013	2.2	60	0.019	5	15.2	42	42.8	Loam
445	Indus Ambar Minor 2, R.D 1+100	0.09	7.9	-	-	4.5	40	0.029	13.25	25.2	70	4.8	Silt Loam
446	Indus Disty 1, R.D 0+200	0.07	7.8	0.4	0.02	7.1	55	0.023	10	27.2	70	2.8	Silt Loam
447	Indus Ambar Main Canal, R.D 18+500	0.08	7.9	0.34	0.017	2.8	60	0.026	4	17.2	24	58.8	Sandy Loam
448	Indus Ambar Main Canal, R.D 16+600	0.1	7.9	0.2	0.01	3.4	40	0.032	4.5	19.2	16	64.8	Sandy Loam
449	Indus Ambar Main Canal, R.D 17+300	0.08	7.5	0.13	0.006	4	70	0.026	5	11.2	6	82.8	Sandy Loam
450	Indus Ambar Main Canal, R.D 15+600	0.06	7.7	0.51	0.025	2	35	0.019	15	13.2	70	16.8	Silt Loam
451	Indus Ambar Main Canal, R.D 28+200	0.07	7.6	0.17	0.008	1.7	60	0.023	5.5	12.8	63	24.2	Silt Loam
452	Indus Ambar Minor 4, R.D 4+000	0.06	8.2	0.34	0.017	1.1	40	0.019	6.75	11.8	64	24.2	Silt Loam

Sample#	Source	ECx10^3 dsm^{-1}	pH	OM	N	P	K	TSS	$CaCO_3$	Texture(%)			Class
										Clay	Silt	Sand	
453	Indus Ambar Main Canal, R.D 12+700	0.06	7.8	0.62	0.031	2	50	0.019	12	14.8	47	38.2	Loam
454	Indus Ambar Main Canal, R.D 11+800	0.09	8	0.31	0.015	1.4	40	0.029	12.5	11.8	62	26.2	Silt Loam
455	Indus Ambar Main Canal, R.D 6+400	0.21	7.9	0.31	0.015	2.8	45	0.067	6.75	13.8	60	26.2	Silt Loam
456	Indus Ambar Main Canal, R.D 4+200. Indus Ambar Minor 5, R.D 0+000	0.11	8.1	0.37	0.018	2.8	55	0.035	6.5	5.8	9	85.2	Loamy Sand
457	Janda Boka Canal, R.D 6+500	0.1	7.8	0.48	0.024	1.7	35	0.032	6.25	10.8	64	25.2	Silt Loam
458	Indus Ambar Main Canal, R.D 22+150	0.06	7.7	0.4	0.02	2.2	60	0.019	5	12.8	63	24.2	Silt Loam
459	Indus Ambar Main Canal, R.D 8+800	0.08	8	0.48	0.024	4.2	50	0.026	12.5	6.8	39	54.2	Sandy Loam
460	Indus Ambar Main Canal, R.D 1+000. Indus Ambar Main Canal Minor 3, R.D 0+000	0.08	8.1	0.48	0.024	1.7	30	0.026	11.25	17.2	60	22.8	Silt Loam
461	Janda Boka Canal, R.D 4+980	0.09	7.8	0.4	0.02	1.4	45	0.029	10.75	16.2	61	22.8	Silt Loam
462	Indus Minor 1, R.D 2+450	0.11	7.9	0.51	0.025	2.8	35	0.035	11.5	23.8	41	35.2	Loam
463	Indus Ambar Main Canal, R.D 21+000	0.05	7.6	0.48	0.024	2.2	55	0.016	11	11.8	10	78.2	Sandy Loam
464	Indus Ambar Minor 4, R.D 2+800	0.07	8.1	0.4	0.02	2.5	60	0.023	9.5	9.4	8	82.2	Loamy Sand
465	Janda Boka Canal, R.D 3+200	0.04	7.2	0.48	0.024	2.8	40	0.012	10	8.8	10	81.2	Loamy Sand

Sample#	Source	ECx10^3 dsm^{-1}	pH	OM	N	P	K	TSS	$CaCO_3$	Texture(%)			Class
										Clay	Silt	Sand	
466	Janda Boka Canal, R.D 2+000	0.13	7.8	0.4	0.02	1.1	45	0.041	9.5	24.8	58	17.2	Silt Loam

ANNEXURE-III

GROUNDWATER QUALITY MONITORING RESULTS

Government of Pakistan
Ministry of Science & Technology
Pakistan Council of Research in Water Resources
Water Resources Research Center
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WATER QUALITY ANALYSIS REPORT

Report No.	WQL-WRRC-PSH-15/196	Sampling date	15-06-2015
Client Name	ICS-HPK Joint Venture	Sample receipt date	16-06-2015
Client Address	Old Jamrud Lane, University Town.	Temperature C° (at sample receipt)	25
Source		Date of analysis	06-07-2015
Location	Indus Amber Water Sample - 1	Reporting date	17-08-2015

Sr. #	Water quality parameters	Unit	Det. limit	Reference method	Permissible limits (PSQCA, 2008)	Results	Measurement uncertainty
PHYSICAL AND AESTHETIC PARAMETERS							
1.	Color	-	-	Sensory evaluation	Colorless	Colorless	NA
2.	Odor	-	-	Sensory evaluation	Unobjectionable	UO	NA
3.	Taste	-	-	Sensory evaluation	Unobjectionable	UO	NA
4.	E.C	µS/cm	0.2875	APHA, 21st Edition	NGVS	383	±
5.	pH	-	0.02	APHA, 21st Edition	6.5-8.5	7.5	±
6.	Turbidity	NTU	0.2	APHA, 21st Edition	<5	0.89	±
MAJOR CHEMICAL PARAMETERS							
7.	Calcium	ppm	2.0	APHA, 21st Edition	NGVS	56	±
8.	Carbonate	ppm	5.0	APHA, 21st Edition	NGVS	BDL	±
9.	Hardness	ppm	5.0	APHA, 21st Edition	500	220	±
10.	Potassium	ppm	0.2	APHA, 21st Edition	NGVS	01	±
11.	TDS	ppm	-	APHA, 21st Edition	1000 (WHO, 2004)	230	±
12.	Nitrate	ppm	0.06	APHA, 21st Edition	10	1.5	±
13.	Nitrite (NO_2)	ppm	0.05	USEPA 2000	1	BDL	±
14.	Phosphate	ppm	0.05	USEPA 2000	NGVS	0.11	±
15.	Arsenic	ppb	0.15	APHA, 21st Edition	50	1.41	±
16.	COD	ppm	6.0	APHA, 21st Edition	150	BDL	±
17.	DO	ppm	0.6	APHA, 21st Edition	No limit listed	5.89	±
18.	TSS	mg/l	-	NEQS 1999	200	BDL	±
MICROBIOLOGICAL PARAMETERS							
19.	Total Coliform	MPN/100ml		APHA, 21st Edition	Nil	07	NA
20.	Fecal Coliform	MPN/100ml		APHA, 21st Edition	Nil	0	NA
21.	E.Coli	+Ve/-Ve		APHA, 21st Edition	-Ve	-Ve	NA

Quality of Water	Safe ☐	Unsafe ☒

Abbreviations:

NGVS No Guideline Value Set
MPN Maximum Probable Number
E.C Electrical conductivity
WHO World Health Organization
BDL Below Detecting Level
EC European Community
NT Not Tested

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Prepared By: ____________

Checked By: ____________

QC In charge: ____________

Lab. In charge ____________

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WATER QUALITY ANALYSIS REPORT

Report No.	WQL-WRRC-PSH-15/ 197	Sampling date	15-06-2015
Client Name	ICS-HPK Joint Venture	Sample receipt date	16-06-2015
Client Address	Old Jamrud Lane, University Town	Temperature C° (at sample receipt)	25
Source		Date of analysis	06-07-2015
Location	Indus Amber Water Sample-2	Reporting date	17-08-2015

Sr. #	Water quality parameters	Unit	Det. limit	Reference method	Permissible limits (PSQCA, 2008)	Results	Measurement uncertainty
PHYSICAL AND AESTHETIC PARAMETERS							
1.	Color	-	-	Sensory evaluation	Colorless	Colorless	NA
2.	Odor	-	-	Sensory evaluation	Unobjectionable	UO	NA
3.	Taste	-	-	Sensory evaluation	Unobjectionable	UO	NA
4.	E.C	µS/cm	0.2875	APHA, 21st Edition	NGVS	378	±
5.	pH	-	0.02	APHA, 21st Edition	6.5-8.5	7.9	±
6.	Turbidity	NTU	0.2	APHA, 21st Edition	<5	0.5	±
MAJOR CHEMICAL PARAMETERS							
7.	Calcium	ppm	2.0	APHA, 21st Edition	NGVS	44	±
8.	Carbonate	ppm	5.0	APHA, 21st Edition	NGVS	BDL	±
9.	Hardness	ppm	5.6	APHA, 21st Edition	500	210	±
10.	Potassium	ppm	0.2	APHA, 21st Edition	NGVS	01	±
11.	TDS	ppm	-	APHA, 21st Edition	1000 (WHO, 2004)	227	±
12.	Nitrate	ppm	0.06	APHA, 21st Edition	10	1.5	±
13.	Nitrite (NO_2)	ppm	0.05	USEPA 2000	3	BDL	±
14.	Phosphate	ppm	0.05	USEPA 2000	NGVS	0.08	±
15.	Arsenic	ppb	0.13	APHA, 21st Edition	50	2.0	±
16.	COD	ppm	6.0	APHA, 21st Edition	150	07	±
17.	DO	ppm	0.6	APHA, 21st Edition	No limit listed	6.5	±
18.	TSS	mg/l	-	NEQS 1999	200	BDL	±
MICROBIOLOGICAL PARAMETERS							
19.	Total Coliform	MPN/100ml		APHA, 21st Edition	Nil	15	NA
20.	Fecal Coliform	MPN/100ml		APHA, 21st Edition	Nil	05	NA
21.	E.Coli	+Ve/-Ve		APHA, 21st Edition	-Ve	+Ve	NA

Quality of Water	Safe ☐	Unsafe ☒

Abbreviations:
NGVS No Guideline Value Set
MPN Maximum Probable Number
E/C Electrical conductivity
WHO World Health Organization
BDL Below Detecting Level
EC European Community
NT Not Tested

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WATER QUALITY ANALYSIS REPORT

Report No.	WQL-WRRC-PSH-15/ 178	Sampling date	15-06-2015
Client Name	ICS-HPK Joint Venture	Sample receipt date	16-06-2015
Client Address	Old Jamrud Lane, University Town	Temperature C° (at sample receipt)	25
Source		Date of analysis	06-07-2015
Location	Indus Amber Water Sample-3	Reporting date	17-08-2015

Sr. #	Water quality parameters	Unit	Det. limit	Reference method	Permissible limits (PSQCA, 2008)	Results	Measurement uncertainty
PHYSICAL AND AESTHETIC PARAMETERS							
1.	Color	-	-	Sensory evaluation	Colorless	Colorless	NA
2.	Odor	-	-	Sensory evaluation	Unobjectionable	UO	NA
3.	Taste	-	-	Sensory evaluation	Unobjectionable	UO	NA
4.	E.C	µS/cm	0.2875	APHA, 21st Edition	NGVS	333	±
5.	pH	-	0.02	APHA, 21st Edition	6.5-8.5	8.1	±
6.	Turbidity	NTU	0.2	APHA, 21st Edition	<5	0.03	±
MAJOR CHEMICAL PARAMETERS							
7.	Calcium	ppm	2.0	APHA, 21st Edition	NGVS	36	±
8.	Carbonate	ppm	5.0	APHA, 21st Edition	NGVS	BDL	±
9.	Hardness	ppm	5.0	APHA, 21st Edition	500	230	±
10.	Potassium	ppm	0.2	APHA, 21st Edition	NGVS	01	±
11.	TDS	ppm	-	APHA, 21st Edition	1000 (WHO, 2004)	193	±
12.	Nitrate	ppm	0.06	APHA, 21st Edition	10	0.6	±
13.	Nitrite (NO_2)	ppm	0.05	USEPA 2000	3	BDL	±
14.	Phosphate	ppm	0.05	USEPA 2000	NGVS	0.11	±
15.	Arsenic	ppb	0.13	APHA, 21st Edition	50	2.8	±
16.	COD	ppm	6.0	APHA, 21st Edition	150	09	±
17.	DO	ppm	0.6	APHA, 21st Edition	No limit listed	6.05	±
18.	TSS	mg/l	-	NEQS 1999	200	BDL	±
MICROBIOLOGICAL PARAMETERS							
19.	Total Coliform	MPN/100ml		APHA, 21st Edition	Nil	10	NA
20.	Fecal Coliform	MPN/100ml		APHA, 21st Edition	Nil	0	NA
21.	E.Coli	+Ve/-Ve		APHA, 21st Edition	-Ve	-Ve	NA

Quality of Water	**Safe** ☐	**Unsafe** ☒

Abbreviations:

NGVS No Guideline Value Set
MPN Maximum Probable Number
EC Electrical conductivity
WHO World Health Organization
BDL Below Detecting Level
EC European Community
NT Not Tested

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WATER QUALITY ANALYSIS REPORT

Report No.	WQL-WRRC-PSH-15/ 199	Sampling date	15-06-2015
Client Name	ICS-HPK Joint Venture	Sample receipt date	16-06-2015
Client Address	Old Jamrud Lane, University Town	Temperature C° (at sample receipt)	25
Source		Date of analysis	06-07-2015
Location	Indus Amber Water Sample-4	Reporting date	17-08-2015

Sr. #	Water quality parameters	Unit	Det. limit	Reference method	Permissible limits (PSQCA, 2008)	Results	Measurement uncertainty
PHYSICAL AND AESTHETIC PARAMETERS							
1.	Color	-	-	Sensory evaluation	Colorless	Colorless	NA
2.	Odor	-	-	Sensory evaluation	Unobjectionable	UO	NA
3.	Taste	-	-	Sensory evaluation	Unobjectionable	UO	NA
4.	E.C	µS/cm	0.2875	APHA, 21st Edition	NGVS	322	±
5.	pH	-	0.02	APHA, 21st Edition	6.5-8.5	8.2	±
6.	Turbidity	NTU	0.2	APHA, 21st Edition	<5	0.05	±
MAJOR CHEMICAL PARAMETERS							
7.	Calcium	ppm	3.0	APHA, 21st Edition	NGVS	36	±
8.	Carbonate	ppm	5.0	APHA, 21st Edition	NGVS	BDL	±
9.	Hardness	ppm	5.0	APHA, 21st Edition	500	200	±
10.	Potassium	ppm	0.2	APHA, 21st Edition	NGVS	01	±
11.	TDS	ppm	-	APHA, 21st Edition	1000 (WHO, 2004)	193	±
12.	Nitrate	ppm	0.06	APHA, 21st Edition	10	0.6	±
13.	Nitrite (NO_2)	ppm	0.05	USEPA 2000	3	BDL	±
14.	Phosphate	ppm	0.05	USEPA 2000	NGVS	0.13	±
15.	Arsenic	ppb	0.13	APHA, 21st Edition	50	2.8	±
16.	COD	ppm	6.0	APHA, 21st Edition	150	09	±
17.	DO	ppm	0.6	APHA, 21st Edition	No limit listed	6.05	±
18.	TSS	mg/l	-	NEQS 1999	200	BDL	±
MICROBIOLOGICAL PARAMETERS							
19.	Total Coliform	MPN/100ml		APHA, 21st Edition	Nil	16	NA
20.	Fecal Coliform	MPN/100ml		APHA, 21st Edition	Nil	08	NA
21.	E.Coli	+Ve/-Ve		APHA, 21st Edition	-Ve	+Ve	NA

Quality of Water	Safe ☐	Unsafe ☒

Abbreviations:

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MPN Maximum Probable Number
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WATER QUALITY ANALYSIS REPORT

Report No.	WQL-WRRC-PSH-15/206	Sampling date	15-06-2015
Client Name	ICS-HPK Joint Venture	Sample receipt date	16-06-2015
Client Address	Old Jamrud Lane, University Town	Temperature C° (@sample receipt)	25
Source		Date of analysis	06-07-2015
Location	Indus Amber Water Sample-5	Reporting date	17-08-2015

Sr. #	Water quality parameters	Unit	Det. limit	Reference method	Permissible limits (PSQCA, 2008)	Results	Measurement uncertainty
PHYSICAL AND AESTHETIC PARAMETERS							
1.	Color	-	-	Sensory evaluation	Colorless	Colorless	NA
2.	Odor	-	-	Sensory evaluation	Unobjectionable	UO	NA
3.	Taste	-	-	Sensory evaluation	Unobjectionable	UO	NA
4.	E.C	µS/cm	0.7875	APHA, 21st Edition	NGVS	309	±
5.	pH	-	0.02	APHA, 21st Edition	6.5-8.5	8.2	±
6.	Turbidity	NTU	0.2	APHA, 21st Edition	<5	0.2	±
MAJOR CHEMICAL PARAMETERS							
7.	Calcium	ppm	2.0	APHA, 21st Edition	NGVS	40	±
8.	Carbonate	ppm	5.0	APHA, 21st Edition	NGVS	BDL	±
9.	Hardness	ppm	5.0	APHA, 21st Edition	500	220	±
10.	Potassium	ppm	0.2	APHA, 21st Edition	NGVS	01	±
11.	TDS	ppm	-	APHA, 21st Edition	1000 (WHO, 2004)	185	±
12.	Nitrate	ppm	0.06	APHA, 21st Edition	10	1.5	±
13.	Nitrite (NO_2)	ppm	0.05	USEPA 2000	3	BDL	±
14.	Phosphate	ppm	0.05	USEPA 2000	NGVS	0.20	±
15.	Arsenic	ppb	0.13	APHA, 21st Edition	50	1.59	±
16.	COD	ppm	6.0	APHA, 21st Edition	150	08	±
17.	DO	ppm	0.6	APHA, 21st Edition	No limit listed	5.9	±
18.	TSS	mg/l	-	NEQS 1999	200	BDL	±
MICROBIOLOGICAL PARAMETERS							
19.	Total Coliform	MPN/100ml		APHA, 21st Edition	Nil	20	NA
20.	Fecal Coliform	MPN/100ml		APHA, 21st Edition	Nil	09	NA
21.	E.Coli	+Ve/-Ve		APHA, 21st Edition	-Ve	+Ve	NA

Quality of Water	**Safe** ☐	**Unsafe** ☒

Abbreviations:
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MPN Maximum Probable Number
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WHO World Health Organization
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WATER QUALITY ANALYSIS REPORT

Report No.	WQL-WRRC-PSH-15/2p.f	Sampling date	15-06-2015
Client Name	ICS-HPK Joint Venture	Sample receipt date	16-06-2015
Client Address	Old Jamrud Lane, University Town	Temperature C° (at sample receipt)	25
Source		Date of analysis	06-07-2015
Location	Indus Amber Water Sample-6	Reporting date	17-08-2015

Sr. #	Water quality parameters	Unit	Det. limit	Reference method	Permissible limits (PSQCA, 2008)	Results	Measurement uncertainty
PHYSICAL AND AESTHETIC PARAMETERS							
1.	Color	-	-	Sensory evaluation	Colorless	Colorless	NA
2.	Odor	-	-	Sensory evaluation	Unobjectionable	UO	NA
3.	Taste	-	-	Sensory evaluation	Unobjectionable	UO	NA
4.	E.C	uS/cm	0.2875	APHA, 21st Edition	NGVS	368	±
5.	pH	-	0.02	APHA, 21st Edition	6.5-8.5	8.1	±
6.	Turbidity	NTU	0.2	APHA, 21st Edition	<5	1.12	±
MAJOR CHEMICAL PARAMETERS							
7.	Calcium	ppm	2.0	APHA, 21st Edition	NGVS	48	±
8.	Carbonate	ppm	5.0	APHA, 21st Edition	NGVS	BDL	±
9.	Hardness	ppm	5.0	APHA, 21st Edition	500	300	±
10.	Potassium	ppm	0.2	APHA, 21st Edition	NGVS	01	±
11.	TDS	ppm	-	APHA, 21st Edition	1000 (WHO, 2004)	221	±
12.	Nitrate	ppm	0.06	APHA, 21st Edition	10	1.5	±
13.	Nitrite (NO_2)	ppm	0.05	USEPA 2000	3	BDL	±
14.	Phosphate	ppm	0.05	USEPA 2000	NGVS	0.25	±
15.	Arsenic	ppb	0.13	APHA, 21st Edition	50	1.25	±
16.	COD	ppm	6.0	APHA, 21st Edition	150	12	±
17.	DO	ppm	0.6	APHA, 21st Edition	No limit listed	5.87	±
18.	TSS	mg/l	-	NEQS 1999	200	0.02	±
MICROBIOLOGICAL PARAMETERS							
19.	Total Coliform	MPN/100ml		APHA, 21st Edition	Nil	50	NA
20.	Fecal Coliform	MPN/100ml		APHA, 21st Edition	Nil	30	NA
21.	E.Coli	+Ve/-Ve		APHA, 21st Edition	-Ve	+Ve	NA

Quality of Water	Safe ☐	Unsafe ☒

Abbreviations:

NGVS No Guideline Value Set
MPN Maximum Probable Number
E.C Electrical conductivity
WHO World Health Organization
BDL Below Detecting Level
EC European Community
NT Not Tested

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WATER QUALITY ANALYSIS REPORT

Report No.	WQL-WRRC-PSH-15/262	Sampling date	15-06-2015
Client Name	ICS-HPK Joint Venture	Sample receipt date	16-06-2015
Client Address	Old Jamrud Lane, University Town	Temperature C° (at sample receipt)	25
Source		Date of analysis	06-07-2015
Location	Indus Amber Water Sample-7	Reporting date	17-08-2015

Sr. #	Water quality parameters	Unit	Det. limit	Reference method	Permissible limits (PSQCA, 2008)	Results	Measurement uncertainty
PHYSICAL AND AESTHETIC PARAMETERS							
1.	Color	-	-	Sensory evaluation	Colorless	Colorless	NA
2.	Odor	-	-	Sensory evaluation	Unobjectionable	UO	NA
3.	Taste	-	-	Sensory evaluation	Unobjectionable	UO	NA
4.	E.C	µS/cm	0.2875	APHA, 21st Edition	NGVS	348	±
5.	pH	-	0.02	APHA, 21st Edition	6.5-8.5	8.1	±
6.	Turbidity	NTU	0.2	APHA, 21st Edition	<5	0.73	±
MAJOR CHEMICAL PARAMETERS							
7.	Calcium	ppm	2.0	APHA, 21st Edition	NGVS	40	±
8.	Carbonate	ppm	3.0	APHA, 21st Edition	NGVS	BDL	±
9.	Hardness	ppm	5.0	APHA, 21st Edition	500	190	±
10.	Potassium	ppm	0.2	APHA, 21st Edition	NGVS	01	±
11.	TDS	ppm	-	APHA, 21st Edition	1000 (WHO, 2004)	209	±
12.	Nitrate	ppm	0.06	APHA, 21st Edition	10	1.5	±
13.	Nitrite (NO_2)	ppm	0.05	USEPA 2000	3	BDL	±
14.	Phosphate	ppm	0.05	USEPA 2000	NGVS	0.21	±
15.	Arsenic	ppb	0.13	APHA, 21st Edition	50	2.1	±
16.	COD	ppm	6.0	APHA, 21st Edition	150	BDL	±
17.	DO	ppm	0.6	APHA, 21st Edition	No limit listed	6.2	±
18.	TSS	mg/l	-	NEQS 1999	200	BDL	±
MICROBIOLOGICAL PARAMETERS							
19.	Total Coliform	MPN/100ml		APHA, 21st Edition	Nil	20	NA
20.	Fecal Coliform	MPN/100ml		APHA, 21st Edition	Nil	10	NA
21.	E.Coli	+Ve/-Ve		APHA, 21st Edition	-Ve	+Ve	NA

Quality of Water	**Safe** ☐	Unsafe ☒

Abbreviations:

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MPN Maximum Probable Number
E.C Electrical conductivity
WHO World Health Organization
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EC European Community
NT Not Tested

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WATER QUALITY ANALYSIS REPORT

Report No.	WQL-WRRC-PSH-15/263	Sampling date	15-06-2015
Client Name	KS-HPK Joint Venture	Sample receipt date	16-06-2015
Client Address	Old Jamrud Lane, University Town	Temperature C° (at sample receipt)	25
Source		Date of analysis	06-07-2015
Location	Indus Amber Water Sample-8	Reporting date	17-08-2015

Sr. #	Water quality parameters	Unit	Det. limit	Reference method	Permissible limits (PSQCA, 2008)	Results	Measurement uncertainty
PHYSICAL AND AESTHETIC PARAMETERS							
1.	Color	-	-	Sensory evaluation	Colorless	Colorless	NA
2.	Odor	-	-	Sensory evaluation	Unobjectionable	UO	NA
3.	Taste	-	-	Sensory evaluation	Unobjectionable	UO	NA
4.	EC	µS/cm	0.2875	APHA, 21st Edition	NGVS	296	±
5.	pH	-	0.02	APHA, 21st Edition	6.5-8.5	8.3	±
6.	Turbidity	NTU	0.2	APHA, 21st Edition	<5	2.02	±
MAJOR CHEMICAL PARAMETERS							
7.	Calcium	ppm	2.0	APHA, 21st Edition	NGVS	0.9	±
8.	Carbonate	ppm	5.0	APHA, 21st Edition	NGVS	BDL	±
9.	Hardness	ppm	5.0	APHA, 21st Edition	500	160	±
10.	Potassium	ppm	0.2	APHA, 21st Edition	NGVS	01	±
11.	TDS	ppm	-	APHA, 21st Edition	1000 (WHO, 2004)	178	±
12.	Nitrate	ppm	0.06	APHA, 21st Edition	10	1.1	±
13.	Nitrite (NO_2)	ppm	0.05	USEPA 2000	3	BDL	±
14.	Phosphate	ppm	0.05	USEPA 2000	NGVS	0.17	±
15.	Arsenic	ppb	0.13	APHA, 21st Edition	50	2.2	±
16.	COD	ppm	6.0	APHA, 21st Edition	150	BDL	±
17.	DO	ppm	0.6	APHA, 21st Edition	No limit listed	5.97	±
18.	TSS	mg/l	-	NEQS 1999	200	0.025	±
MICROBIOLOGICAL PARAMETERS							
19.	Total Coliform	MPN/100ml		APHA, 21st Edition	Nil	50	NA
20.	Fecal Coliform	MPN/100ml		APHA, 21st Edition	Nil	22	NA
21.	E.Coli	+Ve/-Ve		APHA, 21st Edition	-Ve	+Ve	NA

Quality of Water	Safe ☐	Unsafe ☒

Abbreviations:

NGVS No Guideline Value Set | **WHO** World Health Organization | **EC** European Community
MPN Maximum Probable Number | **BDL** Below Detecting Level | **NT** Not Tested
E.C Electrical conductivity

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WATER QUALITY ANALYSIS REPORT

Report No.	WQL-WRRC-PSH-15/269	Sampling date	15-06-2015
Client Name	ICS-HPK Joint Venture	Sample receipt date	16-06-2015
Client Address	Old Jamrud Lane, University Town	Temperature C° (at sample receipt)	25
Source		Date of analysis	06-07-2015
Location	Indus Amber Water Sample-9	Reporting date	17-08-2015

Sr. #	Water quality parameters	Unit	Det. limit	Reference method	Permissible limits (PSQCA, 2008)	Results	Measurement uncertainty
PHYSICAL AND AESTHETIC PARAMETERS							
1.	Color	-	-	Sensory evaluation	Colorless	Colorless	NA
2.	Odor	-	-	Sensory evaluation	Unobjectionable	UO	NA
3.	Taste	-	-	Sensory evaluation	Unobjectionable	UO	NA
4.	E.C	µS/cm	0.2875	APHA, 21st Edition	NGVS	317	±
5.	pH	-	0.02	APHA, 21st Edition	6.5-8.5	8.4	±
6.	Turbidity	NTU	0.2	APHA, 21st Edition	<5	0.39	±
MAJOR CHEMICAL PARAMETERS							
7.	Calcium	ppm	2.0	APHA, 21st Edition	NGVS	36	±
8.	Carbonate	ppm	5.0	APHA, 21st Edition	NGVS	BDL	±
9.	Hardness	ppm	5.0	APHA, 21st Edition	500	170	±
10.	Potassium	ppm	0.2	APHA, 21st Edition	NGVS	02	±
11.	TDS	ppm	-	APHA, 21st Edition	1000 (WHO, 2004)	190	±
12.	Nitrate	ppm	0.06	APHA, 21st Edition	10	0.8	±
13.	Nitrite (NO_2)	ppm	0.05	USEPA 2000	3	BDL	±
14.	Phosphate	ppm	0.05	USEPA 2000	NGVS	0.10	±
15.	Arsenic	ppb	0.13	APHA, 21st Edition	50	1.97	±
16.	COD	ppm	6.0	APHA, 21st Edition	150	07	±
17.	DO	ppm	0.6	APHA, 21st Edition	No limit listed	6.07	±
18.	TSS	mg/l	-	NEQS 1999	200	BDL	±
MICROBIOLOGICAL PARAMETERS							
19.	Total Coliform	MPN/100ml		APHA, 21st Edition	Nil	44	NA
20.	Fecal Coliform	MPN/100ml		APHA, 21st Edition	Nil	18	NA
21.	E.Coli	+Ve/-Ve		APHA, 21st Edition	-Ve	+Ve	NA

Quality of Water	Safe ☐	Unsafe ☒

Abbreviations:

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MPN Maximum Probable Number
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WATER QUALITY ANALYSIS REPORT

Report No.	WQL-WRRC-PSH-15/265	Sampling date	15-06-2015
Client Name	ICS-HPK Joint Venture	Sample receipt date	16-06-2015
Client Address	Old Jamrud Lane, University Town	Temperature C° (at sample receipt)	25
Source		Date of analysis	06-07-2015
Location	Indus Amber Water Sample-10	Reporting date	17-08-2015

Sr. #	Water quality parameters	Unit	Det. limit	Reference method	Permissible limits (PSQCA, 2008)	Results	Measurement uncertainty
PHYSICAL AND AESTHETIC PARAMETERS							
1.	Color	-	-	Sensory evaluation	Colorless	Colorless	NA
2.	Odor	-	-	Sensory evaluation	Unobjectionable	UO	NA
3.	Taste	-	-	Sensory evaluation	Unobjectionable	UO	NA
4.	E.C	µS/cm	0.2875	APHA, 21st Edition	NGVS	327	±
5.	pH	-	0.02	APHA, 21st Edition	6.5-8.5	8.4	±
6.	Turbidity	NTU	0.2	APHA, 21st Edition	<5	0.38	±
MAJOR CHEMICAL PARAMETERS							
7.	Calcium	ppm	2.0	APHA, 21st Edition	NGVS	28	±
8.	Carbonate	ppm	5.0	APHA, 21st Edition	NGVS	BDL	±
9.	Hardness	ppm	5.0	APHA, 21st Edition	500	200	±
10.	Potassium	ppm	0.2	APHA, 21st Edition	NGVS	01	±
11.	TDS	ppm	-	APHA, 21st Edition	1000 (WHO, 2004)	196	±
12.	Nitrate	ppm	0.06	APHA, 21st Edition	10	1.3	±
13.	Nitrite (NO_2)	ppm	0.05	USEPA 2000	3	BDL	±
14.	Phosphate	ppm	0.05	USEPA 2000	NGVS	0.21	±
15.	Arsenic	ppb	0.13	APHA, 21st Edition	50	1.57	±
16.	COD	ppm	6.0	APHA, 21st Edition	150	16	±
17.	DO	ppm	0.6	APHA, 21st Edition	No limit listed	6.12	±
18.	TSS	mg/l	-	NEQS 1999	200	BDL	±
MICROBIOLOGICAL PARAMETERS							
19.	Total Coliform	MPN/100ml		APHA, 21st Edition	Nil	30	NA
20.	Fecal Coliform	MPN/100ml		APHA, 21st Edition	Nil	15	NA
21.	E.Coli	+Ve/-Ve		APHA, 21st Edition	-Ve	+Ve	NA

Quality of Water	Safe ☐	Unsafe ☒

Abbreviations:
NGVS No Guideline Value Set
MPN Maximum Probable Number
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WATER QUALITY ANALYSIS REPORT

Report No.	WQL-WRRC-PSH-15/264	Sampling date	15-06-2015
Client Name	ICS-HPK Joint Venture	Sample receipt date	16-06-2015
Client Address	Old Jamrud Lane, University Town	Temperature C° (at sample receipt)	25
Source		Date of analysis	06-07-2015
Location	Indus Amber Water Sample-11	Reporting date	17-08-2015

Sr. #	Water quality parameters	Unit	Det. limit	Reference method	Permissible limits (PSQCA, 2008)	Results	Measurement uncertainty
PHYSICAL AND AESTHETIC PARAMETERS							
1.	Color	-	-	Sensory evaluation	Colorless	Colorless	NA
2.	Odor	-	-	Sensory evaluation	Unobjectionable	UO	NA
3.	Taste	-	-	Sensory evaluation	Unobjectionable	UO	NA
4.	E.C	µS/cm	0.2875	APHA, 21st Edition	NGVS	358	±
5.	pH	-	0.02	APHA, 21st Edition	6.5-8.5	8.3	±
6.	Turbidity	NTU	0.2	APHA, 21st Edition	<5	0.78	±
MAJOR CHEMICAL PARAMETERS							
7.	Calcium	ppm	2.0	APHA, 21st Edition	NGVS	48	±
8.	Carbonate	ppm	5.0	APHA, 21st Edition	NGVS	BDL	±
9.	Hardness	ppm	5.0	APHA, 21st Edition	500	200	±
10.	Potassium	ppm	0.2	APHA, 21st Edition	NGVS	1	±
11.	TDS	ppm	-	APHA, 21st Edition	1000 (WHO, 2004)	172	±
12.	Nitrate	ppm	0.06	APHA, 21st Edition	10	1.3	±
13.	Nitrite (NO_2)	ppm	0.05	USEPA 2000	3	BDL	±
14.	Phosphate	ppm	0.05	USEPA 2000	NGVS	0.26	±
15.	Arsenic	ppb	0.13	APHA, 21st Edition	2.17	2.17	±
16.	COD	ppm	6.0	APHA, 21st Edition	150	12	±
17.	DO	ppm	0.6	APHA, 21st Edition	No limit listed	6.02	±
18.	TSS	mg/l	-	NEQS 1999	200	BDL	±
MICROBIOLOGICAL PARAMETERS							
19.	Total Coliform	MPN/100ml		APHA, 21st Edition	Nil	30	NA
20.	Fecal Coliform	MPN/100ml		APHA, 21st Edition	Nil	Nil	NA
21.	E.Coli	+Ve/-Ve		APHA, 21st Edition	-Ve	-Ve	NA

Quality of Water	Safe ☐	Unsafe ☒

Abbreviations:

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WATER QUALITY ANALYSIS REPORT

Report No.	WQL-WRRC-PSH-15/d 67	Sampling date	15-06-2015
Client Name	ICS-HPK Joint Venture	Sample receipt date	16-06-2015
Client Address	Old Jamrud Lane, University Town	Temperature C° (at sample receipt)	25
Source		Date of analysis	06-07-2015
Location	Indus Amber Water Sample-17	Reporting date	17-08-2015

Sr. #	Water quality parameters	Unit	Det. limit	Reference method	Permissible limits (PSQCA, 2008)	Results	Measurement uncertainty
PHYSICAL AND AESTHETIC PARAMETERS							
1.	Color	-	-	Sensory evaluation	Colorless	Colorless	NA
2.	Odor	-	-	Sensory evaluation	Unobjectionable	UO	NA
3.	Taste	-	-	Sensory evaluation	Unobjectionable	UO	NA
4.	EC	µS/cm	0.2875	APHA, 21[st] Edition	NGVS	287	±
5.	pH	-	0.02	APHA, 21[st] Edition	6.5-8.5	8.3	±
6.	Turbidity	NTU	0.2	APHA, 21[st] Edition	<5	0.16	±
MAJOR CHEMICAL PARAMETERS							
7.	Calcium	ppm	2.0	APHA, 21[st] Edition	NGVS	28	±
8.	Carbonate	ppm	5.0	APHA, 21[st] Edition	NGVS	BDL	±
9.	Hardness	ppm	5.0	APHA, 21[st] Edition	500	170	±
10.	Potassium	ppm	0.2	APHA, 21[st] Edition	NGVS	1	±
11.	TDS	ppm	-	APHA, 21[st] Edition	1000 (WHO, 2004)	143	±
12.	Nitrate	ppm	0.06	APHA, 21[st] Edition	10	0.3	±
13.	Nitrite (NO_2)	ppm	0.05	USEPA 2000	3	BDL	±
14.	Phosphate	ppm	0.05	USEPA 2000	NGVS	0.22	±
15.	Arsenic	ppb	0.13	APHA, 21[st] Edition	50	2.6	±
16.	COD	ppm	6.0	APHA, 21[st] Edition	150	BDL	±
17.	DO	ppm	0.6	APHA, 21[st] Edition	No limit listed	6.0	±
18.	TSS	mg/l	-	NEQS 1999	200	BDL	±
MICROBIOLOGICAL PARAMETERS							
19.	Total Coliform	MPN/100ml		APHA, 21[st] Edition	Nil	25	NA
20.	Fecal Coliform	MPN/100ml		APHA, 21[st] Edition	Nil	15	NA
21.	E.Coli	+Ve/-Ve		APHA, 21[st] Edition	-Ve	+Ve	NA

Quality of Water	Safe ☐	Unsafe ☒

Abbreviations:

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WATER QUALITY ANALYSIS REPORT

Report No.	WQL-WRRC-PSH-15/268	Sampling date	15-06-2015
Client Name	ICS-HPK Joint Venture	Sample receipt date	16-06-2015
Client Address	Old Jamrud Lane, University Town	Temperature C° (at sample receipt)	25
Source		Date of analysis	06-07-2015
Location	Indus Amber Water Sample-13	Reporting date	17-08-2015

Sr. #	Water quality parameters	Unit	Det. limit	Reference method	Permissible limits (PSQCA, 2008)	Results	Measurement uncertainty
PHYSICAL AND AESTHETIC PARAMETERS							
1.	Color	-	-	Sensory evaluation	Colorless	Colorless	NA
2.	Odor	-	-	Sensory evaluation	Unobjectionable	UO	NA
3.	Taste	-	-	Sensory evaluation	Unobjectionable	UO	NA
4.	E.C	µS/cm	0.2875	APHA, 21st Edition	NGVS	383	±
5.	pH	-	0.02	APHA, 21st Edition	6.5-8.5	8.3	±
6.	Turbidity	NTU	0.2	APHA, 21st Edition	<5	1.19	±
MAJOR CHEMICAL PARAMETERS							
7.	Calcium	ppm	2.0	APHA, 21st Edition	NGVS	44	±
8.	Carbonate	ppm	5.0	APHA, 21st Edition	NGVS	BDL	±
9.	Hardness	ppm	5.0	APHA, 21st Edition	500	170	±
10.	Potassium	ppm	0.2	APHA, 21st Edition	NGVS	1	±
11.	TDS	ppm	-	APHA, 21st Edition	1000 (WHO, 2004)	193	±
12.	Nitrate	ppm	0.06	APHA, 21st Edition	10	1.0	±
13.	Nitrite (NO_2)	ppm	0.05	USEPA 2000	3	BDL	±
14.	Phosphate	ppm	0.05	USEPA 2000	NGVS	0.23	±
15.	Arsenic	ppb	0.13	APHA, 21st Edition	50	3.34	±
16.	COD	ppm	6.0	APHA, 21st Edition	150	6.27	±
17.	DO	ppm	0.6	APHA, 21st Edition	No limit listed	9.6	±
18.	TSS	mg/l	-	NEQS 1999	200	BDL	±
MICROBIOLOGICAL PARAMETERS							
19.	Total Coliform	MPN/100ml		APHA, 21st Edition	Nil	28	NA
20.	Fecal Coliform	MPN/100ml		APHA, 21st Edition	Nil	15	NA
21.	E.Coli	+Ve/-Ve		APHA, 21st Edition	-Ve	+Ve	NA

Quality of Water	Safe ☐	Unsafe ☒

Abbreviations:

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MPN Maximum Probable Number
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QC In charge: ______________ **Lab. In charge** ______________

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Ph: # 091-9217807-Fax: # 091-9217816, e-mail: pcrwrpsh@yahoo.com

WATER QUALITY ANALYSIS REPORT

Report No.	WQL-WRRC-PSII-15/269	Sampling date	15-06-2015
Client Name	ICS-HPK Joint Venture	Sample receipt date	16-06-2015
Client Address	Old Jamrud Lane, University Town	Temperature C° (at sample receipt)	25
Source		Date of analysis	06-07-2015
Location	Indus Amber Water Sample-14	Reporting date	17-08-2015

Sr. #	Water quality parameters	Unit	Det. limit	Reference method	Permissible limits (PSQCA, 2008)	Results	Measurement uncertainty
PHYSICAL AND AESTHETIC PARAMETERS							
1.	Color	-	-	Sensory evaluation	Colorless	Colorless	NA
2.	Odor	-	-	Sensory evaluation	Unobjectionable	UO	NA
3.	Taste	-	-	Sensory evaluation	Unobjectionable	UO	NA
4.	E.C	µS/cm	0.2875	APHA, 21st Edition	NGVS	788	±
5.	pH	-	0.02	APHA, 21st Edition	6.5-8.5	8.3	±
6.	Turbidity	NTU	0.2	APHA, 21st Edition	<5	0.82	±
MAJOR CHEMICAL PARAMETERS							
7.	Calcium	ppm	2.0	APHA, 21st Edition	NGVS	24	±
8.	Carbonate	ppm	5.0	APHA, 21st Edition	NGVS	BDL	±
9.	Hardness	ppm	5.0	APHA, 21st Edition	500	290	±
10.	Potassium	ppm	0.2	APHA, 21st Edition	NGVS	02	±
11.	TDS	ppm	-	APHA, 21st Edition	1000 (WHO, 2004)	394	±
12.	Nitrate	ppm	0.06	APHA, 21st Edition	10	1.7	±
13.	Nitrite (NO_2)	ppm	0.05	USEPA 2000	3	0.09	±
14.	Phosphate	ppm	0.05	USEPA 2000	NGVS	0.29	±
15.	Arsenic	ppb	0.13	APHA, 21st Edition	50	2.19	±
16.	COD	ppm	6.0	APHA, 21st Edition	150	BDL	±
17.	DO	ppm	0.6	APHA, 21st Edition	No limit listed	5.95	±
18.	TSS	mg/l	-	NEQS 1999	200	BDL	±
MICROBIOLOGICAL PARAMETERS							
19.	Total Coliform	MPN/100ml		APHA, 21st Edition	Nil	30	NA
20.	Fecal Coliform	MPN/100ml		APHA, 21st Edition	Nil	10	NA
21.	E.Coli	+Ve/-Ve		APHA, 21st Edition	-Ve	+Ve	NA

Quality of Water	Safe ☐	Unsafe ☒

Abbreviations:

NGVS No Guideline Value Set
MPN Maximum Probable Number
E.C Electrical conductivity
WHO World Health Organization
BDL Below Detecting Level
EC European Community
NT Not Tested

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Prepared By: ____________ **Checked By:** ____________

QC In charge: ____________ **Lab. In charge** ____________

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WATER QUALITY ANALYSIS REPORT

Report No.	WQL-WRRC-PSH-15/316	Sampling date	15-06-2015
Client Name	ICS-HPK Joint Venture	Sample receipt date	16-06-2015
Client Address	Old Jamrud Lane, University Town	Temperature C° (at sample receipt)	25
Source		Date of analysis	06-07-2015
Location	Indus Amber Water Sample-15	Reporting date	17-08-2015

Sr. #	Water quality parameters	Unit	Det. limit	Reference method	Permissible limits (PSQCA, 2008)	Results	Measurement uncertainty
PHYSICAL AND AESTHETIC PARAMETERS							
1.	Color	-	-	Sensory evaluation	Colorless	Colorless	NA
2.	Odor	-	-	Sensory evaluation	Unobjectionable	UO	NA
3.	Taste	-	-	Sensory evaluation	Unobjectionable	UO	NA
4.	E.C	µS/cm	0.2875	APHA, 21st Edition	NGVS	403	±
5.	pH	-	0.02	APHA, 21st Edition	6.5-8.5	8.5	±
6.	Turbidity	NTU	0.2	APHA, 21st Edition	<5	1.5	±
MAJOR CHEMICAL PARAMETERS							
7.	Calcium	ppm	2.0	APHA, 21st Edition	NGVS	40	±
8.	Carbonate	ppm	5.0	APHA, 21st Edition	NGVS	BDL	±
9.	Hardness	ppm	5.0	APHA, 21st Edition	500	320	±
10.	Potassium	ppm	0.2	APHA, 21st Edition	NGVS	01	±
11.	TDS	ppm	-	APHA, 21st Edition	1000 (WHO, 2004)	201	±
12.	Nitrate	ppm	0.06	APHA, 21st Edition	10	0.09	±
13.	Nitrite (NO_2)	ppm	0.05	USEPA 2000	3	BDL	±
14.	Phosphate	ppm	0.05	USEPA 2000	NGVS	0.33	±
15.	Arsenic	ppb	0.13	APHA, 21st Edition	50	0.89	±
16.	COD	ppm	6.0	APHA, 21st Edition	150	07	±
17.	DO	ppm	0.6	APHA, 21st Edition	No limit listed	5.90	±
18.	TSS	mg/l	-	NEQS 1998	200	0.12	±
MICROBIOLOGICAL PARAMETERS							
19.	Total Coliform	MPN/100ml		APHA, 21st Edition	Nil	80	NA
20.	Fecal Coliform	MPN/100ml		APHA, 21st Edition	Nil	59	NA
21.	E.Coli	+Ve/-Ve		APHA, 21st Edition	-Ve	+Ve	NA

Quality of Water	**Safe** ☐	**Unsafe** ☒

Abbreviations:

NGVS No Guideline Value Set
MPN Maximum Probable Number
E.C Electrical conductivity
WHO World Health Organization
BDL Below Detecting Level
EC European Community
NT Not Tested

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WATER QUALITY ANALYSIS REPORT

Report No.	WQL-WRRC-PSH-15/2[illegible]	Sampling date	15-06-2015
Client Name	ICS-HPK Joint Venture	Sample receipt date	16-06-2015
Client Address	Old Jamrud Lane, University Town	Temperature C° (at sample receipt)	25
Source		Date of analysis	06-07-2015
Location	Indus Amber Water Sample-16	Reporting date	17-08-2015

Sr. #	Water quality parameters	Unit	Det. limit	Reference method	Permissible limits (PSQCA, 2008)	Results	Measurement uncertainty
PHYSICAL AND AESTHETIC PARAMETERS							
1.	Color	-	-	Sensory evaluation	Colorless	Colorless	NA
2.	Odor	-	-	Sensory evaluation	Unobjectionable	UO	NA
3.	Taste	-	-	Sensory evaluation	Unobjectionable	UO	NA
4.	E.C	µS/cm	0.2875	APHA, 21st Edition	NGVS	129	±
5.	pH	-	0.02	APHA, 21st Edition	6.5-8.5	8.1	±
6.	Turbidity	NTU	0.2	APHA, 21st Edition	<5	15.3	±
MAJOR CHEMICAL PARAMETERS							
7.	Calcium	ppm	2.0	APHA, 21st Edition	NGVS	44	±
8.	Carbonate	ppm	5.0	APHA, 21st Edition	NGVS	BDL	±
9.	Hardness	ppm	5.0	APHA, 21st Edition	500	110	±
10.	Potassium	ppm	0.2	APHA, 21st Edition	NGVS	03	±
11.	TDS	ppm	-	APHA, 21st Edition	1000 (WHO, 2004)	64	±
12.	Nitrate	ppm	0.06	APHA, 21st Edition	10	0.0	±
13.	Nitrite (NO_2)	ppm	0.05	USEPA 2000	3	BDL	±
14.	Phosphate	ppm	0.05	USEPA 2000	NGVS	0.38	±
15.	Arsenic	ppb	0.13	APHA, 21st Edition	50	1.14	±
16.	COD	ppm	6.0	APHA, 21st Edition	150	07	±
17.	DO	ppm	0.6	APHA, 21st Edition	No limit listed	6.13	±
18.	TSS	mg/l	-	NEQS 1999	200	0.53	±
MICROBIOLOGICAL PARAMETERS							
19.	Total Coliform	MPN/100ml		APHA, 21st Edition	Nil	85	NA
20.	Fecal Coliform	MPN/100ml		APHA, 21st Edition	Nil	40	NA
21.	E.Coli	+Ve/-Ve		APHA, 21st Edition	-Ve	+Ve	NA

Quality of Water	Safe ☐	Unsafe ☒

Abbreviations:
NGVS No Guideline Value Set
MPN Maximum Probable Number
E.C Electrical conductivity
WHO World Health Organization
BDL Below Detecting Level
EC European Community
NT Not Tested

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WATER QUALITY ANALYSIS REPORT

Report No.	WQL-WRRC-PSH-15/71A	Sampling date	15-06-2015
Client Name	ICS-HPK Joint Venture	Sample receipt date	16-06-2015
Client Address	Old Jamrud Lane, University Town	Temperature C° (at sample receipt)	25
Source		Date of analysis	06-07-2015
Location	Indus Amber Water Sample-17	Reporting date	17-08-2015

Sr. #	Water quality parameters	Unit	Det. limit	Reference method	Permissible limits (PSQCA, 2008)	Results	Measurement uncertainty
PHYSICAL AND AESTHETIC PARAMETERS							
1.	Color	-	-	Sensory evaluation	Colorless	Colorless	NA
2.	Odor	-	-	Sensory evaluation	Unobjectionable	UO	NA
3.	Taste	-	-	Sensory evaluation	Unobjectionable	UO	NA
4.	E.C	µS/cm	0.2875	APHA, 21st Edition	NGVS	380	±
5.	pH	-	0.02	APHA, 21st Edition	6.5-8.5	8.2	±
6.	Turbidity	NTU	0.2	APHA, 21st Edition	<5	0.95	±
MAJOR CHEMICAL PARAMETERS							
7.	Calcium	ppm	2.0	APHA, 21st Edition	NGVS	28	±
8.	Carbonate	ppm	5.0	APHA, 21st Edition	NGVS	BDL	±
9.	Hardness	ppm	5.0	APHA, 21st Edition	500	200	±
10.	Potassium	ppm	0.2	APHA, 21st Edition	NGVS	01	±
11.	TDS	ppm	-	APHA, 21st Edition	1000 (WHO, 2004)	190	±
12.	Nitrate	ppm	0.06	APHA, 21st Edition	10	0.1	±
13.	Nitrite (NO_2)	ppm	0.05	USEPA 2000	3	BDL	±
14.	Phosphate	ppm	0.05	USEPA 2000	NGVS	0.18	±
15.	Arsenic	ppb	0.13	APHA, 21st Edition	50	0.64	±
16.	COD	ppm	6.0	APHA, 21st Edition	150	10	±
17.	DO	ppm	0.6	APHA, 21st Edition	No limit listed	6.00	±
18.	TSS	mg/l	-	NEQS 1999	200	BDL	±
MICROBIOLOGICAL PARAMETERS							
19.	Total Coliform	MPN/100ml		APHA, 21st Edition	Nil	0	NA
20.	Fecal Coliform	MPN/100ml		APHA, 21st Edition	Nil	0	NA
21.	E.Coli	+Ve/-Ve		APHA, 21st Edition	-Ve	-Ve	NA

Quality of Water	Safe ☒	Unsafe ☐

Abbreviations:

NGVS No Guideline Value Set
MPN Maximum Probable Number
E.C Electrical conductivity
WHO World Health Organization
BDL Below Detecting Level
EC European Community
NT Not Tested

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WATER QUALITY ANALYSIS REPORT

Report No.	WQL-WRRC-PSH-15/073	Sampling date	15-06-2015
Client Name	ICS-HPK Joint Venture	Sample receipt date	16-06-2015
Client Address	Old Jamrud Lane, University Town	Temperature C° (at sample receipt)	25
Source		Date of analysis	06-07-2015
Location	Indus Amber Water Sample-18	Reporting date	17-08-2015

Sr. #	Water quality parameters	Unit	Det. limit	Reference method	Permissible limits (PSQCA, 2008)	Results	Measurement uncertainty
PHYSICAL AND AESTHETIC PARAMETERS							
1.	Color	-	-	Sensory evaluation	Colorless	Colorless	NA
2.	Odor	-	-	Sensory evaluation	Unobjectionable	UO	NA
3.	Taste	-	-	Sensory evaluation	Unobjectionable	UO	NA
4.	EC	µS/cm	0.2875	APHA, 21st Edition	NGVS	130	±
5.	pH	-	0.02	APHA, 21st Edition	6.5-8.5	8.3	±
6.	Turbidity	NTU	0.2	APHA, 21st Edition	<5	149	±
MAJOR CHEMICAL PARAMETERS							
7.	Calcium	ppm	2.0	APHA, 21st Edition	NGVS	88	±
8.	Carbonate	ppm	5.0	APHA, 21st Edition	NGVS	BDL	±
9.	Hardness	ppm	5.0	APHA, 21st Edition	500	100	±
10.	Potassium	ppm	0.2	APHA, 21st Edition	NGVS	01	±
11.	TDS	ppm	-	APHA, 21st Edition	1000 (WHO, 2004)	65	±
12.	Nitrate	ppm	0.06	APHA, 21st Edition	10	0.1	±
13.	Nitrite (NO_2)	ppm	0.05	USEPA 2000	3	BDL	±
14.	Phosphate	ppm	0.05	USEPA 2000	NGVS	0.29	±
15.	Arsenic	ppb	0.13	APHA, 21st Edition	50	1.17	±
16.	COD	ppm	8.0	APHA, 21st Edition	150	20	±
17.	DO	ppm	0.6	APHA, 21st Edition	No limit listed	6.97	±
18.	TSS	mg/l	-	NEQS 1999	200	0.34	±
MICROBIOLOGICAL PARAMETERS							
19.	Total Coliform	MPN/100ml		APHA, 21st Edition	Nil	40	NA
20.	Fecal Coliform	MPN/100ml		APHA, 21st Edition	Nil	15	NA
21.	E.Coli	+Ve/-Ve		APHA, 21st Edition	-Ve	+Ve	NA

Quality of Water	Safe ☐	Unsafe ☒

Abbreviations:
NGVS No Guideline Value Set
MPN Maximum Probable Number
EC Electrical conductivity
WHO World Health Organization
BDL Below Detecting Level
EC European Community
NT Not Tested

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WATER QUALITY ANALYSIS REPORT

Report No.	WQL-WRRC-PSH-15/216	Sampling date	15-06-2015
Client Name	ICS-HPK Joint Venture	Sample receipt date	16-06-2015
Client Address	Old Jamrud Lane, University Town	Temperature C° (at sample receipt)	23
Source		Date of analysis	06-07-2015
Location	Indus Amber Water Sample-19	Reporting date	17-08-2015

Sr. #	Water quality parameters	Unit	Det. limit	Reference method	Permissible limits (PSQCA, 2008)	Results	Measurement uncertainty
PHYSICAL AND AESTHETIC PARAMETERS							
1.	Color	-	-	Sensory evaluation	Colorless	Colorless	NA
2.	Odor	-	-	Sensory evaluation	Unobjectionable	UO	NA
3.	Taste	-	-	Sensory evaluation	Unobjectionable	UO	NA
4.	E.C	µS/cm	0.2875	APHA, 21st Edition	NGVS	473	±
5.	pH	-	0.02	APHA, 21st Edition	6.5-8.5	8.2	±
6.	Turbidity	NTU	0.2	APHA, 21st Edition	<5	6.3	±
MAJOR CHEMICAL PARAMETERS							
7.	Calcium	ppm	2.0	APHA, 21st Edition	NGVS	24	±
8.	Carbonate	ppm	5.0	APHA, 21st Edition	NGVS	BDL	±
9.	Hardness	ppm	5.0	APHA, 21st Edition	500	270	±
10.	Potassium	ppm	0.2	APHA, 21st Edition	NGVS	02	±
11.	TDS	ppm	-	APHA, 23rd Edition	1000 (WHO, 2004)	257	±
12.	Nitrate	ppm	0.06	APHA, 21st Edition	10	1.4	±
13.	Nitrite (NO_2)	ppm	0.05	USEPA 2000	3	BDL	±
14.	Phosphate	ppm	0.05	USEPA 2000	NGVS	0.10	±
15.	Arsenic	ppb	0.15	APHA, 21st Edition	50	2.47	±
16.	COD	ppm	6.0	APHA, 21st Edition	150	07	±
17.	DO	ppm	0.6	APHA, 21st Edition	No limit listed	6.29	±
18.	TSS	mg/l	-	NEQS 1999	200	BDL	±
MICROBIOLOGICAL PARAMETERS							
19.	Total Coliform	MPN/100ml		APHA, 21st Edition	Nil	0	NA
20.	Fecal Coliform	MPN/100ml		APHA, 21st Edition	Nil	0	NA
21.	E.Coli	+Ve/-Ve		APHA, 21st Edition	-Ve	-Ve	NA

Quality of Water	Safe ☒	Unsafe ☐

Abbreviations:
NGVS No Guideline Value Set **WHO** World Health Organization **EC** European Community
MPN Maximum Probable Number **BDL** Below Detecting Level **NT** Not Tested
E.C Electrical conductivity

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WATER QUALITY ANALYSIS REPORT

Report No.	WQL-WRRC-PSH-15/15	Sampling date	15-06-2015
Client Name	ICS-HPK Joint Venture	Sample receipt date	16-06-2015
Client Address	Old Jamrud Lane, University Town	Temperature C° (at sample receipt)	23
Source		Date of analysis	06-07-2015
Location	Indus Amber Water Sample-20	Reporting date	17-08-2015

Sr. #	Water quality parameters	Unit	Det. limit	Reference method	Permissible limits (PSQCA, 2008)	Results	Measurement uncertainty
PHYSICAL AND AESTHETIC PARAMETERS							
1.	Color	-	-	Sensory evaluation	Colorless	Colorless	NA
2.	Odor	-	-	Sensory evaluation	Unobjectionable	UO	NA
3.	Taste	-	-	Sensory evaluation	Unobjectionable	UO	NA
4.	E.C	µS/cm	0.2875	APHA, 21th Edition	NGVS	470	±
5.	pH	-	0.02	APHA, 21th Edition	6.5-8.5	8.1	±
6.	Turbidity	NTU	0.2	APHA, 21th Edition	<5	1.1	±
MAJOR CHEMICAL PARAMETERS							
7.	Calcium	ppm	2.0	APHA, 21st Edition	NGVS	28	±
8.	Carbonate	ppm	5.0	APHA, 21st Edition	NGVS	BDL	±
9.	Hardness	ppm	5.0	APHA, 21st Edition	500	230	±
10.	Potassium	ppm	0.2	APHA, 21st Edition	NGVS	03	±
11.	TDS	ppm	-	APHA, 21st Edition	1000 (WHO, 2004)	235	±
12.	Nitrate	ppm	0.06	APHA, 21st Edition	10	1.4	±
13.	Nitrite (NO_2)	ppm	0.05	USEPA 2000	3	0.07	±
14.	Phosphate	ppm	0.05	USEPA 2000	NGVS	0.14	±
15.	Arsenic	ppb	0.13	APHA, 21th Edition	50	2.034	±
16.	COD	ppm	6.0	APHA, 21st Edition	150	11	±
17.	DO	ppm	0.6	APHA, 21th Edition	No limit listed	6.17	±
18.	TSS	mg/l	-	NEQS 1999	200	BDL	±
MICROBIOLOGICAL PARAMETERS							
19.	Total Coliform	MPN/100ml		APHA, 21th Edition	Nil	10	NA
20.	Fecal Coliform	MPN/100ml		APHA, 21th Edition	Nil	Nil	NA
21.	E.Coli	+Ve/-Ve		APHA, 21st Edition	-Ve	-Ve	NA

Quality of Water	Safe ☐	Unsafe ☒

Abbreviations:

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MPN Maximum Probable Number
E.C Electrical conductivity
WHO World Health Organization
BDL Below Detecting Level
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QC In charge: ______________ Lab. In charge ______________

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WATER QUALITY ANALYSIS REPORT

Report No.	WQL-WRRC-PSH-15/276	Sampling date	15-06-2015
Client Name	ICS-HPK Joint Venture	Sample receipt date	16-06-2015
Client Address	Old Jamrud Lane, University Town	Temperature C° (at sample receipt)	25
Source		Date of analysis	06-07-2015
Location	Indus Amber Water Sample-21	Reporting date	17-08-2015

Sr. #	Water quality parameters	Unit	Det. limit	Reference method	Permissible limits (PSQCA, 2008)	Results	Measurement uncertainty
PHYSICAL AND AESTHETIC PARAMETERS							
1.	Color	-	-	Sensory evaluation	Colorless	Colorless	NA
2.	Odor	-	-	Sensory evaluation	Unobjectionable	UO	NA
3.	Taste	-	-	Sensory evaluation	Unobjectionable	UO	NA
4.	E.C	µS/cm	0.2875	APHA, 21st Edition	NGVS	342	±
5.	pH	-	0.02	APHA, 21st Edition	6.5-8.5	8.1	±
6.	Turbidity	NTU	0.2	APHA, 21st Edition	<5	0.5	±
MAJOR CHEMICAL PARAMETERS							
7.	Calcium	ppm	2.0	APHA, 21st Edition	NGVS	40	±
8.	Carbonate	ppm	5.0	APHA, 21st Edition	NGVS	BDL	±
9.	Hardness	ppm	5.0	APHA, 21st Edition	500	180	±
10.	Potassium	ppm	0.2	APHA, 21st Edition	NGVS	02	±
11.	TDS	ppm	-	APHA, 21st Edition	1000 (WHO, 2004)	171	±
12.	Nitrate	ppm	0.06	APHA, 21st Edition	10	3.5	±
13.	Nitrite (NO_2)	ppm	0.05	USEPA 2000	3	0.10	±
14.	Phosphate	ppm	0.05	USEPA 2000	NGVS	0.10	±
15.	Arsenic	ppb	0.13	APHA, 21st Edition	50	2.24	±
16.	COD	ppm	6.0	APHA, 21st Edition	150	09	±
17.	DO	ppm	0.6	APHA, 21st Edition	No limit listed	6.05	±
18.	TSS	mg/l	-	NEQS 1999	200	BDL	±
MICROBIOLOGICAL PARAMETERS							
19.	Total Coliform	MPN/100ml		APHA, 21st Edition	Nil	0	NA
20.	Fecal Coliform	MPN/100ml		APHA, 21st Edition	Nil	0	NA
21.	E.Coli	+Ve/-Ve		APHA, 21st Edition	-Ve	-Ve	NA

Quality of Water	Safe ☒	Unsafe ☐

Abbreviations:

NGVS No Guideline Value Set
MPN Maximum Probable Number
E.C Electrical conductivity
WHO World Health Organization
BDL Below Detecting Level
EC European Community
NT Not Tested

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WATER QUALITY ANALYSIS REPORT

Report No.	WQL-WRRC-PSH-15/217	Sampling date	15-06-2015
Client Name	ICS-HPK Joint Venture	Sample receipt date	16-06-2015
Client Address	Old Jamrud Lane, University Town	Temperature C° (at sample receipt)	25
Source		Date of analysis	06-07-2015
Location	Indus Amber Water Sample-22	Reporting date	17-08-2015

Sr. #	Water quality parameters	Unit	Det. limit	Reference method	Permissible limits (PSQCA, 2008)	Results	Measurement uncertainty
				PHYSICAL AND AESTHETIC PARAMETERS			
1.	Color	-	-	Sensory evaluation	Colorless	Colorless	NA
2.	Odor	-	-	Sensory evaluation	Unobjectionable	UO	NA
3.	Taste	-	-	Sensory evaluation	Unobjectionable	UO	NA
4.	E.C	µS/cm	0.2875	APHA, 21st Edition	NGVS	531	±
5.	pH	-	0.02	APHA, 21st Edition	6.5-8.5	8.3	±
6.	Turbidity	NTU	0.2	APHA, 21st Edition	<5	1.17	±
				MAJOR CHEMICAL PARAMETERS			
7.	Calcium	ppm	2.0	APHA, 21st Edition	NGVS	60	±
8.	Carbonate	ppm	5.0	APHA, 21st Edition	NGVS	BDL	±
9.	Hardness	ppm	5.0	APHA, 21st Edition	500	220	±
10.	Potassium	ppm	0.2	APHA, 21st Edition	NGVS	03	±
11.	TDS	ppm	-	APHA, 21st Edition	1000 (WHO, 2004)	265	±
12.	Nitrate	ppm	0.06	APHA, 21st Edition	10	3.6	±
13.	Nitrite (NO_2)	ppm	0.05	USEPA 2000	3	0.11	±
14.	Phosphate	ppm	0.05	USEPA 2000	NGVS	0.19	±
15.	Arsenic	ppb	0.13	APHA, 21st Edition	50	1.26	±
16.	COD	ppm	6.0	APHA, 21st Edition	150	18	±
17.	DO	ppm	0.6	APHA, 21st Edition	No limit listed	5.97	±
18.	TSS	mg/l	-	NEQS 1999	200	BDL	±
				MICROBIOLOGICAL PARAMETERS			
19.	Total Coliform	MPN/100ml		APHA, 21st Edition	Nil	0	NA
20.	Fecal Coliform	MPN/100ml		APHA, 21st Edition	Nil	0	NA
21.	E.Coli	+Ve/-Ve		APHA, 21st Edition	-Ve	-Ve	NA

Quality of Water	Safe ☒	Unsafe ☐

Abbreviations:

NGVS No Guideline Value Set
MPN Maximum Probable Number
E.C Electrical conductivity
WHO World Health Organization
BDL Below Detecting Level
EC European Community
NT Not Tested

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WATER QUALITY ANALYSIS REPORT

Report No.	WQL-WRRC-PSH-15/218	Sampling date	15-06-2015
Client Name	ICS-HPK Joint Venture	Sample receipt date	16-06-2015
Client Address	Old Jamrud Lane, University Town	Temperature C° (at sample receipt)	25
Source		Date of analysis	06-07-2015
Location	Indus Amber Water Sample-23	Reporting date	23-07-2015

Sr. #	Water quality parameters	Unit	Det. limit	Reference method	Permissible limits (PSQCA, 2008)	Results	Measurement uncertainty
PHYSICAL AND AESTHETIC PARAMETERS							
1.	Color	-	-	Sensory evaluation	Colorless	Colorless	NA
2.	Odor	-	-	Sensory evaluation	Unobjectionable	UO	NA
3.	Taste	-	-	Sensory evaluation	Unobjectionable	UO	NA
4.	E.C	µS/cm	0.2875	APHA, 21th Edition	NGVS	303	±
5.	pH	-	0.02	APHA, 21th Edition	6.5-8.5	8.1	±
6.	Turbidity	NTU	0.2	APHA, 21th Edition	<5	0.46	±
MAJOR CHEMICAL PARAMETERS							
7.	Calcium	ppm	2.0	APHA, 21th Edition	NGVS	28	±
8.	Carbonate	ppm	5.0	APHA, 21th Edition	NGVS	BDL	±
9.	Hardness	ppm	5.0	APHA, 21th Edition	500	150	±
10.	Potassium	ppm	0.2	APHA, 21th Edition	NGVS	01	±
11.	TDS	ppm	-	APHA, 21th Edition	1000 (WHO, 2004)	152	±
12.	Nitrate	ppm	0.06	APHA, 21th Edition	10	3.6	±
13.	Nitrite (NO_2)	ppm	0.05	USEPA 2000	3	0.10	±
14.	Phosphate	ppm	0.05	USEPA 2000	NGVS	0.10	±
15.	Arsenic	ppb	0.13	APHA, 21th Edition	50	1.32	±
16.	COD	ppm	6.0	APHA, 21th Edition	150	BDL	±
17.	DO	ppm	0.6	APHA, 21th Edition	No limit listed	6.07	±
18.	TSS	mg/l	-	NEQS 1999	200	BDL	±
MICROBIOLOGICAL PARAMETERS							
19.	Total Coliform	MPN/100ml		APHA, 21th Edition	Nil	0	NA
20.	Fecal Coliform	MPN/100ml		APHA, 21th Edition	Nil	0	NA
21.	E. Coli	+Ve/-Ve		APHA, 21th Edition	-Ve	-Ve	NA

Quality of Water	Safe ☒	Unsafe ☐

Abbreviations:

NGVS No Guideline Value Set | **WHO** World Health Organization | **EC** European Community
MPN Maximum Probable Number | **BDL** Below Detecting Level | **NT** Not Tested
E.C Electrical conductivity

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WATER QUALITY ANALYSIS REPORT

Report No.	WQL-WRRC-PSH-15/219	Sampling date	15-06-2015
Client Name	ICS-HPK Joint Venture	Sample receipt date	16-06-2015
Client Address	Old Jamrud Lane, University Town	Temperature C° (at sample receipt)	25
Source		Date of analysis	06-07-2015
Location	Indus Amber Water Sample-24	Reporting date	23-07-2015

Sr. #	Water quality parameters	Unit	Det. limit	Reference method	Permissible limits (PSQCA, 2008)	Results	Measurement uncertainty
PHYSICAL AND AESTHETIC PARAMETERS							
1.	Color	-	-	Sensory evaluation	Colorless	Colorless	NA
2.	Odor	-	-	Sensory evaluation	Unobjectionable	UO	NA
3.	Taste	-	-	Sensory evaluation	Unobjectionable	UO	NA
4.	E.C	µS/cm	0.2875	APHA, 21[th] Edition	NGVS	265	±
5.	pH	-	0.02	APHA, 21[th] Edition	6.5-8.5	8.2	±
6.	Turbidity	NTU	0.2	APHA, 21[th] Edition	<5	1.45	±
MAJOR CHEMICAL PARAMETERS							
7.	Calcium	ppm	2.0	APHA, 21[th] Edition	NGVS	20	±
8.	Carbonate	ppm	5.0	APHA, 21[th] Edition	NGVS	BDL	±
9.	Hardness	ppm	5.0	APHA, 21[th] Edition	500	120	±
10.	Potassium	ppm	0.2	APHA, 21[th] Edition	NGVS	02	±
11.	TDS	ppm	-	APHA, 21[st] Edition	1000 (WHO, 2004)	122	±
12.	Nitrate	ppm	0.06	APHA, 21[th] Edition	10	3.3	±
13.	Nitrite (NO_2)	ppm	0.05	USEPA 2000	3	0.08	±
14.	Phosphate	ppm	0.05	USEPA 2000	NGVS	0.20	±
15.	Arsenic	ppb	0.13	APHA, 21[th] Edition	50	1.53	±
16.	COD	ppm	6.0	APHA, 21[th] Edition	150	10	±
17.	DO	ppm	0.6	APHA, 21[th] Edition	No limit listed	6.1	±
18.	TSS	mg/l	-	NEQS 1999	200	0.11	±
MICROBIOLOGICAL PARAMETERS							
19.	Total Coliform	MPN/100ml		APHA, 21[th] Edition	Nil	10	NA
20.	Fecal Coliform	MPN/100ml		APHA, 21[th] Edition	Nil	0	NA
21.	E. Coli	+Ve/-Ve		APHA, 21[th] Edition	-Ve	-Ve	NA

Quality of Water	Safe ☐	Unsafe ☒

Abbreviations:
NGVS No Guideline Value Set
MPN Maximum Probable Number
E.C Electrical conductivity
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WATER QUALITY ANALYSIS REPORT

Report No.	WQL-WRRC-PSH-15/220	Sampling date	15-06-2015
Client Name	ICS-HPK Joint Venture	Sample receipt date	16-06-2015
Client Address	Old Jamrud Lane, University Town	Temperature C (at sample receipt)	25
Source		Date of analysis	06-07-2015
Location	Indus Amber Water Sample-25	Reporting date	23-07-2015

Sr. #	Water quality parameters	Unit	Det. limit	Reference method	Permissible limits (PSQCA, 2008)	Results	Measurement uncertainty
				PHYSICAL AND AESTHETIC PARAMETERS			
1.	Color	-	-	Sensory evaluation	Colorless	Colorless	NA
2.	Odor	-	-	Sensory evaluation	Unobjectionable	UO	NA
3.	Taste	-	-	Sensory evaluation	Unobjectionable	UO	NA
4.	E.C	µS/cm	0.2875	APHA, 21st Edition	NGVS	521	±
5.	pH	-	0.02	APHA, 21st Edition	6.5-8.5	8.3	±
6.	Turbidity	NTU	0.2	APHA, 21st Edition	<5	0.2	±
				MAJOR CHEMICAL PARAMETERS			
7.	Calcium	ppm	2.0	APHA, 21st Edition	NGVS	61	±
8.	Carbonate	ppm	5.0	APHA, 21st Edition	NGVS	BDL	±
9.	Hardness	ppm	5.0	APHA, 21st Edition	500	300	±
10.	Potassium	ppm	0.2	APHA, 21st Edition	NGVS	02	±
11.	TDS	ppm	-	APHA, 21st Edition	1000 (WHO, 2004)	180	±
12.	Nitrate	ppm	0.06	APHA, 21st Edition	10	40	±
13.	Nitrite (NO_2)	ppm	0.05	USEPA 2000	3	1.06	±
14.	Phosphate	ppm	0.05	USEPA 2000	NGVS	0.11	±
15.	Arsenic	ppb	0.13	APHA, 21st Edition	50	1.37	±
16.	COD	ppm	6.0	APHA, 21st Edition	150	BDL	±
17.	DO	ppm	0.6	APHA, 21st Edition	No limit listed	6.07	±
18.	TSS	mg/l	-	NEQS 1999	200	BDL	±
				MICROBIOLOGICAL PARAMETERS			
19.	Total Coliform	MPN/100ml		APHA, 21st Edition	Nil	0	NA
20.	Fecal Coliform	MPN/100ml		APHA, 21st Edition	Nil	0	NA
21.	E. Coli	+Ve/-Ve		APHA, 21st Edition	-Ve	-Ve	NA

Quality of Water	Safe ☐	Unsafe ☒

Abbreviations:

NGVS No Guideline Value Set
MPN Maximum Probable Number
E.C Electrical conductivity
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WATER QUALITY ANALYSIS REPORT

Report No.	WQL-WRRC-PSH-15/221	Sampling date	15-06-2015
Client Name	JCS-HPK Joint Venture	Sample receipt date	16-06-2015
Client Address	Old Jamrud Lane, University Town	Temperature C° (at sample receipt)	25
Source		Date of analysis	06-07-2015
Location	Janda Baka Water Sample -1	Reporting date	23-07-2015

Sr. #	Water quality parameters	Unit	Det. limit	Reference method	Permissible limits (PSQCA, 2008)	Results	Measurement uncertainty
PHYSICAL AND AESTHETIC PARAMETERS							
1.	Color	-	-	Sensory evaluation	Colorless	Colorless	NA
2.	Odor	-	-	Sensory evaluation	Unobjectionable	UO	NA
3.	Taste	-	-	Sensory evaluation	Unobjectionable	UO	NA
4.	E.C	µS/cm	0.2875	APHA, 21st Edition	NGVS	393	±
5.	pH	-	0.02	APHA, 21st Edition	6.5-8.5	8.3	±
6.	Turbidity	NTU	0.2	APHA, 21st Edition	<5	1.4	±
MAJOR CHEMICAL PARAMETERS							
7.	Calcium	ppm	2.0	APHA, 21st Edition	NGVS	22	±
8.	Carbonate	ppm	5.0	APHA, 21st Edition	NGVS	BDL	±
9.	Hardness	ppm	5.0	APHA, 21st Edition	500	300	±
10.	Potassium	ppm	0.2	APHA, 21st Edition	NGVS	06	±
11.	TDS	ppm	-	APHA, 21st Edition	1000 (WHO, 2004)	235	±
12.	Nitrate	ppm	0.06	APHA, 21st Edition	10	3.4	±
13.	Nitrite (NO_2)	ppm	0.05	USEPA 2000	3	0.08	±
14.	Phosphate	ppm	0.05	USEPA 2000	NGVS	0.22	±
15.	Arsenic	ppb	0.13	APHA, 21st Edition	50	0.85	±
16.	COD	ppm	6.0	APHA, 21st Edition	150	BDL	±
17.	DO	ppm	0.6	APHA, 21st Edition	No limit listed	6.20	±
18.	TSS	mg/l	-	NEQS 1999	200	BDL	±
MICROBIOLOGICAL PARAMETERS							
19.	Total Coliform	MPN/100ml		APHA, 21st Edition	Nil	9	NA
20.	Fecal Coliform	MPN/100ml		APHA, 21st Edition	Nil	0	NA
21.	E. Coli	+Ve/-Ve		APHA, 21st Edition	-Ve	-Ve	NA

Quality of Water	Safe ☒	Unsafe ☐

Abbreviations:

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WATER QUALITY ANALYSIS REPORT

Report No.	WQL-WRRC-PSH-15/222-	Sampling date	15-06-2015
Client Name	ICS-HPK Joint Venture	Sample receipt date	16-06-2015
Client Address	Old Jamrud Lane, University Town	Temperature C° (at sample receipt)	25
Source		Date of analysis	06-07-2015
Location	Janda Baku Water Sample-2	Reporting date	23-07-2015

Sr. #	Water quality parameters	Unit	Det. limit	Reference method	Permissible limits (PSQCA, 2008)	Results	Measurement uncertainty
PHYSICAL AND AESTHETIC PARAMETERS							
1.	Color	-	-	Sensory evaluation	Colorless	Colorless	NA
2.	Odor	-	-	Sensory evaluation	Unobjectionable	UO	NA
3.	Taste	-	-	Sensory evaluation	Unobjectionable	UO	NA
4.	E.C	µS/cm	0.2875	APHA, 21st Edition	NGVS	190	±
5.	pH	-	0.02	APHA, 21st Edition	6.5-8.5	8.3	±
6.	Turbidity	NTU	0.2	APHA, 21st Edition	<5	0.2	±
MAJOR CHEMICAL PARAMETERS							
7.	Calcium	ppm	2.0	APHA, 21st Edition	NGVS	64	±
8.	Carbonate	ppm	5.0	APHA, 21st Edition	NGVS	BDL	±
9.	Hardness	ppm	5.0	APHA, 21st Edition	500	200	±
10.	Potassium	ppm	0.2	APHA, 21st Edition	NGVS	03	±
11.	TDS	ppm	-	APHA, 21st Edition	1000 (WHO, 2004)	115	±
12.	Nitrate	ppm	0.06	APHA, 21st Edition	10	2.2	±
13.	Nitrite (NO_2)	ppm	0.05	USEPA 2000	3	0.07	±
14.	Phosphate	ppm	0.05	USEPA 2000	NGVS	0.10	±
15.	Arsenic	ppb	0.13	APHA, 21st Edition	50	0.70	±
16.	COD	ppm	6.0	APHA, 21st Edition	150	13	±
17.	DO	ppm	0.6	APHA, 21st Edition	No limit listed	6.17	±
18.	TSS	mg/l	-	NEQS 1999	200	BDL	±
MICROBIOLOGICAL PARAMETERS							
19.	Total Coliform	MPN/100ml		APHA, 21st Edition	Nil	15	NA
20.	Fecal Coliform	MPN/100ml		APHA, 21st Edition	Nil	8	NA
21.	E. Coli	+Ve/-Ve		APHA, 21st Edition	-Ve	+Ve	NA

Quality of Water	Safe ☐	Unsafe ☒

Abbreviations:

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WATER QUALITY ANALYSIS REPORT

Report No.	WQL-WRRC-PSH-15/223	Sampling date	15-06-2015
Client Name	ICS-HPK Joint Venture	Sample receipt date	16-06-2015
Client Address	Old Jamrud Lane, University Town	Temperature C° (at sample receipt)	25
Source		Date of analysis	06-07-2015
Location	Janda Baka Water Sample-3	Reporting date	23-07-2015

Sr. #	Water quality parameters	Unit	Det. limit	Reference method	Permissible limits (PSQCA, 2008)	Results	Measurement uncertainty
PHYSICAL AND AESTHETIC PARAMETERS							
1.	Color	-	-	Sensory evaluation	Colorless	Colorless	NA
2.	Odor	-	-	Sensory evaluation	Unobjectionable	UO	NA
3.	Taste	-	-	Sensory evaluation	Unobjectionable	UO	NA
4.	E.C	µS/cm	0.2875	APHA, 21st Edition	NGVS	521	±
5.	pH	-	0.02	APHA, 21st Edition	6.5-8.5	8.0	±
6.	Turbidity	NTU	0.2	APHA, 21st Edition	<5	2.0	±
MAJOR CHEMICAL PARAMETERS							
7.	Calcium	ppm	2.0	APHA, 21st Edition	NGVS	60	±
8.	Carbonate	ppm	5.0	APHA, 21st Edition	NGVS	BDL	±
9.	Hardness	ppm	5.0	APHA, 21st Edition	500	300	±
10.	Potassium	ppm	0.2	APHA, 21st Edition	NGVS	01	±
11.	TDS	ppm	-	APHA, 21st Edition	1000 (WHO, 2004)	312	±
12.	Nitrate	ppm	0.06	APHA, 21st Edition	10	6.5	±
13.	Nitrite (NO_2)	ppm	0.05	USEPA 2000	3	0.12	±
14.	Phosphate	ppm	0.05	USEPA 2000	NGVS	0.22	±
15.	Arsenic	ppb	0.13	APHA, 21st Edition	50	0.24	±
16.	COD	ppm	6.0	APHA, 21st Edition	150	10	±
17.	DO	ppm	0.6	APHA, 21st Edition	No limit listed	5.89	±
18.	TSS	mg/l	-	NEQS 1999	200	0.15	±
MICROBIOLOGICAL PARAMETERS							
19.	Total Coliform	MPN/100ml		APHA, 21st Edition	Nil	0	NA
20.	Fecal Coliform	MPN/100ml		APHA, 21st Edition	Nil	0	NA
21.	E. Coli	+Ve/-Ve		APHA, 21st Edition	-Ve	-Ve	NA

Quality of Water	Safe ☒	Unsafe ☐

Abbreviations:

NGVS No Guideline Value Set
MPN Maximum Probable Number
E.C Electrical conductivity
WHO World Health Organization
BDL Below Detecting Level
EC European Community
NT Not Tested

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QC In charge: ____________ **Lab. In charge** ____________

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WATER QUALITY ANALYSIS REPORT

Report No.	WQL-WRRC-PSH-15/ 2-24	Sampling date	15-06-2015
Client Name	JCS-HPK Joint Venture	Sample receipt date	16-06-2015
Client Address	Old Jamrud Lane, University Town	Temperature C° (at sample receipt)	25
Source		Date of analysis	06-07-2015
Location	Janda Baka Water Sample-4	Reporting date	23-07-2015

Sr. #	Water quality parameters	Unit	Det. limit	Reference method	Permissible limits (PSQCA, 2008)	Results	Measurement uncertainty
PHYSICAL AND AESTHETIC PARAMETERS							
1.	Color	-	-	Sensory evaluation	Colorless	Colorless	NA
2.	Odor	-	-	Sensory evaluation	Unobjectionable	UO	NA
3.	Taste	-	-	Sensory evaluation	Unobjectionable	UO	NA
4.	E.C	µS/cm	0.2875	APHA, 21st Edition	NGVS	182	±
5.	pH	-	0.02	APHA, 21st Edition	6.5-8.5	8.3	±
6.	Turbidity	NTU	0.2	APHA, 21st Edition	<5	0.5	±
MAJOR CHEMICAL PARAMETERS							
7.	Calcium	ppm	2.0	APHA, 21st Edition	NGVS	40	±
8.	Carbonate	ppm	5.0	APHA, 21st Edition	NGVS	BDL	±
9.	Hardness	ppm	5.0	APHA, 21st Edition	500	180	±
10.	Potassium	ppm	0.2	APHA, 21st Edition	NGVS	02	±
11.	TDS	ppm	-	APHA, 21st Edition	1000 (WHO, 2004)	109	±
12.	Nitrate	ppm	0.06	APHA, 21st Edition	10	2.3	±
13.	Nitrite (NO_2)	ppm	0.05	USEPA 2000	3	0.07	±
14.	Phosphate	ppm	0.05	USEPA 2000	NGVS	0.11	±
15.	Arsenic	ppb	0.13	APHA, 21st Edition	50	1.09	±
16.	COD	ppm	6.0	APHA, 21st Edition	150	08	±
17.	DO	ppm	0.6	APHA, 21st Edition	No limit listed	5.97	±
18.	TSS	mg/l	-	NEQS 1999	200	BDL	±
MICROBIOLOGICAL PARAMETERS							
19.	Total Coliform	MPN/100ml		APHA, 21st Edition	Nil	0	NA
20.	Fecal Coliform	MPN/100ml		APHA, 21st Edition	Nil	0	NA
21.	E. Coli	+Ve/-Ve		APHA, 21st Edition	-Ve	-Ve	NA

Quality of Water	Safe ☒	Unsafe ☐

Abbreviations:

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E.C Electrical conductivity
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BDL Below Detecting Level
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NT Not Tested

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WATER QUALITY ANALYSIS REPORT

Report No.	WQL-WRRC-PSH-15/225	Sampling date	15-06-2015
Client Name	ICS-HPK Joint Venture	Sample receipt date	16-06-2015
Client Address	Old Jamrud Lane, University Town	Temperature C° (at sample receipt)	25
Source		Date of analysis	06-07-2015
Location	Janda Baka Water Sample-5	Reporting date	23-07-2015

Sr. #	Water quality parameters	Unit	Det. limit	Reference method	Permissible limits (PSQCA, 2008)	Results	Measurement uncertainty
PHYSICAL AND AESTHETIC PARAMETERS							
1.	Color	-	-	Sensory evaluation	Colorless	Colorless	NA
2.	Odor	-	-	Sensory evaluation	Unobjectionable	UO	NA
3.	Taste	-	-	Sensory evaluation	Unobjectionable	UO	NA
4.	E.C	µS/cm	0.2875	APHA, 21st Edition	NGVS	233	±
5.	pH	-	0.02	APHA, 21st Edition	6.5-8.5	8.4	±
6.	Turbidity	NTU	0.2	APHA, 21st Edition	<5	0.6	±
MAJOR CHEMICAL PARAMETERS							
7.	Calcium	ppm	2.0	APHA, 21st Edition	NGVS	60	±
8.	Carbonate	ppm	5.0	APHA, 21st Edition	NGVS	BDL	±
9.	Hardness	ppm	5.0	APHA, 21st Edition	500	220	±
10.	Potassium	ppm	0.2	APHA, 21st Edition	NGVS	02	±
11.	TDS	ppm	-	APHA, 21st Edition	1000 (WHO, 2004)	140	±
12.	Nitrate	ppm	0.06	APHA, 21st Edition	10	3.4	±
13.	Nitrite (NO_2)	ppm	0.05	USEPA 2000	3	0.07	±
14.	Phosphate	ppm	0.05	USEPA 2000	NGVS	0.16	±
15.	Arsenic	ppb	0.15	APHA, 21st Edition	50	0.73	±
16.	COD	ppm	6.0	APHA, 21st Edition	150	19	±
17.	DO	ppm	0.6	APHA, 21st Edition	No limit listed	6.07	±
18.	TSS	mg/l	-	NEQS 1999	200	BDL	±
MICROBIOLOGICAL PARAMETERS							
19.	Total Coliform	MPN/100ml		APHA, 21st Edition	Nil	0	NA
20.	Fecal Coliform	MPN/100ml		APHA, 21st Edition	Nil	0	NA
21.	E. Coli	+Ve/-Ve		APHA, 21st Edition	-Ve	-Ve	NA

Quality of Water	Safe ☒	Unsafe ☐

Abbreviations:

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MPN Maximum Probable Number
E.C Electrical conductivity
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WATER QUALITY ANALYSIS REPORT

Report No.	WQL-WRRC-PSH-15/226	Sampling date	15-06-2015
Client Name	ICS-HPK Joint Venture	Sample receipt date	16-06-2015
Client Address	Old Jamrud Lane, University Town	Temperature C° (at sample receipt)	25
Source		Date of analysis	06-07-2015
Location	Basak Water Sample -2	Reporting date	23-07-2015

Sr. #	Water quality parameters	Unit	Det. limit	Reference method	Permissible limits (PSQCA, 2008)	Results	Measurement uncertainty
PHYSICAL AND AESTHETIC PARAMETERS							
1.	Color	-	-	Sensory evaluation	Colorless	Colorless	NA
2.	Odor	-	-	Sensory evaluation	Unobjectionable	UO	NA
3.	Taste	-	-	Sensory evaluation	Unobjectionable	UO	NA
4.	E.C	µS/cm	0.2875	APHA, 21st Edition	NGVS	154	±
5.	pH	-	0.02	APHA, 21st Edition	6.5-8.5	8.4	±
6.	Turbidity	NTU	0.2	APHA, 21st Edition	<5	0.2	±
MAJOR CHEMICAL PARAMETERS							
7.	Calcium	ppm	2.0	APHA, 21st Edition	NGVS	32	±
8.	Carbonate	ppm	5.0	APHA, 21st Edition	NGVS	BDL	±
9.	Hardness	ppm	5.0	APHA, 21st Edition	500	150	±
10.	Potassium	ppm	0.2	APHA, 21st Edition	NGVS	01	±
11.	TDS	ppm	-	APHA, 21st Edition	1000 (WHO, 2004)	90	±
12.	Nitrate	ppm	0.06	APHA, 21st Edition	10	2.8	±
13.	Nitrite (NO_2)	ppm	0.05	USEPA 2000	3	0.06	±
14.	Phosphate	ppm	0.05	USEPA 2000	NGVS	0.08	±
15.	Arsenic	ppb	0.13	APHA, 21st Edition	50	0.37	±
16.	COD	ppm	6.0	APHA, 21st Edition	150	12	±
17.	DO	ppm	0.6	APHA, 21st Edition	No limit listed	6.1	±
18.	TSS	mg/l	-	NEQS 1999	200	BDL	±
MICROBIOLOGICAL PARAMETERS							
19.	Total Coliform	MPN/100ml		APHA, 21st Edition	Nil	15	NA
20.	Fecal Coliform	MPN/100ml		APHA, 21st Edition	Nil	0	NA
21.	E. Coli	+Ve/-Ve		APHA, 21st Edition	-Ve	-Ve	NA

Quality of Water	**Safe** ☐	**Unsafe** ☒

Abbreviations:
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MPN Maximum Probable Number
E.C Electrical conductivity
WHO World Health Organization
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WATER QUALITY ANALYSIS REPORT

Report No.	WQL-WRRC-PSH-15/2-2-7	Sampling date	15-06-2015
Client Name	ICS-HPK Joint Venture	Sample receipt date	16-06-2015
Client Address	Old Jamrud Lane, University Town	Temperature C° (at sample receipt)	25
Source		Date of analysis	06-07-2015
Location	Barak Water Sample-3	Reporting date	23-07-2015

Sr. #	Water quality parameters	Unit	Det. limit	Reference method	Permissible limits (PSQCA, 2008)	Results	Measurement uncertainty
PHYSICAL AND AESTHETIC PARAMETERS							
1.	Color	-	-	Sensory evaluation	Colorless	Colorless	NA
2.	Odor	-	-	Sensory evaluation	Unobjectionable	UO	NA
3.	Taste	-	-	Sensory evaluation	Unobjectionable	UO	NA
4.	E.C	µS/cm	0.2875	APHA, 21st Edition	NGVS	246	±
5.	pH	-	0.02	APHA, 21st Edition	6.5-8.5	8.2	±
6.	Turbidity	NTU	0.2	APHA, 21st Edition	<5	0.5	±
MAJOR CHEMICAL PARAMETERS							
7.	Calcium	ppm	2.0	APHA, 21st Edition	NGVS	68	±
8.	Carbonate	ppm	5.0	APHA, 21st Edition	NGVS	BDL	±
9.	Hardness	ppm	5.0	APHA, 21st Edition	500	230	±
10.	Potassium	ppm	0.2	APHA, 21st Edition	NGVS	01	±
11.	TDS	ppm	-	APHA, 21st Edition	1000 (WHO, 2004)	147	±
12.	Nitrate	ppm	0.06	APHA, 21st Edition	10	3.1	±
13.	Nitrite (NO_2)	ppm	0.05	USEPA 2000	3	0.07	±
14.	Phosphate	ppm	0.05	USEPA 2000	NGVS	0.08	±
15.	Arsenic	ppb	0.13	APHA, 21st Edition	50	0.56	±
16.	COD	ppm	6.0	APHA, 21st Edition	150	BDL	±
17.	DO	ppm	0.6	APHA, 21st Edition	No limit listed	6.27	±
18.	TSS	mg/l	-	NEQS 1999	200	BDL	±
MICROBIOLOGICAL PARAMETERS							
19.	Total Coliform	MPN/100ml		APHA, 21st Edition	Nil	0	NA
20.	Fecal Coliform	MPN/100ml		APHA, 21st Edition	Nil	0	NA
21.	E. Coli	+Ve/-Ve		APHA, 21st Edition	-Ve	-Ve	NA

Quality of Water	**Safe** ☒	**Unsafe** ☐

Abbreviations:

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MPN Maximum Probable Number
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WHO World Health Organization
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WATER QUALITY ANALYSIS REPORT

Report No.	WQL-WRRC-PSH-15/228	Sampling date	15-06-2015
Client Name	ICS-HPK Joint Venture	Sample receipt date	16-06-2015
Client Address	Old Jamrud Lane, University Town	Temperature C° (at sample receipt)	25
Source		Date of analysis	06-07-2015
Location	Topi Water Sample-1	Reporting date	23-07-2015

Sr. #	Water quality parameters	Unit	Det. limit	Reference method	Permissible limits (PSQCA, 2008)	Results	Measurement uncertainty
PHYSICAL AND AESTHETIC PARAMETERS							
1.	Color	-	-	Sensory evaluation	Colorless	Colorless	NA
2.	Odor	-	-	Sensory evaluation	Unobjectionable	UO	NA
3.	Taste	-	-	Sensory evaluation	Unobjectionable	UO	NA
4.	EC	µS/cm	0.2875	APHA, 21[th] Edition	NGVS	535	±
5.	pH	-	0.02	APHA, 21[th] Edition	6.5-8.5	8.2	±
6.	Turbidity	NTU	0.2	APHA, 21[th] Edition	<5	1.4	±
MAJOR CHEMICAL PARAMETERS							
7.	Calcium	ppm	2.0	APHA, 21[st] Edition	NGVS	72	±
8.	Carbonate	ppm	5.0	APHA, 21[st] Edition	NGVS	BDL	±
9.	Hardness	ppm	5.0	APHA, 21[st] Edition	500	480	±
10.	Potassium	ppm	0.2	APHA, 21[st] Edition	NGVS	01	±
11.	TDS	ppm	-	APHA, 21[st] Edition	1000 (WHO, 2004)	321	±
12.	Nitrate	ppm	0.06	APHA, 21[st] Edition	10	2.6	±
13.	Nitrite (NO_2)	ppm	0.05	USEPA 2000	3	0.08	±
14.	Phosphate	ppm	0.05	USEPA 2000	NGVS	0.10	±
15.	Arsenic	ppb	0.13	APHA, 21[th] Edition	50	0.37	±
16.	COD	ppm	6.0	APHA, 21[th] Edition	150	09	±
17.	DO	ppm	0.6	APHA, 21[th] Edition	No limit listed	6.12	±
18.	TSS	mg/l	-	NEQS 1999	200	BDL	±
MICROBIOLOGICAL PARAMETERS							
19.	Total Coliform	MPN/100ml		APHA, 21[st] Edition	Nil	20	NA
20.	Fecal Coliform	MPN/100ml		APHA, 21[st] Edition	Nil	09	NA
21.	E. Coli	+Ve/-Ve		APHA, 21[st] Edition	-Ve	+Ve	NA

Quality of Water	Safe ☒	Unsafe ☐

Abbreviations:

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WATER QUALITY ANALYSIS REPORT

Report No.	WQL-WRRC-PSH-15/229	Sampling date	15-06-2015
Client Name	ICS-HPK Joint Venture	Sample receipt date	16-06-2015
Client Address	Old Jamrud Lane, University Town	Temperature C° (at sample receipt)	25
Source		Date of analysis	06-07-2015
Location	Topi Water Sample-2	Reporting date	23-07-2015

Sr. #	Water quality parameters	Unit	Det. limit	Reference method	Permissible limits (PSQCA, 2008)	Results	Measurement uncertainty
PHYSICAL AND AESTHETIC PARAMETERS							
1.	Color	-	-	Sensory evaluation	Colorless	Colorless	NA
2.	Odor	-	-	Sensory evaluation	Unobjectionable	UO	NA
3.	Taste	-	-	Sensory evaluation	Unobjectionable	UO	NA
4.	E.C	µS/cm	0.2875	APHA, 21st Edition	NGVS	244	±
5.	pH	-	0.02	APHA, 21st Edition	6.5-8.5	8.2	±
6.	Turbidity	NTU	0.2	APHA, 21st Edition	<5	0.3	±
MAJOR CHEMICAL PARAMETERS							
7.	Calcium	ppm	2.0	APHA, 21st Edition	NGVS	44	±
8.	Carbonate	ppm	5.0	APHA, 21st Edition	NGVS	BDL	±
9.	Hardness	ppm	5.0	APHA, 21st Edition	500	160	±
10.	Potassium	ppm	0.2	APHA, 21st Edition	NGVS	02	±
11.	TDS	ppm	-	APHA, 21st Edition	1000 (WHO, 2004)	146	±
12.	Nitrate	ppm	0.06	APHA, 21st Edition	10	3.7	±
13.	Nitrite (NO_2)	ppm	0.05	USEPA 2000	3	0.07	±
14.	Phosphate	ppm	0.05	USEPA 2000	NGVS	0.31	±
15.	Arsenic	ppb	0.13	APHA, 21st Edition	50	0.79	±
16.	COD	ppm	6.0	APHA, 21st Edition	150	BDL	±
17.	DO	ppm	0.6	APHA, 21st Edition	No limit listed	6.06	±
18.	TSS	mg/l	-	NEQS 1999	200	BDL	±
MICROBIOLOGICAL PARAMETERS							
19.	Total Coliform	MPN/100ml		APHA, 21st Edition	Nil	0	NA
20.	Fecal Coliform	MPN/100ml		APHA, 21st Edition	Nil	0	NA
21.	E. Coli	+Ve/-Ve		APHA, 21st Edition	-Ve	-Ve	NA

Quality of Water	Safe ☒	Unsafe ☐

Abbreviations:
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WATER QUALITY ANALYSIS REPORT

Report No.	WQL-WRRC-PSH-15/2-2(?)	Sampling date	15-06-2015
Client Name	ICS-HPK Joint Venture	Sample receipt date	16-06-2015
Client Address	Old Jamrud Lane, University Town	Temperature C° (at sample receipt)	25
Source		Date of analysis	06-07-2015
Location	Malikabad Water Sample	Reporting date	23-07-2015

Sr. #	Water quality parameters	Unit	Det. limit	Reference method	Permissible limits (PSQCA, 2008)	Results	Measurement uncertainty
PHYSICAL AND AESTHETIC PARAMETERS							
1.	Color	-	-	Sensory evaluation	Colorless	Colorless	NA
2.	Odor	-	-	Sensory evaluation	Unobjectionable	UO	NA
3.	Taste	-	-	Sensory evaluation	Unobjectionable	UO	NA
4.	E.C	µS/cm	0.2875	APHA, 21st Edition	NGVS	336	±
5.	pH	-	0.02	APHA, 21st Edition	6.5-8.5	8.2	±
6.	Turbidity	NTU	0.2	APHA, 21st Edition	<5	0.6	±
MAJOR CHEMICAL PARAMETERS							
7.	Calcium	ppm	2.0	APHA, 21st Edition	NGVS	60	±
8.	Carbonate	ppm	5.0	APHA, 21st Edition	NGVS	BDL	±
9.	Hardness	ppm	5.0	APHA, 21st Edition	500	300	±
10.	Potassium	ppm	0.2	APHA, 21st Edition	NGVS	07	±
11.	TDS	ppm	-	APHA, 21st Edition	1000 (WHO, 2004)	202	±
12.	Nitrate	ppm	0.06	APHA, 21st Edition	10	3.2	±
13.	Nitrite (NO_2)	ppm	0.05	USEPA 2000	3	0.08	±
14.	Phosphate	ppm	0.05	USEPA 2000	NGVS	0.15	±
15.	Arsenic	ppb	0.13	APHA, 21st Edition	50	0.33	±
16.	COD	ppm	6.0	APHA, 21st Edition	150	07	±
17.	DO	ppm	0.6	APHA, 21st Edition	No limit listed	6.22	±
18.	TSS	mg/l	-	NEQS 1999	200	BDL	±
MICROBIOLOGICAL PARAMETERS							
19.	Total Coliform	MPN/100ml		APHA, 21st Edition	Nil	10	NA
20.	Fecal Coliform	MPN/100ml		APHA, 21st Edition	Nil	0	NA
21.	E. Coli	+Ve/-Ve		APHA, 21st Edition	-Ve	-Ve	NA
Quality of Water		Safe ☐			Unsafe ☒		

Abbreviations:

NGVS No Guideline Value Set
MPN Maximum Probable Number
E.C Electrical conductivity
WHO World Health Organization
BDL Below Detecting Level
EC European Community
NT Not Tested

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- PCRWR reserves the right to accept or reject samples for analysis without assigning any reason.

Prepared By: ____________

Checked By: ____________

OC In charge: ____________

Lab. In charge ____________

ANNEXURE-IV AMBIENT AIR QUALITY MONITORING RESULTS

Gadoon Industrial Area 1

S. No	Date	Time	SO_2 (µg/m³)	NO (µg/m³)	NO2 (µg/m³)	CO (mg/m³)	Noise (dBA)	O_3 (µg/m³)	PM 2.5 (µg/m³)	PM 10 (µg/m³)	SPM(µg/m³)	Air TEMP.(°C)	Hum. (%)	Wind Speed (m/s)	Wind Dir (Deg)
1	6/9/2015	1200	40.3	30.9	25.0	3	59	17	23	89	276	37	33	3.1	41
2	6/9/2015	1300	39.7	31	24.8	3	62	16				38	31	2.1	44
3	6/9/2015	1400	40.5	31	23.9	3.1	53	18				38	29	1.5	142
4	6/9/2015	1500	39.8	31.3	23.3	3	51	20				39	26	1.2	41
5	6/9/2015	1600	39.7	32.7	23.4	3.1	55	21				40	26	0.9	41
6	6/9/2015	1700	40.3	32.2	23.3	3.2	58	22				38	27	1.3	43
7	6/9/2015	1800	39.9	32	23.1	3	60	22				37	31	1.5	41
8	6/9/2015	1900	39.8	32	23.9	2.8	61	19				35	34	1.4	41
9	6/9/2015	2000	39.7	31.6	24.5	2.7	63	16				34	36	1.1	41
10	6/9/2015	2100	38.3	28.9	23.9	2.5	55	11				32	41	1.9	319
11	6/9/2015	2200	38	28.4	22.5	2.6	51	10				31	40	1	319
12	6/9/2015	2300	38.2	28.2	22.0	2.7	45	10				30	43	0.8	319
13	6/10/2015	0000	38.1	27.3	21.8	2.5	43	10				29	45	0.9	233
14	6/10/2015	0100	38.1	27.6	20.9	2.5	42	10				28	48	1.2	237
15	6/10/2015	0200	37.7	27.5	21.0	2.6	43	10				28	45	1.3	233
16	6/10/2015	0300	37.2	27.8	21.3	2.7	42	11				27	48	1.7	233
17	6/10/2015	0400	37.4	27.9	21.2	2.6	43	13				26	51	0.9	142
18	6/10/2015	0500	37	28.6	22.3	2.8	50	16				25	51	0.2	233
19	6/10/2015	0600	37.3	28.7	21.4	2.8	57	16				26	51	0.6	142
20	6/10/2015	0700	40.5	28.2	21.6	2.9	62	14				28	45	0.9	258
21	6/10/2015	0800	40.7	30	21.5	3	61	17				31	38	1.6	142
22	6/10/2015	0900	40.9	32.2	22.8	2.9	61	20				34	34	2.8	211

S. No	Date	Time	SO_2 (µg/m^3)	NO (µg/m^3)	NO2 (µg/m^3)	CO (mg/m^3)	Noise (dBA)	O_3 (µg/m^3)	PM $_{2.5}$ (µg/m^3)	PM $_{10}$ (µg/m^3)	SPM(µg/m^3)	Air TEMP.(°C)	Hum. (%)	Wind Speed (m/s)	Wind Dir (Deg)
23	6/10/2015	1000	39.8	32.6	22.9	2.8	60	20				35	30	3.9	142
24	6/10/2015	1100	40.2	32.8	23.5	2.8	56	21				36	29	2.4	291
Minimum			37	27.3	20.9	2.5	42	10	23	89	276	25	26	0.2	41
Average			39.1	30.1	22.7	2.8	53.9	15.8				32.6	38.0	1.5	163.7
Maximum			40.9	32.8	25	3.2	63	22				40	51	3.9	319

Gadoon Industrial Area 2

S. No	Date	Time	SO_2 (µg/m^3)	NO (µg/m^3)	NO2 (µg/m^3)	CO (mg/m^3)	Noise (dBA)	O_3 (µg/m^3)	PM $_{2.5}$ (µg/m^3)	PM $_{10}$ (µg/m^3)	SPM(µg/m^3)	Air TEMMP.(°C)	Hum. (%)	Wind Speed (m/s)	Wind Dir (Deg)
1	6/10/2015	1230	24.6	15.8	10.3	1.4	48	19	19	71	115	37	27	7.2	41
2	6/10/2015	1330	28.4	17	9.6	1.7	45	19				37	29	6.2	44
3	6/10/2015	1430	22.9	17.2	8.7	1.3	49	15				36	32	10.3	41
4	6/10/2015	1530	23.8	16.4	9.3	1.1	44	15				37	30	4.1	142
5	6/10/2015	1630	22.4	16	9.9	1.1	43	12				38	29	4.1	142
6	6/10/2015	1730	22.2	17.3	9.4	1.1	48	13				33	41	10.3	233
7	6/10/2015	1830	22.3	15.6	9.7	0.9	42	12				33	41	8.2	211
8	6/10/2015	1930	22.7	15.5	8.7	0.9	46	12				31	43	5.1	233
9	6/10/2015	2030	22	17.6	8.9	0.9	48	11				31	43	4.1	241
10	6/10/2015	2130	21.7	15.2	9.0	0.8	43	9				30	45	4.1	41
11	6/10/2015	2230	20.2	17.5	9.2	0.9	41	10				29	45	3.1	192
12	6/10/2015	2330	18.9	16.2	8.0	0.9	36	9				28	48	3.1	197
13	6/11/2015	0030	18.4	16.5	7.9	0.8	37	10				27	51	3.1	192
14	6/11/2015	0130	18.9	16.1	8.1	0.5	38	10				26	54	2.1	41

S. No	Date	Time	SO_2 (µg/m³)	NO (µg/m³)	NO2 (µg/m³)	CO (mg/m³)	Noise (dBA)	O_3 (µg/m³)	PM 2.5 (µg/m³)	PM 10 (µg/m³)	SPM(µg/m³)	Air TEMMP.(°C)	Hum. (%)	Wind Speed (m/s)	Wind Dir (Deg)
15	6/11/2015	0230	18.5	16.7	8.1	0.5	34	10				25	57	5.6	319
16	6/11/2015	0330	18.2	19.4	8.4	0.7	37	11				25	57	2.8	11
17	6/11/2015	0430	21.5	21.6	8.9	1	43	12				27	54	2.4	319
18	6/11/2015	0530	23.9	21.2	8.9	1.2	42	11				29	48	3.1	319
19	6/11/2015	0630	25.7	21.2	9.1	1.1	46	13				32	36	2.9	48
20	6/11/2015	0730	25.2	20.6	9.1	1.3	40	15				34	30	3.8	41
21	6/11/2015	0830	23.8	20	9.4	1.2	44	16				35	29	2.2	233
22	6/11/2015	0930	25.4	19.2	9.5	1.3	43	17				35	26	2.9	214
23	6/11/2015	1030	25.5	20.2	9.5	1.1	45	17				36	26	5.7	142
24	6/11/2015	1130	25.6	19.4	9.4	1.1	43	17				36	26	1.8	256
Minimum			18.2	15.2	7.9	0.5	34	9	19	71	115	25	26	1.8	11
Average			22.6	17.9	9.0	1.0	42.7	13.1				32.0	39.5	4.4	162.2
Maximum			28.4	21.6	10.3	1.7	49	19				38	57	10.3	319

Topi City (Yousufabad)

S. No	Date	Time	SO_2 (µg/m³)	NO (µg/m³)	NO2 (µg/m³)	CO (mg/m³)	Noise (dBA)	O_3 (µg/m³)	PM 2.5 (µg/m³)	PM 10 (µg/m³)	SPM(µg/m³)	Air TEMMP.(°C)	Hum. (%)	Wind Speed (m/s)	Wind Dir (Deg)
1	6/11/2015	1300	26.1	17.2	9.0	2.6	60	23	24	66	197	38	27	4.1	142
2	6/11/2015	1400	26.2	16.6	9.2	2.7	63	20				37	29	6.2	41

S. No	Date	Time	SO_2 (µg/m³)	NO (µg/m³)	NO2 (µg/m³)	CO (mg/m³)	Noise (dBA)	O_3 (µg/m³)	PM 2.5 (µg/m³)	PM 10 (µg/m³)	SPM(µg/m³)	Air TEMMP.(°C)	Hum. (%)	Wind Speed (m/s)	Wind Dir (Deg)
3	6/11/2015	1500	24.2	16	8.8	2.8	60	27				36	32	5.8	41
4	6/11/2015	1600	23.9	16.9	8.8	2.8	66	22				36	30	7.2	41
5	6/11/2015	1700	23	16.9	8.6	2.7	64	20				35	30	2.7	41
6	6/11/2015	1800	22.5	17.2	8.7	2.5	66	14				33	31	4.1	319
7	6/11/2015	1900	22.5	17.5	9.4	2.5	68	14				32	36	3.4	319
8	6/11/2015	2000	21.3	17.8	8.6	2.4	65	13				30	40	2.1	278
9	6/11/2015	2100	20	18.5	8.4	2.4	62	15				29	40	0.9	319
10	6/11/2015	2200	19.8	17.9	8.6	2.2	60	11				28	45	3.1	289
11	6/11/2015	2300	19.9	15.8	8.4	2.3	61	11				27	51	2.1	233
12	6/12/2015	0000	20	17	8.0	2	56	12				27	58	Calm	48
13	6/12/2015	0100	20	16.8	8.1	2.1	58	11				27	58	Calm	49
14	6/12/2015	0200	20.1	19.3	8.1	2.3	55	11				26	57	Calm	47
15	6/12/2015	0300	20.5	19.3	8.2	2.3	55	12				27	58	Calm	38
16	6/12/2015	0400	21	20.3	8.3	2.1	54	12				29	51	Calm	98
17	6/12/2015	0500	22	16.7	8.6	2.3	55	11				32	43	2.3	41
18	6/12/2015	0600	22.6	19.7	8.5	2.5	53	11				34	38	3.1	46
19	6/12/2015	0700	22.2	19.2	8.0	2.6	52	16				35	34	3.1	42
20	6/12/2015	0800	22.9	18.6	8.8	2.7	57	18				36	34	3.5	41
21	6/12/2015	0900	22.9	18.8	8.8	2.6	65	20				37	30	3.1	47
22	6/12/2015	1000	23.1	18.4	9.0	2.6	61	19				38	27	5.1	41
23	6/12/2015	1100	23.4	20.3	9.2	2.7	62	20				39	27	4.1	192
24	6/12/2015	1200	23	20.8	9.1	2.7	58	20				39	27	4.8	41

S. No	Date	Time	SO_2 (µg/m^3)	NO (µg/m^3)	NO2 (µg/m^3)	CO (mg/m^3)	Noise (dBA)	O_3 (µg/m^3)	$PM_{2.5}$ (µg/m^3)	PM_{10} (µg/m^3)	SPM(µg/m^3)	Air TEMMP.(°C)	Hum. (%)	Wind Speed (m/s)	Wind Dir (Deg)
Minimum			19.8	15.8	8	2	52	11	24	66	197	26	27	0.9	38
Average			22.2	18.1	8.6	2.5	59.8	16.0	24.0	66.0	197.0	32.8	38.9	3.7	118.1
Maximum			26.2	20.8	9.4	2.8	68	27	24	66	197	39	58	7.2	319

Topi Road

S. No	Date	Time	SO_2 (µg/m^3)	NO (µg/m^3)	NO2 (µg/m^3)	CO (mg/m^3)	Noise (dBA)	O_3 (µg/m^3)	$PM_{2.5}$ (µg/m^3)	PM_{10} (µg/m^3)	SPM(µg/m^3)	Air TEMMP.(°C)	Hum. (%)	Wind Speed (m/s)	Wind Dir (Deg)
1	6/10/2015	1330	25.1	16.4	8.1	3.1	73	17				40	26	4.4	41
2	6/10/2015	1430	24	15.5	7.7	2.9	79	19				41	26	5.4	41
3	6/10/2015	1530	25.7	16	7.6	2.9	77	21				40	24	2.3	142
4	6/10/2015	1630	23.4	16.5	7.4	3	76	20				39	26	3.4	157
5	6/10/2015	1730	23.8	14.4	7.5	2.8	74	17				38	27	3.9	149
6	6/10/2015	1830	24.3	14.1	7.1	3.2	71	13				36	30	2.5	176
7	6/10/2015	1930	23.2	14.2	7.0	3	76	14	29	112	296	34	32	3.1	41
8	6/10/2015	2030	23.1	13.7	6.6	2.9	74	15				33	31	3.7	45
9	6/10/2015	2130	20.2	13.4	5.8	3	72	11				31	35	5.9	44
10	6/10/2015	2230	18.9	13.4	5.8	2.9	77	15				30	35	2.7	46
11	6/10/2015	2330	18.8	12.5	5.9	2.7	70	11				30	35	2.1	41
12	6/10/2015	0030	19.8	12.5	5.9	2.6	69	10				30	37	4.2	319
13	6/11/2015	0130	17.8	12.5	6.0	2.6	64	10				29	37	1.8	318

S. No	Date	Time	SO_2 (µg/m^3)	NO (µg/m^3)	NO2 (µg/m^3)	CO (mg/m^3)	Noise (dBA)	O_3 (µg/m^3)	PM $_{2.5}$ (µg/m^3)	PM $_{10}$ (µg/m^3)	SPM(µg/m^3)	Air TEMMP.(°C)	Hum. (%)	Wind Speed (m/s)	Wind Dir (Deg)
14	6/11/2015	0230	17.8	12.3	6.2	2.7	61	9				28	39	2.9	311
15	6/11/2015	0330	17.6	12.1	6.2	2.6	61	9				28	39	2.5	142
16	6/11/2015	0430	17.4	12.6	6.5	2.6	59	9				29	37	4.8	41
17	6/11/2015	0530	17	12.2	6.5	2.7	68	11				31	33	7.6	41
18	6/11/2015	0630	19.2	14.7	7.7	3.1	71	14				33	36	2.1	41
19	6/11/2015	0730	19.6	15.1	7.8	3.1	71	17				34	34	3.3	233
20	6/11/2015	0830	19.9	14.9	8.7	2.8	72	17				37	35	2.3	142
21	6/11/2015	0930	23.2	15.1	7.7	2.8	77	17				38	33	2.1	148
22	6/11/2015	1030	24.1	16.6	7.0	2.8	79	17				39	31	5.4	142
23	6/11/2015	1130	24.4	17.2	7.1	2.7	73	17				39	30	2.9	319
24	6/11/2015	1230	24.4	17.7	7.4	2.9	74	17				40	28	2.7	322
Minimum			17	12.1	5.8	2.6	59	9	29	112	296	28	24	1.8	41
Average			21.4	14.4	7.0	2.9	71.6	14.5				34.5	32.3	3.5	143.4
Maximum			25.7	17.7	8.7	3.2	79	21				41	39	7.6	322

Jahangira Road

S. No	Date	Time	SO_2 (µg/m^3)	NO (µg/m^3)	NO2 (µg/m^3)	CO (mg/m^3)	Noise (dBA)	O_3 (µg/m^3)	PM $_{2.5}$ (µg/m^3)	PM $_{10}$ (µg/m^3)	SPM(µg/m^3)	Air TEMMP.(°C)	Hum. (%)	Wind Speed (m/s)	Wind Dir (Deg)
1	6/13/2015	1400	43.1	26.7	14.1	3.4	70	22	28	127	377	39	31	5.3	133
2	6/13/2015	1500	43.6	26.9	14.0	3.4	67	19				40	29	2.5	148
3	6/13/2015	1600	44.7	27.2	13.9	3.6	66	21				40	29	2.9	145
4	6/13/2015	1700	44	27.7	14.1	3.5	66	23				41	30	4.5	146
5	6/13/2015	1800	44	27.5	14.6	3.7	72	23				40	29	5.4	142
6	6/13/2015	1900	43.7	27.2	14.2	3.6	73	21				38	31	5.8	41
7	6/13/2015	2000	44.1	27.2	14.3	3.6	67	20				36	37	3.6	41
8	6/13/2015	2100	42.4	26.3	14.2	3.4	72	20				33	29	2.5	319
9	6/13/2015	2200	42.8	26.4	14.0	3.5	72	20				32	40	3.6	11
10	6/13/2015	2300	41.1	26.2	14.0	3.2	69	16				32	40	3.9	27
11	6/14/2015	0000	40.5	26	14.1	3.1	64	16				31	40	7.4	39
12	6/14/2015	0100	40.3	26	14.0	3	63	14				30	45	1.5	34
13	6/14/2015	0200	39.8	25.8	13.7	2.7	63	15				29	45	1.4	22
14	6/14/2015	0300	39.5	26.3	13.6	2.9	58	16				29	45	2.8	39
15	6/14/2015	0400	39.4	25.6	13.9	3	57	13				28	48	4.1	38
16	6/14/2015	0500	39.3	25.6	13.8	3.1	61	16				28	48	3.1	142
17	6/14/2015	0600	39.6	25	13.3	3.2	56	17				27	51	3.1	12
18	6/14/2015	0700	40.5	25	14.9	3.2	57	18				27	51	4.1	17
19	6/14/2015	0800	40.1	25.3	15.6	3.4	58	19				29	45	3.1	41
20	6/14/2015	0900	40.1	25.6	16.2	3.4	61	22				30	45	4.9	11
21	6/14/2015	1000	42.3	25.4	16.3	3.4	67	26				32	40	1.8	41
22	6/14/2015	1100	42.1	25.9	16.3	3.3	69	26				33	38	1.5	33

S. No	Date	Time	SO_2 (µg/m^3)	NO (µg/m^3)	NO2 (µg/m^3)	CO (mg/m^3)	Noise (dBA)	O_3 (µg/m^3)	PM $_{2.5}$ (µg/m^3)	PM $_{10}$ (µg/m^3)	SPM(µg/m^3)	Air TEMMP.(°C)	Hum. (%)	Wind Speed (m/s)	Wind Dir (Deg)
23	6/14/2015	1200	41.7	26.3	16.3	3.4	74	25				34	36	1.7	48
24	6/14/2015	1300	41.8	26.5	16.3	3.4	75	25				35	32	2.8	41
Minimum			39.3	25	13.3	2.7	56	13				27	29	1.4	11
Average			41.7	26.2	14.6	3.3	65.7	19.7	28	127	377	33.0	38.9	3.5	71.3
Maximum			44.7	27.7	16.3	3.7	75	26				41	51	7.4	319

Gajju khan

S. No	Date	Time	SO_2 (µg/m^3)	NO (µg/m^3)	NO2 (µg/m^3)	CO (mg/m^3)	Noise (dBA)	O_3 (µg/m^3)	PM $_{2.5}$ (µg/m^3)	PM $_{10}$ (µg/m^3)	SPM(µg/m^3)	Air TEMMP.(°C)	Hum. (%)	Wind Speed (m/s)	Wind Dir (Deg)
1	6/14/2015	1430	18.6	12.7	7.2	1	54	16				40	27	4.1	142
2	6/14/2015	1530	19.8	11.8	7.4	0.9	52	14				39	29	5.1	157
3	6/14/2015	1630	21.7	11.4	7.4	1.1	55	13				38	31	8.2	142
4	6/14/2015	1730	22.1	11.3	8.1	1.1	55	13				36	30	7.9	164
5	6/14/2015	1830	22.1	10.9	7.6	1.3	54	12				33	31	7.8	41
6	6/14/2015	1930	22	10.7	7.7	1	54	13	22	97	235	31	35	8.6	47
7	6/14/2015	2030	20.8	10	7.2	0.8	51	14				30	35	7.2	319
8	6/14/2015	2130	20.2	8.7	6.3	0.9	52	12				29	37	6.8	11
9	6/14/2015	2230	19.8	8.6	5.8	0.9	46	10				28	42	5.1	17
10	6/14/2015	2330	17.6	8.8	6.0	0.9	44	8				27	48	7.2	41
11	6/15/2015	0030	13.7	8.3	5.7	0.8	44	8				27	48	5.1	11

S. No	Date	Time	SO_2 (µg/m^3)	NO (µg/m^3)	NO2 (µg/m^3)	CO (mg/m^3)	Noise (dBA)	O_3 (µg/m^3)	PM $_{2.5}$ (µg/m^3)	PM $_{10}$ (µg/m^3)	SPM(µg/m^3)	Air TEMMP.(°C)	Hum. (%)	Wind Speed (m/s)	Wind Dir (Deg)
12	6/15/2015	0130	13.9	8.1	6.0	0.7	43	8				26	51	4.9	49
13	6/15/2015	0230	11.5	8.1	5.7	0.7	44	8				25	54	8.7	47
14	6/15/2015	0330	12	7.9	5.6	0.6	44	6				24	57	6.9	55
15	6/15/2015	0430	11.3	7.8	5.8	0.5	41	7				25	54	3.1	319
16	6/15/2015	0530	11.6	8	5.9	0.5	36	7				26	51	4.6	58
17	6/15/2015	0630	9.9	9.2	5.5	1.5	37	7				27	51	3.1	61
18	6/15/2015	0730	9.8	11.1	6.4	0.9	36	9				30	45	3.1	64
19	6/15/2015	0830	16.1	11.7	6.6	1	44	10				30	43	3.1	41
20	6/15/2015	0930	18.3	11.6	6.8	1.1	52	10				31	40	5.1	66
21	6/15/2015	1030	20.8	11.9	7.7	1	50	13				32	38	7.2	41
22	6/15/2015	1130	18.7	12.3	8.3	1.1	55	14				34	36	8.2	49
23	6/15/2015	1230	18.1	10	8.3	1	54	15				36	36	3.8	319
24	6/15/2015	1330	18.2	10.3	7.2	0.9	55	15				37	33	2.9	11
Minimum			9.8	7.8	5.5	0.5	36	6	22	97	235	24	27	2.9	11
Average			17.0	10.1	6.8	0.9	48.0	10.9	22.0	97.0	235.0	30.9	40.9	5.7	94.7
Maximum			22.1	12.7	8.3	1.5	55	16	22	97	235	40	57	8.7	319

Col. Sher Khan Interchange (Near Motorway)

S. No	Date	Time	SO_2 (µg/m^3)	NO (µg/m^3)	NO2 (µg/m^3)	CO (mg/m^3)	Noise (dBA)	O_3 (µg/m^3)	PM $_{2.5}$ (µg/m^3)	PM $_{10}$ (µg/m^3)	SPM(µg/m^3)	Air TEMMP.(°C)	Hum. (%)	Wind Speed (m/s)	Wind Dir (Deg)
1	6/15/2015	1500	19.2	12.3	6.7	3	71	21				35	34	8.2	41
2	6/15/2015	1600	18.6	14.3	6.8	3.2	70	21				34	34	7.2	42
3	6/15/2015	1700	18.2	13.6	6.3	3.1	70	21				34	34	6.2	142
4	6/15/2015	1800	19.4	13.7	7.4	2.9	70	16				34	28	5.1	142
5	6/15/2015	1900	18.9	14.2	7.2	3	71	18				33	29	7.9	57
6	6/15/2015	2000	19.1	13.3	7.5	2.7	71	16				33	29	8.1	41
7	6/15/2015	2100	19.3	13.4	6.9	2.5	70	12				32	33	4.3	157
8	6/15/2015	2200	17.8	13.6	6.3	2.3	69	13				30	43	4.8	142
9	6/15/2015	2300	17.4	11.7	6.5	2.1	68	10				29	45	5.1	41
10	6/16/2015	0000	15.1	11.5	6.3	2	68	11				29	45	1.9	51
11	6/16/2015	0100	15.7	10.1	6.7	1.7	65	10				28	48	6.2	54
12	6/16/2015	0200	13.8	10.6	6.4	2	65	9	17	73	143	27	48	6.2	49
13	6/16/2015	0300	12.3	10.3	6.3	1.9	59	10				26	47	5.1	105
14	6/16/2015	0400	11.9	11	6.3	2.1	57	9				25	50	4.6	107
15	6/16/2015	0500	12.6	11.3	6.3	2	56	11				25	50	5.8	95
16	6/16/2015	0600	13.6	10.4	7.1	2.1	57	13				24	53	2.4	46
17	6/16/2015	0700	14.4	10.2	7.3	2	68	14				25	47	3.1	48
18	6/16/2015	0800	15.8	11.3	7.6	2.1	62	13				26	51	2.8	42
19	6/16/2015	0900	18.3	12.9	7.3	2.1	68	12				29	45	2.4	43
20	6/16/2015	1000	16.3	14.4	7.6	1.9	64	16				32	36	3.1	41
21	6/16/2015	1100	17.9	12.3	7.9	2	62	16				33	36	3.1	319
22	6/16/2015	1200	16.6	13.6	7.5	2.5	64	17				34	32	3.1	149
23	6/16/2015	1300	17.3	15.1	7.4	2.7	67	19				35	28	4.3	142

S. No	Date	Time	SO_2 (µg/m^3)	NO (µg/m^3)	NO2 (µg/m^3)	CO (mg/m^3)	Noise (dBA)	O_3 (µg/m^3)	PM $_{2.5}$ (µg/m^3)	PM $_{10}$ (µg/m^3)	SPM(µg/m^3)	Air TEMMP.(°C)	Hum. (%)	Wind Speed (m/s)	Wind Dir (Deg)
24	6/16/2015	1400	20.1	14.1	6.1	1.6	64	15				36	27	5.1	41
Minimum			11.9	10.1	6.1	1.6	56	9				24	27	1.9	41
Average			16.7	12.5	6.9	2.3	65.7	14.3	17	73	143	30.3	39.7	4.8	89.0
Maximum			20.1	15.1	7.9	3.2	71	21				36	53	8.2	319

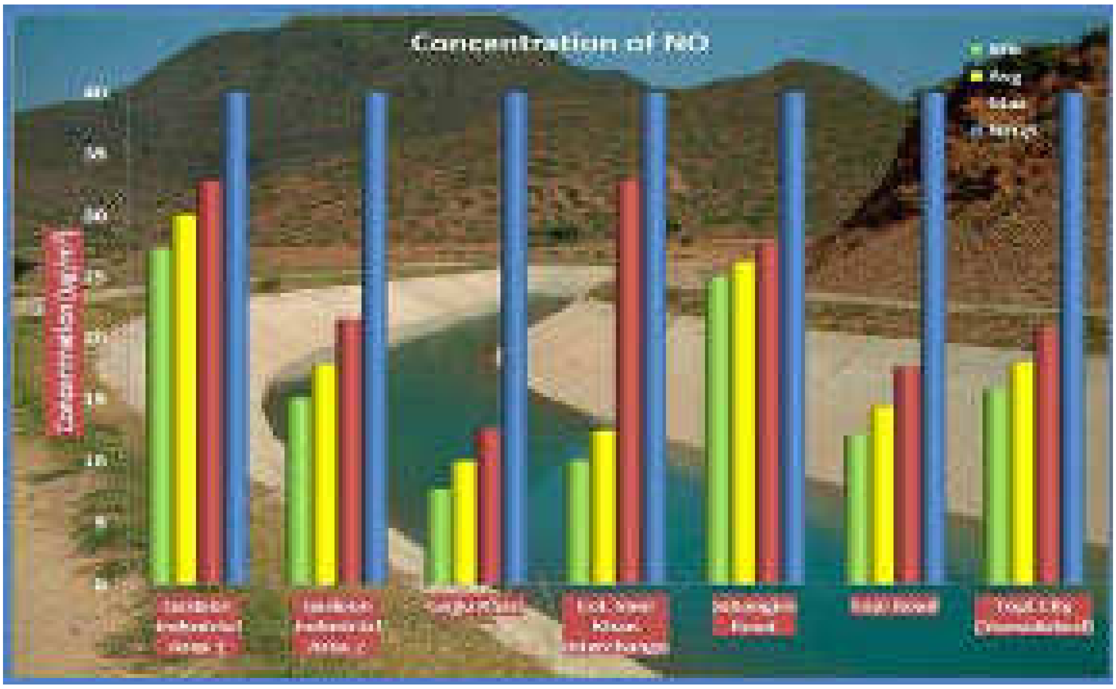


Figure: (a): Minimum, Maximum and Average (24hrs) Concentration of NO at different Locations of PHLCE Project area

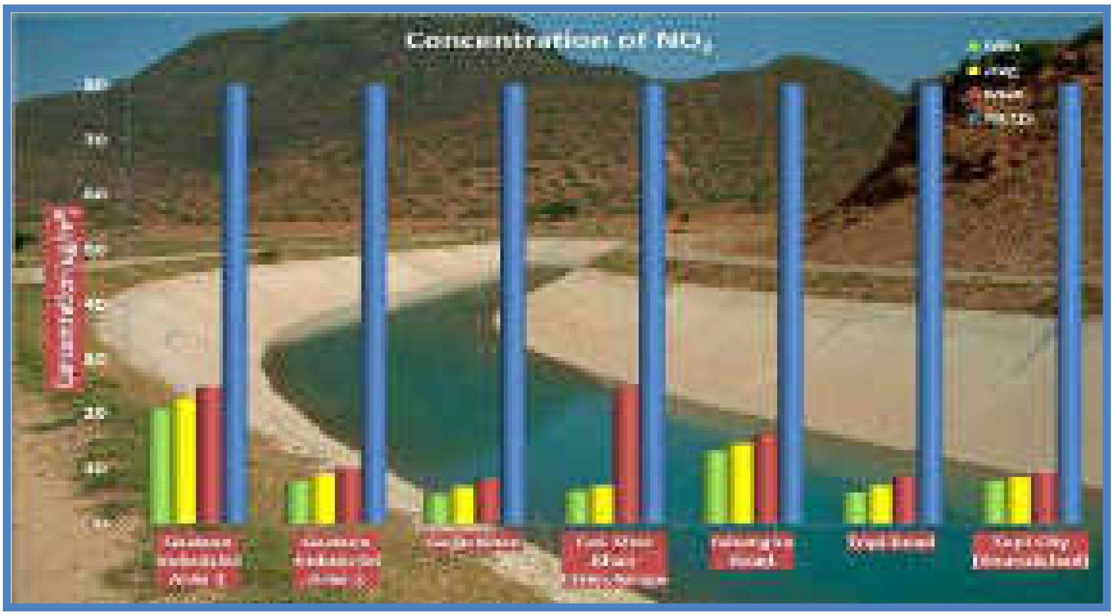


Figure (b): Minimum, Maximum and Average (24hrs) Concentration of NO_2 at different locations of PHLCE Project area

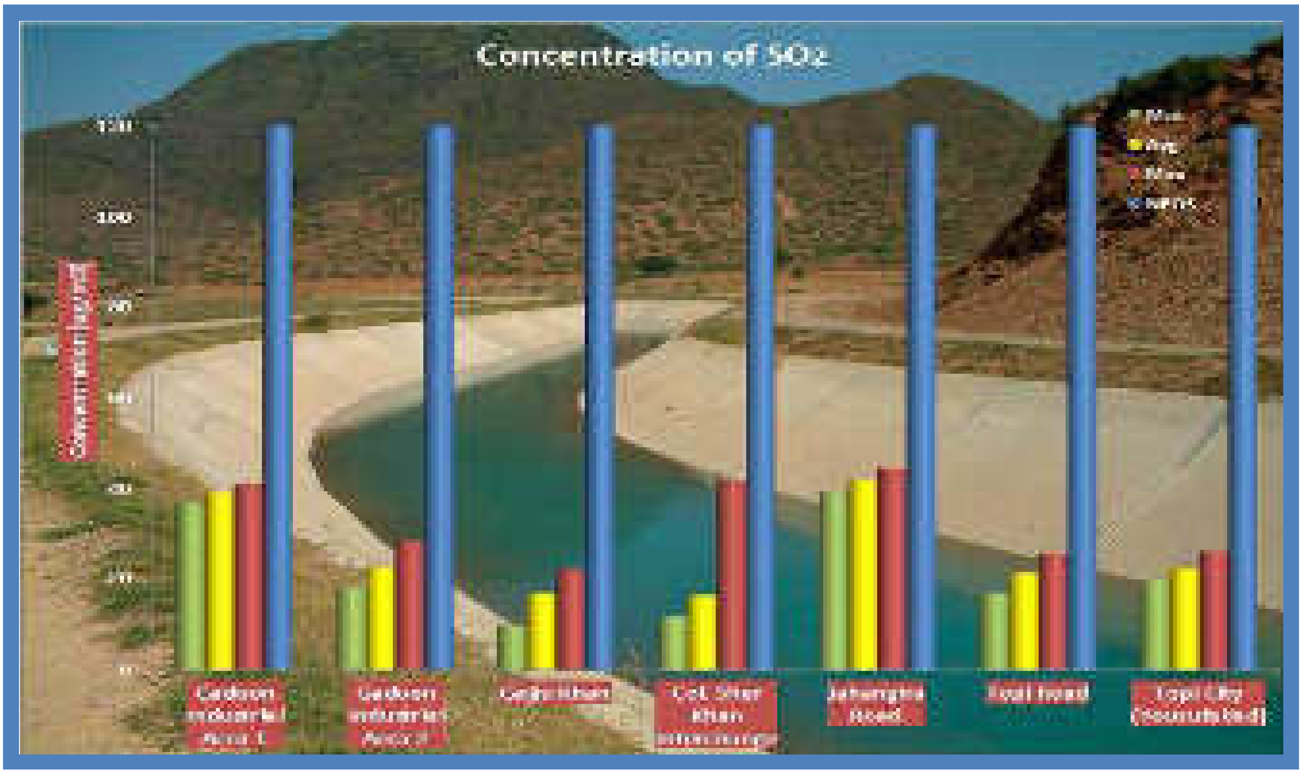


Figure: Minimum, Maximum and Average (24hrs) Concentration of SO2 at different locations of PHLCE Project area

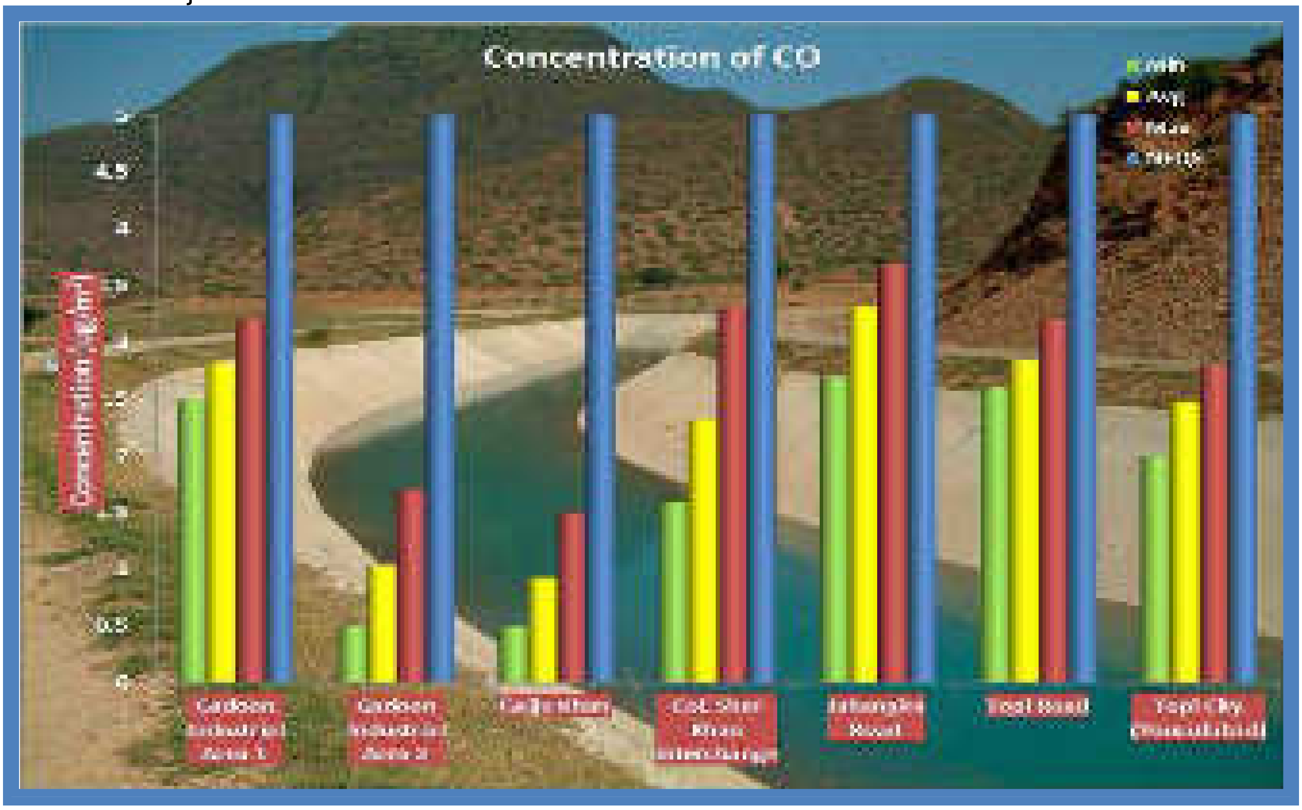


Figure: Minimum, Maximum and Average (24hrs) Concentration of CO at different locations of PHLCE Project area

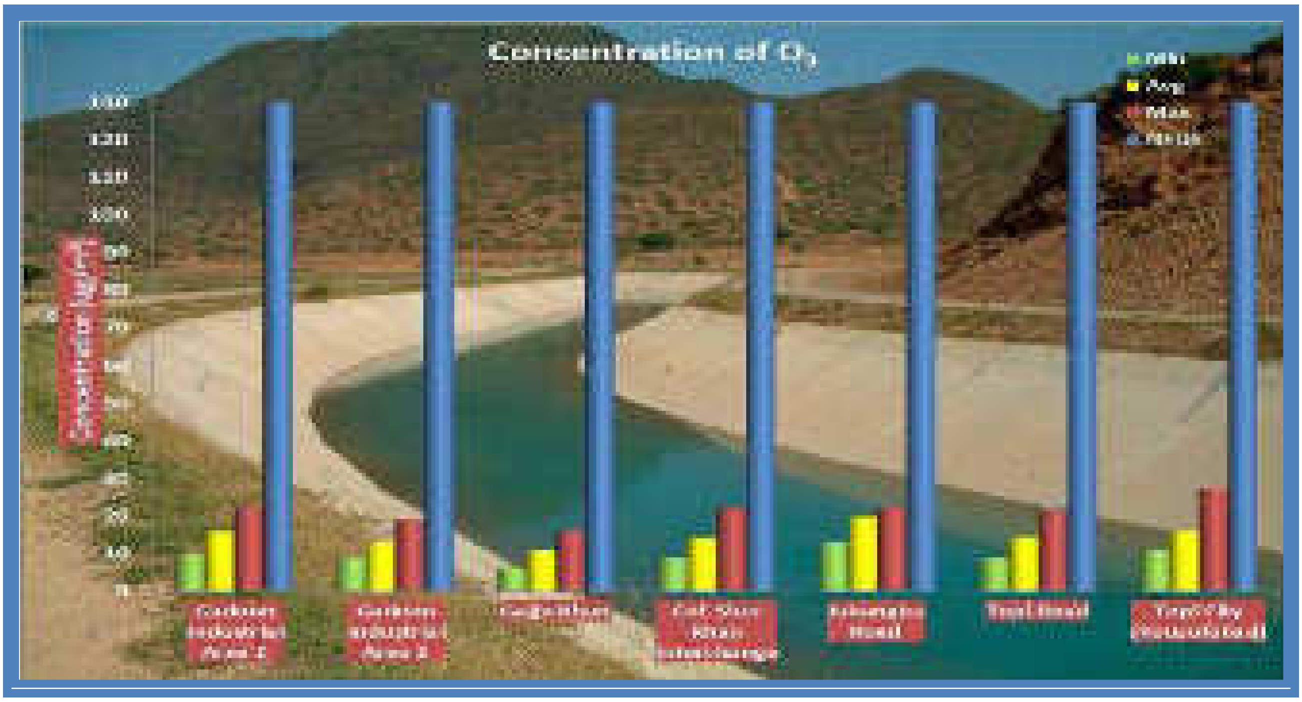


Figure: Minimum, Maximum and Average (24hrs) Concentration of O3 at different locations of PHLCE Project area

Figure: Average (24hrs) Concentration of PM2.5 at different locations of PHLCE Project area

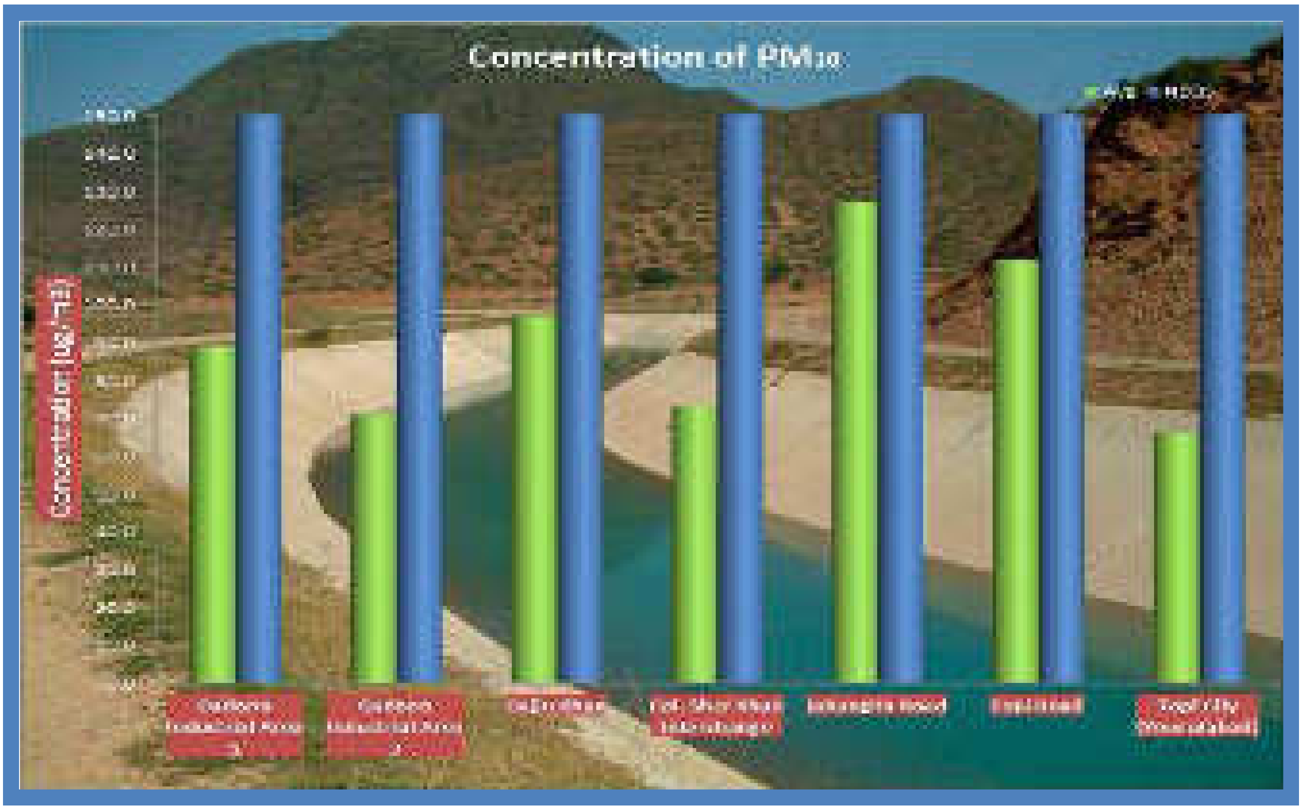


Figure: Average (24hrs) Concentration of PM10 at different locations of PHLCE Project area

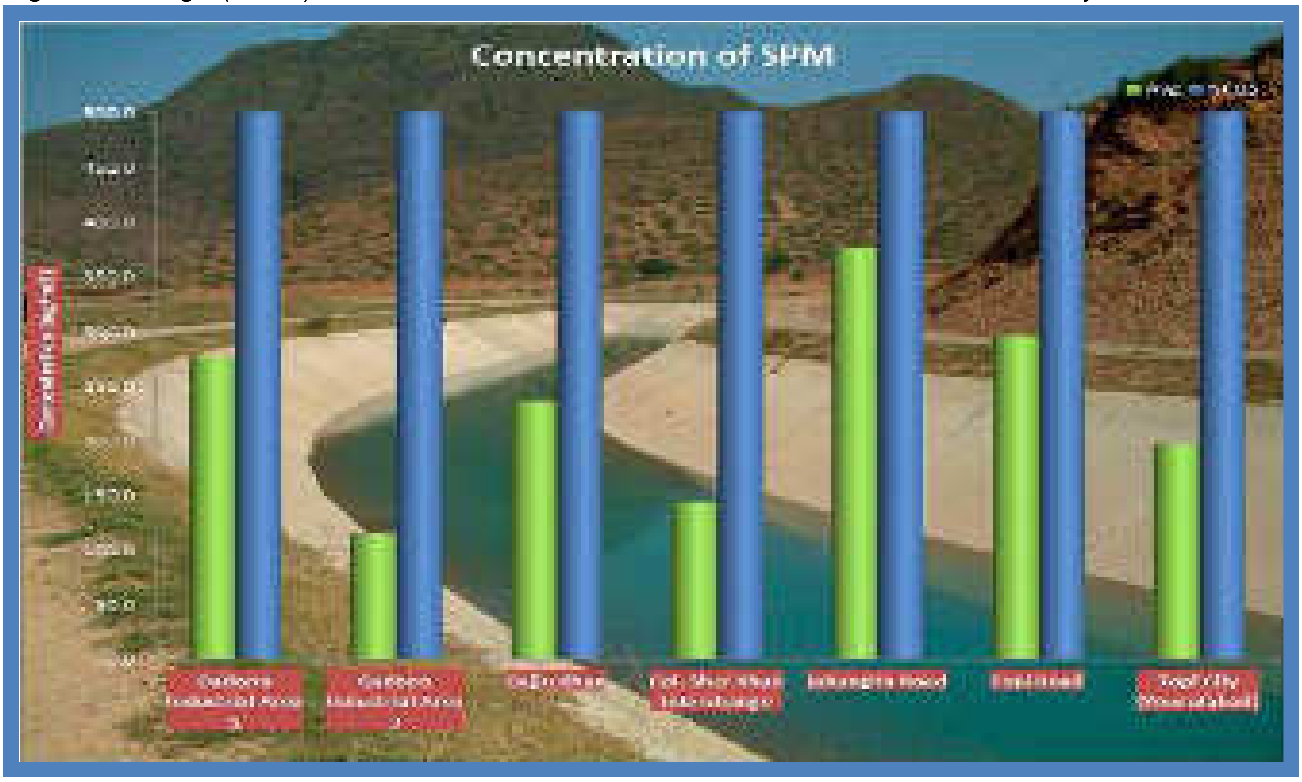


Figure 4-16: Average (24hrs) Concentration of SPM at different locations of PHLCE Project area

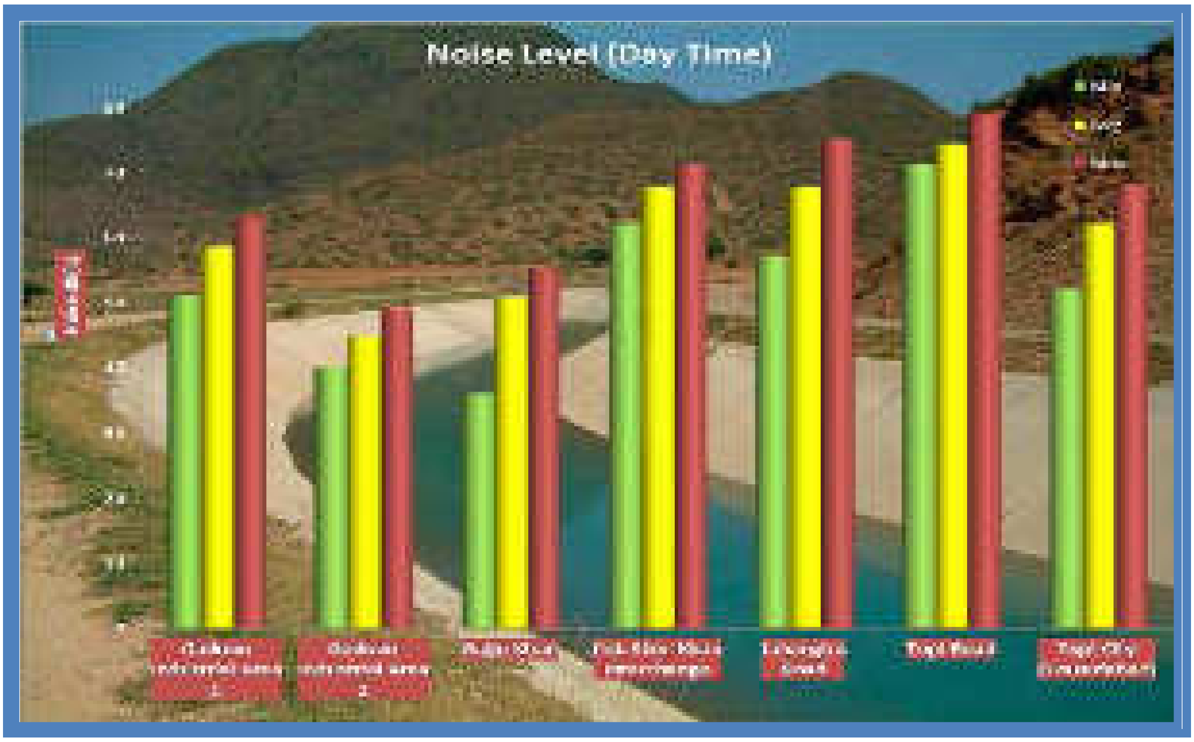


Figure (a): Minimum, Maximum and Average (Day Time) Noise level at different locations of PHLCE Project area.

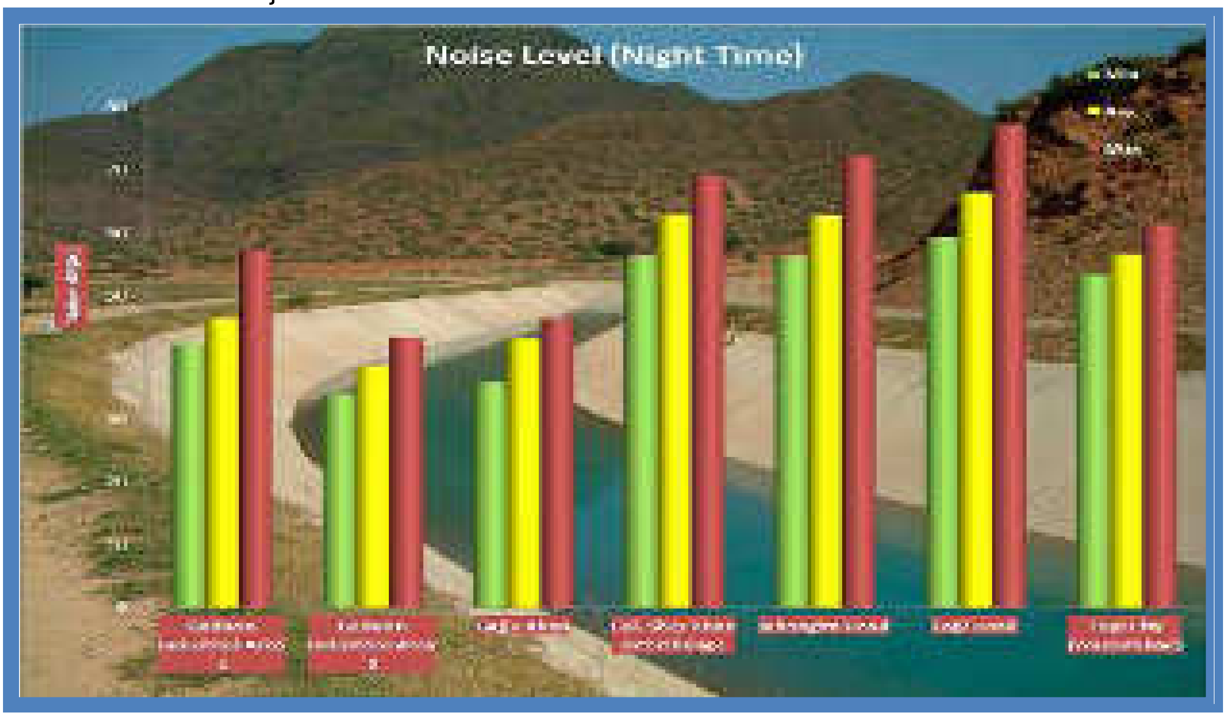


Figure ***(B): MINIMUM, MAXIMUM AND AVERAGE (DAY TIME) NOISE LEVEL AT DIFFERENT LOCATIONS OF PHLCE PROJECT AREA***

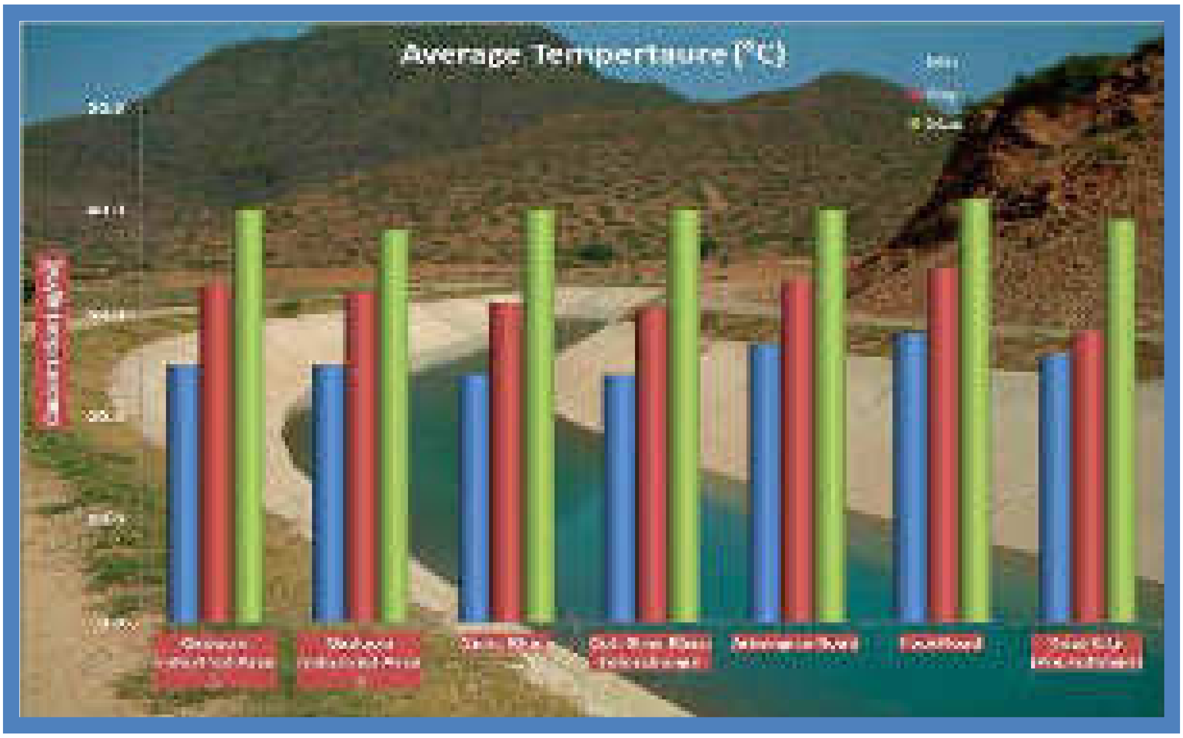


Figure: Minimum, Average and Maximum Values (24hrs) values of Temperature at different locations of PHLCE Project area

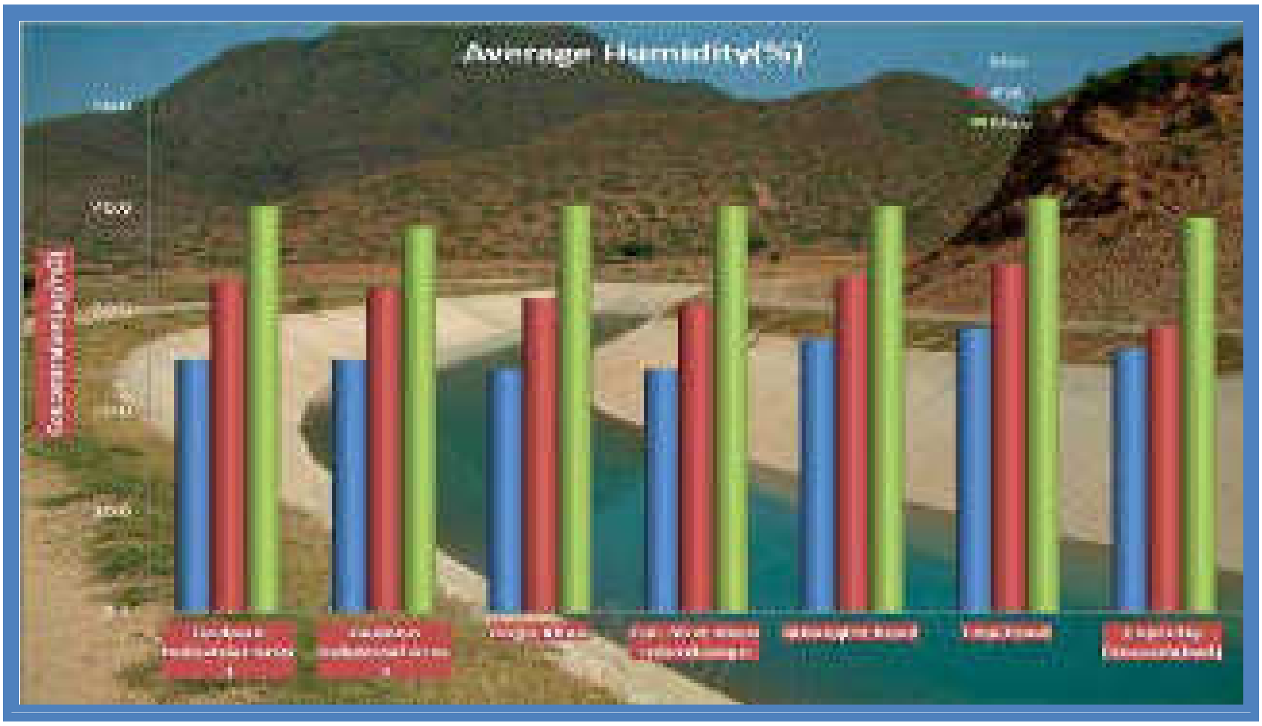


Figure: Minimum, Average and Maximum Values (24hrs) of Humidity at different locations of PHLCE Project area

Figure: Minimum, Average and Maximum (24hrs) values of Wind Speed at different

Pesticide Residue of Food Samples												
S. No.	Parameters (Residual Pesticide)	Units	Test Methods	Results								Limit FAO/WHO
				CH1	LF1	ON1	PK1	SF1	TO1	WM1	WH1	
1	Parathion	µg/g	GC-ECD/FID	<0.001	<0.001	<0.001	0.005	0.008	<0.001	<0.001	<0.001	0.2
2	Methyl Parathion	µg/g	GC-ECD/FID	0.012	0.088	0.308	0.042	0.317	0.006	0.017	<0.001	5
3	Malathion	µg/g	GC-ECD/FID	0.043	0.024	0.166	0.036	0.160	0.079	0.034	0.022	1
4	Chlorpyriphos	µg/g	GC-ECD/FID	0.018	0.070	0.004	<0.001	0.015	0.015	0.004	0.010	2
5	Pyrofenofos	µg/g	GC-ECD/FID	0.001	0.008	<0.001	<0.001	0.018	<0.001	0.008	0.003	3
6	Diazinon	µg/g	GC-ECD/FID	<0.001	<0.001	0.008	<0.001	<0.001	<0.001	<0.001	<0.001	0.5
7	Dichlorovos	µg/g	GC-ECD/FID	0.012	0.005	0.027	<0.001	0.040	0.008	0.001	0.006	7
8	Phosmet	µg/g	GC-ECD/FID	0.003	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.05
9	Cypermethrin	µg/g	GC-ECD/FID	<0.001	<0.001	0.098	0.072	0.077	0.006	0.003	<0.001	2
10	Endosulfan	µg/g	GC-ECD/FID	0.019	**0.022**	<0.001	<0.001	0.006	**0.012**	0.007	**0.010**	0.05
11	Fenvalerate	µg/g	GC-ECD/FID	**0.016**	**0.025**	**0.053**	**0.006**	**0.012**	**0.053**	<0.001	<0.001	0.03
12	Monocrotophos	µg/g	GC-ECD/FID	0.024	0.033	<0.001	0.005	0.024	0.019	0.014	0.003	-
13	Quinolphos	µg/g	GC-ECD/FID	<0.001	<0.001	0.004	<0.001	<0.001	<0.001	<0.001	<0.001	-
14	Azinphos-methyl	µg/g	GC-ECD/FID	<0.001	<0.001	<0.001	<0.001	<0.001	0.004	<0.001	<0.001	10
15	Penthoate	µg/g	GC-ECD/FID	<0.001	**0.008**	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.003
16	Dimethoate	µg/g	GC-ECD/FID	**0.025**	**0.015**	**0.015**	<0.001	**0.037**	0.008	<0.001	0.002	0.05
17	Phosphamidon	µg/g	GC-ECD/FID	<0.001	0.012	<0.001	0.007	0.024	0.027	<0.001	0.014	-

Pesticide Residue of Food Samples												
S. No.	Parameters (Residual Pesticide)	Units	Test Methods	Results								Limit FAO/WHO
				CH1	LF1	ON1	PK1	SF1	TO1	WM1	WH1	
18	Pirimiphos-methyl	µg/g	GC-ECD/FID	<0.001	<0.001	<0.001	0.006	<0.001	<0.001	<0.001	<0.001	0.5
19	Heptachlor	µg/g	GC-ECD/FID	**0.008**	**0.026**	<0.001	**0.011**	<0.001	**0.015**	0.008	0.002	0.01
20	Aldrin	µg/g	GC-ECD/FID	0.0012	0.0023	0.007	<0.001	0.005	<0.001	0.017	**0.019**	0.05
21	DDE	µg/g	GC-ECD/FID	0.008	0.0014	<0.001	0.0025	0.009	<0.001	0.003	0.038	-
22	Dieldrin	µg/g	GC-ECD/FID	0.003	0.001	**0.018**	**0.016**	**0.018**	0.004	<0.001	**0.020**	0.05
23	Endrin	µg/g	GC-ECD/FID	<0.001	0.006	0.018	0.007	0.003	<0.001	<0.001	<0.001	0.05
24	DDT	µg/g	GC-ECD/FID	0.093	0.083	0.020	0.034	**0.128**	0.024	0.014	0.007	0.1
25	Methyl Chlor	µg/g	GC-ECD/FID	0.019	0.0035	<0.001	<0.001	<0.001	<0.001	0.002	0.005	-
26	Alachlor	µg/g	GC-ECD/FID	<0.001	<0.001	0.019	0.009	<0.001	<0.001	<0.001	<0.001	-
27	Alpha BHC	µg/g	GC-ECD/FID	0.002	<0.001	0.012	0.003	<0.001	<0.001	0.008	0.018	-
28	β-BHC	µg/g	GC-ECD/FID	0.005	<0.001	<0.001	<0.001	0.003	0.003	<0.001	<0.001	-
29	Gama BHC	µg/g	GC-ECD/FID	<0.001	<0.001	0.014	<0.001	<0.001	<0.001	<0.001	<0.001	-
30	Heptachlor Epoxide	µg/g	GC-ECD/FID	<0.001	<0.001	<0.001	<0.001	<0.001	0.002	<0.001	<0.001	0.02
31	Hexa achloro benzene	µg/g	GC-ECD/FID	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	-
32	Mirex	µg/g	GC-ECD/FID	0.019	<0.001	<0.001	<0.001	0.001	<0.001	<0.001	<0.001	-
34	Oxychlordane	µg/g	GC-ECD/FID	<0.001	<0.001	0.003	<0.001	<0.001	<0.001	<0.001	<0.001	-

Pesticide Residue of Food Samples												
S. No.	**Parameters (Residual Pesticide)**	**Units**	**Test Methods**	**Results**								**Limit FAO/WHO**
				CH1	**LF1**	**ON1**	**PK1**	**SF1**	**TO1**	**WM1**	**WH1**	
35	lindane	µg/g	GC-ECD/FID	0.005	0.007	0.002	0.0052	**0.093**	**0.020**	**0.016**	0.002	0.01

ANNEXURE-V PESTICIDE RESIDUE IN FOOD SAMPLES IN THE COMMAND AREA

Pesticide Residue of Water Samples									
S. No.	Parameters (Residual Pesticide)	Units	Test Methods	Results					Limit FAO-WHO Food Standards
				Indus Amber			Besik	Janda Boka	
				IA1	IA2	IA3	B1	TB1	
1	Parathion	µg/L	GC-ECD/FID	<0.001	<0.001	0.003	<0.001	0.009	0.2
2	Methyl Parathion	µg/L	GC-ECD/FID	0.005	0.017	0.010	0.021	0.024	5
3	Malathion	µg/L	GC-ECD/FID	<0.001	0.014	0.007	0.012	0.002	1
4	Chlorpyriphos	µg/L	GC-ECD/FID	0.004	<0.001	0.015	0.008	0.019	2
5	Pyrofenofos	µg/L	GC-ECD/FID	<0.001	<0.001	0.003	0.018	0.007	3
6	Diazinon	µg/L	GC-ECD/FID	<0.001	<0.001	<0.001	<0.001	<0.001	0.5
7	Dichlorovos	µg/L	GC-ECD/FID	0.010	0.007	0.009	<0.001	0.012	7
8	Phosmet	µg/L	GC-ECD/FID	<0.001	<0.001	<0.001	<0.001	<0.001	0.05
9	Cypermethrin	µg/L	GC-ECD/FID	<0.001	<0.001	<0.001	0.007	<0.001	2
10	Endosulfan	µg/L	GC-ECD/FID	0.010	0.003	<0.001	<0.001	0.007	0.05
11	Fenvalerate	µg/L	GC-	<0.001	0.005	<0.001	0.037	0.014	0.03

Pesticide Residue of Water Samples									
S. No.	Parameters (Residual Pesticide)	Units	Test Methods	Results					Limit FAO-WHO Food Standards
				Indus Amber			Besik	Janda Boka	
			ECD/FID						
12	Monocrotophos	µg/L	GC-ECD/FID	0.007	0.006	0.014	<0.001	0.017	-
13	Quinolphos	µg/L	GC-ECD/FID	<0.001	<0.001	<0.001	<0.001	<0.001	-
14	Azinphos-methyl	µg/L	GC-ECD/FID	<0.001	<0.001	<0.001	<0.001	<0.001	10
15	Penthoate	µg/L	GC-ECD/FID	<0.001	<0.001	<0.001	<0.001	<0.001	0.003
16	Dimethoate	µg/L	GC-ECD/FID	<0.001	<0.001	0.009	0.012	0.015	0.05
17	Phosphamidon	µg/L	GC-ECD/FID	<0.001	<0.001	0.007	<0.001	<0.001	-
18	Pirimiphos-methyl	µg/L	GC-ECD/FID	<0.001	<0.001	<0.001	<0.001	<0.001	0.5
19	Heptachlor	µg/L	GC-ECD/FID	0.001	<0.001	<0.001	<0.001	<0.001	0.01
20	Aldrin	µg/L	GC-ECD/FID	0.005	<0.001	<0.001	0.007	0.009	0.05
21	DDE	µg/L	GC-ECD/FID	<0.001	<0.001	0.017	0.012	0.018	-
22	Dieldrin	µg/L	GC-ECD/FID	0.002	0.005	<0.001	0.005	0.019	0.05
23	Endrin	µg/L	GC-ECD/FID	0.002	0.011	<0.001	<0.001	0.007	0.05

Pesticide Residue of Water Samples									
S. No.	Parameters (Residual Pesticide)	Units	Test Methods	Results					Limit FAO-WHO Food Standards
				Indus Amber			Besik	Janda Boka	
24	DDT	µg/L	GC-ECD/FID	0.005	0.008	0.019	0.003	0.020	0.1
25	Methyl Chlor	µg/L	GC-ECD/FID	<0.001	<0.001	0.006	0.013	<0.001	-
26	Alachlor	µg/L	GC-ECD/FID	<0.001	<0.001	<0.001	0.006	0.007	-
27	Alpha BHC	µg/L	GC-ECD/FID	<0.001	<0.001	0.003	0.004	0.005	-
28	β-BHC	µg/L	GC-ECD/FID	<0.001	<0.001	0.001	<0.001	<0.001	-
29	Gama BHC	µg/L	GC-ECD/FID	<0.001	<0.001	<0.001	0.002	<0.001	-
30	Heptachlor Epoxide	µg/L	GC-ECD/FID	<0.001	<0.001	<0.001	<0.001	<0.001	0.02
31	Hexa achloro benzene	µg/L	GC-ECD/FID	<0.001	<0.001	<0.001	<0.001	<0.001	-
32	Mirex	µg/L	GC-ECD/FID	<0.001	<0.001	<0.001	<0.001	<0.001	-
34	Oxychlordane	µg/L	GC-ECD/FID	<0.001	<0.001	<0.001	<0.001	<0.001	-
35	lindane	µg/L	GC-ECD/FID	<0.001	0.002	<0.001	0.015	0.007	0.01
									0.2

ANNEXURE-VI TREE INVENTORY ALONG THE ROW

RD	S/No.	Local Name	Botonical Name	No of Trees
RD 0+000-1+000	1	Lachi	*Eucalyptus globulus*	16
	2	Bikyana	*Melia azedarach*	7
	3	Chinar	*Platanus orientalis Linn*	25
R.D 1+000 – 2+000	1	Toot	*Morus alba*	8
	2	Bikyana	*Melia azedarach*	13
	3	Chinar	*Platanus orientalis Linn*	8
	4	Injeer	*Ficus carica*	4
R.D 2+000 – 2+300	1	Toot	*Morus alba*	4
	2	Bikyana	*Melia azedarach*	21
	3	Srinj	Alaizia lebbeck	4
	4	Injeer	*Ficus carica*	4
Total				**114**
Tree Inventory for Janda Boka Canal				
R.D 0+000 – 1+000	1	Lachi	*Eucalyptus globulus*	261
	2	Bikyana	*Melia azedarach*	32
	3	Toot	*Morus alba*	12
	4	Injeer	*Ficus carica*	3
	5	Beera	*Zizipus jujuba*	3
R.D 1+000 – 2+000		Trees are not present		
R.D 2+000 – 3+000		Toot	*Morus alba*	27
R.D 3+000 – 4+000		Trees are not present		
R.D 4+000 – 5+000	1	Lachi	*Eucalyptus globulus*	22
	2	Bikyana	*Melia azedarach*	56
	3	Toot	*Morus alba*	50
R.D 5+000 – 6+000		Trees are not present		0
R.D 6+000 – 7+000	1	Bikyana	*Melia azedarach*	13
	2	Toot	*Morus alba*	4
R.D 7+000 – 8+000	1	Bikyana	*Melia azedarach*	45
	2	Toot	*Morus alba*	38
R.D 8+000 – 9+000	1	-	-	-
R.D 9+000 – 10+300	1	-	-	-
Total				**566**
Tree Inventory for Indus Ambar Pressure pipe from R.D 0+000 – 22+800				
R.D 0+000 – 1+000		Lachi	*Eucalyptus*	9
		Beera	*Ziziphus jujuba*	10
R.D 1+000 – 2+000		Shawa	*Dalbergia sissoo*	3
		Bikyana	*Melia azedarach*	4
		Toot	*Morus alba*	3
R.D 2+000 – 3+000		Lachi	*Eucalyptus*	3
		Shawa	*Dalbergia sissoo*	4
		Bikyana	*Melia azedarach*	41
		Toot	*Morus alba*	50

RD	S/No.	Local Name	Botonical Name	No of Trees
		Srinja	*Albizia lebbeck*	5
		Beera	*Ziziphus jujuba*	1
		Injeer	*Ficus carica*	7
R.D 3+000 – 4+000		Lachi	*Eucalyptus*	4
		Shawa	*Dalbergia sissoo*	1
		Bikyana	*Melia azedarach*	5
		Toot	*Morus alba*	28
		Srinja	*Albizia lebbeck*	1
		Beera	*Ziziphus jujuba*	1
		Safeeda	*White poplar*	22
			Bamboosa	1
R.D 4+000 – 5+000		Lachi	*Eucalyptus*	17
		Shawa	*Dalbergia sissoo*	11
		Bikyana	*Melia azedarach*	10
		Toot	*Morus alba*	12
		Injeer	*Ficus carica*	7
		Safeeda	*White poplar*	46
		palosa	*Acacia modesta*	1
		Simbal	*Salmalia malabarica*	1
R.D 5+000 – 6+000		Lachi	*Eucalyptus*	5
		Shawa	*Dalbergia sissoo*	42
		Bikyana	*Melia azedarach*	44
		Toot	*Morus alba*	16
		Beera	*Ziziphus jujuba*	2
		Safeeda	*White poplar*	6
		Simbal	*Acacia modesta*	2
R.D 6+000 – 7+000	1.	Toot	*Morus alba*	2
	2.		*Ghaz*	1
R.D 7+000 – 8+000	1.	Shawa	*Dalbergia sissoo*	12
	2.	Bikyana	*Melia azedarach*	7
	3.	Toot	*Morus alba*	3
	4.	Injeer	*Ficus carica*	6
	5.	Chinar	*Platanus orientalis Linn* (Chinar)	1
R.D 8+000 – 9+000	1.	Lachi	*Eucalyptus*	17
	2.	Bikyana	*Melia azedarach*	19
	3.	Toot	*Morus alba*	9
	4.	Injeer	*Ficus carica*	3
	5.	Chinar	*Platanus orientalis Linn* (Chinar)	35
	6.		*Ghaz like pine*	3
	7.	Amrood	*Psidium guajava (guava)*	11
	8.	aam	*Mangifera indica (mango)*	2
	9.		*Citrus sinensis*	1
R.D 9+000 – 10+000	1.	Shawa	*Dalbergia sissoo*	9
	2.	Bikyana	*Melia azedarach*	8
	3.	Toot	*Morus alba*	31
	4.	Srinja	*Albizia lebbeck*	1
	5.	Injeer	*Ficus carica*	2
	6.	palosa	*Acacia modesta*	2

RD	S/No.	Local Name	Botonical Name	No of Trees
	7.		*Citrus sinensis*	1
	1.	Bikyana	*Melia azedarach*	8
	2.	Toot	*Morus alba*	40
	3.	Injeer	*Ficus carica*	3
	4.	Pine	*Pine*	1
R.D 10+000 – 11+000	5.	Chinar	*Platanus orientalis Linn* (Chinar)	24
R.D 11+000 – 12+000		Plain agricultural land		0
	1.	Shawa	*Dalbergia sissoo*	8
	2.	Bikyana	*Melia azedarach*	28
	3.	Toot	*Morus alba*	29
	4.		*Bamboosa (bunch)*	1
	5.	Injeer	*Ficus carica*	2
	6.	Simbal	*Salmalia malabarica*	1
R.D 12+000 – 13+000	7.	Chinar	*Platanus orientalis Linn* (Chinar)	87
	1.	Shawa	*Dalbergia sissoo*	11
	2.	Bikyana	*Melia azedarach*	49
	3.	Toot	*Morus alba*	13
	4.	Injeer	*Ficus carica*	4
	5.	Simbal	*Salmalia malabarica*	2
	6.	Srinja	*Albizia lebbeck*	2
	7.		*Prunus domestica*	4
	8.		*Pruneus arminiaca*	1
	9.		*Diospyrus kaki Linn*	2
R.D 13+000 – 14+000	10.		*Psidium guajava (guava)*	1
	1.	Bikyana	*Melia azedarach*	77
	2.	Toot	*Morus alba*	7
R.D 14+000 – 15+000	3.	Safeeda	*White poplar*	3
	1.	Shawa	*Dalbergia sissoo*	2
	2.	Bikyana	*Melia azedarach*	48
	3.	Toot	*Morus alba*	46
	4.	Srinja	*Albizia lebbeck*	1
	5.	Injeer	*Ficus carica*	3
R.D 15+000 – 16+000	6.	palosa	*Acacia modesta*	7
R.D 16+000 – 17+000	1.	Bikyana	*Melia azedarach*	3
	2.	Toot	*Morus alba*	9
	1.	Shawa	*Dalbergia sissoo*	1
	2.	Bikyana	*Melia azedarach*	4
R.D 17+000 – 18+000	3.	Toot	*Morus alba*	70
	1.	Chinar	*Platanus orientalis Linn* (Chinar)	9
	2.	Shawa	*Dalbergia sissoo*	19
	3.	Bikyana	*Melia azedarach*	183
	4.	Toot	*Morus alba*	336
	5.	Srinja	*Albizia lebbeck*	3
R.D 18+000 – 19+000	6.	Safeeda	*White poplar*	9
	1.	Lachi	*Eucalyptus*	15
	2.	Bikyana	*Melia azedarach*	10
R.D 19+000 – 20+300	3.	Toot	*Morus alba*	14

RD	S/No.	Local Name	Botonical Name	No of Trees
	4.	Chinar	*Platanus orientalis Linn (Chinar)*	48
R.D 20+300 – 21+600	1.	Lachi	*Eucalyptus (Forest)*	1500
	2.	Shawa	*Dalbergia sissoo*	1
	3.	Bikyana	*Melia azedarach*	14
	4.	Toot	*Morus alba*	23
	5.	Chinar	*Platanus orientalis Linn (Chinar)*	18
R.D 21+600 – 22+800		Trees are not present in RoW of P.P.		0
Total				**3415**
Tree Inventory for Indus Ambar Main Canal				
			Indus Ambar Canal from RD 0+000 – 28+200	0
R.D 0+000 – 1+000			Trees are not present	0
R.D 1+000 – 2+000			Trees are not present	0
R.D 2+000 – 3+000			Trees are not present.	0
R.D 3+000 – 4+000	1.	Shawa	*Dalbergia sissoo*	7
R.D 4+000 – 5+000	1.	Lachi	*Eucalyptus globulus*	10
	2.	Amrood	*Psidium guajava (guava)*	7
R.D 5+000 – 6+000			Trees are not present	0
R.D 6+000 – 7+000	1.	Lachi	*Eucalyptus globulus*	8
R.D 7+000 – 8+000			Trees are not present.	0
R.D 8+000 – 9+000	1.	Bikyana	*Melia azedarach*	20
	2.	toot	*Morus alba*	10
R.D 9+000 – 10+000	1.	Lachi	*Eucalyptus globulus*	26
	2.	Shawa	*Dalbergia sissoo*	3
	3.	Bikyana	*Melia azedarach*	24
	1.	toot	*Morus alba*	18
	2.	beera	*Zizipus jujuba*	1
R.D 10+000 – 11+000	1.	Lachi	*Eucalyptus globulus*	10
	2.	Shawa	*Dalbergia sissoo*	1
	3.	Bikyana	*Melia azedarach*	50
	4.	toot	*Morus alba*	26
	5.	Safeeda	*White poplar*	2
	6.	Simbal	*Salmalia malabarica*	4
	7.	beera	*Zizipus jujuba*	1
R.D 11+000 – 12+000	1.	Lachi	*Eucalyptus globulus*	3
	2.	Shawa	*Dalbergia sissoo*	4
	3.	Bikyana	*Melia azedarach*	11
	4.	toot	*Morus alba*	12
	5.	Injeer	*Ficus carica*	1
	6.	beera	*Zizipus jujuba*	8
	7.	Amrood	*Psidium guajava (guava)*	7
R.D 12+000 –	1.	Shawa	*Dalbergia sissoo*	29

RD	S/No.	Local Name	Botonical Name	No of Trees
13+000	2.	Bikyana	*Melia azedarach*	113
	3.	toot	*Morus alba*	35
	4.	Injeer	*Ficus carica*	24
	5.		*Ghaz*	5
	6.	beera	*Ziziphus jujuba*	3
R.D 13+000 – 14+000	1.	Bikyana	Melia azedarach	186
	2.	Injeer	Ficus carica	4
	3.	Chinar	*Platanus orientalis Linn*	9
	4.	Ghaz	*Tamarix Sp*	1
R.D 14+000 – 15+000	1.	Shawa	*Dalbergia sissoo*	25
	2.	Bikyana	*Melia azedarach*	65
	3.	toot	*Morus alba*	5
	4.	Injeer	*Ficus carica*	10
R.D 15+000 – 16+000	1.	Lachi	*Eucalyptus globules*	14
	2.	Shawa	*Dalbergia sissoo*	3
	3.	Bikyana	*Melia azedarach*	78
	4.	Chinar	*Platanus orientalis Linn*	24
R.D 16+000 – 17+000	1.	Shawa	*Dalbergia sissoo*	1
	2.	toot	*Morus alba*	6
R.D 17+000 – 18+000	1.	toot	*Morus alba*	2
	2.	beera	*Ziziphus jujuba*	6
R.D 18+000 – 19+000	1.	beera	*Ziziphus jujuba*	1
R.D 19+000 – 20+000	1.	Lachi	*Eucalyptus globules*	2
	2.	Shawa	*Dalbergia sissoo*	1
	3.	Bikyana	*Melia azedarach*	70
	4.	Injeer	*Ficus carica*	3
R.D 20+000 – 21+000	1.	beera	*Ziziphus jujuba*	4
R.D 21+000 – 22+000	1.	Lachi	*Eucalyptus globulus*	50
R.D 22+000 – 23+000	1.	beera	*Ziziphus jujuba*	10
	2.	Palosa	*Acacia modesta*	22
R.D 23+000 – 24+000	1.	beera	*Ziziphus jujuba*	5
R.D 24+000 – 25+000	1.	Lachi	*Eucalyptus globulus*	250
	2.	Limbo	*Orchird (Qurban Khan)*	100
R.D 25+000 – 26+000	1.	Lachi	*Eucalyptus globulus*	7
R.D 26+000 – 27+000	1.	Lachi	*Eucalyptus globulus*	8
R.D 27+000 – 28+200	1.	Lachi	*Eucalyptus globulus*	40
	2.	Bikyana	*Melia azedarach*	65
Total				**1560**
Trees are not present in RoW of Indus Ambar Minor 1				
Indus Ambar Minor 2				
R.D 0+000 – 1+000	1.	Bikyana	*Melia azedarach*	3
	2.	Beera	*Ziziphus jujube*	2
R.D 1+000 – 2+000			Trees are not present	0
R.D 2+000 – 3+000			Trees are not present	0

RD	S/No.	Local Name	Botonical Name	No of Trees
R.D 3+000 – 4+000	1.	Lachi	*Eucalyptus globulus*	1
	2.	Bikyana	*Melia azedarach*	9
	3.	Toot	*Morus alba*	14
R.D 4+000 – 5+000	1.	Bikyana	*Melia azedarach*	12
	2.	Toot	*Morus alba*	3
R.D 5+000 – 6+000	1.	Bikyana	*Melia azedarach*	63
	2.	Toot	*Morus alba*	15
R.D 6+000 – 7+000			*Trees are not present*	0
R.D 7+000 – 8+000			*Trees are not present*	0
Total				**122**
Tree Inventory on Indus Ambar Minor 3				0
Tree Inventory on Indus Ambar Minor 4				
R.D 0+000 – 4+000		0	0	0
R.D 0+000 – 1+000			*Trees are not present*	
R.D 1+000 – 2+000	1.	Lachi	*Eucalyptus globulus*	55
R.D 2+000 – 3+000	1.	Lachi	*Eucalyptus globulus*	143
R.D 3+000 – 4+000	1.	Lachi	*Eucalyptus globulus*	95
	2.	Shawa	*Dalbergia sissoo*	4
	3.	Bikyana	*Melia azedarach*	1
	4.	Toot	*Morus alba*	1
Total				**299**
Tree Inventory on Indus Ambar Minor 5				
R.D 0+000 – 1+000			*Trees are not present*	0
R.D 1+000 – 2+000			*Trees are not present*	0
R.D 2+000 – 3+000	1.	Bikyana	*Melia azedarach*	12
	2.	Toot	*Morus alba*	4
	3.	Beera	*Ziziphus jujuba*	4
R.D 3+000 – 4+000			*Trees are not present*	0
R.D 4+000 – 4+800			*Trees are not present*	0
Total				**20**
Tree Invventory on Indus Minor 1				
R.D 0+000 – 1+000	1.	Lachi	*Eucalyptus globulus*	12
	2.	Bikyana	*Melia azedarach*	8
	3.	Toot	*Morus alba*	2
	4.	Injeer	*Ficus carica*	5
	5.	Chinar	*Platanus orientalis Linn*	25
Total				**52**
Tree Inventory on Indus Minor 2				
R.D 0+000 – 1+000	1.	Lachi	*Eucalyptus globulus*	15
R.D 1+000 – 2+000	1.	Lachi	*Eucalyptus globulus*	3

RD	S/No.	Local Name	Botonical Name	No of Trees
R.D 2+000 – 3+000	1.	Lachi	*Eucalyptus globulus*	10
	2.	Beera	*Ziziphus jujuba*	8
R.D 3+000 – 4+350	1.	Beera	*Ziziphus jujuba*	8
Total				**44**
Tree Inventory on Indus Disty – 1				
R.D 0+000 – 1+000	1.	Lachi	*Eucalyptus globulus*	20
	2.	Bikyana	*Melia azedarach*	20
	3.	Toot	*Morus alba*	3
	4.	Injeer	*Ficus carica*	9
R.D 1+000 – 2+000	1.	Lachi	*Eucalyptus globulus*	22
	2.	Toot	*Morus alba*	3
	3.	Beera	*Ziziphus jujuba*	3
R.D 2+000 – 3+000	1.	Lachi	*Eucalyptus globulus*	9
	2.	Beera	*Ziziphus jujuba*	3
R.D 3+000 – 4+000	1.	Lachi	*Eucalyptus globulus*	16
	2.	Beera	*Ziziphus jujuba*	3
R.D 4+000 – 5+000	1.	Lachi	*Eucalyptus globulus*	4
	2.	Beera	*Ziziphus jujuba*	3
	3.	Shawa	*Dalbergia sissoo*	3
R.D 5+000 – 6+600	1.	Lachi	*Eucalyptus globulus*	93
	2.	Beera	*Ziziphus jujuba*	7
	3.	Shawa	*Dalbergia sissoo*	2
Total				**223**
GRAND TOTAL				**6415**

ANNEXURE-VII Public/Stakeholder's consultation on PHLCEP

Cosultative Meeting with Seconday Stakeholders of KP Forest Department Mardan Division

Meeting date and time	*Location*	*Stakeholders participating*		*Key Issues/Topics Discussed (Questions of the Participants and Answers of the Project Proponent and PPTA Consultants)*
		Names of Project Proponent and PPTA Consultants	*Names and Type of Participant Farmers (Farmers, tenants, women, land owner, traders or laborers)*	
3RD March 2015 11:00 AM	**Forest Department Government of KP.**	PPTA Team 1. Mr. S.M Kakar (Environmental Specialist-National) 2. Mr. Sibghat Ullah Khan (Environmentalist) and 3. Mr. Zaheer Ahmad (Sociologist)	Mr.Abdul Manan (Divisional Forest Officer Mardan Division).	• The plantation if proposed under the PHLCE needs to be formally handed over to the Forest Department for standardised plantation and after care. The plants will be under the ownership of the Department in the long run.

PHOTOGALLERY

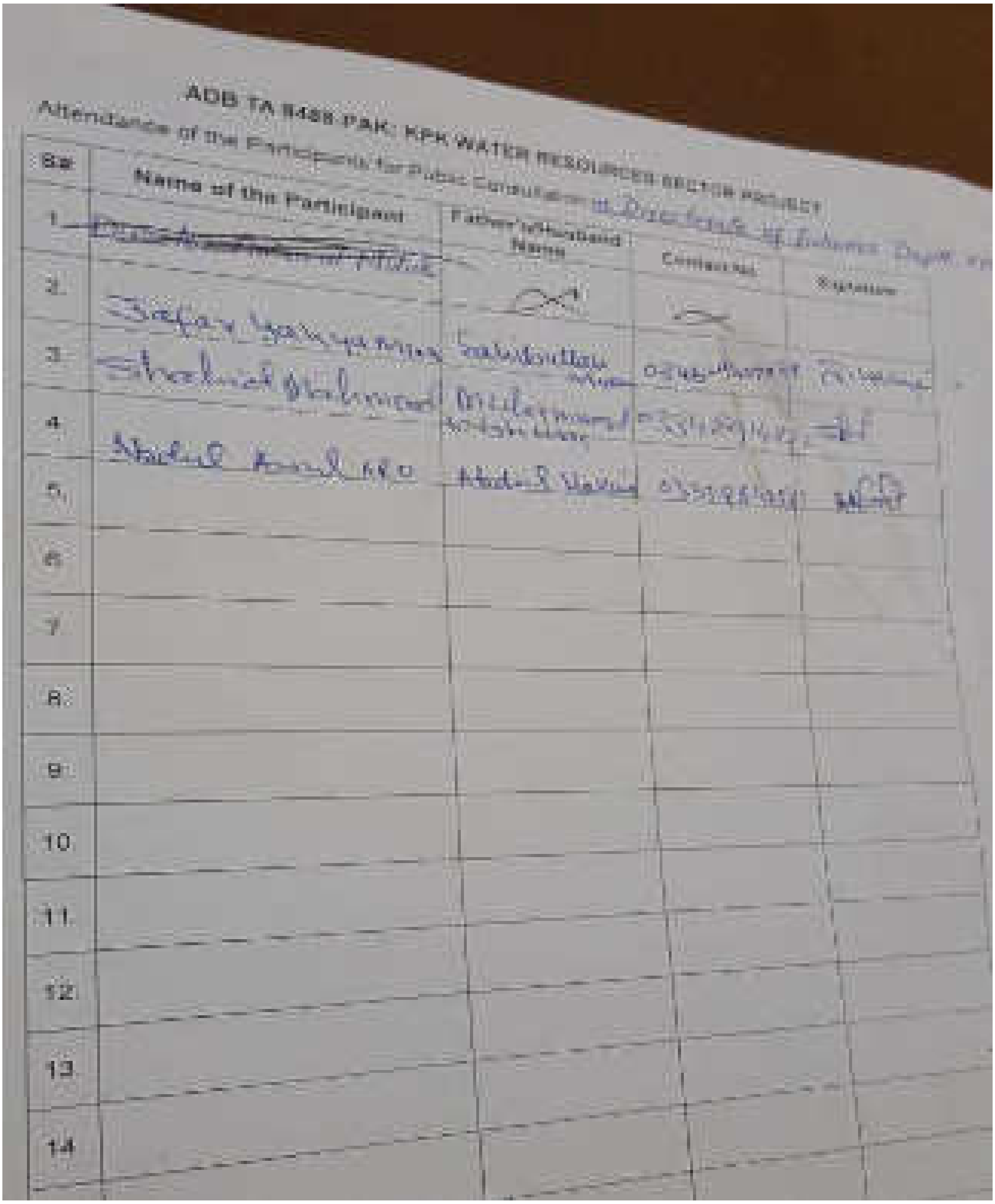

PPTA Team meeting with DFO Mardan Division

Cosultative Meeting with Seconday Stakeholders of KP Fisheries Department

Meeting date and time	*Location*	*Stakeholders participating*		*Key Issues/Topics Discussed*
		Names of Project Proponent and PPTA Consultants	*Names and Type of Participant Farmers* *(Farmers, tenants, women, land owner, traders or laborers)*	
Name of the Core Sub Project: PHLC Extension				
5th November 2015 11:30 AM	Directorate of Fisheries Department KPK	PPTA Team 1. Mr. Sibghat Ullah Khan (Environmentalist) and 2. Mr. Zaheer Ahmad (Sociologist)	Officials: • Director Fisheries Department Peshawar. • Deputy Director Fisheries Department Peshawar. • Assistant Director Fisheries Department Mardan. • Assistant Director Fisheries Department Swabi.	• PPTA team briefed the officila about the proposed PHLCE project interventions and the officilas ensured that no fisheries hotspot exist in the project corrdior except an hatchery is under planning in Malik Abad on Janda Boka area. • According to the officials the proposed project will not disturb their fisheries hotspots. • The officials requested for provision of fresh

			• ARO Fisheries Department Peshawar.	water to the proposed hatchery throuhg Janda Boka branch.

Attendance of the Participants for Public Consultation in Directorate of Fisheries Department KPK



ADB TA 8488-PAK: KPK WATER RESOURCES SECTOR PROJECT

Attendance of the Participants for Public Consultation at Directorate of Fisheries Deptt. [illegible]

Sr.	Name of the Participant	Father's/Husband Name	Contact No.	Signature
1.	~~[illegible]~~			
2.				
3.	[illegible]	[illegible]	[illegible]	[illegible]
4.	[illegible]	[illegible]	[illegible]	[illegible]
5.	[illegible]	[illegible]	[illegible]	[illegible]
6.				
7.				
8.				
9.				
10.				
11.				
12.				
13.				
14.				

PHOTOGALLERY

Consultation meeting in Directorate of Fisheries Department Khyber Pakhtunkhwa (KPK)
Dated: 5th November 2015

Consultation meeting with Deputy Director KPK, A.D Swabi, A.D Mardan, ARO Peshawar in Directorate of fisheries deparment KPK.

PPTA team Discussion with Deputy Director Fisheries Department Government of KPK.

Meeting with the officials

PPTA team sharing proposed alignment on Laptop with representatives of Fisheries Department Government of KPK.

Indus Ambar Pressure pipe: Cosultative Meeting with Primary Stakeholders Likely to be affected during Installation of Pressure pipe

Meeting date and time	*Location*	*Stakeholders participating*		*Key Issues/Topics Discussed* *(Questions of the Participants and Answers of the Project Proponent and PPTA Consultants)*	*Views of the Public 2ND Round of Public Consultation*
		Names of Project Proponent and PPTA Consultants	*Names and Type of Participant Farmers* *(Farmers, tenants, women, land owner, traders or laborers)*		
9th March 24, 2015 11:00 AM	***Public Consultation Meetings in Primary Impact Zone of Pressure pipe SMKM Government College Kotha.***	PPTA Team 1. Mr. Sibghat Ullah Khan (Environmentalist) and 2. Mr. Zaheer Ahmad (Sociologist)	Principal Mr. Isteraj and college staff.	• The Principal of SMKM Government College Kotha, opined that at this stage, he cannot give any suggestions with regards to installation of Pressure pipe as proposed to be passing within the college boundary, because after some months, Benazir Women University will be shifted in the college building and SMKM college will be relocated to a new place. • He expressed concern that during installation of the pressure pipe, the studies of the students may be affected due to heavy traffic movement and noise, therefore; it will be preferable to undertake the works during off days of the week. • According to the participants, the	Change in the alignment of the pressure pipe is under progress.

Meeting date and time	Location	Stakeholders participating: Names of Project Proponent and PPTA Consultants	Stakeholders participating: Names and Type of Participant Farmers (Farmers, tenants, women, land owner, traders or laborers)	Key Issues/Topics Discussed (Questions of the Participants and Answers of the Project Proponent and PPTA Consultants)	Views of the Public 2ND Round of Public Consultation
				drinking water pipeline originating from the source for the college building is falling in the RoW of the proposed PP and may be affected. • College play ground may be disturbed during excavation works. • The stakeholders demanded for rehabilitation/restoration of infrastructure if damaged due to the propose project works. • They feel that the passage/main entrance of the college may be disturbed due to the excavation/ Installation of pressure pipe and requested for remedial measures.	

S#	Name of the Participant	[illegible]	Contact No.	Signature
1	[illegible]	[illegible]	[illegible]	
2	[illegible]	[illegible]	[illegible]	
3	[illegible]	[illegible]	[illegible]	
4	[illegible]	[illegible]	[illegible]	
5	[illegible]	[illegible]	[illegible]	
6	[illegible]	[illegible]	[illegible]	

PHOTO GALLERY


PPTA team consultative meeting with SMKM college staff


Participatory site with the SMKM college staff


SMKM College Play ground likely to be affected

The existing drinking water pipeline likely to be affected during the installation of P.P.

SMKM College main entrance from where the proposed pressure pipe will be passing.

Indus Ambar Pressure pipe: Public Consultation Meeting In Haji Khail Village

Meeting date and time	Location	Stakeholders participating		Key Issues/Topics Discussed (Questions of the Participants and Answers of the Project Proponent and PPTA Consultants)	Views of the Public 2ND Round of Public Consultation
		Names of Project Proponent and PPTA Consultants	Names and Type of Participant Farmers (Farmers, tenants, women, land owner, traders or laborers)		
9th March 2015 2:00 PM	Village Haji Khail	PPTA Team 1. Mr. Sibghat Ullah Khan (Environmentalist) and 2. Mr. Zaheer Ahmad (Sociologist)	Land owners and Farmers	• Mostly land-owners belongs to village Maini. • Stakeholders requested for outlets from Pressure pipe for village Haji Kheil and surrounding areas for irrigation purposes. • According to the participants, two outlets from PHLC (local name Stepa) are already given, but are not completely functional. • The participants expressed concerns if they provide land for pressure pipe then the given land will become property of the irrigation department and they cannot cultivate or construct houses in future; therefore; they have not benefits from this project. • According to the participants, they had already lost 1700 kanal land	The villages are not the actual owners of the land; therefore; not consulted during the second round.

Meeting date and time	Location	Stakeholders participating: Names of Project Proponent and PPTA Consultants	Names and Type of Participant Farmers (Farmers, tenants, women, land owner, traders or laborers)	Key Issues/Topics Discussed (Questions of the Participants and Answers of the Project Proponent and PPTA Consultants)	Views of the Public 2ND Round of Public Consultation
				due to various projects like Road construction, PHLC and Transmission lines etc. • According to the participants, the key issues about installation of P.P in our land will be discussed in reforming assembly (ISLAHI JIRGA) in village Maini. • Accordingly a separate meeting was arranged and the decision of the reforming assembly and findings are given in the same report.	

Attendance of the Participants for Public Consultation in Haji Khail

Attendance of the Participants for Public Consultation in the Village: Haji Khail

S#.	Name of the Participant	Father's/Husband Name	Contact No	Signature
(1)	[illegible]	[illegible]		[illegible]
(2)	[illegible]	[illegible]		[illegible]
(3)	[illegible]	[illegible]		[illegible]
(4)	[illegible]	[illegible]		[illegible]
(5)	[illegible]	[illegible]		[illegible]
(6)	[illegible]	[illegible]	[illegible]	[illegible]
(7)	[illegible]	[illegible]		[illegible]
(8)				

1ST ROUND P.C PHOTOGALLERY


PPTATeam Meeting with inhabitants of Haji Khail Village

PPTA team recording the views of participants

PPTA Team site visit with the villagers

PPTA team briefing the participants about the alignment of the proposed pressure pipe

Shakri Road falling in ROW of Pressure pipe.

Indus Ambar Pressure pipe: Public Consultation Meeting in Village Baja By-Pass

Meeting date and time	*Location*	*Stakeholders participating*		*Key Issues/Topics Discussed (Questions of the Participants and Answers of the Project Proponent and PPTA Consultants)*	*Views of the Public 2ND Round of Public Consultation*
		Names of Project Proponent and PPTA Consultants	*Names and Type of Participant Farmers (Farmers, tenants, women, land owner, traders or laborers)*		
1ST ROUND PC on 3rd March 2015 11:00 AM 2ND Round P.C on 11 June 2015 2:00 PM	**Village Baja (By pass)**	PPTA Team 1. Mr. Sibghat Ullah Khan (Environmentalist) and 2. Mr. Zaheer Ahmad (Sociologist)	Land Owners and Farmers	• The participants were willing to provide their agricultural land for installation of Pressure pipe. • The participants requested for the land located near “by-pass” which is rain- fed for provision of outlets from Pressure pipe to irrigate their land. • According to stakeholders, compensation against land acquisition may be given in accordance to the current land rate. • House of Mr. Hanif will be affected by the installation of Pressure pipe. He requested for the change the alignment of proposed Pressure pipe at RD 09+200.	• The stakeholders indicated that they have no objection to provide their land for installation of the pressure pipe. • PPTA team members informed the participants that provision of outlets from P.P is not possible. • PPTA team members apprised the participants that provision of outlets from the pressure pipe is not possible. • Participants were informed by PPTA team that a social and resettlement survey is planned and a resettlement framework is being prepared which will outline the procedure for compensation of the land to be acquired. • Mr. Hanif house will not be affected by installation of pressure pipe. PPTA team members convinced Mr.Hanif by showing engineering drawings.

Attendance of the Participants for 1st Round of Public Consultation in Village Baja (By pass)

Attendance of the Participants for Public Consultation in the Village: Baja (Bypass)

S#	Name of the Participant	Father's/Husband Name	Contact No	Signature
(1)	Mukamil Khan	Musharaf Khan	03462568427	[illegible]
(2)	Amir Zeb	Haroon Rashid	03477839880	[illegible]
(3)	Musharaf Khan	Sultan Khan		[illegible]
(4)	Rahman said	Shahzad gul	03016372190	[illegible]
(5)	Rasib Khan	Musharaf Khan	03036789443	[illegible]
(6)	Sajid Hamid	Haroon Rashid	0	[illegible]
(7)	Tamoeez Khan	Hasan Khan	0306574[illegible]	T.KHAN

Attendance of the Participants for 2nd Round of Public Consultation inVillage Baja (By pass)

Attendance of the Participants for second round of Public Consultation

in the Village: Baja Bypass

S/No.	Name of the Participant	Father's/Husband Name	Contact No	Signature
1.	[illegible]	[illegible]	[illegible]	[illegible]
2.	[illegible]	[illegible]	[illegible]	[illegible]
3.	[illegible]	[illegible]	[illegible]	[illegible]
4.	[illegible]	[illegible]	[illegible]	[illegible]
5.	[illegible]	[illegible]	[illegible]	[illegible]
6.	[illegible]	[illegible]	[illegible]	[illegible]
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2ND ROUND P.C PHOTOGALLAERY

Date: 11-06-2015

(The pictures of the 1ST Round is not available)

Public consultation meeting in village Baja by pass.

Carefully recording views of the participants.

Discussing about the proposed project.

PPTA members convincing the participants.

Participants sharing their views.

Participant's attendance conformation.

Indus Ambar Pressure pipe: Public Consultation Meeting in Jamal Abad

Meeting date and time	Location	Stakeholders participating		Key Issues/Topics Discussed (Questions of the Participants and Answers of the Project Proponent and PPTA Consultants)	Issues Status in the light of Project Management, Engineer and Resettlement Expert's Opinion
		Names of Project Proponent and PPTA Consultants	Names and Type of Participant Farmers (Farmers, tenants, women, land owner, traders or laborers)		
1ST ROUND P.C on 11th March, 2015 02:00 PM 2nd Round P.C 9th June 2015 11:00 AM	Village Jamal Abad.	PPTA Team 1. Mr. Sibghat Ullah Khan (Environmentalist) and 2. Mr. Zaheer Ahmad (Sociologist)	Land Owners, Tenants	• Mostly participants agreed to the installation of Pressure pipe. • The participants were requesting for provision of outlets from PP. • According to the participsnts, the land is mostly rain-fed and Irrigation water from the existing outlets of PHLC (commonly known as Stepa) cannot reach to their fields. • According to the local people, compensation against land required for the pressure pipe should be given according to present market rate. • The participants requested for reconstruction of infrastructure falling witihin in RoW of the proposed PP. • Mostly participants were agreed for the installation of PP passing into their	• Participants of village Jamal Abad replied that they have no objection for pressure pipe installation. • PPTA team members informed the participants that provision of outlets from P.P is not possible. • Participants were informed by PPTA team that a social and resettlement survey is planned and a resettlement framework is being prepared which will outline the procedure for compensation of the land to be acquired • PPTA team members replied that contractors will be responsible for the rehabilitation of any damaged infrastructures.

Meeting date and time	Location	Stakeholders participating: Names of Project Proponent and PPTA Consultants	Stakeholders participating: Names and Type of Participant Farmers (Farmers, tenants, women, land owner, traders or laborers)	Key Issues/Topics Discussed (Questions of the Participants and Answers of the Project Proponent and PPTA Consultants)	Issues Status in the light of Project Management, Engineer and Resettlement Expert's Opinion
				agricultural land. • Participants requested for the provision of drinking water supply from Pressure pipe. • Land-Owners Hajji Akbar, Ghulam Akbar, Muhammad Akbar and Kareem Akbar expressed concern that they have planned to construct houses in their agricultural land which is falling within the RoW of Pressure pipe. They paid high price to purchase access path to their fields and houses. After installation of the pressure pipe, the land will be useless for them as it will be property of irrigation department. • The participants were requesting for rehabilitation of road falling within the ROW of proposed PP in village Jamal Abad.	

Attendance of the Participants for 1st Round Public Consultation in the Village: <u>Jamal Abad</u>

Attendance of the Participants for Public Consultation in the Village: [illegible]

S#	Name of the Participant	Father's/Husband Name	Contact No	Signature
1	[illegible]	[illegible]	[illegible]	[illegible]
2	[illegible]	[illegible]	[illegible]	[illegible]
3	[illegible]	[illegible]	[illegible]	[illegible]
4	[illegible]	[illegible]	[illegible]	[illegible]
5	[illegible]	[illegible]	[illegible]	[illegible]
6	[illegible]	[illegible]	[illegible]	[illegible]
7	[illegible]	[illegible]	[illegible]	[illegible]
8	[illegible]	[illegible]		[illegible]
9	[illegible]	[illegible]	[illegible]	[illegible]
10	[illegible]	[illegible]	[illegible]	[illegible]
11	[illegible]	[illegible]	[illegible]	[illegible]

PHOTO GALLERY 1ST ROUND


PPTA Team briefing the participants


Participants expressing their views


Participants expressing their views

Participants expressing their views

PPTA Team obtaining signatures of the participants

Attendance of the Participants for second round of Public Consultation

in the Village: Jamil Abad

S/No.	Name of the Participant	Father's/Husband Name	Contact No:	Signature
1.	Haji Akbar	[illegible] Akbar	0333-45[illegible]	
2.	[illegible] Akbar	Haji Akbar	—	
3.	Mohammad Akbar	[illegible] Akbar	0302-5[illegible]	
4.	[illegible] Akbar	Mohammad Akbar	—	
5.	Zahid Ali	Ghulam Akbar	0331-[illegible]	
6.	[illegible] Akbar	[illegible] Khan	—	
7.	Mohammad Ayaz	Mohammad Akbar	0314-[illegible]	
8.	Mohammad [illegible]	Mohammad [illegible]	—	
9.	Mohammad Ashraf	Mohammad Akbar		
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2ND ROUND PHOTOGALLERY


PPTA Team briefing the participants


Participants expressing their views


Participants expressing their views

Indus Ambar Pressure pipe: Public Consultation Meeting in Village Khanpur abad

Meeting date and time	Location	*Stakeholders participating* Names of Project Proponent and PPTA Consultants	Names and Type of Participant Farmers (Farmers, tenants, women, land owner, traders or laborers)	Key Issues/Topics Discussed (Questions of the Participants and Answers of the Project Proponent and PPTA Consultants)	Views of the Public 2ND Round of Public Consultation
1st ROUND P.C on 1st March 2015 11:00 AM 2ND Round P.C on 8 June 2015 11:00 AM	Village Khanpur Abad	PPTA Team 1. Mr. Sibghat Ullah Khan (Environmentalist) and 2. Mr. Zaheer Ahmad (Sociologist)	Land Owners, Farmers.	• The participants requested for the change of the proposed alignment of PP from dwelling areas, and it may be re-aligned in nearby agricultural land, where settlements do not exist. • House of Javid Ahmad (Rtd Pak Army) will be affected which is falling within RoW of the proposed PP. • According to the participants, their economic status is not well enough; therefore; they were partially willing for the installation of P.P in their agricultural land. • They asked that, the land falling within Right of way of P.P; will it be considered as property of irrigation department or the existing ownership will remain in place?	• The participants completely agreed with the proposed change in alignment of proposed pressure pipe. Mr. Javid's house will not be affected by changing the alignment of P.P. • PPTA team informed the participants that the land which comes in P.P RoW will be acquired and considered the property of KPID. • According to the participants during installation of P.P payment of cultivated crops may be given. • PPTA team members informed the participants that a social and resettlement survey is planned and a resettlement framework is being prepared which will outline the procedure for compensation of the land to be acquired.

		• The participants demanded that the land falling in the RoW of proposed P.P must be compensated in accordance to the rate in village Khanpur Abad at the time of project implementation.	• The participants of village khanpur abad requested, for the supply of drinking water from the pressure pipe.

Attendance of the Participants for 1st Round Public Consultation in the Village: Khanpur Abad

Attendance of the Participants for Public Consultation in the Village: Khanpur Abad

SR.	Name of the Participant	Father's/Husband Name	Contact No	Signature
1.	[illegible]	[illegible]	[illegible]	[illegible]
2.	[illegible]	[illegible]	[illegible]	[illegible]
3.	[illegible]	[illegible]	[illegible]	[illegible]
4.	[illegible]	[illegible]	[illegible]	[illegible]
5.	[illegible]	[illegible]	[illegible]	[illegible]
6.	[illegible]	[illegible]		[illegible]
7.	[illegible]	[illegible]	[illegible]	[illegible]

1ST ROUND P.C PHOTO GALLERY

PPTA Team briefing the participants.

Participants expressing their views

PPTA Team obtaining signatures of the participants

PPTA Team recording views of the participants

House of Javid Ahmad (Rtd Pak Army) likely to be affected falling in R.O.W of P.P at R.D 8+100

Attendance of the Participants for 2nd Round Public Consultation in the Village: Khanpur Abad

Attendance of the Participants for second round of Public Consultation

in the Village: Khanpur Abad

S.No.	Name of the Participant	Father's/Husband Name	Contact No	Signature
1	Javed Ahmad	[illegible]	[illegible]	[illegible]
2	[illegible]	[illegible]	[illegible]	[illegible]
3	Syed Abbas	Ahmad Shah	[illegible]	[illegible]
4	[illegible] Muhammad	[illegible]	[illegible]	[illegible]
5	[illegible] Muhammad	[illegible] Muhammad	[illegible]	[illegible]
6	[illegible] Ahmad	[illegible]		[illegible]
7	[illegible]	[illegible] Muhammad	[illegible]	[illegible]
8	[illegible] Ali	[illegible]	[illegible]	[illegible]
9	Ali [illegible]	[illegible]	[illegible]	[illegible]
10	[illegible]	[illegible]	[illegible]	[illegible]
11	[illegible] Ahmad	[illegible] Ahmad	[illegible]	[illegible]
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2nd Round P.C PHOTOGALLERY

2nd Round Public consultation meeting in village Khanpurabad

Discussion about the proposed project.

Carefully recording the views of participants.

Indus Ambar Pressure pipe: Public Consultation Meeting in Village Kambary

Meeting date and time	Location	Stakeholders participating: Names of Project Proponent and PPTA Consultants	Stakeholders participating: Names and Type of Participant Farmers	Key Issues/Topics Discussed (Questions of the Participants and Answers of the Project Proponent and PPTA Consultants)	Issues Status in the light of Project Management, Engineer and Resettlement Expert's Opinion
1ST ROUND P.C on 9th March 2015 12:30 PM 2ND Round P.C 8th June 2015 4:30 PM	Village Kambary	PPTA Team 1. Mr. Sibghat Ullah Khan (Environmentalist) and 2.Mr. Zaheer Ahmad (Sociologist)	Land Owners and Tenants	• The participants expressed concern that sizeable number of houses may be affected due to the installation of proposed Pressure pipe. • Participants requested to re-align the pressure pipe from dwelling areas to government property which is located to the nearby settlements and the site for realignment of the PP as proposed by the participants is referenced with GPS Co-ordinates: N=34°06'06.0" E=072°37'46.1" • The participants reported that constructions of more houses are in progress falling within the RoW of proposed P.P. • From R.D 1+200 – 1+400, settlement is located in the RoW of Pressure pipe.	• The participants completely agreed with the change in alignment of P.P. According to the participants mostly houses will not be disturbed during installation of P.P. • According to the participants tube wells are present, and they have tested the quality of drinking water and test results shows, that the water is unfit for drinking, they requested for drinking water supply from P.P.

Attendance of the Participants for Public Consultation in the Village: Kambary

Attendance of the Participants for Public Consultation in the Village: [illegible]

S#	Name of the Participant	Father's/Husband Name	Contact No	Signature
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]		[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
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[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
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[illegible]	[illegible]	[illegible]		[illegible]

1ST ROUND PHOTO GALLERY


PPTA Team briefing the participants on site about the proposed interventions and alignment of the pressure pipe


PPTA Team walk through survey along with the participants


New settlements are in progress and views of the participants are recorded by the PPTA Team

Public consultation meeting in village Kambary.

The stakeholders requested to re-align the pressure pipe in this area which is mitigating the impacts to houses and agriculture land of the local people as the direction of pipe will be straightened. The referenced GPS Coordinates are; N= 34°06’06.0”, E= 072°37’46.1”

Attendance of the Participants for 2nd Round Public Consultation in the Village: Kambary

Attendance of the Participants for second round of Public Consultation
in the Village: [illegible]

S.No.	Name of the Participant	Father/Husband Name	Contact No	Signature
1	[illegible]	[illegible]	[illegible]	[illegible]
2	[illegible]	[illegible]	[illegible]	[illegible]
3	[illegible]	[illegible]	[illegible]	[illegible]
4	[illegible]	[illegible]	[illegible]	[illegible]
5	[illegible]	[illegible]	[illegible]	[illegible]
6	[illegible]	[illegible]	[illegible]	[illegible]
7	[illegible]	[illegible]	[illegible]	[illegible]
8	[illegible]	[illegible]	[illegible]	[illegible]
9	[illegible]	[illegible]	[illegible]	[illegible]
10	[illegible]	[illegible]	[illegible]	[illegible]
11	[illegible]	[illegible]	[illegible]	[illegible]
12	[illegible]	[illegible]	[illegible]	[illegible]
13	[illegible]	[illegible]	[illegible]	[illegible]
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2nd Round P.C PHOTOGALLERY

Public consultation meeting in village Kamabary

Carefully recording views of the participants

PPTA team discussing importance of the proposed project to the participants.

Participant's attendance conformation.

Indus Ambar Pressure pipe: Public Consultation Meeting in Village Noor Abad

Meeting date and time	Location	Stakeholders participating		Key Issues/Topics Discussed (Questions of the Participants and Answers of the Project Proponent and PPTA Consultants)	Views of the Public 2ND Round of Public Consultation
		Names of Project Proponent and PPTA Consultants	Names and Type of Participant Farmers (Farmers, tenants, women, land owner, traders or laborers)		
1ST ROUND P.C on 10th March 2015 11:00 AM 2ND Round P.C On 9th June 2015 4:00 PM	Village Noor Abad	PPTA Team 1. Mr. Sibghat Ullah Khan (Environmentalist) and 2. Mr. Zaheer Ahmad (Sociologist)	Land Owners, Farmers.	• The participants did not completely agree with the alignment of the proposed location of P.P which is passing into their agricultural land. They requested that, the width (ROW) for the proposed Pressure pipe may be decreased from 10m to 5m. • The participants enquired about the land which is falling within RoW of the proposed P.P; will it be considered as Government property or existing ownership will remain in place? • The inhabitants of village Noor Abad asked that, will they cultivate crops after completion of works on the land which is falling with in RoW of the proposed Pressure pipe. • The participants requested for compensation against land falling in the RoW in	• Participants of village Noor Abad requested to change the alignment of the proposed P.P, towards the barren land of village Kala Khoro. • Or the proposed alignment of P.P should move along the road of Kala Khoro. • According to the participants the P.P should not pass through their agricultural land as they are not getting benefited.

Meeting date and time	***Location***	***Stakeholders participating***		***Key Issues/Topics Discussed*** ***(Questions of the Participants and Answers of the Project Proponent and PPTA Consultants)***	***Views of the Public 2ND Round of Public Consultation***
		Names of Project Proponent and PPTA Consultants	***Names and Type of Participant Farmers*** ***(Farmers, tenants, women, land owner, traders or laborers)***		
				accordance to the latest market rate. They informed PPTA team that current rate of their land has been increased after the establishment of Women University in the area. • The participants requested that excavation for P.P should not be done in sowing and harvesting seasons. • The stakeholders requested that Pressure pipe may pass along the edge of their agricultural land. They were requesting to realign the P.P.	

Attendance of the Participants for Public Consultation in the Village: Noor Abad

Attendance of the Participants for Public Consultation in the Village: [illegible]

S#	Name of the Participant	Father's/Husband Name	Contact No.	Signature
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
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[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]		[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]		[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

1ST ROUND PHOTO GALLERY


PPTA Consultative meeting with the inhabitants of Noor Abad Village


PPTA team recording views of the participants


PPTA team is obtaining signatures of the participants

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Attendance of the Participants for 2nd Round Public Consultation in the Village: Noor Abad

Attendance of the Participants for second round of Public Consultation

In the Village: [illegible]

S.No.	Name of the Participant	Father's/Husband Name	Contact No	Signature
1	[illegible]	[illegible]	[illegible]	[illegible]
2	[illegible]	[illegible]		[illegible]
3	[illegible]	[illegible]	[illegible]	[illegible]
4	[illegible]	[illegible]		[illegible]
5	[illegible]	[illegible]	[illegible]	[illegible]
6	[illegible]	[illegible]		[illegible]
7	[illegible]	[illegible]	[illegible]	[illegible]
8	[illegible]	[illegible]	[illegible]	[illegible]
9	[illegible]	[illegible]	[illegible]	[illegible]
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2nd Round P.C PHOTOGALLERY


PPTA Consultative meeting with the inhabitants of Noor Abad Village


PPTA team recording views of the participants


Participants expressing their views

Indus Ambar Pressure pipe: Public Consultation Meeting in Village Sogandi

Meeting date and time	Location	Stakeholders participating		Key Issues/Topics Discussed (Questions of the Participants and Answers of the Project Proponent and PPTA Consultants)	Views of the Public 2ND Round of Public Consultation
		Names of Project Proponent and PPTA Consultants	Names and Type of Participant Farmers (Farmers, tenants, women, land owner, traders or laborers)		
1ST ROUND P.C on 11th March 2015 10:30 AM 2ND Round P.C on 10th June 2015 10:00 AM	Village Sogandi	PPTA Team 1. Mr. Sibghat Ullah Khan (Environmentalist) and 2. Mr. Zaheer Ahmad (Sociologist)	Land Owners and Farmers	• The participants were completely willing to provide their land for Pressure pipe installation. • The villagers requested that during excavation for P.P, diversion for the Ghareeb Abad Sogandi track should be noticed. • Participants requested that compensation against land acquisition should be given according to the latest market rate. • During consultative meeting, the stakeholders highlighted that the reconstruction of the community structures should be highly noticed. • The participants	• The participants were completely willing to provide their land for Pressure pipe installation. • PPTA team members replied that contractors will be responsible for the rehabilitation of damaged infrastructures. • Participants were informed by PPTA team that a social and resettlement survey is planned and a resettlement framework is being prepared which will outline the procedure for compensation of the land to be acquired.. • PPTA team members informedthe stakeholders that

Meeting date and time	Location	Stakeholders participating		Key Issues/Topics Discussed (Questions of the Participants and Answers of the Project Proponent and PPTA Consultants)	Views of the Public 2ND Round of Public Consultation
		Names of Project Proponent and PPTA Consultants	Names and Type of Participant Farmers (Farmers, tenants, women, land owner, traders or laborers)		
				requested to change the alignment of the proposed P.P from dwellings areas otherwise compensation should be given to the affected house owners. • The participants requested that the labours should be hired from village Sogandi, during installation of P.P. • They requested to rehabilitate the Gareeb Abad Sogandi track immediately after the installation of P.P. • According to Javid Zaman (influential person), the existing outlet from P.H.L.C (stepa canal) may be damaged during installation of P.P.	PPTA team is trying to change the alignment of P.P from dwelling areas towards the path near existing PHLC and Swabi Model School Kotha. • The participants requested that labour should be hired from village Sogandi, PPTA members replied that it is the responsibility of contractor who will be encouraged to hire local labour. 1. According to the participants, construction activities will disturb: people by noise pollution and dust, PPTA team replied that remedial measures will be adopted to minimise the adverse effects during construction.

Attendance of the Participants for Public Consultation in the Village: Sogandi

Attendance of the Participants for Public Consultation in the Village: Sogandi

S#	Name of the Participant	Father's/Husband Name	Contact No	Signature
(1)	[illegible]	[illegible]	[illegible]	[illegible]
(2)	[illegible]	[illegible]	[illegible]	[illegible]
(3)	Sultan Zaman	[illegible]	[illegible]	[illegible]
(4)	Haroon Khan	[illegible]	[illegible]	[illegible]
(5)	M. Haneef	[illegible] Khan	[illegible]	[illegible]
(6)	Dilawar Khan	Umer Sad	[illegible]	[illegible]
(7)	Umer Sad	[illegible]	"	[illegible]
(8)	Shams-ul-Rehman	[illegible]	[illegible]	[illegible]
(9)	[illegible] Mohammad Khan	Khan Bahadur	[illegible]	[illegible]
(10)	[illegible] Khan	[illegible] Rehman	[illegible]	[illegible]
(11)	Afzal Khan	[illegible]	[illegible]	[illegible]
(12)	[illegible]	[illegible] Mohammad	[illegible]	[illegible]
(13)	[illegible]	[illegible]	[illegible]	[illegible]
(14)	[illegible] Rehman	[illegible]	[illegible]	[illegible]

1ST ROUND PHOTO GALLERY

Consultative meeting of the PPTA team with the villagers

Participants of the consultative meeting

Participants signing the attendance list

Attendance of the Participants for 2nd Round Public Consultation in the Village: Sogandi

Attendance of the Participants for second round of Public Consultation

In the Village: Sogandi.

S/No.	Name of the Participant	Father's/Husband Name	Contact No.	Signature
1.	Shams-ul Rehman	[illegible]	[illegible]	[illegible]
2.	Gul Muhammad [illegible]	Khan Bahadur	[illegible]	[illegible]
3.	Sohail Zaman	[illegible]	[illegible]	[illegible]
4.	[illegible]	[illegible]	[illegible]	[illegible]
5.	Saeed Zaman	Adam Khan	[illegible]	[illegible]
6.	[illegible] Khan	[illegible] Shah	[illegible]	[illegible]
7.	[illegible]	[illegible]	[illegible]	[illegible]
8.	Wali Rehman	Habib Khan	[illegible]	[illegible]
9.	[illegible]	[illegible]		[illegible]
10.	[illegible]	[illegible] Khan	[illegible]	[illegible]
11.	[illegible] Khan	[illegible] Khan		[illegible]
12.	[illegible]	[illegible] Rehman	[illegible]	[illegible]
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2nd Round P.C PHOTOGALLERY

Consultative meeting of the PPTA team with the villagers

Carefully recording participants views in consultative meeting

Participants signing the attendance list

Indus Ambar- Minor-3: Public Consultation Meeting in Village Shaheeda

Meeting date and time	Location	Stakeholders participating: Names of Project Proponent and PPTA Consultants	Stakeholders participating: Names and Type of Participant Farmers (Farmers, tenants, women, land owner, traders or laborers)	Key Issues/Topics Discussed (Questions of the Participants and Answers of the Project Proponent and PPTA Consultants)	Views of the Public 2ND Round of Public Consultation
1st Round P.C on 5th March 2015 1:30 PM 2nd Round P.C on 12th June 2015 6:00 PM	**Village Shaheeda**	PPTA Team 1. Mr. Sibghat Ullah Khan (Environmentalist) and 2. Mr. Zaheer Ahmad (Sociologist)	Landowners and Tenants	• Land owner Mr. Zahid was not willing for construction of the proposed Indus Ambar Minor 3 which is aligning within his agriculture active land. He requested to change the alignment of Ambar Minor 3 to protect his land. According to him he had his own tube-well for irrigation purposes and has no interest to pass Ambar Minor 3 with in his land. He reported that he had only 15 to 20 kanal agricultural land, which will be totally affected due to the alignment of the proposed minor. According to him he invested about one million Rupees on levelling and filling of land with	• During Public Consultation meeting PPTA team insure Mr. Zahid that request for change in alignment is already noticed during 1st Round P.C meeting. PPTA team has requested to change the alignment from agricultural land to kacha track.

Meeting date and time	Location	Stakeholders participating		Key Issues/Topics Discussed (Questions of the Participants and Answers of the Project Proponent and PPTA Consultants)	Views of the Public 2ND Round of Public Consultation
		Names of Project Proponent and PPTA Consultants	Names and Type of Participant Farmers (Farmers, tenants, women, land owner, traders or laborers)		
				clay. • Orchard is also present in RoW for Ambar Minor 3.	

Attendance of the Participants for Public Consultation in Village Shaheeda

Attendance of the participants for Public Consultation in the village Shaheeda

Sr.	Name of the Participant	Father's/Husband's Name	Contact No	Signature
(1)	Muhammad [illegible]	Abdul [illegible]	[illegible]	[illegible]
(2)	[illegible]	[illegible]	[illegible]	[illegible]
(3)	Afzal	[illegible]	[illegible]	[illegible]
(4)	Adnan	Javed Shah		[illegible]
(5)	Muhammad [illegible]	[illegible] Khan	[illegible]	[illegible]

1ST ROUND PHOTOGALLERY

PPTA Team site visits with the villagers of Shaheeda village

Consultative meeting with the person likely to be affected

PPTA Team is recording views of the participants

PPTA Team is obtaining signatures of the participants

Attendance of the Participants for 2nd Round Public Consultation in the Village: Shaheeda

Attendance of the Participants for second round of Public Consultation

in the Village: Shaheeda

S/No.	Name of the Participant	Father's/Husband Name	Contact No	Signature
1	MUHAMMAD HAROON	MOHD ZARIN	[illegible]	
2	RAJAZ	MIRZA [illegible]	[illegible]	
3	MOHD ZIAD	ABDUL WASIQ	[illegible]	
4	ABDUR RAHMAN	ABDUL HAMID	[illegible]	
5	WIQAS KHAN	MOHD [illegible]	[illegible]	
6	MOHD ILYAS	[illegible] RAHMAN		
7	AYAZ KHAN	ABID		
8	MOHD ANWAR	MOHD ZARIN	[illegible]	
9	TAIMOR	SARDAR	[illegible]	
10	SIRAJ AHMAD	RAJAB	[illegible]	
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2nd Round P.C PHOTOGALLERY

Consultative meeting with the person likely to be affected

PPTA team discussing importance of the proposed project to the participants.

Carefully listening participants views in consultative meeting

Indus Ambar Canal: Public Consultation Meeting in village Chota Lahor (Sharki)

Meeting date and time	*Location*	*Stakeholders participating*		*Key Issues/Topics Discussed*	*Views of the Public 2ND Round of Public Consultation*
		Names of Project Proponent and PPTA Consultants	*Names and Type of Participant Farmers* *(Farmers, tenants, women, land owner, traders or laborers)*	*(Questions of the Participants and Answers of the Project Proponent and PPTA Consultants)*	
1ST ROUND P.C on 9th April 2015 10:30am 2ND Round P.C on 11 June 2015 5:00 PM	Chota Lahor (Sharki)	PPTA Team 1. Mr. Sibghat Ullah Khan (Environmentalist) and 2. Mr. Zaheer Ahmad (Sociologist)	Land owners	• Inhabitants of Chota Lahore (Sharki) were completely willing to provide their land in Maira, for the construction of PHLC Extension. • According to the inhabitants, the proposed project is a gift for them, because the land in Maira is completely rain fed and perennial water will be available for their crops. • According to the inhabitants, they will completely cooperate during construction phase for the proposed PHLC extension project. • The land owner Tilawat s/o Miradad requested for the	• Land owners of Chota Lahore (Sharki) were completely willing to provide their land in Maira, for the construction of PHLC extension. • According to the participants they will completely cooperate during construction phase for the proposed PHLC extension project. • PPTA team replied the participants that the provision/request of outlets from the proposed Indus Ambar minor 5 on both sides has been noticed. • Participants were informed by PPTA team that a social and resettlement survey is planned

Meeting date and time	*Location*	*Stakeholders participating*		*Key Issues/Topics Discussed (Questions of the Participants and Answers of the Project Proponent and PPTA Consultants)*	*Views of the Public 2ND Round of Public Consultation*
		Names of Project Proponent and PPTA Consultants	*Names and Type of Participant Farmers (Farmers, tenants, women, land owner, traders or laborers)*		
				provision of outlets from the proposed Indus Ambar minor 5 on both sides to irrigate about 17000 Kanal lands which is the property of the inhabitants of Chota Lahore. • The land owners requested for compensation against land falling within RoW and shall be in accordance to the latest market rate. • The participants requested that compensation should be given under the supervision of ADB, and Patwari should not be involved in payment process, because they do not trust on Patwari System.	and a resettlement framework is being prepared which will outline the procedure for compensation of the land to be acquired

Attendance of the Participants for Public Consultation in Village Chota Lahor (Sharki)

Attendance of the Participants for Public Consultation in the Village Chota Lahor (Sharki).

S#	Name of the Participant	Father's/Husband Name	Contact No.	Signature
1-	Ashraf Khan	Khitab Khan		[illegible]
2-	Shah Nawaz	Saneh Gul	03349178801	[illegible]
3-	Sirtaj Khan	Zardad Khan	03119996155	[illegible]
4-	Mir Aslam Khan	Abdul Ghafoor	03449819884	[illegible]
5-	Sayed Hassan Shah	Sayed Qadad Shah	[illegible]	[illegible]
6-	Wajid Khan	Sumer Khan	[illegible]	[illegible]
7-	Sah Zar	Aslam Khan		[illegible]
8-	Sayed Rafiq Khan	Kasam Khan	03449515609	[illegible]
9-	Muhammad Zimat	Abdul Ghafoor	[illegible]	[illegible]
10-	Mumtaz Khan	Mir Dad	[illegible]	[illegible]
11-	Fareed Khan	Faizal Khan	[illegible]	[illegible]
12-	Saeed ur Rehman	Saeed Prawn	[illegible]	[illegible]
13-	Hidayat Ullah	Rehman Khan	[illegible]	[illegible]
14-	Khan Muhammad	Muhammad Zaman	[illegible]	[illegible]
15-	Wajid Khan	Gul Muhammad Khan	[illegible]	[illegible]

1ST ROUND PHOTOGALLERY


Consultative meeting with the inhabitants of Chota Lahore (Sharki)


Briefing by the PPTA team


PPTA Team is recording views of the participants


PPTA team is recording views and obtaining signatures of the participants

Attendance of the Participants for 2nd Round Public Consultation in the Village: Chota Lahor (Sharki)

Attendance of the Participants for second round of Public Consultation

in the Village: [illegible]

S/No	Name of the Participant	Father's/Husband Name	Contact No	Signature
1	[illegible]	[illegible]	[illegible]	[illegible]
2	[illegible]	[illegible]	[illegible]	[illegible]
3				
4	[illegible]	[illegible]	[illegible]	[illegible]
5	[illegible]	[illegible]	[illegible]	[illegible]
6	[illegible]	[illegible]	[illegible]	[illegible]
7	[illegible]	[illegible]	[illegible]	[illegible]
8	[illegible]	[illegible]		[illegible]
9	[illegible]	[illegible]	[illegible]	[illegible]
10	[illegible]	[illegible]	[illegible]	[illegible]
11	[illegible]	[illegible]	[illegible]	[illegible]
12	[illegible]	[illegible]	[illegible]	[illegible]
13	[illegible]	[illegible]	[illegible]	[illegible]
14	[illegible]	[illegible]		[illegible]
15	[illegible]	[illegible]	[illegible]	[illegible]
16	[illegible]	[illegible]	[illegible]	[illegible]
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2nd Round P.C PHOTOGALLERY

Consultative meeting with the inhabitants of Chota Lahor (Sharki)

Briefing by the PPTA team

PPTA Team is recording views of the participants

Indus Ambar Canal and Indus Minor-1: Public Consultation Meeting in village Jalsai

Meeting date and time	*Location*	*Stakeholders participating*		*Key Issues/Topics Discussed* (Questions of the Participants and Answers of the Project Proponent and PPTA Consultants)	*Views of the Public 2^ND Round of Public Consultation*
		Names of Project Proponent and PPTA Consultants	*Names and Type of Participant Farmers* (Farmers, tenants, women, land owner, traders or laborers)		
1^ST ROUND P.C 8^th April 2015 on 11:00 AM 2^ND Round P.C on 13^th June 2015 11:00AM	**Village Jalsai**	PPTA Team 1. Mr. Sibghat Ullah Khan (Environmentalist) and 2. Mr. Zaheer Ahmad (Sociologist)	Land Owners and Tenants	• The inhabitants of village Jalsai were showing concern about the land falling within the RoW. • They requested for the provision of outlets from main canal to irrigate the overall land falling in the command of canal. • The villagers requested for the realignment of proposed Indus Minor 1 which is currently passing through their lands. • They requested for minor canal across the motorway towards Nowshehra where the fertile rain fed land will be irrigated by perennial source through this project.	• PPTA team informed the participants that the request for provision of outlets from the proposed Indus Ambar Canal on both sides has been noticed. • According to the participants road bridges may be constructed on canal in village Jalsai. PPTA team replied that provision of bridges construction is also included in the project. • The provision for realignment of Indus Minor 1 is not required. The canal is passing through agricultural land. • PPTA team informed that the provision of minor across the motorway towards Nowshehra is not possible because

Meeting date and time	Location	Stakeholders participating		Key Issues/Topics Discussed (Questions of the Participants and Answers of the Project Proponent and PPTA Consultants)	Views of the Public 2ND Round of Public Consultation
		Names of Project Proponent and PPTA Consultants	Names and Type of Participant Farmers (Farmers, tenants, women, land owner, traders or laborers)		
					the capacity is not enough to irrigate additional lands.

Attendance of the Participants for Public Consultation in Village Jalsai

Attendance of the Participants for Public Consultation in the Village: Jalsai

S#	Name of the Participant	Father's/Husband Name	Contact No	Signature
(1)	Raj Mohammad	Badshah Gul	03475929594	[illegible]
(2)	Sher Khan Haji	Pajan [illegible]		[illegible]
(3)	Mirza Khan	Amir Khan		[illegible]
(4)	Momin Khan	Lal Khan		Momin
(5)	Anwar Khan	Said Akbar	03439499881	[illegible]
(6)	Sayar Khan	Anwar Khan	"	[illegible]
(7)	Daraz	Zulqadar	03249991330	[illegible]
(8)	Zamand	[illegible]	03085601460	[illegible]
(9)	Rasool Khan	Said Akbar	03369908973	[illegible]
(10)	Saeed Khan	Jamal Khan	3549971[illegible]851	[illegible]
(11)	Shokat Khan	Manfad Khan	03075770839	Shaukat Khan
(12)	Fazal Ali	Gulab	03339961836	[illegible]
(13)	Humayun	Sayed Umar	0354[illegible]3/142	[illegible]
(14)	Samiur Rahman	Amjalat Khan	03324293999	[illegible]
(15)	Mohammad	Mazadar		[illegible]
(16)	Khan Sher	Sadar		[illegible]
(17)	Zabihullah Ullah	Fazal Ullah	03485229862	[illegible]
(18)	[illegible] Khan	[illegible] Khan		[illegible]
(19)	[illegible] Khan	Farzat Khan		[illegible]
(20)	Fakhr Alah Pamad	Hakam Shah	03405350794	[illegible]

1^{ST} ROUND PHOTOGALLERY


PPTA team consultative meeting with the inhabitants of village Jalsai.


Another view


Another view

PPTA team is recording views and obtaining signatures

Attendance of the Participants for 2nd Round Public Consultation in the Village: Jalsai

Attendance of the Participants for second round of Public Consultation

in the Village: Jalsai

S/No.	Name of the Participant	Father's/Husband Name	Contact No	Signature
1.	Mehmood Khan	Meer Khan	[illegible]	[illegible]
2.	Mehmood Khan	Anwar Khan	[illegible]	[illegible]
3.	Bahar Ali	Zamarud Khan	[illegible]	Bahar ali
4.	Syed Khan	Anwar Khan	[illegible]	[illegible]
5.	Akbar Ali	Zulfiqar Khan	[illegible]	[illegible]
6.	Fazal ullah	Syed Afsar		[illegible]
7.				
8.	Rawal Khan	Syed Afsar	[illegible]	[illegible]
9.	Hassan	Rawal Khan	[illegible]	[illegible]
10.	Darvesh Khan	Abdul Khaliq	[illegible]	[illegible]
11.	Mirza Khan	Anwar Khan		[illegible]
12.	Gul Muhammad	Bacha	[illegible]	[illegible]
13.	[illegible]	Shaukat Ali	[illegible]	[illegible]
14.	Hussain	Wakil Khan	[illegible]	[illegible]
15.	Saeed Khan	Jawad Khan	[illegible]	[illegible]
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2nd Round P.C PHOTOGALLERY

PPTA team consultative meeting with the inhabitants of village Jalsai.

Briefing by the PPTA team

PPTA team is recording views of the participants

Indus Ambar Canal: Public Consultation Meeting in village Jalbai

Meeting date and time	*Location*	*Stakeholders participating*		*Key Issues/Topics Discussed (Questions of the Participants and Answers of the Project Proponent and PPTA Consultants)*	*Views of the Public 2ND Round of Public Consultation*
		Names of Project Proponent and PPTA Consultants	*Names and Type of Participant Farmers (Farmers, tenants, women, land owner, traders or laborers)*		
1ST ROUND P.C on 8th April 2015 02:00 PM 2ND Round P.C on 13th June 2015 5:00PM	**Village Shair Ullah Abad (Jalbai)**	PPTA Team 1. Mr. Sibghat Ullah Khan (Environmentalist) and 2. Mr. Zaheer Ahmad (Sociologist)	Land Owners and Farmers	• Inhabitants of Village Shair Ullah Abad (Jalbai) were willing for the construction of the proposed Canal within their land. • The villagers requested for the provision of outlets from proposed Indus Ambar Canal for the village Jalbai, because village Jalbai has vast rain fed agricultural land. • According to the Land owners, compensation against land to be acquired for the canal should be in accordance to	• Participants of Village Shair Ullah Abad (Jalbai) completely agreed with construction of the proposed canal within their lands. • PPTA team informed the participants that the provision/request of outlets from the proposed Indus Ambar Canal has been noticed. • PPTA team informed that a social and resettlement survey is planned and a resettlement framework is being prepared which will outline

Meeting date and time	Location	Stakeholders participating: Names of Project Proponent and PPTA Consultants	Stakeholders participating: Names and Type of Participant Farmers (Farmers, tenants, women, land owner, traders or laborers)	Key Issues/Topics Discussed (Questions of the Participants and Answers of the Project Proponent and PPTA Consultants)	Views of the Public 2ND Round of Public Consultation
				the latest market rate. • The participants expressed concern that the Government land rates are not acceptable and Patwari should not be involved in payment process because stakeholders of Jalbai do not trust on Patwari system. • Settlements including mosque may be affected due to construction of canal at R.D=14+250 needs to be protected by realigning of the canal. • House owners Mr. Kaleem Ullah and Sadeeq Ullah requested to change the alignment of the proposed canal. • According to	the procedure for compensation of the land to be acquired.. • PPTA team ensured the participants that settlements including mosque are protected. Change in alignment is not required. • PPTA team informed the participants that rehabilitation of damaged infrastructure is the responsibility of contractor. • Participants of village Jalbai requested for drinking water supply.

Meeting date and time	Location	Stakeholders participating		Key Issues/Topics Discussed (Questions of the Participants and Answers of the Project Proponent and PPTA Consultants)	Views of the Public 2ND Round of Public Consultation
		Names of Project Proponent and PPTA Consultants	Names and Type of Participant Farmers (Farmers, tenants, women, land owner, traders or laborers)		
				villagers Jalbai, the track will be affected due to construction activities at R.D= 14+250. They requested to use remedial measures.	

Attendance of the Participants for Public Consultation in Village Jalbai

Attendance of the Participants for Public Consultation in the Village: Jal Bai

S#	Name of the Participant	Father's/Husband Name	Contact No	Signature
	Azghar Khan	Mohd Ali	[illegible]	[illegible]
	Gulbaar Khan	Lajbar Khan	[illegible]	[illegible]
	Sherullah Haji	Aziz ullah	[illegible]	[illegible]
	Muhammad Rafiq	Misbar Khan	[illegible]	
	Haji Mir Azam	Abdul Hanan	[illegible]	[illegible]
	Mudassir	Mohd Sharif	[illegible]	[illegible]
	Fazal Hussain	Haider Khan	[illegible]	[illegible]
	Aurangzeb Khan	Zardar	[illegible]	[illegible]
	Afzal Khan	Zardari	[illegible]	[illegible]
	Masal Khan	Zardari		[illegible]
	Muhammad Sharif	Misbar Khan	[illegible]	[illegible]
	Sadiq ullah	Muhammad Khan	[illegible]	[illegible]
	Sardar Hussain	Shireen		[illegible]
	Mohd Rafiq	Misbar Khan	—	—
	Afsar Khan	Wali Khan	[illegible]	[illegible]
	Lajbar Khan	Muzaffar Khan	[illegible]	[illegible]

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1ST ROUND PHOTOGALLERY

Participants of the meeting in village Jalbai.

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PPTA team briefing the participants

PPTA team recording views of the participants

Attendance of the Participants for 2nd Round Public Consultation in the Village: Jalbai

Attendance of the Participants for second round of Public Consultation

in the Village: Jalbai

S.No.	Name of the Participant	Father's/Husband Name	Contact No	Signature
1	Haji Shair Ullah	Aziz Ullah	[illegible]	[illegible]
2				
3	Hamid Ullah	Aziz Ullah	[illegible]	[illegible]
4	Bahar Ali	Siraj Uddin	[illegible]	[illegible]
5	Bilal Khan	Shair Rehman	[illegible]	[illegible]
6	Bakht Buland	Shair Rehman		[illegible]
7	Fazal Hussain	Haider Khan	[illegible]	[illegible]
8	Sadiq Ullah	Muhammad Khan	[illegible]	[illegible]
9	Zahid	Fazal Hussain	[illegible]	[illegible]
10	Karim Ullah	Malik Khan	[illegible]	[illegible]
11	Muhammad	Aziz Ullah	[illegible]	[illegible]
12	Habib Ullah	Shair Ullah	[illegible]	[illegible]
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2nd Round P.C PHOTOGALLERY

2nd Round Public consultation meeting in village Jalbai

Discussion with influential person by showing engineering maps of proposed project.

Discussion on engineering maps.

Indus Ambar Canal: Public Consultation Meeting in village MughalKi

Meeting date and time	*Location*	*Stakeholders participating*		*Key Issues/Topics Discussed (Questions of the Participants and Answers of the Project Proponent and PPTA Consultants)*	*Views of the Public 2ND Round of Public Consultation*
		Names of Project Proponent and PPTA Consultants	*Names and Type of Participant Farmers (Farmers, tenants, women, land owner, traders or laborers)*		
23rd April 2015 03:30 Pm 2nd Round P.C meeting 14th June 2015 10:00 AM	**Mughal Ki**	PPTA Team 1. Mr. Sibghat Ullah Khan (Environmentalist) and 2. Mr. Zaheer Ahmad (Sociologist)	Land owners	• Inhabitants of the village were supportiveof the proposed canal construction. • The land is completely rain-fed, the villagers requested for the provision of outlet on both sides of the proposed PHLC. • The villagers requested for compensation against the land falling within the RoW in accordance to the latest market rate. • The villagers were willing to provide all kinds of security to the workers during construction phase.	• Participants of the village Mughal Ki were completely supportive of the proposed canal construction. They ensured PPTA team that they will provide all kinds of support to the project during implementation phase. • PPTA team informed that a social and resettlement survey is planned and a resettlement framework is being prepared which will outline the procedure for compensation of the land to be acquired.. • During 2nd Round P.C meeting the participants requested for provision of Minors from PHLCE to Villages Raj Muhammad,

Meeting date and time	Location	Stakeholders participating: Names of Project Proponent and PPTA Consultants	Stakeholders participating: Names and Type of Participant Farmers (Farmers, tenants, women, land owner, traders or laborers)	Key Issues/Topics Discussed (Questions of the Participants and Answers of the Project Proponent and PPTA Consultants)	Views of the Public 2ND Round of Public Consultation
					Village Meshak, Village Nandarak and Village Mian Essa. PPTA team replied that the provision of minor across the motorway towards Nowshehra is not possible because the water is not available to irrigate additional land.

Attendance of the Participants for Public Consultation in <u>Village:Mughal Ki</u>

Attendance of the Participants for Public Consultation in the Village: Mughal Ki

S#	Name of the Participant	Father's/Husband Name	Contact No	Signature
(1)	Shahzad Ali (Member)	Irshad Gul	03339377346	[illegible]
(2)	Haroon Rashid	M Ayub	03361935858	[illegible]
(3)	Fageer Mohammad	Parvez Khan	03339403318	[illegible]
(4)	Khayal Mohammad	Pervaiz Khan	[illegible]	[illegible]
(5)	[illegible]ullah	[illegible]ullah	[illegible]	[illegible]
(6)	Malik Faizullah Khan	Mir Zaman	03339123326	[illegible]
(7)	Tajullah Said	Saidan Said	03349420458	[illegible]
(8)	Faqeer Hassan	Noor Hassan	03319697678	[illegible]
(9)	Habib Ullah Khan	Faiz Ullah Khan	03349351936	[illegible]
(10)	Ramdad Khan	Habib Rahman	03465632385	
(11)	Fazal Aman	Malak Aman	03339242383	[illegible]
(12)	M. Saeed	Abdul Majeed	03369733446	[illegible]
(13)	M. Zahid	Abdul Majeed		[illegible]
(14)	Sher Zada	Daraad Gul	03329725333	Sher Zada
(15)	Shahkoor Khan	Akbar Khan		[illegible]
(16)	Gul Wahab	Wali dad Khan	03325912956	[illegible]
(17)	Rahman Shah	Nazeem Shah		[illegible]
(18)	Sajjad Khan	Gul Wahab	03329472391	[illegible]
(19)	Sajawal Khan	Ramdad Khan	03115758415	[illegible]
(20)	Nabi Hassan	Gul Hassan	03349743098	[illegible]
(21)	Munaf[illegible] Khan	Tala Rus Khan		[illegible]
(22)	Faqeer Bacha	Mir dad Khan	03331592521	[illegible]
(23)	Nasir Khan	[illegible]	0333[illegible]	[illegible]
(24)	Luqman Khan	Mutlai Aman	03339460833	[illegible]
(25)	Sadbar Khan	Lajbar Khan	03339480857	[illegible]
(26)	Mudasir Khan	Adalat Khan	0314932[illegible]	[illegible]

1ST ROUND P.C PHOTOGALLERY

PPTA team is briefing the participants and recording their views

PPTA team is obtaining signatures from the participants on the attendance list

PPTA team is obtaining signatures from the participants on the attendance list

Attendance of the Participants for 2nd Round Public Consultation in the Village: Mughalki

Attendance of the Participants for second round of Public Consultation

In the Village: Mughalki

S/No.	Name of the Participant	Father's/Husband Name	Contact No	Signature
1	Ghulam Habib	Abdul Habib	03018898271	[illegible]
2	Said Qamar	Attaullah	03465830146	[illegible]
3	Atta Ullah	Karim Shah	0333904[illegible]	[illegible]
4	Said Ullah	[illegible] Shah	0335[illegible]	[illegible]
5	Said Jehan Shah	Mahmood Shah	0332[illegible]	[illegible]
6	Afsar Khan	Sher Ali	0332[illegible]	[illegible]
7	Taj Mohammad	Lal Mohammad	0334[illegible]	
8	Sardar [illegible] Shah	Lal Shah	03318[illegible]777	[illegible]
9	Aziz Khan	[illegible] Khan	03465853335	
10	[illegible] Khan	Habib Rahman	0 [illegible]	[illegible]
11	[illegible] Shah	Sikandar Shah		[illegible]
12	[illegible] Khan	Karim Shah	0303[illegible]	[illegible]
13	[illegible] Shah	[illegible] Shah	0314[illegible]9717	[illegible]
14	[illegible] Shah	Sardar Shah	0334[illegible]	
15	Taj Wali	M. Saddiq	03319[illegible]	[illegible]
16	[illegible] Khan	Afsar Khan	0345[illegible]	[illegible]
17	[illegible] Khan	[illegible] Ali	0348[illegible]986803	[illegible]
18	Afzal Khan	[illegible]		[illegible]
19	M. [illegible]	M. [illegible]		
20	Zaheer [illegible]	[illegible] Khan	03465073327	[illegible]
21	[illegible]			
22				
23	[illegible] Shah	[illegible]	0332[illegible]	
24				

Attendance of the Participants for second round of Public Consultation

In the Village: Mughal Ki

S/No.	Name of the Participant	Father's/Husband Name	Contact No.	Signature
1	Faiz Ullah Khan	Mir Zaman	03359093[illegible]	[illegible]
2	Rooraz Khan	Sarfaraz Khan	03005372[illegible]	[illegible]
3	Saif Ullah	Fazal Ali	0336811007[illegible]	[illegible]
4				
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2nd Round P.C PHOTOGALLERY

2nd Round Public consultation in village Mughalki

PPTA team briefing the participants

Discussion with participants by showing engineering maps of proposed project.

Indus Ambar Canal: Public Consultation Meeting in village Tube-well Kabaryan

Meeting date and time	Location	Stakeholders participating: Names of Project Proponent and PPTA Consultants	Stakeholders participating: Names and Type of Participant Farmers (Farmers, tenants, women, land owner, traders or laborers)	Key Issues/Topics Discussed (Questions of the Participants and Answers of the Project Proponent and PPTA Consultants)	Issues Status in the light of Project Management, Engineer and Resettlement Expert's Opinion
1ST ROUND P.C on 23rd April 2015 11:00 AM 2nd Round P.C meeting on 14th June 2015 5:00 PM	**Village Tube-well Kabaryan**	PPTA Team 1. Mr. Sibghat Ullah Khan (Environmentalist) and 2. Mr. Zaheer Ahmad (Sociologist)	Land Owners and Tenants	• The participants reported that the land which is falling in the command area of proposed PHLC is acquired for China Zone project (China Industrial Zone). • The villagers were not willing to sell their land to the China Zone (Industrial zone) project. • The villagers were willing for canal construction within their lands. • The villagers requested to realign the canal to protect the settlements. • The villagers	• Participants of the village tube-well Kabaryan were completely willing for the construction of proposed canal. According to the participants it is a gift for us. • PPTA team ensured the participants that settlements are protected. Change in alignment is not required. • PPTA team informed that a social and resettlement survey is planned and a resettlement framework is being prepared

Meeting date and time	Location	Stakeholders participating: Names of Project Proponent and PPTA Consultants	Stakeholders participating: Names and Type of Participant Farmers (Farmers, tenants, women, land owner, traders or laborers)	Key Issues/Topics Discussed (Questions of the Participants and Answers of the Project Proponent and PPTA Consultants)	Issues Status in the light of Project Management, Engineer and Resettlement Expert's Opinion
				requested for land compensation falling with in RoW in accordance to the latest market rate. • An influential person requested for provision of drinking water supply to the village Kabaryan.	which will outline the procedure for compensation of the land to be acquired.

<u>Attendance of the Participants for Public Consultation in Village: Tube-wellKabaryan</u>

Attendance of the Participants for Public Consultation in the Village Tehsil [illegible] Kohayer

S#	Name of the Participant	Father's/Husband name	Contact No	Signature
1.	Abdul Qayyum	Nasar Khan		[illegible]
2.	Ilbar Khan	Hakam [illegible]	03466257370	[illegible]
3.	Fazli Malik	Faiz Muhammad	[illegible]	Fazli Malik
4.	Hikmat Shah	Hakam Khan	03465649764	[illegible]
5.	Shad Ali Khan	Adam Khan	03469358073	[illegible]
6.	[illegible]	Din Muhammad	0345773[illegible]	[illegible] Zeb
7.	Gul Sher	[illegible]	[illegible]	Gul Sher
8.	Ghulam Sakhi	Lonai Khan	[illegible]	[illegible]
9.	Anwar Zeb	Din Muhammad	0345[illegible]	Anwar Zeb
10.	Jamal Gul	Faiz Muhammad	[illegible]	[illegible]
11.	Muhammad Shah	Abdul Hakam	[illegible]	[illegible]
12.	Saddam Hussain	Ilbar Khan	0344[illegible]	[illegible]
13.	[illegible]	[illegible] Khan	[illegible]	[illegible]

1ST ROUND P.C PHOTO GALLERY


The PPTA team is briefing the inhabitants of village Kabaryan.


Participants of the consultative meeting


PPTA team is recording views of the participants

PPTA team is getting required information from the stakeholders.

Participant's attendance confirmation in public consultation meeting in village Kabaryan.

Attendance of the Participants for 2nd Round Public Consultation in the Village: Kabaryan Tubewell

Attendance of the Participants for second round of Public Consultation
in the Village: [illegible]

S/No.	Name of the Participant	Father's/Husband Name	Contact No	Signature
1	[illegible]	[illegible]	[illegible]	[illegible]
2	[illegible]	[illegible]	[illegible]	[illegible]
3	[illegible]	[illegible]	[illegible]	[illegible]
4	[illegible]	[illegible]	[illegible]	[illegible]
5	[illegible]	[illegible]	[illegible]	[illegible]
6	[illegible]	[illegible]	[illegible]	[illegible]
7	[illegible]	[illegible]	[illegible]	[illegible]
8	[illegible]	[illegible]	[illegible]	[illegible]
9	[illegible]	[illegible]	[illegible]	[illegible]
10	[illegible]	[illegible]	[illegible]	[illegible]
11	[illegible]	[illegible]	[illegible]	[illegible]
12	[illegible]	[illegible]	[illegible]	[illegible]
13	[illegible]	[illegible]	[illegible]	[illegible]
14	[illegible]	[illegible]	[illegible]	[illegible]
15	[illegible]	[illegible]	[illegible]	[illegible]
16	[illegible]	[illegible]		[illegible]
17	[illegible]	[illegible]	[illegible]	[illegible]
18	[illegible]	[illegible]	[illegible]	[illegible]
19	[illegible]	[illegible]	[illegible]	[illegible]
20	[illegible]	[illegible]		[illegible]
21	[illegible]	[illegible]	[illegible]	[illegible]
22	[illegible]	[illegible]	[illegible]	[illegible]
23	[illegible]		[illegible]	[illegible]
24	[illegible]	[illegible]	[illegible]	[illegible]

2nd Round P.C PHOTOGALLERY

2nd Round Public consultation in village Tube-well Kabaryan

The PPTA team is briefing the inhabitants of village Kabaryan.

Participants expressing their views

Janda Boka Canal: Public Consultation Meeting in village Maina

Meeting date and time	*Location*	*Stakeholders participating*		*Key Issues/Topics Discussed (Questions of the Participants and Answers of the Project Proponent and PPTA Consultants)*	*Views of the Public 2ND Round of Public Consultation*
		Names of Project Proponent and PPTA Consultants	*Names and Type of Participant Farmers (Farmers, tenants, women, land owner, traders or laborers)*		
1ST Round P.C on 9th April 2015 02:30 PM	**Village Maina**	PPTA Team 1. Mr. Engineer Rahmat Ullah Khan (Deputy Team Leader). 2. Mr. Sibghat Ullah Khan (Environmentalist) and 3. Mr. Zaheer Ahmad (Sociologist) 4. Muhammad Zakir (Sub Engineer) **KPID Swabi** 5. Mr. Noor Kamal Khan (XEN Irrigation Swabi)	Land Owners and Political Leader Muhammad Sohail **(Political representative)**	A meeting regarding PHLC Extension was held on the request of notables of the Mainay Kallay Village at Hujra of Mr Muhammad Ishfaq Khan (General Secretary Mainay Kalay[1] Islahi committee). Mr Sohail Khan (Vice president PTI) and other local notable village representative also attended the meeting.. The meeting was chaired by Mr. Sohail Khan. The Islahi Committee Mainay Kalay members showed their concerns about Janda Boka Pressure pipe and Indus and Ambar pipe, which will pass through their lands. The committee members argued that both pipelines are passing through their village land and do not provide any benefit to their area while thousands	2ND round P.C was not carried out due to security problems in the area.

[1] Maini is included in the additional area of PHLC Extension.

Meeting date and time	Location	Stakeholders participating: Names of Project Proponent and PPTA Consultants	Stakeholders participating: Names and Type of Participant Farmers (Farmers, tenants, women, land owner, traders or laborers)	Key Issues/Topics Discussed (Questions of the Participants and Answers of the Project Proponent and PPTA Consultants)	Views of the Public 2ND Round of Public Consultation
				of acres land of other villages would get the benefits through bringing their lands under irrigation and their village Mainay kelay will get nothing in return and even will lose their precious land. The Islahi committee members clarified that they are in favor of this project and are willing to allow passage of pipelines in their land but in return they are expecting some compensation to their village community. They also brought up existing PHLC project under discussion and pointed out that PHLC has already passed through their village land in past through precious land of their village while even at that time they got nothing in return and their lands became water logged, but now, this time they need benefit from this channel (pressure pipe) through their lands. SDO Irrigation clarified that the area where pressure pipe will pass	

Meeting date and time	Location	Stakeholders participating: Names of Project Proponent and PPTA Consultants	Stakeholders participating: Names and Type of Participant Farmers (Farmers, tenants, women, land owner, traders or laborers)	Key Issues/Topics Discussed (Questions of the Participants and Answers of the Project Proponent and PPTA Consultants)	Views of the Public 2ND Round of Public Consultation
				would become the property of Irrigation Department and no public activity of agriculture/ construction would be allowed. According to the stakeholders previous projects that passed through their lands like (PHLC, Grid Station, High voltage power lines and electric poles) had already disturbed their land and their land is not enough. By passing pressure pipes their land will be almost finished. So they demanded compensation. After long discussions they came to the conclusion that following demands should be reviewed by ADB in the return/compensation of pressure pipes passing through their lands. 1. Land acquisition should be done in the presence of ADB representative and ensure that the land is	

Meeting date and time	***Location***	***Stakeholders participating***		***Key Issues/Topics Discussed*** ***(Questions of the Participants and Answers of the Project Proponent and PPTA Consultants)***	***Views of the Public 2ND Round of Public Consultation***
		Names of Project Proponent and PPTA Consultants	***Names and Type of Participant Farmers*** ***(Farmers, tenants, women, land owner, traders or laborers)***		
				purchased on market price. 2. Mainay Kelay should be exEMMPted from payment of Abiana for the area that would be irrigated from PHLCEP. 3. The inspection path from RD 0+000 to 6+000 on PHLC is earthen and is the main access to Mainay Kelay (village) that path/road should be converted to metalled road. 4. Water courses are unlined, these should be lined. 5. Their area is almost waterlogged and no proper drain exists, a drainage project should be included in this project for	

Meeting date and time	Location	Stakeholders participating: Names of Project Proponent and PPTA Consultants	Stakeholders participating: Names and Type of Participant Farmers (Farmers, tenants, women, land owner, traders or laborers)	Key Issues/Topics Discussed (Questions of the Participants and Answers of the Project Proponent and PPTA Consultants)	Views of the Public 2ND Round of Public Consultation
				Maiany Kelay. 6. A Boys Degree College should be considered in this project for their village. In response of the above points PPTA consultants replied that "we will only consider those points which are relevant to this project, like land acquisition and water course lining in this project, while the other remaining points are mostly relevant to the government development programmes so you are advised to consult Government representative for this village development." They agreed but insisting that ADB consultant should forward their demands to ADB representative for review and comments and to inform them whether ADB agrees to their demands or not. If ADB agrees then we shall be very thankful to them but if ADB does not agree than let us know that what possible	

Meeting date and time	***Location***	***Stakeholders participating***		***Key Issues/Topics Discussed*** ***(Questions of the Participants and Answers of the Project Proponent and PPTA Consultants)***	***Views of the Public 2ND Round of Public Consultation***
		Names of Project Proponent and PPTA Consultants	***Names and Type of Participant Farmers*** ***(Farmers, tenants, women, land owner, traders or laborers)***		
				alternative ADB can offer to us in return for using our precious and limited lands for the pressure pipes.	

Attendance of the Participants for Public Consultation in Village Maina

Attendance of the Participants for Public Consultation in the Village: Marza

Sr	Name of the Participant	Father's/Husband Name	Contact No	Signature
	PTI District [illegible] Muhammad Sohail	Saeed Rasa	[illegible]	
	Abdul Bari	Sultan Muhammad	03369713683	
	Faiz Muhammad Khan	Taj Muhammad	03019173087	
	Muhammad Ali	Shah Bahadar	03147786546	
	Jan Badshah	Amir Badshah	03063391440	
	Muhammad Yahya	Shad Muhammad	03462803034	
	Maqbool Zaman	Usman Sher	03462854528	
	Muhammad Nawaz Khan	Zain Khan	03004689778	
	Dar Khan	Hakim Khan	03095500795	
	Iqrar Ahmad	Yaqoob Khan	03004684947	
XEN	Noor Kamal Khan		[illegible]	

1ST ROUND P.C PHOTOGALLERY

Public consultation meeting in village Maina.

PPTA team discussing the importance of proposed project.

PPTA members carefully listening the views of Muhammad Sohail (Political leader).

PPTA team members convincing the stakeholders by engineering maps.

PPTA members receiving the relevant information from the stakeholders.

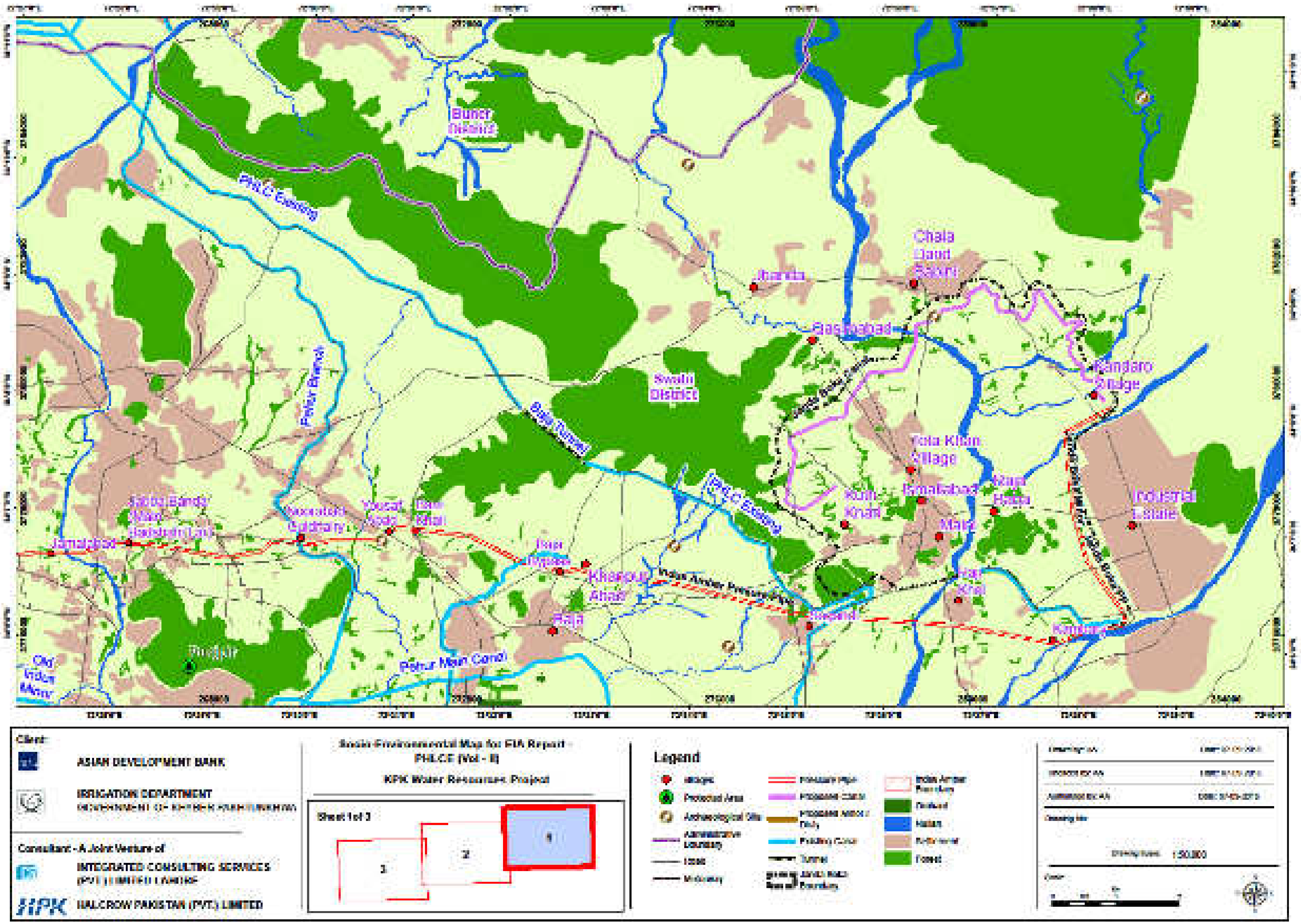
Discussion about the proposed project with the stakeholders in presence of Irrigation Department members.

Public consultation meeting in village Maina in presence of XEN Irrigation Noor Kamal Khan

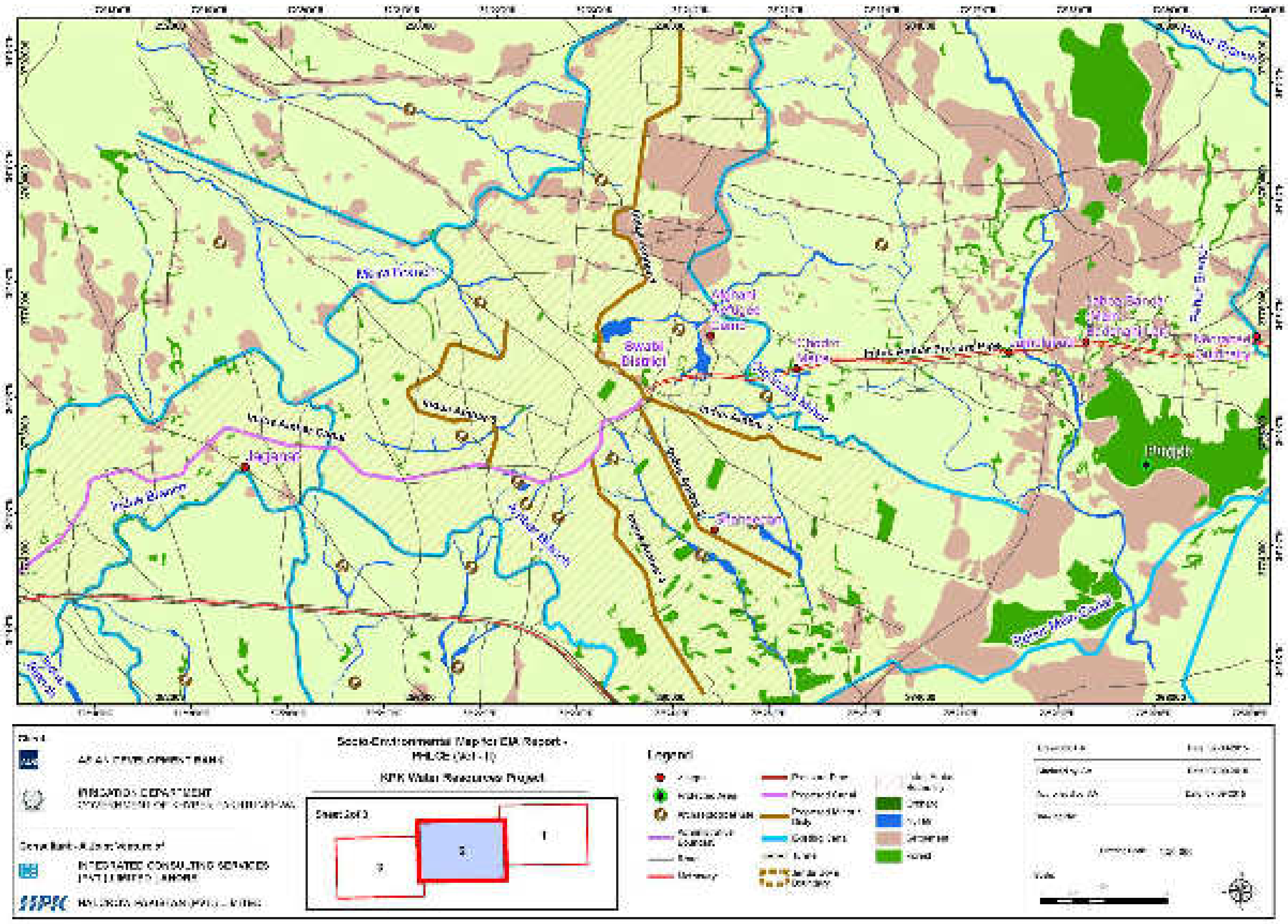
Participant’s attendance confirmation in public consultation meeting in village Maina.

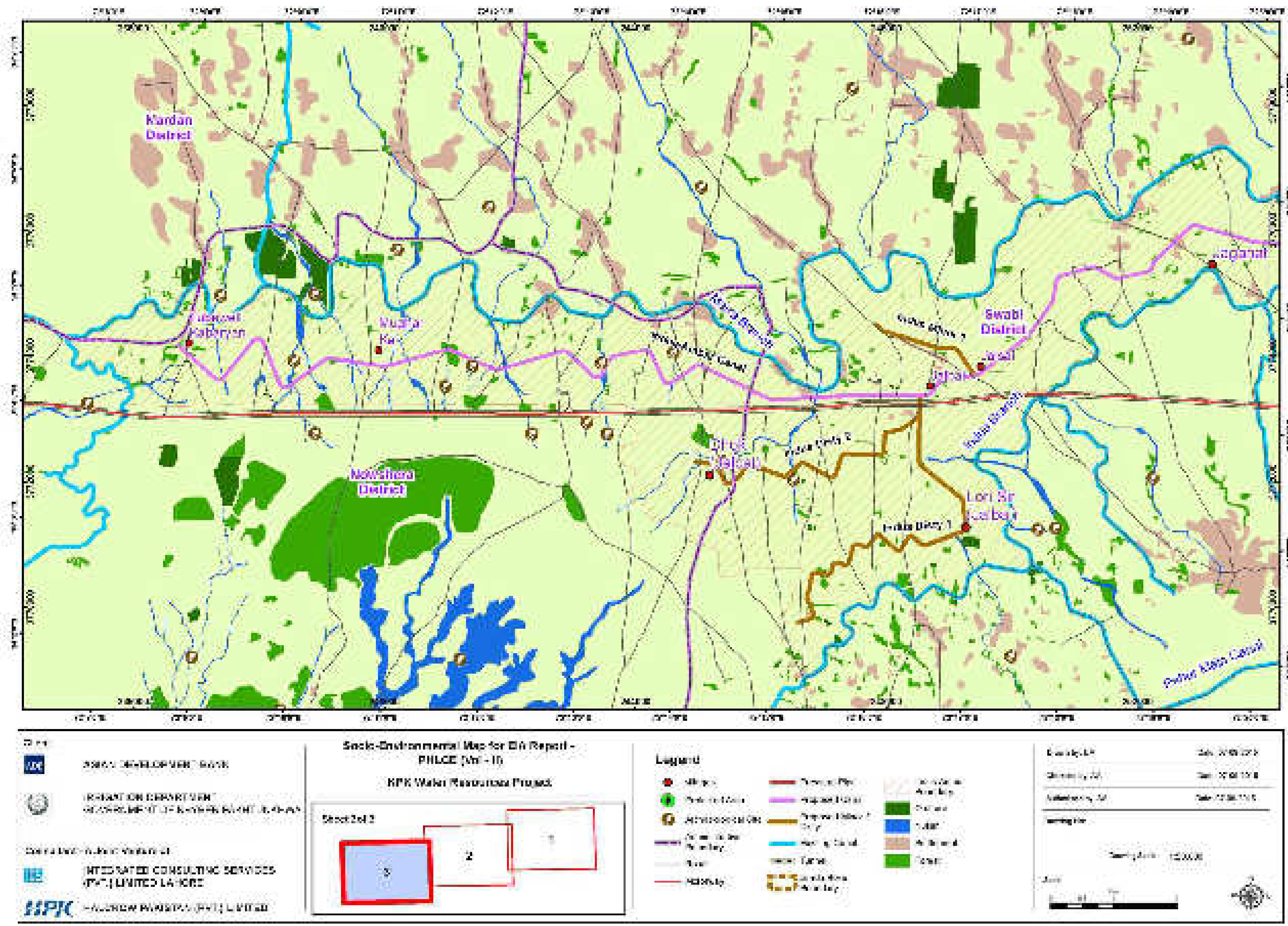
ANNEXURE- VIII

LAND USE MAPS OF THE PROJECT AREA


Buner District
PHLC Existing
Pehur Branch
Swabi District
Chala
Daud
Sabri
Jhanda
Kandaro
Village
Tota Khan
Village
Ismailabad
Industrial
Estate
Kuth
Khan
Maini
Jamalabad
Yousaf
Abad
Khanpur
Ahar
Raja
Pehur Main Canal
Kundal
Client:
ASIAN DEVELOPMENT BANK
IRRIGATION DEPARTMENT
Consultant - A Joint Venture of
INTEGRATED CONSULTING SERVICES
HALCROW PAKISTAN (PVT.) LIMITED
KPK Water Resources Project
Legend
Villages
Protected Area
Archaeological Site
Road
Tunnel
Existing Canal
Forest
Settlement
1:50,000

Landuse Maps of Project Area (1)




Mardan District
Nowshera District
Swabi District
Pehur Main Canal
Socio-Environmental Map for EIA Report - PHLCE (Vol - II)
KPK Water Resources Project
Legend
INTEGRATED CONSULTING SERVICES (PVT.) LIMITED LAHORE
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SITE SPECIFIC ENVIRONMENTAL MANAGEMENT PLAN

(SSEMP) FRAMEWORK

(To be prepared by Contractor)

Introduction

The contractor will submit Site Specific Environmental Management Plan in compliance with ADB SPS 2009. The Site Specific Environmental Management Plan (SSEMP) shall be applied to the actual site where construction activities will occur.

The preparation of the SSEMP must occur before the contractor is given access to the project site. This document provides the framework for preparing SSEMP.

The contract documents would include the requirement that SSEMPs are prepared by the contractor and approved by the PMO's environment specialists at least ten days before the contractor is given access to the site.

There are a number of phases in the preparation of an SSEMP, these are:

A. Definition of Boundaries

Separate SSEMPs shall be prepared for both Indus Ambar and Janda Boka areas

B. Identification of environmental values and sensitive receptors of the site and its surrounds

The sensitive receptors surrounding the site and the environmental values of the area need to be confirmed. The environmental assessment documents will provide the necessary details, but in case there have been changes to the footprint during the detailed design phase for sensitive receptors surrounding the site and the environmental values of the area need to be confirmed by a site visit.

The information is best presented as an overlay on the detailed engineering drawings or maps for the project. This will then assist in the development of detailed site plans after the risk assessment has been completed.

C. Definition of construction activities

A schedule of works for the project will be prepared during the detailed design phase. It is important to understand what the various phases of work are for each site, as different phases will have different activities and therefore different environmental management requirements. As a simplified example the construction of proposed PHLCE project could have the following schedule of works:

- Site surveying, levelling and pegging of boundaries
- Establishment of work camp, batching plant and access roads

- Soil stripping and ripping of sub-soil
- Import of aggregate
- Landscaping and signage
- Construction activities

Planning the environmental management requirements for the project needs to ensure that the necessary environmental management activities take place at the right time. For example the site survey should mark-up areas of vegetation to be removed, trees that must be saved and location of any species of importance. Soil stripping will need to be accompanied by the introduction of erosion control measures to prevent sediment entering into the existing canals and tributaries. The concrete pouring and filling will require a large number of vehicle movements so it may be necessary to develop a traffic management plan to ensure that the vehicles don't cause delays to traffic on existing roads. If there are sensitive receptors nearby there may be a requirement to limit working hours so requiring a change in the work schedule. These measures are easy to plan for by very hard to introduce once the project has started. This again emphasises the need for effective planning of the environmental management measures.

D. Risk assessment

Construction involves many separate activities that are carried out within the environmental conditions that exist at the site. Environmental conditions will affect the construction activity while the activity will also affect the environment. Thus there are risks in undertaking the work e.g. work which is carried out in the wet season will normally have larger risks attached to it than work undertaken during the dry season. The risk of undertaking any construction activity needs to be determined before the activity commences.

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

In all construction activities there will be a range of likelihoods and consequences which will determine the degree of risk that the activity will create. Risk is also dependent on the location where the activity will happen, how this affects sensitive receptors, and the duration of the activity. Activities of short duration normally have less risk than longer duration activities.

The risk assessment process is undertaken with a risk assessment matrix, an example of which can be found in the following table.

RISK ASSESSMENT MATRIX

Construction activity	Issue to consider	Likelihood that the site or sensitive receptors will be affected?	Consequence of the site or sensitive receptors being affected?	Risk score: (consequence likelihood)	Environmental Management Measures
		Score	Score		

In addition; there are a number of stages required to complete the matrix. The first stage is to identify the key activities that will be taking place on site. For the PHLCE Project the following simplified key activities can be entered in the first column of the risk assessment matrix: A risk assessment matrix as follows shall be prepared by the Contractor;

Construction activity	Issues to consider	Likelihood that the site or sensitive receptors will be affected?	Consequence of the site or sensitive receptors being affected?
		Score	Score
Fixing alignment of pressure pipes and canals			
Connection with Gandaf Tunnel			
Soil stripping			
Excavation of trench for Laying Pressure Pipes			
Construction of Structures along pressure pipes			
Laying of pressure pipes			
Backfilling and compaction of trench			
Excavation of canals			
Construction of structures along canals			
Lining of Canals			
Removal of temporary works from site			

The second stage is to then identify all environmental issues associated with the particular activity and to list them in the second column of the risk assessment matrix. Repetition of issues across a number of different activities is not a concern. For example noise issues may arise at a number of different stages, for example the equipment used for soil stripping would generate noise, as would the piling rig during construction and vehicles delivering construction materials could also cause noise impacts. Using the soil stripping activity as an example the second column can be completed:

Construction activity	Issues to consider	Likelihood that the site or sensitive receptors will be affected?
		Source
Soil stripping	Damage to vegetation beyond clearing limits	
	Erosion of exposed areas and sediment carried into river	
	Loss of topsoil	
	Dust generation	
	Noise	

Once all the environmental issues associated with each construction activity have been identified and the second column is filled out the third stage is to assess the likelihood of each of the issues occurring. This is done by assigning a score to each issue using the following scale:

Likelihood scale

Likelihood	Definition	Score
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

(Adapted from: EPA Victoria, 2004. Site EMP Kit- Guidance Notes)

If the soil stripping issues are assessed using this scale then all of issues are categorised as likely or certain to occur, if no control measures are introduced. Issues associated with other construction activities will have a much lower likelihood of occurring, for example a fuel truck overturning and spilling fuel into the river is unlikely to occur during the project so that issue would be scored 1 for rare. The third column of the risk assessment matrix can now be completed:

Construction activity	Issues to consider	Likelihood that the site or sensitive receptors will be affected?
		Score
Soil striping	Damage to vegetation beyond clearing limits	3
	Erosion of exposed areas and sediment carried into river	5
	Loss of topsoil	3
	Dust generation	5
	Noise	3

The next stage is to assess the consequences of each of the issues if they were to occur. This is again done by assigning a score using the following scale:

Consequence Scale

Consequence	**Definition**	**Score**
Catastrophic	The action will cause unprecedented damage or impacts on the environment or surrounding community's 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	5

Consequence	Definition	Score
	sites Occurrence will almost certainly result in the work being halted and a significant fine.	
Major	The action will cause major adverse damage on the environment or surrounding community's e.g. major loss of soil and water resources and quality from storm water runoff major pollution of soil and water resources including contamination from hazardous materials significant effects on ecosystems with isolated deaths of no vulnerable flora and fauna significant annoyance or nuisance to communities major damage to or movement required to archaeological or historical sites Occurrence may result in work being halted and a fine	3
Moderate	The action will cause limited adverse impacts on the environment or surrounding community's e.g. localised, short term noticeable changes in storm water quality short term minor changes on ecosystems some annoyance or nuisance	2

Consequence	Definition	Score
	to communities isolated or partial damage to archaeological or historical sites work is unlikely to be halted, fines unlikely	
Minor	No or minimal adverse environmental or social impacts e.g. no measurable or noticeable changes in storm water quality. Water quality remains within tolerable limits little noticeable effect on ecosystems no or isolated community complaints no or unlikely damage to archaeological or historical sites no likelihood of being fined	1

Using the consequence scale column 4 of the matrix can be completed. The environment specialist completing the matrix must exercise professional judgement in determining the consequence score; considering the environmental values of the site and its surrounds and the location of any sensitive receptors.

Once the consequence score is entered the risk rating can be calculated by multiplying the likelihood score by the consequence score. With columns four and five completed the risk matrix now looks like this:

Construction activity	Issues to consider	Likelihood that the site or sensitive receptors will be affected?	Consequence of the site or sensitive receptors being affected	Risk score: (consequence likelihood
		Score	Score	
Soil stripping	Damage to vegetation beyond clearing limits	3	3	9
	Erosion of exposed areas and sediment carried into river	5	3	15
	Loss of topsoil	3	2	6
	Dust generation	5	3	15
	Noise	3	3	9

The risk score indicates whether environmental management measures are needed to deal with a particular issue using the risk score table;

Risk Score Table

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

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

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 judgement based on the level of risk and the specific site parameters.

E. Preparation of site plans

The completed risk matrix provides a detailed assessment of the environmental management requirements for a construction site. The environmental management requirements now need to be included on a site plan. This is the final, but vital stage in the preparation of the SSEMP. Once completed the SSEMP becomes the site guide for both the contractor and the owner of the project to understand what measures are required and where they are to be located. It provides guidance to the construction teams as to what they should be aware of and gives the PMO's environment specialists an easy reference when conducting site inspections. The site plans can vary from simple line drawings, through marked up engineering drawings to detailed overlays on aerial photographs.

ADB will not consider a SSEMP to be complete unless a site plan accompanied the risk assessment matrix .

A site plan must cover the extent of the construction activity and should contain: North and scale Existing and planned supporting infrastructure; e.g. access roads, water supplies, electricity supplies etc Location of planned work, Contours. Drainage systems and Locations of sensitive receptors.

The environmental management measures are then overlaid onto the site plan. This can be done by hand or using computer graphics packages depending on what is available.

F. Preparation of environment work plans

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.