Environmental Impact Assessment

July 2017

PAK: Jalalpur Irrigation Project

Project No. 46528-002

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Irrigation Department
Government of Punjab

DETAILED DESIGN OF JALALPUR IRRIGATION PROJECT

ENVIRONMENTAL IMPACT ASSESSMENT (EIA)

MAY 2017

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EXECUTIVE SUMMARY

A. INTRODUCTION

1. The proposed Jalalpur Irrigation Project (JIP) is located along the right bank of Jhelum River in Tehsil Pind Dadan Khan (PD Khan) of district Jhelum and Tehsil Khushab of district Khushab. The project area can be accessed through Lahore-Islamabad motorway (M-2) by taking exit from Lilla Interchange. Alternatively, the area may be reached via GT Road from Jhelum to Rasul Barrage. Project area map is given in **Chapter 1** (see **Figure 1.1**).

2. Under the proposed JIP, a new non-perennial irrigation system will be established for enhancing the agricultural produce in Tehsils PD Khan and Khushab. The main canal of about 110 km, off-taking from the right flank of the Rasul Barrage, would traverse along the right bank of Jhelum River to irrigate a command area of about 170,000 acre (68,797 ha) on its left side. The command area of JIP is in the form of long strip of land bounded by the Salt Range hills on northern side and right bank of the Jhelum River on southern side.

3. The main objective of this project is to supply irrigation water to the project area. Most of the area has unusable to marginally usable ground water. However, in areas close to river bank, sweet ground water is available and tube wells are being currently used for irrigation. An irrigation canal not only provides irrigation supplies, but also becomes a source for drinking water where subsurface water is brackish and people have, as a routine, to walk kilometers at an end to fetch drinking water. The construction of the canal would not only benefit in improvement of groundwater quality but would also help to reduce the poverty of area by increasing per capita income of the community and there will be consequential increase of Gross Domestic Product (GDP). Provision of irrigation supplies will also help to leach surface salinity from the soils and therefore saline areas will be reclaimed. The project also aims to develop a sustainable irrigation infrastructure through community engagement at appropriate level i.e. Khal Panchayat (KP), and mechanism for Private Agriculture Support Services (PASS). All these measures will help reducing the poverty in the area and boost the economy at local as well as national-scale.

4. This Environmental Impact Assessment (EIA) has been updated in the light of available data at detailed design stage and the changes in main canal alignment.

B. EIA METHODOLOGY

The methodology adopted to update EIA is in accordance with Pakistan-Environmental Protection Agency's IEE/EIA Regulations, 2000 and Asian Development Bank (ADB)'s Safeguards Policy Statement, 2009 and Environmental Safeguards: A Good Practice Sourcebook Draft Working Document, December 2012. The methodology included the review of updates on project design, carrying out additional field surveys for updating baseline conditions, updating analysis of alternatives, carrying out the second round of consultations, updating impact assessment and the environmental management plan.

C. LEGISLATIVE FRAMEWORK

5. The proposed project will be governed by applicable national and provincial regulations. ADB's relevant policies and guidelines will also direct the proposed project. Amongst the various rules and statutes, the most pertinent from an environmental perspective are as follows:

- ADB's Safeguard Policy Statement, 2009;
- ADB's Public Communication Poilcy, 2011;
- ADB's Accountability Mechanism Policy, 2012;
- Punjab Environmental Protection Act, 1997 (amended 2012);
- Punjab Environmental Quality Standards for Air, Wastewater and Noise, 2010;
- Water Policy in Punjab;
- National & Provincial Water Rights;
- Water Apportionment Accord (1991);
- Land Acquisition Act 1894;
- Forest Act 1927;
- The Punjab Plantation & Maintenance of Trees Act 1974;
- The Antiquities Act, 1975;
- Pakistan Penal Code 1860;
- The Punjab Wildlife Protection Act 1974, and related Amendments;
- The Canal and Drainage Act, 1873; and
- Pakistan Labor Policy, 2010.

D. DESCRIPTION OF PROJECT

6. The main canal will have a length of about 110 km and a design discharge of about 1,350 cusecs (38.15 m^3/s) at Rasul Barrage. The distribution system having an estimated length of 176 km comprises eighteen (18) distributary canals and three (3) minor canals. Main canal and its distributaries would require construction of 787 structures i.e. 195 and 592 for canal and distributaries respectively, including footbridges for pedestrians.

7. The Project involves permanent acquisition of various categories of land, i.e. agricultural land, residential and barren. On the whole, keeping in view the width of Right of Way (RoW) of 275 ft (84 m) for main canal of 110 km and 300 ft (92m) to 125 ft (38m). for distributaries of 176 km long, the total land needs to be acquired is around 3,000 acres (1,214 ha).

8. All required land belongs to various land use categories, i.e. 60.84% agricultural, 38.2% barren and 0.96% other (residential, hilly). Around 92% land located within the RoW along the alignment is owned privately, while remaining 8% is owned by the community and government.

9. A total 408 structures/assets were found within the limit of RoW both for main canal and distributaries however, this would be further investigated during preparation of Land Acquisition and Resettlement Plan (LARP) and at the time of implementation of the Project. Out of these 408 structures, 159 are residential/farm houses (deras), 13 commercial, 3 mosques, 104 tubewells, 77 electric poles, 30 cattle sheds and 22 other structures/assets (like hand pumps etc.). Most of these structures are permanent (concrete) and semi-permanent.

10. The Jalalpur canal traverses a plain comprising flat and mountainous terrain. The initial reach of the Main Canal upto Jalalpur Sharif, 7 km runs through hilly terrain. On the right side is hill slope and on the left side is the Jhelum River. Concrete lined canal is proposed to avoid incidence of flood damage and to reduce RoW. The left bank of the canal upto Jalalpur Sharif will act as Flood Protection Bund. Studs/Spurs of appropriate dimensions will be provided as per findings of physical model study to guide the water away from the Flood Bank. As the right bank is in cut at some locations, retaining walls will need to be provided to support the cut slopes in this area. All distributaries and minors are designed as concrete lined channels/canal reaches.

11. The area from Rasul Barrage to Jalalpur Sharif is prone to hill torrents flash flows along the right bank and flood flows from River Jhelum at the left bank of proposed canal. A toe drain will be constructed along the right bank to carry sheet flow to the nearest drainage crossing. At all nullah crossings, suitable cross-drainages have been provided. From Jalalpur Sharif to tail, spoil bank is provided in cut reaches, which will also act as natural barrier against incoming rainwater from the hill slopes. Stone-pitched Catch water drain has been provided along the bank to carry the flows to the nearest nullahs. Cut slopes or excavations and soil support will be designed to ensure that the overall slope and local inter-berm slopes meet the specified Factors of Safety for sliding and toppling.

12. The command area is mostly underlain by hazardous to marginally usable groundwater. Significant part of the project area is saline. In salt range command areas drainage system has been planned, which will serve two functions, (i) to reduce flooding of

agriculture land and thereby damaging of crop fields due to saline water & associated water-logging and (ii) to act as drainage channel for leaching surface salinity from the fields.

13. JIP is a small project requiring only 0.33 Milion Acre Feet (MAF[1]) for non-perennial supply during flood season which the Punjab Province may afford to allocate with internal adjustments. The crop consumptive requirement is 0.192 MAF (237 million cubic meters) of water. Additional allowance of 0.138 MAF has been made for reclamation of saline areas. Thus total canal withdrawal will be 0.33 MAF (407 MCM) during the Kharif Season as approved by Indus River System Authority (IRSA).

14. The operation of JIP will be as per the general practice of irrigation department such as indenting, "warabandi", operation on rotation. The estimated total capital cost of the proposed JIP during construction is Pak-Rupees 25,921 million whereas; it's annual Operation and Maintenance (O&M) cost will be around Rs. 300 million.

E. PROJECT ALTERNATIVES

I. No Project Option

15. Due to rain fed conditions, there is no likelihood of increase in the cropping intensity of the area. Due to scarcity of rainfall, crop yield is low. There is limited surface irrigation supply with poor drainage and salinity predominant in the area. As per feasibility report (2015) of JIP, It is projected that ultimate cropping intensity of 90% (including 13.1% from rain-fed) will be obtained within period of 3 years after the completion of construction of JIP. The Project is expected to employ hundreds of workers during the construction and operational phases of the project, the no project option would not only hinder the improvement in agriculture but will also take opportunities of livelihood from the locals. Therefore, no project option is not a viable option.

II. Irrigation Options Considered Historically for JIP

16. The idea to irrigate the adjacent areas of Jalalpur and some parts of Khushab district from Jhelum River's water was proposed by Mr. Bedford as early as 1900 A.D. which has gone through various interventions during different times such as inundation canals, pumping project, storage reservoirs in salt range. Finally, idea proposed by Mr. Bedford to develop a non-perennial canal from Rasul Barrage was accepted by Mr. F. F. Haigh, Chief Engineer, in 1943 which was further continued by Govt. of Pakistan and approved by IRSA. Executing Agency for JIP will be Punjab Irrigation Department-EA (PID). In 2008, a feasibility report was prepared. In 2015, PPTA feasibility study was carried out.

III. Canal Alignment Alternatives and Route Optimization

17. The main criteria adopted to lay the canal are based on best hydraulic settings, less resettlement requirements, and avoidance of cross drainage structures which reduced

[1] 1 MAF = 1,233 Million Cubic Meter

project cost. Two alternate canal alignments were studied. The alignment A was proposed in the previous studies (2008) for the project while alternate alignment B is the proposed alignment by the PPTA Consultants at feasibility stage i.e. in 2015. Alternate alignment B was considered as more suitable at feasibility stage as per main criteria. The detailed design consultant reviewed both alternate alignments A & B. At detailed design stage, alignment B has been optimized by considering: 1) extension in command area; 2) minimum earthwork to economize canal design and 3) minimum social and environmental issues by avoiding dense settlements and environmental hotspots.

IV. Channel Lining Options

18. Two types of channel designs were considered all along the proposed alignment either lined or unlined. It is concluded at detailed design stage that almost negligible sediment will enter the canal system. Thus downstream canal system will be prone to be scour and consequently O&M cost will be increased. It is expected by design team that due to low silt load and very fine sediment entering the system, the canal may never approach regime conditions. Keeping in view the above situation, lining of the whole canal is recommended. Options available for lining are either concrete-lined or brick-lined canal. Concrete lining being tough, durable, relatively impermeable and hydraulically efficient was selected for JIP by consultants at detailed design stage.

V. Design Options of Head Regulator at Rasul Barrage

19. For the design of the Head Regulator, following two options were available:

- Design as a free flow crest under full discharge condition; and
- Design as an orifice flow. This requires gate with a baffle slab to restrict maximum opening.

20. Considering the provision of free flow crest type with radial type gate on R-Q Link canal on right of Rasul Barrage, the similar arrangement has been provided for Jalalpur Canal Head Regulator and is a feasible option out of two.

VI. Alternate Institutional Models

21. Four alternate institutional models have been proposed for the JIP. In two alternative models, no FOs will be established and the O&M of the distributary (and minor) canal systems will be the full responsibility of PID. In two of the four alternative models, it is envisaged that the O&M of the watercourses would be the responsibility of the farmers through the formation of Khal Panchayats. In the last two alternative models, communication between farmers and PID will be facilitated through the formation of informal KPs at water course level.

F. BASELINE OF PROJECT AREA

22. Spatial project boundary is defined as the specific site area that includes the areas of construction and operation and the zones of influence around the project site. The adjacent land includes any area that is directly disturbed by the construction and operational activities of the project. The project boundary may vary for different major areas covered under physical, biological and socio-economic environment depending upon the Area of Influence (AOI).

23. The existing environmental conditions of the proposed project's AOI (500 m corridor) will be used as a benchmark for comparison of before and after construction phases of the project. During the previous EIA study carried out at the feasibility stage, the baseline conditions of the physical, biological and socio-economic components of the receiving environment were assessed. At detailed design stage, updated EIA has included: 1) one more round of instrumental monitoring; 2) biodiversity survey in winter season; 3) collection of additional updated data on physical, biological and socio-economic environment in project's AOI; and 4) another round of meetings held with various stakeholders in District Jhelum, Mandi Bahauddin and Khushab. For the primary data acquisition for updated EIA, the EIA team conducted the reconnaissance and detailed field visits in September 2016, December 2016, January-March 2017.

I. Physical Environment

24. The initial reach of the proposed main canal from Rasul Barrage to Jalalpur Sharif runs through hilly terrain. Numerous hill torrents cross the main canal at various locations. From Bhelowal to Daiwal, the proposed canal runs through plain land. Torrent water is used for cultivation practices. Uncultivated area is under shrubs and forests. The project area crosses over four types of surficial characteristics. In the beginning the alignment passes through the Potwar fluvio where diversified nature of soil is encountered. Abrased rock fragments intermixed with sand and clay are abundant in the piedmont plains of the Potwar and Salt ranges. It is observed that 35.25 % area is non-saline, 20.5 % slightly saline, 8.01% moderately saline and 32.77% strongly saline. The remaining 3.47% is miscellaneous area.

25. The seismic zoning map of Pakistan indicates that the Project Area lies in the zone 2B and has moderate seismic risk.

26. The climate is semi-arid, hot sub-tropical continental and is characterized by hot summer and severe winters. May to July are the hottest months; maximum temperature may rise as high as 49°C during the month of June. The temperature remains nearly constant during October and November (25°C). December and January are the coldest months. The climate data indicated that mean temperature over the period of 34 years is 30.68°C. The average yearly rainfall is 34.8 in (885 mm) while the pan evaporation is more than 64.4 in

(1637 mm). The maximum annual rainfall was recorded as 1300 mm in the year 1997 and minimum annual rainfall was around 500 mm in year 2009.

27. Large nullahs and stagnant water ponds in the project's AOI are sources of surface water. The major groundwater sources in the project area and its AOI are tube wells, hand pumps and electric suction pumps for extracting ground water.

28. Ambient air in the project area, in general, is clean, because no major industrial activity exists within the project area limits and vehicular traffic, except on the Jehlum-PD Khan Road. Ambient air quality analysis clearly depicts that the air quality is apparently clean as the values are far below the values of National Environmental Quality Standards (NEQS) in summer monitoring at feasibility stage and below Punjab Environmental Quality Standards (PEQS) in winter monitoring at detailed design stage. Few industries like ICI Soda Ash plant and Gharibwal Cement factory are also located away from project alignment.

29. Measured noise levels at four locations, range between 60-85.3 dB (A) at Jalalpur Sharif, 60-85 dB (A) at Aduwal, 48-67 dB(A) at Mire and 52.5-72 dB (A) at Kurar during summer monitoring. This range corresponds to a calm to moderate noise atmosphere of the rural areas, associated with low levels of vehicular traffic and industrial/commercial activities. The noise levels were measured at eight (08) locations during winter monitoring. Noise levels exceeded PEQS at two locations i.e. Misri More and Pind Dadan Khan mainly due to traffic.

30. Surface water of proposed Jalalpur canal is same as carried by the Jhelum River and is excellent in quality and its continuous use in the project area will not create any salinity/sodicity problem. River water of the project contains about 100 to 200 mg/l of soluble salts and is reckoned as excellent in quality. Results of tested water quality of hill torrents revealed that water is neither good for irrigation purpose nor fit for human consumption at all. Winter monitoring results of surface water were compared with FAO limits and were found in compliance except one parameter copper at Jalalpur Sharif due to mixing of Jalalpur Sharif sewerage into the source. Wastewater sampling was carried out at the detailed design stage from the settlements within the project's AOI and the results were found within PEQS limits.

31. Ground water sampling was executed in three categories at the project preparatory/feasibility stage in late summer. However at the detailed design stage two more categories were added. Explanation of categories is as follows:

- Category-1: This category was formed to check water quality of hand pumps installed near river bank for drinking purpose;
- Category-2: This covers those tube wells whose water is being used only for agriculture purpose;
- Category-3: This category was devised to check the ground water quality for agriculture purpose near streams carrying wastewater or located near industrial activities;

- Category-4: This category was devised to check the ground water quality at the proposed construction camp locations potentially to be used by labourers for drinking and other purposes during construction; and
- Category-5: This category was devised to check the ground water quality of natural springs in the project's AOI used for drinking and other purposes.

32. Groundwater is relatively brackish in nature and contains more salts than the surface water. Ground water sources are not of good quality due to presence of microbial contamination (Category-1), excessive salt (Category-2), high content of alkalis (Category-3), and sulphate and TDS (Category-4). These four categories were found to be unfit for drinking and agriculture purposes. However, Category-5 was suitable for bathing and domestic purposes.

II. Biological Environment

33. One of the major objective of updating EIA was to collect more primary baseline information on biological environment and to assess the ecological sensitivities as discussed and recommended in the previous EIA at the feasibility stage. The natural and biological environment observation including biodiversity surveys have been carried out for winter season at detailed design stage. Based on the existing edaphic regime, the area has been stratified into three zones: 1) area connecting the system with Rasul Barrage; 2) facultative production zone; and 3) area with marginal to no productivity. The environment hotspots lying outside the AOI are Rasul Barrage Game Reserve, Jalalpur Wildlife Sanctuary, CBO Western Jhelum and Rakh Kandal Wildlife Sanctuary. The minimum distances from JIP AOI to Rasul Barrage Game Reserve and Rakh Kandal are 1.3 km and 1.2 km respectively.

34. Consultants, through PID, requested Director General Punjab Wildlife and Parks Department for the identification of the protected areas in the vicinity of the proposed alignment of the canal (Rasul Barrage Game Reserve, Jalalpur Wildlife Sanctuary and Community Based Organizations managed Wildlife area). It was confirmed by the department that sensitive areas are away from Project AOI.

35. JIP area starts with a patch of dense canopy, gradually diluting into almost an open field with grass covered. There is no real forest canopy. The area comprises sub-tropical dry evergreen scrub flora with dominating species of Phulai, Kahu, Sanatha, Gurgura and Pataki. Around Jhelum, the forests are deciduous shrub type, with poor stocking particularly upon sandstone and red marl. Within low land plains and hills of the district Khushab, fertile land prevails. Overall the area being devoid of forest canopy, is abundantly equipped with grasses and forages. The area is facing ecological resource exploitation due to grazing, expanding settlements and unsustainable industrial activities. The dominant species in Salt Range include *Acacia modesta*, *Dalbergia sissoo* and *Zizyphud numularia*. Some road side plantations are managed by the Punjab Forest Department.

36. The Rasool Barrage lying at the starting point of JIP inhabits submerged aquatic flora of *Carex fedia, Hydrilla verticillata, Nelumbo nucifera, Nymphaea lotus, Phragmites karka, Potamogeton crispus, P. pectinatus, Typha angustata, Vallisneria spiralis* and *Zannichelia palustris* abundantly. Additionally it inhabits a number of waterfowl species. Diverse Ichthyofauna species have been reported in the Salt Range. Fauna observation points including birds along the main canal alignment at each points with location and coordinates are given in Chapter 6.

37. Common Pochard *(Aythya ferina)*, Lapwing (*Vanellus vanellus*) among avifauna are vulnerable. Among fish species, Gulfam (*Cyprinus carpio*) which is vulnerable in IUCN red list of species and Malhee (*Wallago attu*) and Silver Carp (*Hypophthalmichthys molitrix*) which are near threatened, are also found in River Jhelum/Rasul Barrage and JIP AOI. No other vulnerable or near threatened species has been noticed or reported from the vicinity or surrounding of JIP. The JIP area has been found in no conflict with the natural environment and the temporary alteration in ecosystem.

III. Demographic and Socio-economic Environment

38. According to the demographic survey, the total households of the sample villages are 19,340 with the total population of 132,785 persons, comprising 62,924 males and 69,861 females. The average family size was found as 6.8. The number of children below 10 years was reported as 25% of total population. It was also reported by the respondents that out of this, less than 50% children go to school and other fall in infant category or work as child labor. The sex ratio was 100:111.

39. Traditional joint family system characterizes the social fabric of the area. Almost 75% households live in joint family system, while the rest 25% are nuclear families. Joint family system also provides them an opportunity to try and explore economic opportunities outside the Project Area, and even outside the country, as the family is perceived to be safe and taken care of in a joint system. Major castes are Gondal, Jat, Raja, Arain, Awan and Mughal.

40. There used to be sizeable Hindu and Sikh population in the area before Partition, as evident from some temples still existing albeit in a dilapidated condition. However, in terms of religion, now almost the entire population is Muslim. Followers of both major sects of Islam, Sunny (Hanafi) and Shia (Asna-Ashri) live in the area. There seemed to be no visible fault lines along the religious faith. In fact, Shia population is almost 30%, which is more than most parts of the country.

41. There is no group of people that could be termed as “Indigenous Community”, under the definition of ADB.

42. The level of basic education is satisfactory and improving, though the education level in the older generation is lower. Based on the collected information, it is estimated that around 21% population of the area has an education level of Matriculation or above.

43. Dry cough, skin disease and diarrhoea are commonly noted diseases. The brackish and contaminated water is the main cause of the above mentioned diseases.

44. Despite being a rain-fed area, majority of the households are connected directly or indirectly with agriculture owners, tenant, sharecroppers, seasonal labourers (skilled, unskilled) and traders trading agricultural commodities. Furthermore, farming is the ancestral for most of the people in the area and still considered prestigious. The overall farming occupation was recorded 72.3% followed by employment in government sector as 11.9%. The rest are engaged in private service (within or outside the area), own business and daily wage. As far as female employees are concerned, women do have major contribution in the agriculture, without mostly being recognized as formal workers. Besides, they were working mostly in private education sector.

45. The facilities including water supply, electricity, garbage disposal, railways, roadways etc., are mostly available in the area but generally need improvement.

G. STAKEHOLDERS CONSULTATION

46. The consultations were carried out at feasibility stage with relevant federal, provincial, district level government departments, NGOs and community. Second round of consultations was done at detailed design stage. The purpose was to engage all the stakeholders and to know their concerns. During stakeholders' consultations, information regarding project main features and its benefits were shared. The stakeholders concerns on land acquisition, resettlement, wildlife, water conflict and agriculture were acquired and addressed accordingly. A Grievance Redress Mechanism has been proposed to facilitate the concerns and grievances of affected persons during project implementation.

H. POTENTIAL IMPACTS AND MITIGATION MEASURES

47. The project is expected to have major positive impacts due to JIP interventions are:

- The project will create employment opportunity for the local population. Since the project interventions will require substantial input from manual labor, even people with relatively lower levels of education or skills could get short term employment;
- Reduced future water conflicts arising from more uncoordinated/unplanned development;
- Increase in institutional capacity for coordinated irrigation and agricultural management;
- Based on experience of other similar projects of canals and other irrigation improvement in the region, the average household income is expected to increases substantially for

this project. This is mainly on account of improved crop yields, increase in the number of animals, and availability of other occupational opportunities. The Agriculture Report clearly indicates that with the execution of the Project, the cultivated area will be increased significantly by 44.2%. There will be green revolution in the agriculture sector having positive impacts on all social aspects of the local communities;

- The major crops cultivated currently are wheat, cotton, bajra, jowar and maize. After the farms are irrigated by the water available through the proposed project, some new crops may be cultivated, such as vegetables including chili, tomato, ladyfinger, potato, onion, and round gourd. Besides this, the production and yield of crops already under cultivation will increase;
- The proposed project is expected to have both direct and indirect impacts on the current social status of women resulting in general improvement in their living conditions;
- The proposed project will create an opportunity for famers to cultivate high value market intensive crops; and
- JIP intervention would facilitate flood irrigation in salt range which would result in reclamation of soil salinity and conversion of relatively barren land into fertile, by flashing away the salt cover.

48. In broader spectrum, the project activities could be categorized in the following three phases: 1) Planning & Design Phase; 2) Implementation & Construction Phase; and 3) Operations & Maintenance Phase. Phase-wise summary of adverse impacts due to JIP interventions is given below:

a) Design & Planning Phase

- **Permanent Land Acquisition**: The project involves permanent acquisition of various categories of land, i.e. agricultural land, residential and barren. This impact would be of high significance.

  Mitigation: This impact will be mitigated by ensuring compliance with LARP prepared for the project and with Land Acquisition Act, 1894, addressing community grievances on priority basis and timely compensation to affectees.
- **Water Right Issues:** Water being the most precious commodity in the area, its usage rights has been established traditionally. Any perceived or real disturbance to these water rights will almost certainly lead to social disturbance in the area. This impact would be of high significance.

  Mitigation: Proper water distribution through warabandi system and considering traditional water rights of the area at design stage.
- **Loss of Crops:** The Project will involve acquisition of around 2,625 acres (1,050 ha) of cultivated land. Besides loss of land, the owners will also lose the immediate economic benefits of the crops on such lands. The impact would be of high significance.

  Mitigation: The Project will compensate for the economic loss due to loss of crops on the lands to be acquired. The LARP estimates that around PKR 100 million will be paid in compensation.

- **Borrow Pits Selection:** Wrong selection of borrow pits in project AOI, for extraction of fill material may cause serious issues to land stability and loss of fertile soil. The impact would be of high significance.
  Mitigation: Borrow pits to be selected on criteria which emphasis on avoiding communities, tree cut, cultivation, protected areas, archaeological sites and blasting.
- **Disruption to Sensitive Areas:** National Parks and Game Reserves fall outside the project area. The impact on these areas area from project activities would be insignificant.
  Mitigation: The impact is of insignificant nature and further precautions would be taken as defined in mitigation measures for construction and operation stages.
- **Community Fragmentation:** Fragmentation or division of land of many farmers on both sides of proposed main canal and distributaries may happen. This would result difficulties for a single farmer to manage cultivation practices on both sides of canal or distributary. Similarly, amenities such as schools, graveyards, dispensaries etc. may fall on the other side of canal.
  Mitigation: Inter-Community fragmentation has been avoided during optimization of canal alignment. Moreover, 30 numbers of footbridges for pedestrian have been proposed for main canal and distributaries.
- **Disruption to Public Life:** A total number of 408 structures/assets were found within the RoWs of main Canal and distributaries, out of which 159 are residential/farm deras, 13 commercial buildings, three (03) mosques, 104 tubewells, 77 electric poles, 30 cattle sheds and 22 other structures/ assets (like, hand pumps etc.). The impact would be of high significance.
  Mitigation: Project should relocate the community structures at the cost of the proponents and fair compensation for private structures should be provided in accordance with LARP.

b) Construction Phase

- **Soil Erosion/Stability:** Soil erosion may occur due to instability of top soil surface, improper management of construction activities and unmanaged extraction. Cut and fill designed channels may result in high risk and damage to canal stability. This impact would be of high significance.
  Mitigation: Provision of safe support structures wherever cuts and fills are vulnerable, minimum land clearance, ramming of topsoil immediately after excavation and unconsolidated soil left after completion of work.
- **Soil Contamination:** Soil may be contaminated as a result of fuel/oils/chemicals spillage and leakage, and inappropriate disposal. Solid waste generation with an expected influx of workers from offices, residential colonies and contractor camps. This would generate moderate significant impact.
  Mitigation: Clearance waste and construction debris should be sent to designated disposal site while waste from equipment cleaning and maintenance should be

segregated and stored in color coded containers, these can be sold again or reprocessed. No accumulation of solid waste at site will be allowed. Best management practices should be adopted to minimize the solid waste generation and for that three 'R' policy i.e. Reduce, Recycle and Reuse policy should be adopted.

- **Water Pollution:** Water pollution will be of moderate significance which will be caused by potential discharge from anthropogenic or construction wastes. Contamination of receiving water bodies (i.e. river and torrents) may also result due to spilling of construction materials and wastewater to be generated from construction camps.

  Mitigation: Appropriate sanitation system and water supply facilities will be provided in the labor camps. Proper sewerage disposal arrangements to be provided such as septic tanks and soaking pits at Camp Sites.
- **Air & Noise Pollution:** The potential sources of air pollution from construction activities include excavation works, exhaust gases from motor vehicles, operation of construction machinery and dust. Expected emissions due to construction activities comprise CO, NO_x, SO_x and PM_{10}, these emissions will be mainly restricted to the Project site. The emissions from diesel generator sets, construction equipment/machinery and vehicles may deteriorate the air quality in the area. The major sources of noise pollution during construction activities would be during slope cutting, excavation, loading, transportation, loading/unloading of materials and operation of construction equipment etc. Sensitive receptors such as schools and hospitals are at safe distance from construction camps.

  Mitigation: Proper compliance of PEQS and periodic monitoring and mitigation measures as mentioned in Environmental Management Plan, will result in decrease in air & noise pollution. In case of any air and noise issue to sensitive receptors, routes and camps location must be shifted away.
- **Flora:** The major or primary impact on flora will be tree cutting carried out during construction of JIP. The proposed Project will involve cutting/removal of about 7,256 trees including some 32 fruit trees. Construction activities will also affect grasses and shrubs in RoW.

  Mitigation: The loss of tree removal should be compensated by carrying out tree plantation on large scale in accordance with Tree Plantation Plan. The collaboration with Forest Department would be helpful in choosing appropriate species. Dumping of material in vegetated areas and unnecessary cutting of vegetation will be avoided.
- **Fauna:** The large mammalian species and birds will shift from the construction sites to the safer places. However there will be possible disturbance to small mammals, amphibians, reptiles and insects due to the loss of habitat. No vulnerable/near threatened avifauna and aquatic species within Project would be disturbed.

  Mitigation: No hunting, toxic release to water bodies would be allowed. Contractors' staff would be trained and watched. Further mitigation measures are in EMP.
- **Social Issues:** The area being a part of a rural setup, improper dissemination may occur. It is quite uncommon for residents to experience and easily adjust to the presence of outsiders in their areas for any length of time. The significance of the impact is considered to be moderate.

Mitigation: An Environmental & Social Management and Monitoring Cell (ESMMC) will be established by EA (PID) who will be responsible for stakeholder engagement and timely information dissemination. The Contractor will develop a construction camp management plan for management of labour and other construction camp related issues. It is highly recommended that the project proponent should include some Corporate Social Responsibility (CSR) measures specifically for the tail-end population.

- **Public Utilities:** Due to the proposed project in construction phase, public utilities affected may create disruption of public services and economics. This impact is however temporary and moderate in significance.

  Mitigation measures: Incorporate technical design features to minimize effects on public utilities; and **a**ll public utilities likely to be affected by the proposed project need to be relocated well ahead of the commencement of construction work and Contractor should obtain NOCs from concerned Departments.
- **Health & Safety of workers:** Various activities during the construction phase of the Project could have health & safety impacts on workers and the people living in the nearby vicinity.

  Mitigation: By adopting the following measures the impact would be finally of low significance:
  - Provisions of proper signboards and informing the local people about the activity
  - Provision of Personal Protection Equipment (PPEs) to workers
  - Adequate water supply and sanitation facilities will be provided in the labor camps
  - First aid facility should be in place and an ambulance should be available at site for 24 hrs
- **Community Health & Safety:** Labor influx can lead to adverse health, safety and social risks and impacts on community. Increased risk of accidents, interaction with workers, burden on health facilities and change in natural drainage pattern may cause health and safety issues to community.

  Mitigation: Construction Camp Management Plan (CCMP) will prepared by the Contractor. By providing training to workers, provision of safe structures and effective implementation of GRM may reduce the impact.

c) Operation & Maintenance Phase

- **Social Issues over Irrigation Water:** As per feasibility calculations, sufficient water will be available for non-perennial operations of the JIP but issues may arise due to breach of canal and distributaries. This impact would be of high significance.

  Mitigation: By adopting following measures impact would be finally of low significance:
  - Agreements between different communities/tribes and farmers
  - Involve local communities, KPs and groups to operate the canals, channels, gates, inlets, outlets and other structures
  - Compensate farmers in downstream areas in case they lose their water rights
  - Compensate deprived of Project's water rights for drinking water supply schemes
  - Discourage spate agriculture

- **Breaching of Canal, Distributaries and Structures:** Breaching of canal, distributaries and structures will decrease system sustainability. The impact will be of high significance.
  Mitigation: To ensure system sustainability following steps need to be taken:
  - Monitor the system regularly
  - Liaison with the communities to identify potential weaknesses in the system that could cause breaches.
  - Follow emergency response plan
- **Salinity:** The flood water from Salt Range would ultimately fall into River Jhelum, carrying huge salt load within. The huge amount of salt would become part of the river.
  Mitigation: The impact is not expected to be significant because during flood periods the flows in the river Jehelum are very high having high dilution capacity and minimizing the impact of salts coming from the hill torrents..
- **Minimum Flows:** The project may hinder water supplies due to reduction in the minimum flows after feeding the Jalalpur Canal.
  Mitigation: As the canal is non-perennial, it will operate for six months only in a calendar year i.e., from April to September, during which it will only divert flood water. As per estimates, it will consume not more than 6% of the flood water, thus it may not hinder the minimum flows.
- **Health and Safety Issues:** Disposal of waste in the canal and waste streams may cause serious health issues. Kids in nearby canals may fall in canal. Flash floods from hill torrents may hit the communities. The impact would be of high significance.
  Mitigation: No wastewater discharge or solid waste disposal should be be allowed into the JIP or any other canal or stream. Fencing of canal near settlements, provision of lights on footbridges, effective drainage system and culverts as proposed in design would reduce the impact.
- **Socio-Economic Issues:** The Project may cause accessibility issues for local communities to cross the canal. Project may also result in increased demand of energy resources. On the other hand, project will have positive impact of enhanced agriculture and accessibility to market.
  Mitigation: To resolve the inter community accessiblity issue, provision of total 30 number of footbridges/pedestrian crossings i.e. 13 across main canal and 17 over distributaries has been given by designers. In addition, provision of 125 road bridges/culverts on main canals and distributaries has been made in the design. Communities should be facilitated to use solar energy as an alternate energy resource.
- **Increased Use of Pesticides:** With additional area under cultivation, and with better water availability for existing area, cropping intensity will increase, resulting in an automatic increase of fertilizers and pesticides use. Use of any harmful/banned fertilizer and pesticide will cause health issues.
  Mitigation: Integrated Pest Management (IPM) practices should be adopted in coordination with Agriculture Department as explained in **Chapter 8**.
- **Solid Waste:** Periodic cleaning of canal and distributaries will generate solid waste. This impact would be of high significance if not managed properly.

O

Mitigation: Solid waste needs to be properly disposed of in a designated dump site.

- **Social Issues over Community Participation:** The community engagement through KPs will ensure the smooth running of the irrigation system and the system sustainability. The impact may lead to social and system sustainability issues and would be of moderate significance.

  Mitigation: By adopting the following measures the impact would be finally of low significance:
  - Ensure community participation in management and operation of the irrigation system;
  - Training of related communities.
- **Climate Change Impact on JIP:** Changes in the climate can have significant impact on infrastructure viability and operation, as well as on the surrounding communities. It is projected that the impact on JIP due to frequency and intensity of extreme rainfall events (fewer but larger) would happen. Higher temperatures could increase evaporation leading to drier soils. Moreover, due to shift in rainfall patterns, water availability will reduce in the winter season. This impact would be of moderate significance.

  Mitigation: 7-10% enhanced discharges in canal have been proposed. Gradual increase in plantation and vegetation cover and watershed management would reduce the impact.

I. CUMULATIVE IMPACTS

49. Cumulative Impact Assessment (CIA) is a challenging task as its analysis builds upon information derived from direct and indirect impacts due to past, present and future interventions in a defined geographical area including the current and proposed project. AOI for CIA would be the broader area where other proposed projects either operational or planned are envisaged to have cumulative impact on environment. The list of existing and proposed interventions surrounding JIP AOI is given below:

- Existing industries:
  - ICI Soda Ash Plant;
  - Gharibwal Cement Factory;
  - Dandot Cement Factory; and
  - Salt Mines.

- Proposed developments within AOI:
  - 300MW Local Coal Fired Power Plant;
  - Special Economic Zone;
  - Proposed National Safari Park; and
  - Rasul Hydropower Project.

50. For this EIA, Consultants made their best effort to acquire the information on project description, project footprint, environmental documents, reports on above identified future

development interventions but data was not available except the locations. Consultants through their subjective judgment and utilizing previous experiences of similar type of projects identified the resources. Based on desk study of resources areas and screening exercise, no sensitive receptor will be directly affected by JIP interventions.

51. Some Valued Environmental Components (VECs) i.e. ambient air quality, surface water quality and agriculture would be negatively affected due to JIP and other interventions. Soil and groundwater quality resources will have positive cumulative impacts due to JIP operations.

52. It is concluded that the implementation of proposed monitoring provided in EMP will identify any incremental increase in pollution due to future projects in the AOI.

J. ENVIRONMENTAL MANAGEMENT PLAN (EMP)

53. The EMP sets out mitigation actions, monitoring actions, responsibilities, and schedules for impact mitigation and monitoring. Environmental monitoring has to be undertaken during both the construction and operational phases to ensure the effectiveness of the proposed mitigation measures.

54. EMP also provides its implementation mechanism during construction and operational phases

- **Implementation during Construction Phase**: The EA for this Project is Punjab Irrigation Department (PID) having core implementation responsibility. The immediate requirement considering the existing institutional setup of EA (PID) is the establishment of Environmental & Social Management and Monitoring Cell (ESMMC). The ESMMC will overall monitor the environment related activities of Supervision Consultant and Construction Contractor and report to EPA-Punjab regarding implementation status of EMP. Construction Contractor will be in direct coordination with Supervision Consultant through its HSE Department. Contractor's HSE Department is highly recommended to be on-board before mobilization.
- **Implementation during O&M**: The key players involved during operation of the proposed project are the ESMMC of EA (PID), District Environmental Officers of Khushab and Jhelum, KPs and PMU monitoring units. ESMMC will get input from KPs of Tehsil Khushab and PD Khan, randomly check the project operation in context of EMP and report to District Environment Officers annually.

55. The EMP is prepared taking into account environmental consequences of the proposed action. Mitigation measures are suggested in Environmental Mitigation Plan at different stages of project with performance indicators to mitigate the potential impacts.

56. Environmental Monitoring Plan has also been prepared as a part of EMP which details about monitoring mechanism of a specific receptor/item, its frequency and physical/ecological parameters to be considered. The designer has carefully considered all recommendations related to the design. Though construction impacts are not severe, but implementation of proper mitigation measures would be needed. A suitable training program is proposed to train the Contractor(s) staff who will be involved during construction stage and the professional staff from the Proponent involved at the operational phase of the project. All required permits shall be obtained from the concerned departments before starting the related activity. Grievances Redressal Mechanism has also been given in the EMP. The reporting mechanism has also been provided in EMP.

EMP Budget

57. The EMP budget for one time monitoring before start of construction would be around Pak-Rupees 400,000. Expenditures during construction period of JIP are Pak-Rupees 364 million, which covers cost of laboratory analysis, supervision consultant, third party monitoring, tree plantation, trainings and CSR. For operation and maintenance phase, the cost is estimated for initial three years of operation which is Pak-Rupees 4.2 million covering costs of laboratory analysis, third party monitoring, trainings and community engagement. Environmental cost to be borne by the Contractor is as Pak-Rupees 36 million.

K. CONCLUSION

58. The report provides conclusions based on the impacts assessed and the mitigation measures suggested. The project does not causeadverse/critical negative impacts except resettlement, impact due to hill torrents and increased use of pesticides during operation stage. Proper mitigation measures for many important high and moderate impacts under the physical and socio-economic criterions have been suggested in Chapter 8. Tree plantation plan has also been proposed. Nevertheless, project causes low other ecological impacts as no sensitive area falls within boundaries of project AOI. The nearest sensitive area is Jalalpur Wildlife Sanctuary which falls 1.3 km away from project AOI. The main impacts are: cutting of 7,256 trees, stability issues, resettlement of people, deposition of salt in lower command areas of Jhelum River and increased use of pesticides in project AOI during O&M stage etc. Impact significance will be lowered down after proper implementation of EMP

59. The report recommends that EA (PID) on priority basis shall initiate the establishment of ESMMC within its existing institutional structure. It is also recommended that EMP will be made a part of all bidding/tender documents. Contractor will be bound to completely implement relevant mitigation measures set out in the EMP. Also the cost related to these mitigation measures has to be borne by the Contractor. Contractor shall prepare detailed Borrow, Quarrying and Disposal Plan, site specific HSE Plan as mentioned in EMP and construction camp management plans. It is highly recommended that the contractor should

provide necessary awareness to its workers as to how to handle any “chance encounter” with fauna and wildlife during construction. Due attention must be paid to vulnerable/near threatened species in Project AOI. Under no circumstances, hunting or preying of animals will be allowed to the contractors’ workers in and around the Project Area

60. Local KPs need to be trained and involved to operate the canals, channels, gates, inlets, outlets and other structures. For improvement and enhanced implementation of Integrated Pest Management, coordination with Agricultural Department should be done before operation stage of JIP. If there are any changes in Project layout due to stability issues, or any other changes in project description then change should be carried out through Change Management Plan included in EMP of this EIA report.

CHAPTER-1 INTRODUCTION

1.1 Project Backdrop

1. The Islamic Republic of Pakistan has received a loan as in the form of Project Design Advance (PDA) from the Asian Development Bank (ADB). The loan will be utilized to meet the cost of preparing detailed engineering design, construction drawings and bidding documents for Jalalpur Irrigation Project (JIP).

2. The Project is expected to give rise to crop production and reduce the land degradation by minimizing the usage of marginal quality groundwater. The project envisages construction of new irrigation system and the appurtenant structures to irrigate about 170,000 acres (68,797 hactares) of land in Jhelum (Tehsil Pind Dadan Khan) and Khushab districts.

3. Punjab Irrigation Department (PID) will be the Executing Agency (EA) of the project and Punjab Irrigation and Drainage Authority (PIDA) will act as institutional component of the project. Feasibility studies for JIP were prepared by National Engineering Services Pakistan (NESPAK) and Integrated Consulting services (ICS) in a joint venture under ADB's Project Preparatory Technical Assistance (PPTA) assignment 8404- PAK, during 2015. The contract for preparing detailed design of JIP was signed between PID and the consultants comprising NESPAK as lead and sub-consultants ICS and Technical Resources Services (TRS). In accordance with the notice to proceed with the services, the consultants commenced services on April 01, 2016. The overall assignment comprises preparation of detail engineering design, construction drawings, Planning Commission document (PC-I) and bidding documents along with the update of the Environmental Impact Assessment (EIA) prepared earlier during feasibility stage of the project.

1.2 Requirement to Conduct EIA

4. The apex Pakistani law governing the subject of environment is the Pakistan Environmental Protection Act – 1997 (PEPA 1997). After the 18th amendment to the constitution of Pakistan, environment governing authorities were transferred to provinces, and Punjab Environmental Protection Act - 1997 (as amended in 2012) is the core environmental law for JIP. In terms of its contents, the provincial act is exactly the same as national act. Under Section 12 of the Act, it is mandatory for the proponents of the projects[1] to execute the Initial Environmental Examination (IEE) and/ or EIA, where warranted, and get the approval from concerned Environmental Protection Agency (EPA), which is Punjab-EPA for this project.

5. The EIA/ IEE regulations of 2000 provide screening categories of projects for which IEE or EIA needs to be conducted. JIP falls under the Category 'E' of "Water management, dams, irrigation and flood protection – Irrigation & Drainage Projects serving 15,000 hectares (37065 acres) or above". This category requires an EIA to be conducted.

6. According to ADB's Safeguards Policy Statement (SPS), 2009, any proposed project is classified[2] as 'Category A' if it is likely to have significant adverse environmental impacts that are sensitive, diverse, or unprecedented. These impacts may affect an area broader than the sites or facilities subject to physical works. For a Category A project, the borrower is responsible

[1] The Act defines a Project as: *"Any activity, plan, scheme, proposal or understanding involving any change in the environment and includes:*
- *Construction or use of buildings or other works;*
- *Construction or use of roads or other transport systems;*
- *Construction or operation of factories or other installations;*
- *Mineral prospecting, mining, quarrying, stone-crushing, drilling, and the like;*
- *Any change of land use or water use; and*
- *Alteration, expansion, repair, decommissioning or abandonment of existing buildings or other works, roads or other transport systems, factories or other installations."*

[2] Para 50 sub clause i of ADB Safeguard Policy Statement June 2009

for preparing a report, normally an EIA (or a suitably comprehensive regional or sectoral EA). As per Terms of References (TOR), JIP was considered as Category A project.

7. Based on the above requirements of national and provincial regulations, as well as the ADB's SPS, 2009, an EIA of the proposed Project has been prepared and updated.

1.3 Purpose of Updating the EIA

8. The previous EIA for JIP was prepared at the feasibility stage in 2015, by third party consultants i.e. NEC Consultants (Pvt.) Ltd., hired by NESPAK-ICS. During feasibility study, it was decided with the consent of ADB that the EIA will be updated later at the detailed design stage. The scope of work as per Terms of Reference (ToR) emphasizes on updating the EIA including Environmental Management Plan (EMP). The updating of EIA for the JIP has been carried out at the detailed design stage by NESPAK keeping in view the changes in project footprint, canal alignment and gaps in previously conducted EIA. The EIA was updated in accordance with Punjab Environmental Protection Act (PEPA) 1997 (as amended in 2012), Pakistan Environmental Protection Agency (Review of IEE/EIA) Regulations 2000, ADB's SPS, 2009 and and Environmental Safeguards: A Good Practice Sourcebook Draft Working Document, December 2012.

1.4 Objective of updated EIA

9. The overall objective of this updated EIA is to elucidate the anticipated aspects of the proposed intervention and to propose necessary mitigation measures to prevent/minimize adverse impacts on surrounding environment and community. To achieve this objective, an assessment of the existing environmental conditions of the project site is a prerequisite and, therefore, included after collecting, reviewing and updating the baseline data of major environmental attributes. This EIA has been prepared and updated to ensure adequate environmental and social management during development and implementation stages of JIP. It provides mechanisms to ensure that potential environmental and social impacts of the project are identified, assessed and mitigated as appropriate.

10. More specific objectives to update EIA report are to:

- Meet the statutory requirements set forth by the Punjab Environmental Protection Act, 1997 (amended 2012) and to facilitate decision making by the Environmental Protection Department Punjab (EPD -Punjab) regarding grant of No Objection Certificate (NOC)/Environmental Approval for the project;
- Comply with ADB policies and safeguards for environmental and social management of projects;
- Facilitate proponents and financiers of the project in ensuring environmental and social sustainability of the project;
- Establish a baseline of existing social and environmental conditions prior to project initiation by collecting secondary and primary data/information on physical, biological and socio-economic environment of the project area;
- Identify significant environmental impacts (both positive and negative) during all stages of the Project that may trigger due to updated project footprint and canal alignment;
- Suggest mitigation measures for adverse impacts;
- Conduct, record and report public consultation with stakeholders; and

- Provide Environmental Management Plan (EMP) for all stages of project.

1.5 Project Proponent

11. Project Management Unit of PID is the proponent of JIP for all the stages. The details about key contact personnel are given below:

Mr. Khalid Hussain Qureshi
Project Director, Jalalpur Irrigation Project
Project Management Unit (PMU)
L.B.D.C Improvement Project
Mustafabad, Lahore Pakistan
Fax# 0092-42-99250362

1.6 Nature, Size and Location of the Project

12. Proposed project is the irrigation sector project comprising non-perennial main canal (Jalalpur Canal) having length of about 110 km off-taking from Rasul Barrage. The discharge capacity of main canal would be 1,350 cusecs (38.15 m^3/s). It also includes the distribution system consisting 18 distributaries and three minors having overall length of 176 km.

13. The proposed project area is located between longitude 72° 20' to 73° 31' (east) and latitude from 32° 25' to 32° 43' (north) along right bank of River Jhelum in Jhelum and Khushab districts of Punjab, Pakistan. The project is bounded by the salt range hills in the northwest and the river Jhelum in the southwest. The project area can be accessed through Lahore-Islamabad motorway (M-2) by taking exit from Lilla interchange. Alternatively, the area may be reached via Grand Trunk (GT) road from Jhelum to Rasul barrage. The location of the project is shown in **Figure 1.1**.

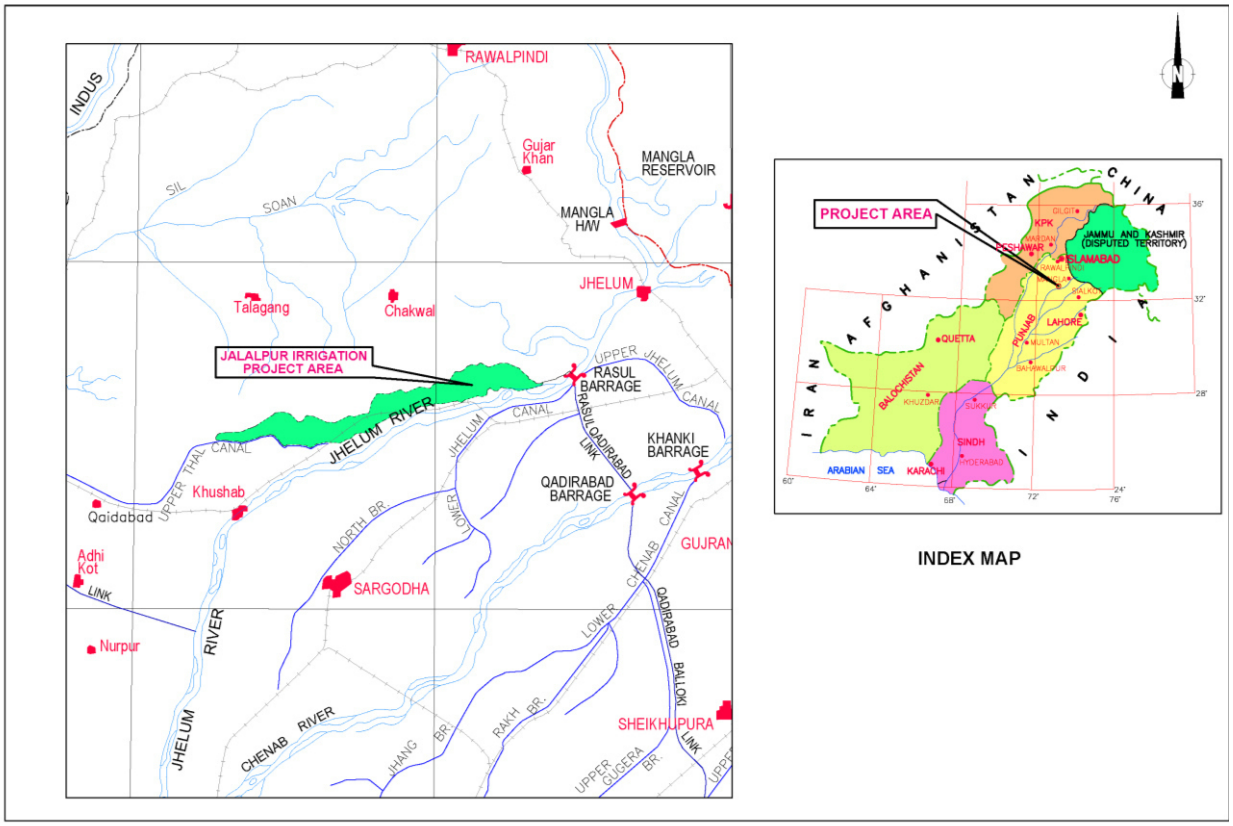

Figure 1.1: Project Location Map

1.7 Stage of Project Preparation

14. At the time of EIA writing, project's detail design is in progress. As per ToR, Consultants shall complete the detailed engineering designs of all structures for the selected alternatives of the project components i.e. main canal, distribution system, crossings of hill torrents and drainage measures including electro-mechanical works.

1.8 Consultant EIA Team

15. NESPAK's EIA Team is involved in updating the EIA for the proposed project. Based on the requirements of ToR and objectives of the study, Consultant formed a team of experts comprising Team Leader (Environmental Specialist) with a professional support from Environmental Engineers, Safeguards Advisor and Ecologist. The support staff helped the key specialists in data collection, analyzing the data, impact assessment and mitigation measures and report compilation. The social aspects of the EIA were taken up by the Social Safeguards Specialist of the project and the relevant inputs were prepared by social team. These inputs were received and incorporated in the EIA report. In addition, EIA team worked in close coordination with the design team and several inputs were provided by the design specialists to the EIA team. Detail of EIA team is given in **Table 1.1** below:

Table 1.1 Team Composition for the EIA Study

Sr.	Name	Proposed Position
Key Staff		
1	Rafaquat Ali	Team Leader/Project Manager
2	Imran-ul-Haq	Environmental Specialist/EIA Team leader
3	Rana Abdulrehman	Social Safeguards Specialist
Support Staff		
1	Irfan-ul-Haq	GM/Head Environment & Resettlement, Safeguards Advisor
2	Dr. Jahangir Ghauri	Ecologist
3	Mir Ghazanfar Afzal	Senior Environmental Engineer
4	Aman Ahmad Qureshi	Senior Environmental Engineer and HSE Expert

1.9 Organization of Report

16. This report contains 11 chapters. **Chapter 1** describes introduction, location of project, objective and purpose of the EIA report. The contents of other chapters are described as under:

- **Chapter 2** – "Approach and Methodology" explains the Consultant's approach and methodology for updating the EIA study in accordance with Pak-EPA, EPD-Punjab and ADB's requirements;

- **Chapter 3** – "Policy, Legal and Administrative Framework" elucidates the current legal framework including national and funding agency's guidelines which is applicable to the proposed project in the context of environment and sustainable development;

- **Chapter 4** – "Project Description" furnishes an overall description of the project, including its background, features and key components, timeframe and cost;

- **Chapter 5** – "Analysis of Alternatives" provides details on alternate alignments and options considered for the proposed interventions, location and design;

- **Chapter 6** – "Baseline Conditions" comprises a detailed narrative of the existing (baseline) conditions of the project area, with respect to its physical, biological and socio-economic environment;

- **Chapter 7** – "Stakeholder Consultation" provides summary of consultative sessions with the local community as well as with other stakeholders including local politicians, local government officials, policy makers and NGOs for their opinions and suggestions on the project;

- **Chapter 8** – "Potential Environmental Impacts & Mitigations" elaborates the likely impacts of the project on the physical, biological and socio-economic environment during the construction and operation stages and lays down the proposed measures to mitigate the adverse impacts of the project;

- **Chapter 9** – "Cumulative Impact Assessment" describes the collective impacts due to other proposed intervention near project area apart from JIP;

- **Chapter 10** – "Environmental Management Plan" provides the mechanism to be adopted for the implementation of measures and monitoring the environment during all stages; and

- **Chapter 11** – "Conclusion and Recommendations" gives the conclusion of the impact assessment study and recommendations for the construction and operational stages.

CHAPTER-2 APPROACH AND METHODOLOGY

2.1 Updating the EIA

17. The updating of the EIA for JIP has been carried out in accordance with the requirements of local laws (PEPA 1997 (amended 2012), Pak-EPA's IEE/EIA Regulations 2000) and ADB's SPS 2009 and and Environmental Safeguards: A Good Practice Sourcebook Draft Working Document, December 2012. The objective of the updated EIA Report is to identify the impacts of project related activities on the physical, ecological and socio-economic components of the project environment and develop effective and appropriate mitigation measures.

18. The EIA study has been updated at detailed design stage on the basis of following considerations:

- Necessary amendment in route of main canal alignment (Jalalpur canal) has been done to avoid graveyards, settlements, based on the latest topographic surveys performed in the field;
- Baseline conditions for physical, biological and socio-economic conditions to be updated based on the fresh surveys and further investigations; and
- Further investigation and assessment of environmental and social impacts from the project to be done by keeping in mind the sequence as Avoidance → Minimization → Rehabilitation/Restoration → Offset/Mitigation.

19. The major findings of the previous EIA study have been reviewed and studied in detail. The prime focus of this updated EIA was on major areas of concern as identified during canal route optimization, detailed design and those highlighted in previous EIA findings.

20. The major impacts identified in the previous EIA were related to land acquisition, loss of cultivable land and resettlement. Total 927 structures were found within Right of Way (RoW) of main canal and distributaries. The environmental hotspots discussed in the previous EIA were the Rasul Barrage Game Reserve, Jalalpur Wildlife Sanctuary and Community Based Organization (CBO) Western Jhelum. Keeping in view the updated alignment of main canal, an overlay map has been prepared for demarcation of the ecologically sensitive areas in order to check any overlap of the project with any protected/sensitive area.

21. The Consultants have adopted following methodology for updating the EIA:

2.2 Approach and Methodology

22. Consultant reviewed the available data and previous EIA report of project prepared at the feasibility stage. The baseline conditions and potential environmental impacts identified in the previous EIA report have been updated as a pre-requisite for the development of an updated EMP. The tasks to update EIA were carried out in pre-defined stages that are desk study and review of all the available data, acquisition of updated design information, updating baseline conditions and impact assessment, proposing mitigation measures and updating the EMP.

2.2.1 Review of Updates on Project Design

23. This task included review of design changes in project components and features i.e. changes in alignment and other allied structures. The EIA prepared during the feasibility stage was reviewed and updated in the context of project description in accordance with ADB SPS and guidelines. The project alignment has been changed at the various sections of the main canal to minimize the resettlement issues and to maximize the project benefits. All the design changes in the project features have been updated and incorporated in the project Description i.e. Chapter 4 and subsequent sections of the updated EIA report.

2.2.2 Route Optimization for Main Canal and Distributaries

24. Optimization of route alignment of the irrigation channel is the most cost effective method of reducing the environmental and social impacts of the canal and other distributaries. The identification and optimization of the route was the most critical phase of the present study. The objective of route optimization was to obtain first-hand overview of the project environmental and social setting and to conduct an initial analysis of the physical, biological and social constraints posed within the proposed canal route.

25. A criterion for route optimization was developed by NESPAK's Environmental and Social experts on the basis of Geographical Information System (GIS) data, existing information and experience. Efforts were made to avoid environmentally sensitive areas such as protected areas, game reserves, lakes, archaeological and historical sites, settlements etc.

26. To get a better understanding of the existing infrastructure along the canal corridor, a map was prepared by digitizing the Google imageries over which the existing infrastructures such as transmission lines, irrigation channels, houses, tube wells etc. falling in the Right of Way (RoW) of the proposed canal were marked. An initial assessment of the infrastructure, types of land and the settlement pattern was also made using preliminary plans.

27. The following environmental criteria were used in addition to technical and design considerations for the proposed canal alignment.

- Avoid towns/populated areas;
- Avoid cultural, religious and historical buildings;
- Maintain minimum disturbance to the natural habitat and vegetation; and
- Maintain appropriate distance from the sensitive receptors (500 m).

28. Following the above mentioned criteria, route optimization was carried out jointly by the design and environmental teams of NESPAK and route was finalized with the consent of Client i.e. PID.

2.2.3 Delineation of Project's Area of Influence (AOI)

29. As per the ADB's SPS, 2009, impacts and risks have been analyzed within project's AOI. The AOI of the project encompasses primary project site(s) and related facilities that the borrower/client (including its contractors) develops or controls, such as main canal, distributaries, access roads, borrow pits, disposal areas and construction camps. AOI does not include potential impacts that might occur without the project or independently of the project. Environmental impacts and risks will also be analyzed for all relevant stages of the project cycle, including pre-construction, construction and operation.

30. AOI include the actual RoW of project as well as the surrounding area where positive and adverse impacts may be foreseen due to the implementation of the proposed project. RoW of the proposed canal[1] varies from 300 ft (92m) to 125 ft (38m) in different reaches. In addition, the AOI also includes the sites of three construction camps along the canal alignment. For cumulative impact, the activities in the surrounding areas of AOI have also been considered. **Appendix-I** shows JIP AOI.

2.2.4 Survey in the AOI

31. A team of environmental and social experts including environmental engineers, scientists, sociologist, surveyors, ecologist, land experts, valuation experts, enumerators etc. carried out the environmental and social survey in the AOI to familiarize themselves with the local conditions and the environmental settings. During the survey, the information regarding the topography, soils, rock, surface water, groundwater, flora and fauna, forested areas, social settings and villages/towns in project AOI was observed and collected.

[1] The ROW is unequal on both sides of canal due to river on one side and settlement on other side.

2.2.5 Analysis of Alternatives

32. It is mandatory requirement for preparing EIA report that the proposed project is compared with other alternative arrangements that could have been developed to meet the objectives for which the proposed project has been planned.

33. In order to meet the desired objectives of the project, an analysis of alternatives was carried out for the assessment of alignment, technological and design options considering technical, environmental, social and financial aspects. Moreover, no go alternative was also considered with reference to the effect on the command area and associated benefits such as project area development, employment opportunities and socio-economic activities.

2.2.6 Review and Updating of Baseline Data

34. This stage mainly comprised the review and updating the baseline data through the field surveys, data compilation, analysis and finally its documentation. The updating of baseline data was done keeping in mind the changes in the project design and alignment. The tasks during this stage achieved through the field surveys and collection of database of existing situation *via* different primary and secondary information sources including the already conducted EIA. The present EIA team worked in close collaboration with the project design team to extract the required information. For primary data acquisition, the EIA team contacted the relevant government departments and conducted field surveys. The secondary data was made available through web/internet and published sources. Baseline data were updated and analyzed considering the following physical, biological and socio-economic parameters:

2.2.7 Physical

35. After the delineation of project's AOI and finalization/optimization of canal alignment, environmental survey was carried out within the AOI. Detailed investigations were done for environmental components on which project's impacts are envisaged. Baseline surveys to collect physical environment data were carried out from October 2016 to January, 2017. Such data were updated for the following parameters:

a) Climate

36. In accordance with the previous EIA study, the climate in the project area is semi-arid, hot sub-tropical continental and is characterized by hot summer and severe winters. May, June and July are the hottest months; maximum temperature may rise as high as 49°C during the month of June. The temperature remains nearly constant during October and November (25°C). December and January are the coldest months. The average yearly rainfall is 34.8 in (885 mm) while the pan evaporation is more than 64.4 in (1637 mm).

37. Much of the climatic data as mentioned above is same as it was reported in previous EIA report. However, data regarding temperature, relative humidity, rainfall, wind direction/speed, evapotranspiration, climate etc. have been updated. At the feasibility stage, the metrological conditions of the area were monitored at four different locations from August, 28 to September 1, 2015 for temperature, wind direction, wind speed and humidity. During the updating of the EIA, site specific weather data was also monitored and that has also been utilized for the updated EIA.

b) Air Quality & Noise

38. According to the previous EIA, ambient air in the project area, in general, is clean, because no major industrial activity was found within the project AOI. However, vehicular traffic was reported on the Jehlum Pind Dadan Khan Road. Ambient air quality and noise levels' monitoring was carried out in previous EIA at four different locations i.e. Jalalpur Sharif, Aduwal, Mire and Kurar from August 28 to September 01, 2015. Ambient air quality parameters included Nitrogen Dioxide (NO_2), Nitrogen Oxide (NO), Sulfur Dioxide (SO_2), Carbon Monoxide (CO),

Particulate Matter (PM_{10} and $PM_{2.5}$), which were continuously monitored for 24 hours. Ambient air quality analysis clearly depicted that the air quality is apparently clean as the values are far below the limits of National Environmental Quality Standards (NEQS). Similarly, noise levels measured at four locations, ranged between 60-85.3 dB(A) at Jalalpur Sharif, 60-85 dB(A) at Aduwal, 48-67 dB(A) at Mire and 52.5-72 dB(A) at Kurar. This range corresponds to calm to moderate noise atmosphere for rural areas, associated with low levels of vehicular traffic and minimum industrial/commercial activities.

39. While updating of the EIA, the ambient air quality of the project area was monitored for winter season to present a comprehensive seasonal data of air quality (as at feasibility stage monitoring in summers was carried out). Information related to ambient air quality including the paramters such as Particulate Matters (PM_{10}/$PM_{2.5}$) and other gaseous pollutants like NO, CO, SO_2, and noise levels was collected. Consultants adopted instrumental monitoring for all these parameters at the same four locations i.e. Jalalpur Sharif, Aduwal, Mire, Kurar and on some other locations near proposed alignment.

c) Physiography, Geology and Soils

40. The project area crosses over four types of surficial characteristics. In start, right after the Rasul Barrage, the alignment passes through the Potwar fluvio where diversified nature of soil is encountered. Abrased rock fragments intermixed with sand and clay are abundant in the piedmont plains of the Potwar and Salt Range. The information on physiography, geology and soils was collected through field surveys and secondary data and were updated accordingly. The seismic zoning map of Pakistan, prepared by NESPAK indicating different seismic risk zones on map of Pakistan was consulted to investigate the seismicity in project AOI.

d) Hydrology

41. The hydrological data of the project's AOI was collected from feasibility report and updated. Information was also acquired from hydrologist during detailed design of the JIP.

e) Hydrogeology/Groundwater

42. In the previous EIA, ground water sampling was executed in three categories which were devised on the basis of water usage. The categories are as follows:

- Category-1: This category was formed to check water quality of hand pumps installed near river bank for drinking purpose;
- Category-2: This covers those tube wells whose water is being used only for agriculture purpose; and
- Category-3: This category was devised to check the ground water quality for agriculture purpose near streams carrying wastewater or located near industrial activities.

43. It was concluded in previous EIA that the ground water is relatively brackish in nature which is not fit for irrigation purpose. This is due to the fact that brackish irrigation water may cause more salinity in the command area and may cease or negatively impact the growth of plants and cops. Ground water is also not fit for human consumption due to presence of microbial contamination and higher contents of salts.

44. During updating of EIA, second round of water quality monitoring has been carried out to represent the seasonal data on water quality (as first round of monitoring was carried out in summers at feasibility stage). Data related to groundwater flow patterns and water table depth was also collected. Ground water quality was assessed through sampling and testing. Groundwater quality was analyzed for the priority parameters as per standards, considering the use of groundwater for drinking purposes.

f) Surface Water

45. Surface water of proposed Jalalpur canal would be same as carried by the Jhelum River which is excellent in quality and its continuous use in the project area may not create any salinity/sodicity problem. Jhelum River water of the project contains about 100 to 200 mg/l of soluble salts and is reckoned as brilliant in quality. However, according to the previous EIA, results of water quality of hill torrents revealed that water is neither good for irrigation purpose nor fit for human consumption at all.

46. During the recent baseline survey for updated EIA, data related to all perennial and non-perennial, surface water resources in the area was updated. Baseline studies included the determination of detailed characteristics of the water bodies in project AOI as well as more detailed seasonal characterization of the receiving streams (both upstream and downstream).

g) Land Resources

47. The information on land use of project area was acquired during the baseline survey. The primary land uses in the project area are agricultural, barren, hilly and (residential, hilly). Baseline land-use maps prepared at the feasibility stage in the previous EIA report were updated in accordance with the latest alignment at the detailed design stage. Baseline land-use maps were prepared using the GIS Techniques and verified in field which facilitates the determination of impact quantum during the impact assessment.

2.2.8 Natural and Biological Environment

a) Flora

48. As per previous EIA, the project's AOI comprises sub-tropical dry evergreen scrub flora with dominating species of *Acacia modesta* (Phulai), *Olea cuspidate* (Kahu), *Dodonea viscosa* (Sanatha), *Reptonia buxifolia* (Gurgura) and *Gymnosporia royleana* (Pataki). Around Jhelum River, the forests are deciduous shrub type, with poor stocking particularly upon sandstone and red marl. Within low land plains and hills of the district Khushab, fertile land prevails. Overall the area being devoid of forest canopy has abundant growth of grasses and forages. The biological resources of the area are under stress due to grazing, expanding settlements and unsustainable industrial activities. Some linear plantations on various roads are managed by the Punjab Forest Department.

49. During update of the EIA, Consultant covered the description of general forest type of project's AOI with details of existing flora, covering tree species, shrubs and grasses. The existing canopy cover was ranked in relation to normal vegetative cover of that particular forest type on crop density basis. The reduction of tree cover in the past due to manmade activities and other causes, was identified. Consultant identified the kind of tree species including fruit trees coming within the RoW of the main canal and distribution network of the JIP, whereas tree inventory through full enumeration method was updated by Social and Resettlement team for their use in Land Acquisition and Resettlement Plan (LARP), and same was used by the EIA team for biological assessment and developing Tree Plantation Plan. Rare or endangered floral species were also identified with their present status in International Union for Conservation of Nature (IUCN)'s red list of threatened species.

b) Fauna

50. Biological baseline conditions at feasility stage revealed that the project's AOI does not include any biological protected/endangered site. The Jalalpur Game Reserve area which is located away from project AOI includes Punjab Urial (*Ovis vignei punjabiansis)*, a key wildlife specie of the area, which is classified as vulnerable by the IUCN red list of threatened species, 2005. The Punjab Urial is endemic sub specie of Pakistan and is declared as "protected" under all provincial laws. It is known to have a restricted distribution range and found only in the Salt and Kala Chitta Mountain ranges and is confined by a coniferous forest belt in the north, the

Jhelum River in the east-south side and Indus River in the west. It formerly was distributed throughout these mountains, but now the main concentration occurs within the Salt Range, mainly around Kalabagh in the western extremity near the River Indus.

51. To update EIA, consultants assessed the status of all the above mentioned flora and fauna species within the project's AOI. Field survey to investigate existing mammals, reptiles, amphibians and birds and their local distribution was carried out in winter season. The inventory prepared during the earlier EIA report on the species within and around the project's AOI was analyzed for any possible update in view of its seasonal changes. It was investigated that if any wildlife Protected/Sensitive area falling in the project's AOI. The areas such as Rasul Barrage Game Reserve, Jalalpur Wildlife Sanctuary and CBOs managed Urial habitats are nearby project AOI. Current status of Punjab Urial with reference to Jalalpur Wildlife Sanctuary and local CBOs was assessed. Avi-fauna (resident as well as migratory) species, their relative abundance and seasonal biodiversity was observed around proposed canal outlet at Rasul Barrage.

52. Point count method was adopted for avifaunal assessment for being powerful and traditionally preferred avian survey method to measure relative abundances efficiently (Whitman *et al*., 1997). The birds were recorded at multiple stations separated by fixed distances during dusk and dawn times in winter season intermittently i.e. during the months of December, 2016 and January, 2017. The point count stations in project's AOI having radius of 25 m were taken at 500 m interval, along the periphery of barrage and at about 5 km interval along main canal's RoW, to minimize the risk of counting the same individual twice. About 30 minutes were spent at each station, allowing the identification of the species present while minimizing the likelihood of double-counting. Arrangements were made to engage a local ornithologist to accompany the team for better identification of songs of birds. Necessary consultation was undertaken with Wildlife, Forest departments and relevant Non-Government Organizations (NGOs) dealing with conservation/improvement of wetlands and biodiversity of the area.

2.2.9 Socio-Economic Environment

53. This task was completed by the Social and Resettlement team. The socio-economic survey of Project Affected Persons (PAPs) was carried out within the project's AOI, to develop the socio-economic baseline information of the general settled population. Based on the statistical sampling methodology (sample size was taken as 25 % of the total villages), all the PAPs within the AOI were interviewed and consulted for the collection of baseline socio-economic data.

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

- Demographic characteristics;
- Literacy status/ education;
- Number of assets affected;
- area of land affected;
- Nature of business/occupation;
- Livelihood/income;
- Living standard of the population;
- Access to credit;
- Social Infrastructure available;
- Gender issues;
- Pressing needs of the people;
- Community perception about the project etc.; and
- Other aspects.

55. Checklists and Proformas which were used during the baseline surveys for the EIA study are attached as **Appendix-II**.

2.3 Stakeholder Consultations

56. According to the previous EIA study, frequent meetings and consultations were held with the community and other stakeholders' *vis-à-vis* PID, PIDA, Pakistan Railways, Forest Department, Highways, Agriculture, Wildlife, Local Government rrepresentatives, local welfare societies, NGOs and community influential personnel. During the meetings, the project objectives were explained to the participants. Their concerns and suggestions were documented and taken care of to enhance the project acceptability on social grounds. During field visits, a series of public consultations and scoping sessions were carried out at various locations in the project area.

57. During the update of the EIA study, stakeholder's consultation carried out with the direct and indirect PAPs in accordance with the latest design changes. The stakeholder's consultations were conducted as per Pak-EPA guidelines, ADB's SPS, 2009 and in collaboration with the project Management Unit (PMU) of PID. ADB's relevant guidelines prescribe that the PAPs and institutions should be fully informed about the project by disclosing relevant information on project impacts, the proposed policy of mitigation and compensation options to them. The other pertinent objective to perform these consultations is to get feedback of stakeholders about the likely positive and negative impacts due to the implementation of the project activities and to inform the public, how the PMU of PID would take necessary measures in order to control the negative impacts on the local environment. The record of all the proceedings of the meetings, and the stakeholders' apprehensions and recommendations was kept and reported.

58. The Consultants updated the identification of project stakeholders and held meetings with them during the baseline data collection to receive feedback on the expected environmental and social issues related to the project. Meetings were carried out with the PAPs, relevant departments including Irrigation, Wildlife, Agriculture, Fisheries, Provincial EPA, Irrigation Department, NGOs, Civil Society and Academia to discuss the issues/constraints and get their views and feedback to mitigate the potential environmental impacts associated with the implementation and operation of the project. Consultations and group discussions with the local people, residing in the AOI were also carried out.

2.4 Impacts Identification

59. Impacts were identified (using checklists) and updated, starting from baselines surveys and continued throughout all the other stages. Following methodologies were used for updating the impacts identification and assessment:

2.4.1 Project Interaction Matrix

60. Interaction matrix is a two dimensional matrix wherein the project actions are placed along one axis (i.e. along y-axis) and on the other axis there are different environmental parameters likely to be affected by the proposed project actions grouped into categories i.e. Physical, Ecological & Socio-economic Environment. Interaction matrix was used in this project due to the following reasons:

- It provides cause-effect relationship between the project actions and resulting consequent impacts;
- It provides nature (+ve or –ve) and weighting of different impacts; and
- Matrix grouped project actions into temporal phases.

61. For the impact assessment, project interaction matrix was used by distributing the project action into different phases (i.e. construction and operation). The environmental impacts are divided into three main categories including physical, biological and socio-economic domains.

62. The environmental impacts of the project actions identified and weighed into the following categories:

HB = Highly Beneficial
MB = Medium Beneficial
LB = Low Beneficial
0 = None/Insignificant
HA = Highly Adverse
MA = Medium Adverse
LA = Low Adverse

63. The significance of impacts was assigned on the basis of nature, extent, consequence etc. and previous knowledge/ professional judgment of experts.

2.4.2 Overlays and Geographical Information System (GIS)

64. Overlay diagrams were developed during updating the EIA. Overlays used to present the distribution of impacts spatially over the project AOI and to display the affected areas on map. A modern version of overlay method is the computer-based GIS. GIS stores, retrieves, manipulates and displays any data in a spatial format. A set of maps or overlays of a given area provide different types of information scales of resolution.

2.5 Updating the Impact Assessment and Mitigation Measures

65. A logical and systematic approach was adopted for impact identification and assessment. The process began during the screening and continued through scoping which identified the key issues and classified them into different categories. The tools, which were used for impact assessment, are:

- Matrices; and
- Overlays.

66. Identification of potential environmental and social impacts in terms of their nature, magnitude, extent, location, timing and duration were carried out. The impacts were correlated to the project location, design stage, construction stage and operation stage. Using impacts prediction methods and considering public/stakeholder consultations, the Consultants screened the adverse environmental impacts and formulated mitigations measures for the same. The same process was followed for the identification of social impacts. Public consultations (which provided feedback of the impacts from the stakeholder's viewpoint) were used to screen out the insignificant impacts. Matrices and overlays were used for the evaluation of temporal and spatial impacts respectively.

67. The Consultants proposed practicable, feasible and socially acceptable mitigation measures for the significant adverse environmental and social impacts. These measures were based on exploring the ways to achieve the project objectives causing least disturbance to the existing environment by alternative ways, proposing changes in the project design, through improved monitoring and management practices (i.e. storage of construction materials, labour camps location, waste disposal, and disposal of construction debris or through monitory compensation).

68. Mitigation management measures were prepared on the basis of impacts intensity. For instance, if the impact is low enough it can be ignored; if the impact is high, specific mitigation measures enforced and if the impact is medium it may need some mitigation measures or simply be monitored/managed properly in order to ensure that it remains within the acceptable limits.

2.6 Updating Environmental Management Plan

69. According to the previous EIA study, the EMP sets out mitigation actions, monitoring actions, responsibilities, and schedules for impact mitigation and monitoring. Environmental monitoring has to be undertaken during both the construction and operational phases to ensure the effectiveness of the proposed mitigation measures.

70. The EMP for different phases (i.e. construction and operation) of the project developed during previous EIA was reviewed and updated in the light of current design and anticipated impacts. EMP proposed a plan of action that indicated roles/responsibilities and required measures to minimize the negative environmental effects through all stages of project. The EMP sets out recommended actions, necessary arrangements, impact mitigation approaches roles, responsibilities, and schedules for monitoring and follow-up. Environmental monitoring is proposed during construction and operation phases of project to ensure the effectiveness/performance of the proposed mitigation measures. The do-no-harm principle was considered while formulating the EMP.

71. Under EMP, institutional set up of the PMU of PID was studied. The required enhancement in role of PMU, which was deemed necessary for effective management and monitoring of the environmental activities is proposed in updated EIA. The EMP address the following aspects:

- Institutional Arrangements/Analysis
- Roles and Responsibilities (allocation of resources and responsibilities)
- Mitigation Management Matrix (summary of potential impacts and mitigation measures, risk assessment and prioritization of mitigation measures, schedule of action to be taken, responsibilities for execution and supervision of mitigations)
- Environmental Monitoring Programme, Surveillance and Auditing
- Reforestation Plan
- Training Program
- Documentation Plan
- Change Management Plan
- Contingency Plan
- Fines/Penalties (In EMP implementation, the Consultant will develop procedures for fines and penalties if any non-compliance occurred. However, this issue will mainly rely on contractual process).

72. EMP also provides its implementation mechanism during construction and operation phases

- Implementation during Construction Phase: The EA for this project is PID having core implementation responsibility. The immediate requirement considering the existing institutional setup of EA (PID) would be the establishment of Environmental & Social Management and Monitoring Cell (ESMMC). The ESMMC will monitor the environment related activities of Supervisory Consultants and Construction Contractor and will submit compliance status report to EPA-Punjab. Construction Contractor will be in direct coordination with Supervision Consultant through its relevant department. Contractor's Health, Safety & Environment (HSE) Department is highly recommended to be on-board before start of any kind of work.
- Implementation during O&M: The key players involved during operation of the proposed project would be the ESMMC of EA (PID), District Environmental Officers of Khushab and Jhelum, KPs and PMU monitoring units. ESMMC will get input from KPs of Tehsil Khushab and Pind Dadan Khan, randomly check the project operation in context of EMP and report to District Environment Officers annually.

73. The EMP is prepared taking into account environmental consequences of the proposed action. Mitigation measures are suggested along with performance indicators against each impact anticipated from different activities to mitigate the potential impacts. Environmental monitoring plan has also been prepare as a part of EMP which gives details about monitoring mechanism of a specific receptor /item, monitoring frequency and parameters to be considered. The designer has carefully considered all recommendations related to the design given in

previous EIA. A suitable training program is proposed to train both the Contractor(s)' staff who will be involved in construction activities and the proponent's staff involved at the operation phase of the project. It is recommended to obtain all required permits from the concerned departments before starting any related activity.

74. According to the previous EIA, the total budget for EMP implementation during construction stage of JIP was Pak Rs. 109 million covering cost of laboratory analysis, consultants' supervision, third party monitoring, tree plantation and staff trainings. For operation and maintenance phase, the cost was estimated for initial three years is Pak Rs 3.9 million covering costs of laboratory analysis, third party monitoring, trainings and community engagement. Environmental cost to be borne by the Contractor was as PaK Rs. 12 million. This cost has been updated at detailed design stage and is given in Chapter 10.

75. Consultant reviewed and updated cost estimates as desired due to the latest changes in alignment and other components at the detailed design stage, which become part of the EIA and tender documents for the proposed project.

2.7 Conclusions and Recommendations

76. In view of current baseline conditions, updated impacts and suggested mitigation measures and proposed EMP, conclusions are made. Based on the conclusions, recommendations regarding the future plan of action and outcome of the updated EIA report are provided.