Environmental Impact Assessment

July 2017

PAK: Jalalpur Irrigation Project

Project No. 46528-002

Part 9 of 9 of the Main Report

Prepared by Irrigation Department, Government of Punjab for the Asian Development Bank (ADB).

Irrigation Department
Government of Punjab

DETAILED DESIGN OF JALALPUR IRRIGATION PROJECT

ENVIRONMENTAL IMPACT ASSESSMENT (EIA)

MAY 2017

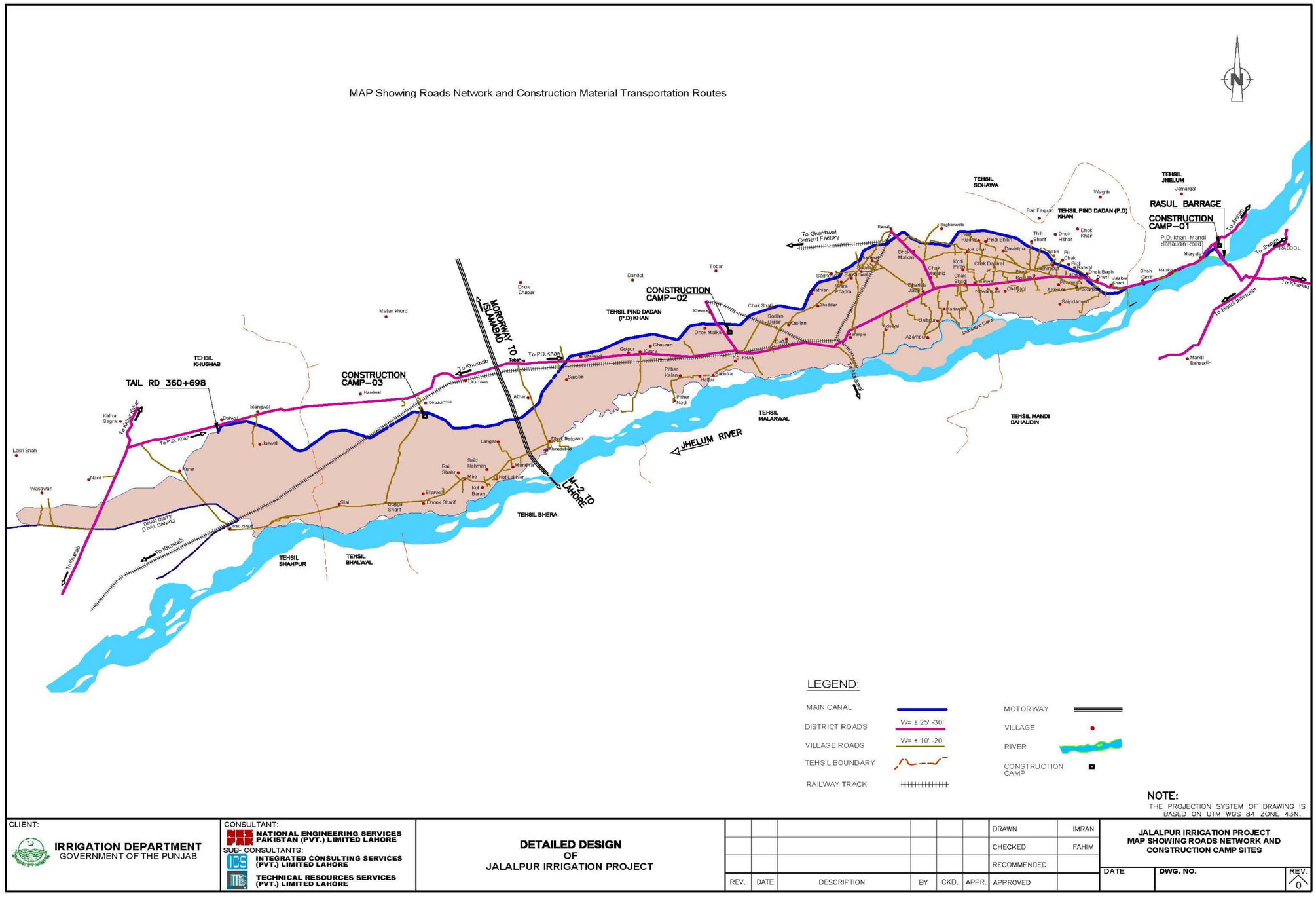


Figure 8.6: Road Map showing Construction Material Transportation Routes

8.8.7. Flora

Potential Impacts

565. 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 as estimated by Social Expert while updating LARP at Detailed Design Stage (Refer **Table 8.12**). The group of tree identified for wood value comprised of *Acacia nilotica* (Kikar/ Babool), *Delbergia sisso* (Sheeshum), whereas, majority of fruit trees comprised *Zizyphus jujoba* (Ber), with couple of *Phoenix sp.* (Date Plam), *Syzygium jambolina* (Jamun) and *Mangifera indica* (Mango). No rare, endangered or endemic terrestrial plant species were observed during the site visit. However, the number of trees to be cut is significant. The project will compensate for the loss of vegetation following the guidelines defined under Forest Act 1927 (amended in 2010), which recommend plantation of ten trees for each tree cut.

Table 8.12: Estimated Quantum of Tree Cutting in JIP Area

Sr.#	Category	Land Required	Tree cutting-wood		Total	Tree cutting- fruit		Total	Grand Total
		acres	Jhelum	Khushab		Jhelum	Khushab		
1	Main Canal	1700	5025	440	5465	30	0	30	5495
2	Distributary	1300	1619	140	1759	2	0	2	1761
Total:		**3000**	**6644**	**580**	**7224**	**32**	**0**	**32**	**7256**

566. The other secondary impacts envisaged on flora during construction are as follows;

- During construction phase clearing of vegetation will be required for the construction of access roads, embankments, cut and fill activities, material dumping and lay down areas, resulting in a direct negative impact on the natural vegetation of the site. The extent of the impact will be confined within the RoW and at construction camp sites;
- Construction dust generated during piling, excavating, filling, backfilling and material handling would affect the surrounding vegetation. Construction dust would cover leaves of trees and shrubs in the area, closer to the Canal alignment, will lead to reduction in photosynthesis rate, abrasion and stomata blockage, thus reducing the quality of plant;
- Soil erosion shall increase due to process of cutting and filling of earth for the main Canal alignment;
- Construction material require for the JIP will be procured from borrow areas. These borrow areas will damage the existing vegetation in the area and cause a minor negative impact;
- Exhaust of noxious gases from movement of heavy machinery may pollute the air which will adversely affect health and vigor of nearby plants; and
- During construction activities the contractor's workers may damage the vegetation and trees (for use as fire-wood to fulfill the construction camps kitchen requirements).

567. The significance of the impact on flora considering the quantitative damage from Project development phase has been given due importance and has been kept on priority. Without compensation the impact would be of high significance.

Mitigation Measures

568. By adopting following measures, impact would be finally of low significance:

- The loss of tree removal should be compensated by carrying out tree plantation on large scale in accordance with Tree Plantation Plan as given in EMP. Compensation will also be made to the owners of the trees according to the type, girth and maturity of the felling trees.

- Design developed for 276 km of canal and its distributaries accommodates a theoretical value of 36,000 plants in two rows on either side, which comes as over three (03) times the number of trees to be lost. However, section 32 (c) (d), Forest Act 1927 (Amended 2010) demands removal of one (01) tree should be compensated by plantation of ten (10) trees; following the above definition the project required to plant some 72,560 plants to fulfill the legal requirements;
- The task for the new tree plantation along the canal is quite difficult but manageable through seeking advice from the Forest Department and involving their local staff to facilitate plantation with appropriate time and space availability to fulfill the desired requirement;
- The collaboration with Forest Department would be helpful in choice of appropriate species, identification of available space and planning the plantation work in right planting season (spring and monsoon);
- To ensure the success, the Project can maintain its monitoring role (survival rate), for a period up to a minimum of three years and a maximum of five years;
- Avoid dumping material in vegetated areas and avoid unnecessary loss of vegetation;
- Get approval from Supervision Consultant for clearance of vegetation. Provide adequate knowledge to the workers regarding protection of nature and the need to avoid felling trees during construction;
- Make selective and careful pruning of trees where possible to reduce need of tree removal;
- Clear only the vegetation that needs to be cleared in accordance with the plans;
- Do not burn off cleared vegetation, wherever feasible, chip or mulch and reuse it for the rehabilitation of affected areas, temporary access tracks or landscaping. Mulch provides a seed source, can limit embankment erosion, retains soil moisture and nutrients, and encourages re-growth and protection from weeds.
- Return topsoil and mulched vegetation (in areas of native vegetation) to approximately the same area of the roadside it came from. Avoid work within the drip-line of trees to prevent damage to the tree roots and compacting the soil.
- Minimize the length of time the ground is exposed or excavation left open by clearing and re-vegetate the area at the earliest in practically possible time.
- Ensure excavation works occur progressively and re-vegetation done at the earliest. Supply appropriate fuel in the work caps to prevent fuel wood collection.
- Project area is devoid of vegetation and possesses sporadic shrubby growth. Awareness programme for local inhabitants about tree planting activity on their private land, should be encouraged.

8.8.8. Fauna

Potential Impacts

569. The potential impacts associated with vegetation loss are closely linked to potential impacts on fauna, since a key determinant of faunal abundance is generally habitat quality. The impact of the proposed Project would vary depending upon the species and habitat types. 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. Wildlife may also be disturbed due to movement of vehicles and labourers; location and operation of camps; operation of batching plant; and site restoration. There would be death or injury risk to fauna by striking with plants or vehicles. Since wildlife has been rarely reported around the proposed project's AOI and all wildlife sanctuaries and protected areas are far away from Project site and AOI, the minimum distance is 1.3 km. There would not be any significant negative impact on wildlife mainly. The vulnerable specie *Urial*, which was not found in Project AOI and was observed only in sensitive areas away from Project AOI, will have no negative impact from the Project. The construction activity in a small segment from Misri Chowk to the beginning of Jalalpur Sharif being close to AOI might cause temporary disturbance, but no significant loss of wildlife habitats has been envisaged. However, the temporary impacts such as vehicular noise during construction phase are expected. There

seems no residual impact on wildlife, the other supporting phenomenon is the ability of the reported specie to readjust its niche by virtue of its intrinsic phenotypic plasticity.

570. Rasul Barrage Game Reserve is a water storage reservoir created by damming the Jhelum River for irrigation, thus falls in manmade category of wetlands; there are many associated marshes and extensive sand banks. When the water level at Rasul Barrage in winter season falls, this wetland appears to be a fragmented structure. Some 2,812.5 acres (1,125 ha) area has been declared as Game Reserve, This is significant area due to congregation of water birds (category A4[10], as per Birdlife International, Criteria for Important Bird Area). Rasul Barrage is also an important habitat for domestic and migratory birds. No threatened species have been seen or reported at this habitat at feasibility stage. However, the recent surveys at the detailed design stage revealed that waterfowls like Common Pochard and Lapwing are present, who fall in the category of vulnerable and near threatened species in the IUCN Red list. Rasul Barrage Game Reserve has been located at upstream of the Rasul Barrage and the proposed main Canal alignment runs through the downstream of the barrage. The provision for the divide wall has already been made during the construction of Rasul Barrage. However, to feed Jalalpur Canal, head regulator will be constructed during low flow periods.

571. The potential impacts to aquatic life in the Project may arise during the implementation of construction activities. Vulnerable fish specie Gulfam (*Cyprinus carpio*) and near threatened Malhee (*Wallago attu*), Silver Carp (*Hypophthalmichthys molitrix*) will be affected by construction activities. The construction of coffer dams at upstream and downstream (RD 0+000 to 45+000) of the Jhelum River and dewatering activity may affect the aquatic life in those reaches. However, it is recommended to commence and proceed the construction activities at barrage and near River in low flow periods to reduce the impact on aquatic life. This impact would be of moderate significance.

Mitigation Measures

572. Impacts on fauna can be minimized by following measures:

- Contractor should include a commitment to wildlife conservation in the environmental policy for the project and ensure it is delivered;
- Site surveys should be undertaken prior to start of construction to determine if any priority species are roosting or nesting in close proximity of development areas, if required a rescue team should be arranged to shift the found animals from the construction sites to safe ecological zones;
- At the administrative level, the construction contractor should be responsible to provide necessary awareness to its workers how to handle any “chance encounter” with fauna and wildlife during construction. Under no circumstances, hunting or preying of animals should be allowed to the contractors’ workers in and around the Project Area. Contractor to submit monitoring reports to proponent;
- Contractor to join hands with Wildlife Department for any chance-encounter training to its workers. All cost to be borne by the contractor.
- Employees, contractors and site visitors should be instructed to avoid harassment and disturbance to the wildlife especially during reproductive (i.e., courtship and nesting) seasons
- Approaching, engaging or disturbing fauna will be prohibited. All construction and construction related activity should be restricted to demarcated areas;
- Pets and unauthorized person entries will not be allowed at site;
- Construction contractor should aware and train their staff to protect fauna at site;
- JIP construction activities at head works should be planned keeping in view of the inherent behavior of the habitat and in close liaison with the concerned line department (Wildlife and Forests) i.e. maximum work to be planned in the period, when the population of water birds

[10] Site known or thought to exceed thresholds set for migratory species at bottleneck sites.

remains minimal. The activities should be planned in close liaison with Wildlife Department Mandi Bahauddin and Jhelum;
- Project activities should not be carried out in the designated wildlife sanctuaries, game reserves and areas of bird's population;
- Contractor's HSE Department shall make night time patrol to monitor any bird/fish poaching activities by the workers;
- Minimum damage to River Jhelum natural flow. No wastewater release into river Jhelum or Rasul Barrage should be allowed;
- In case of any toxic release into the River, compensate the loss by providing fish culture;
- Limit unnecessary driving and track 'creation' in Project area to minimize disturbance to avifauna;
- Avifauna should be carefully monitored by an appropriately qualified ornithologist at pre- and post-construction, and appropriate steps should be taken as and when significant changes are recorded in the number, distribution or breeding behaviour of any of the vulnerable specie;
- Protection of all fenced off/sensitive areas throughout the duration of the project and erection of appropriate signage if necessary;
- Replacement of lost habitat throughout the site or in other areas, where possible;
- Contractor to make sure that no worker will have even licensed weapon in his possession; and
- Heavy penalties shall be imposed on workers if any incident of hunting, poaching, harassing of wild animals or birds takes place.

8.8.9. Socio-economic Impacts

Potential Impacts

573. The construction activity would involve people of labor class frequenting the area for the entire length of construction period. The surrounding residential area is inhabited by people who associate very closely with a certain set of cultural values. The area being a part of a rural setup, 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 Measures

574. By adopting following measures, impact would be finally of low significance:

- In case, people from outside the area are engaged in the construction or operation of the project activities, this might result in cultural conflict with the local communities. Therefore, it is imperative to engage local work force as much as possible, and also develop and implement a strong community communication and participation plan;
- The Contractor will develop a construction camp management plan for management of labour and other construction camp related issues.
- The contractor would be liable to engage at least 50% of its required (unskilled) labor force from within or around the project area; and
- It is highly recommended that the project proponent should include some Corporate Social Responsibility (CSR) measures specifically for the tail-end population.

8.8.10. Health & Safety of workers

Potential Impacts

575. Various activities during the construction phase of the project would have health & safety impacts on workers and labor camp.

576. The activities such as loading and unloading of excavated soil and construction material will be expected during the construction phase of the project. Workers safety would be at risk if they are not adequately trained. The impact on worker safety will be direct and of moderate significance.

577. During the construction of sub and superstructure, activities such as fabrication, installation of formwork, installation of scaffoldings would have serious safety risks to the workers. The use of heavy machinery and vehicle is expected during the excavation and transportation activities. The safety of workers is of prime concern while dealing with such machineries and vehicles. The probability of such accident at project site is low but the significance might be of moderate nature.

Mitigation Measures

578. By adopting following measures, impact would be finally of low significance:

- Usage of heavy machinery should be planned carefully and only skilled persons would be allowed to operate the equipment;
- Provisions of proper signboards and informing the local people about the activity would be important. In addition, personal protection equipment such as helmets, gloves, dust masks, boots and earmuffs etc. will be provided for the workers;
- Adequate water supply and sanitation facilities should be provided in the labor camps;
- Caution signboards for the road users and surrounding people should be provided to avoid any accidents at the work site;
- In case of traffic diversions, proper signboards should be provided sufficiently ahead of the work site; and
- First aid facility should be in place and an ambulance should be available at site for 24 hrs at all three construction camps.

8.8.11. Health & Safety Issues to the Community during Construction

Potential Impacts

579. Labor influx for construction works can lead to a variety of adverse social and environmental risks and impacts on community. The influx of people may bring communicable diseases to the project area, including sexually transmitted diseases, or the incoming workers may be exposed to diseases to which they have low resistance. This can result in an additional burden on local health resources. Workers with health concerns may add load on local medical providers, thereby placing further stress on local resources. Local health and rescue facilities may also be overwhelmed and/or ill-equipped to address the site accidents that can occur construction camps.

580. Delivery of supplies for construction workers and the transportation of workers can lead to an increase in traffic, rise in accidents, as well as additional burden on the transportation infrastructure of the area.

581. Creation of high levels of dust by and particulate matter, and release of exhaust fumes (by operation of vehicles and machinery) in the air especially during the construction work in the dry seasons will affect community health especially of children, elderly and sick persons. Increase of vector borne diseases such as dengue due to construction of trenches, pits, any other structures that can lead to stagnant water collection. Risk of accidents, release of toxic gases and spillage of toxic chemicals can also affect nearby communities.

582. Creation of access roads for project and modification of existing roads may cause change of drainage patterns, and road surface damage, affecting community safety. Overall, the impact would be of moderate significance.

Mitigation Measures

583. Information disclosure, community involvement, and GRMs are fundamental for projects that have potentially significant impacts. By adopting following measures, impact would be of low significance:

- Preparation of construction camp management plan by the Contractor;
- Provision of cultural sensitization training for workers regarding engagement with local community;
- Provision of information regarding Worker Code of Conduct in local language(s);
- Vaccinating workers against common and locally prevalent diseases;
- Education about the transmission of diseases;
- Mandatory and regular training for workers on required lawful conduct in host community and legal consequences for failure to comply with laws;
- Commitment / policy to cooperate with law enforcement agencies investigating perpetrators of gender-based violence;
- Provision of opportunities for workers to regularly return to their families;
- Provision of opportunities for workers to take advantage of entertainment opportunities away from rural host communities;
- Local government engagement with contractor and communities to identify accident hotspots and formulation of solutions;
- Site specific construction camp management plans to be developed in the light of EMP given in chapter 10;
- Mandatory implementation of Environmental Management System i.e. ISO 14001 at construction camps;
- Depending on the size and the skill level of the local workforce, a share of the workers required for the project may be recruited locally. This is generally easier for unskilled workers, while more specialized staff (typically required in smaller numbers) frequently will be hired from elsewhere;
- Preparation and implementation of a traffic management plan to be approved by supervision engineer;
- Organization of commute from camp to project to reduce traffic;
- Road safety training and defensive driving training for staff;
- Sanctions for reckless driving;
- All roads are designed and will be constructed to prevent these negative impacts. The measures including providing adequate culverts, slope protection safety barriers at dangerous locations, and bypasses at locations where existing roads are crossed by open canal or cut & cover conduits; and
- Adequate signs to indicate traffic diversion.

8.9. Impacts during Operation and Maintenance Phase

584. During this phase of Project major impacts, both positive and negative, can become superficial and the earlier predictions would be validated. This phase will comprise commissioning the new interventions. While the operations phase entails mostly engineering activities, it has an equally important requirement of inter-departmental coordination, for harvesting the full potential of positive impacts of the Project.

8.9.1. Unavailability or Improper Distribution of Irrigation Water in the Area

Potential Impacts

585. As per the feasibility calculations, sufficient water will be available for non-perennial operations of the JIP, if no social issue arises at any stage. The proposed Canal will be non-perennial providing irrigation supplies for the period from April to September in a calendar year. Based on the feasibility studies by TA Consultants, it has been concluded that the irrigation

supplies for non-perennial Jalalpur canal of 1350 Cusecs (38.15 cumecs) operating in flood season, can be safely met under the expected hydrological conditions and within the provincial allocations available as per inter provincial Water Apportionment Accord (1991). It may be noted that IRSA has provided No Objection for the proposed Project subject to the condition that province Punjab will meet the share from its share of water. This impact would be of high significance.

Mitigation Measures

586. Following measures will step down the significance of impact from high to low.

- It is obvious that more consistent and regulated availability of water will be a beneficial outcome. To further improve the situation, the previously recommended Environmental & Social Management and Monitoring Cell (ESMMC) would play a key role. The ESMMC would involve the local staff of agriculture department to ensure the best utilization of available water;
- As previously mentioned, many area people mentioned the need for potable water supply arrangements for the area.
- Local people of the area mentioned the demand of potable water supply along the Canal. Once the consistent availability of water is assured, the local administration should make potable water supply arrangements;
- Agreements between different communities should be made;
- Water management rules and regulations must incorporate ways to tackle such issues as water scarcity and surplus flows;
- Local KPs and groups need to be trained and involved to operate the canals, channels, gates, inlets, outlets and other structures;
- Compensate downstream Farmers in case of any water rights losses; and
- Discourage spate agriculture.

8.9.2. Breaching of Canal, Distributaries and Structures

Potential Impacts

587. Breach of canal will threat system sustainability. This impact would be of high significance with low probability. Following factors may trigger the process:

- Improper operation of water control facilities;
- Deterioration of free board due to cattle trespass and other factors;
- Tampering of outlets;
- Canal siltation;
- Action of borrowing animals such as rats and porcupines;
- Inadequate supervision;
- Lack of timely and adequate repairs; and
- Lack of coverage of hydraulic gradient.

Mitigation Measures

588. Following measures will step down the significance of impact from high to low.

- Irrigation Department, Punjab to monitor the system regularly on district level;
- Important facilities that need attention and annual maintenance are canal embankments, falls and control structures and bed levels which are affected by siltation or scour. Canal section has been designed to ensure safety by following the standard design principals to design the banks against piping. In addition, all nullah crossings have been provided with cross-drainage structures of at least 40 years return period flood capacity with adequate freeboard. For major nullahs, canal syphons have been provided so that nullah flows unhindered and therefore does not cause damage to the Canal;
- Include capacity building of the communities in the O&M activities;

- Liaise with the communities to identify potential weaknesses in the system that could cause breaches;
- Ensure that the canal lining is regularly monitored to avoid any cracking impact from weathering;
- Flood protection spurs should be regularly checked to undertake any prone damage;
- Repairs on urgent basis; and
- Emergency response plan for canal breach shall be followed, which is attached as **Appendix-XVI** of this report.

8.9.3. Salinity

Potential Impacts

589. Salinity due to incoming water from the Salt Range will infiltrate within the soil of the JIP command area, if water becomes stagnant and will deteriorate groundwater quality. If flooded water from Salt Range keeps on flowing it would ultimately fall into River Jhelum, carrying huge salt load within. The huge amount of salt would become part of the river, though diluted, but the river water application for irrigation purposes on downstream command areas may result in deposition of salts to those command areas. This may cause serious problem and ultimately pose high significant impact.

Mitigation Measures

590. The impact is significant during operation phase of JIP. The salt content in River water would decide the fate of command area. This would depend upon the quantum of salt that may erode due to flooding water. The salt concentration in River Jhelum should be monitored at Pre-Construction stage, construction stage and during operation. In case, it goes beyond allowable limits during operation stage, the salt intrusion into river should be controlled. The top layers of salt should be removed through mechanical methods so that flooding water should not flash away huge quantity of salt into the River.

8.9.4. Minimum Flows

Potential Impacts

591. The project may hinder water supplies due to reduction in the minimum flows after feeding the Jalalpur Canal. However, the proposed canal is non-perennial and will operate for certain period of time during monsoon and flood season. This impact would be of moderate significance.

Mitigation Measures

592. 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. Moreover the Project has already been approved by IRSA, so there will be no issue on minimum flows.

8.9.5. Socio-Economic Issues

Potential Impacts

593. In general, the operation of canal would have positive socio-economic impact due to increase in agricultural yield. The farmers will be connected to the markets and their livelihood would improve as well. However, the project may also cause few problems in accessibility. Moreover, the project would ultimately enhance the level of life style of communities and

farmers/community may have more demand of energy resources to meet their requirements. This impact would be of moderate significance.

Mitigation Measures

594. To resolve this issue, provision of total 30 number of footbridges/pedestrian crossings i.e. 13 across main canal and 17 over distributaries has been given in design. 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 panels as an efficient and cheap energy source for their better livelihood.

8.9.6. Health & Safety Issues to the Community during O&M

Potential Impacts

595. There are few settlements which would be near the bank of proposed canal. The locals in these settlements especially kids would be prone to falling hazard. Disposal of waste in the canal and waste streams may cause health issues. During canal operation, the canal water can be contaminated due to increased use of pesticides and improper drainage and may pose health and skin issues to consumers. Dredging operation to remove sediments during closure period may also cause health problems in communities. The natural floods from number of hill torrents may cause problem for the dislocated community. This impact would be of high significance.

Mitigation Measures

596. By adopting following measures, impact would be of low significance:

- Fencing of canal near settlements;
- Provision of adequate lighting at footbridges;
- Provision of culverts;
- Enhanced drainage system;
- Effective implementation of Integrated Pest Management;
- No wastewater discharge or solid waste disposal should be allowed into the JIP or any other canal or stream; and
- Proper management of debris/sediment waste during dredging operations and avoiding it throwing openly.

8.9.7. Use of Irrigation Water for Drinking Purposes

Potential Impacts

597. Most of the locals in the project area are devoid of piped water supply. During field surveys and community interaction most of the people demanded Canal water for drinking purposes, because the quality of ground water is highly brackish. With availability of sweet water in the Canal, there will be a tendency to use it for potable purposes as well. However, this may lead to health related issues. This impact would be of moderate significance.

Mitigation Measures

598. Following measures will step down the significance of impact from moderate to low.

- Irrigation Department will be the executor of the Project and with their decision local community may use Canal water for drinking purposes, where required;
- Prior to this, training of local community on safe drinking water will be required;
- Coordinate with local administration to install small filter plants at suitable locations for potable water;
- Put warning and information signs about dangers of using irrigation water for potable purposes;

- Local administration and public health department to assure potable water quality as per PEQS/WHO standards;
- Turbidity and free residual chlorine tests shall be regularly performed;
- Arsenic should be tested as per PEQS/WHO standards; and
- Keep continuous check on the site through employing security professional to check and shun the water usage by local public.

8.9.8. Ground Water Contamination in Command Area

Potential Impacts

599. New irrigation infrastructure might hinder and adversely affect the natural drainage pattern. This may result in localized flooding. This may also lead to water use rights issues later on. However, the current natural flow of rain water is such that it generally comes in flash floods from the salt range and then stagnates over large swathes of land in the Project area due to improper natural drainage channels, high water table, and flat terrain with low gradient. In case of improper drainage system ground water will further contaminated (brackish). This impact would be of moderate significance.

Mitigation Measures

600. By adopting the following measures the impact would be finally of low significance:

- Proposed structures and channels are aligned with natural slope. Canals and super-passages should be provided on canals where necessary at the detailed design stage;
- Periodic maintenance of drainage structures; and
- Ground water monitoring wells should be established in command area to monitor the salinity of ground water by Irrigation Department, Punjab.

8.9.9. Disposal of Waste (Connection of Waste Streams) in the Canal & Distributaries

Potential Impacts

601. Disposal of waste into the Canal from the settlements residing near the Project's AOI will be restricted particularly during Canal closure period as the Canal is non-perennial. This impact will lead to serious health issues and will be of high significance.

Mitigation Measures

602. By adopting the following measures the impact would be finally of low significance:

- Proper monitoring of Canal and distributaries and disconnecting all identified waste streams;
- Keep regular monitoring throughout the lengths so that no waste is dumped within the canals; if it is dumped, fine should be imposed;
- Arrange awareness programs for the local public to educate them about the harms caused by disposal of waste into canals and distributaries;
- Labeled sign boards should be placed/installed at multiple locations to avoid entry of solid or liquid waste disposal; and
- Tehsil governments to provide proper solid and liquid waste collection and disposal systems.

8.9.10. Enhanced Use of Fertilizers and Pesticides and Integrated Pest Management

Potential Impacts

603. 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. It may also cause contamination of fresh water through surface runoff. This would be an impact of high significance.

604. With increased intensity and faster rate of growth, the number and intensity of pests would also increase. The pesticides to be used are toxic chemicals and can cause short or long term toxicity in the farmers of the project area/localities. Toxic effects can also occur in persons handling them or in members of the public who come into contact with them.

- The Pesticides to be used have negative effects on the local Environment/Ecology.
- The use of pesticides will eradicate the pest population. However, there is a risk that non-target organisms are also affected, which leads to species loss in connected areas of canal.
- Ecosystem and biodiversity loss may occur in the area assessed, due to excess use of chemicals.
- Contamination of groundwater resources will happen if large amount of pesticides is used on regular basis for a longer span.

a) Ecological effects of pesticides

605. Pesticides use in irrigated lands often doesn't just kill the target pest. Beneficial insects in and around the fields can be poisoned or killed, as can other animals eating poisoned insects. Pesticides can also kill locally available soil microorganisms.

606. Despite the widespread use of pesticides, almost 80 per cent of the spray never reaches the plant and is left in the soil and eco-systems, where it remains there for a very long time and then the harmful chemicals move further through wind and water.

607. The ecological effects of pesticides (and other organic contaminants) are varied and are often inter-related. Effects at the organism or ecological level will be considered in the project to be an early warning indicator of potential impacts.

b) Pesticides Impact on water resources

608. Water plays an important role here because it is one of the main ways that pesticides are transported from the areas where they are applied to other locations, where they may cause health problem.

609. If JIP AOI would have inappropriate water management and drainage systems, fertilizers and pesticides may lead to run-off from fields to Jhelum River and main Canal and contaminate groundwater sources. These chemicals eventually end up in the marine environment as well.

610. This impact can be considered as slightly significant but irreversible. Pesticide contamination of groundwater is a subject of importance because groundwater is used for drinking by maximum of the population in both districts. The concern people living in the agricultural area where pesticides are most often used, as most the population relies upon groundwater for drinking.

c) Adverse health and socioeconomic impacts from Pesticides

611. The increase in pesticides use will affect health of human beings, aquatic life, honeybees and migratory birds. Small landholdings are another problem encouraging excess pesticides use. If one farmer uses pesticides and a neighbor does not, there will soon be pest attacks from the neighboring field. Therefore, the fields are sprayed again and again. Hence a collective and concerted campaign is required to discourage pests with minimum pesticide use.

Mitigation Measures

612. Integrated Pest Management (IPM) strategy in JIP area will involve combinations of control techniques to optimize pest or vector management according to local conditions. Such strategy will require careful consideration of all available pest control techniques and subsequent integration of appropriate measures that discourage the development of pest populations and allow safe use of pesticides to levels that reduce or minimize risks to human health and the environment.

613. FAO emphasizes the healthy growth of crops with the minimal usage of pesticides and encourages the use of biological pest control methods. IPM focuses on the long term application of ecological-friendly biological methods such as natural predators, resistant plant strains, sterile male technique, and so on. Besides, social codes of conduct need to be encouraged so farmers help each other in the form of Asher (collective work) to minimize the use of pesticides. The focus of IPM is to manage agricultural ecosystems in such a way that pest problems are prevented. By adopting the following measures the impact would be finally of low significance:

- Pest should be controlled with chemicals only if they are causing unacceptable damage;
- Educate and inform health professionals in JIP area to be aware of diagnosing and treating pesticide related diseases;
- Concerted efforts by the department of agriculture to disseminate information regarding sustainable use of fertilizers must be programmed which will help in keeping the use at an optimal level;
- Ammonium Nitrate (AN), organochlorine and Calcium Ammonium Nitrate (CAN) fertilizers should not be allowed;
- A major concern among farmers is the declining effectiveness of chemical pesticides as insect resistance increases through natural selection. This has been demonstrated in many areas. Pesticides such as dieldrin, aldrin and DDT are harmful because they destroy beneficial insects and birds that serve as natural predators of crop and plant pests.
- Take account of specifications produced by FAO and WHO for highly hazardous agricultural pesticides. These specifications detail the appropriate pesticide, formulation, rate of application and suitable equipment for specific pest control;
- Reduced pesticide application must be adopted to avoid problems with soil compaction from pesticide application equipment.
- Minimize use of persistent highly hazardous pesticides is recommended in apropos to ADB's Prohibited Investment Activities List (attached as **Appendix-XVII**) which endorses WHO banned pesticides. Several pesticides are classified as Persistent Organic Pollutants (POPs) under the Stockholm Convention;
- More specific chemicals, such as growth regulators and pheromones that attract insects must be preferred because they tend to be more selective and have less impact on the agricultural ecosystem;
- Pesticides can be part of IPM, but use them only as a last resort and only after trying other methods. Farmer must be sure that pest problem is serious enough to warrant a pesticide treatment and also use the least toxic, yet effective, materials available and use them in ways that reduce human and pet exposure and protect the environment;
- Fourth generation pesticides (microbes, botanical, pheromones, etc.) are recommended because they seem to cause little damage to the environment;
- Adoption of integrated methods for controlling pests is essential for masses, based on biological and cultural methods that include the judicious use of approved and appropriate chemicals;
- Avoid the use of pesticides regarded as obsolete under the WHO classification scheme and those banned by Ministry of Food Security & Research, GoP;
- Biological control should be the main focus; and
- Use of restricted pesticides identified by WHO shall not be allowed. The list of restricted pesticides is attached as **Appendix-XVIII** of this report.

614. The most effective, long-term way to manage pests is by using a combination of methods in the area that work better together than separately. Approaches recommended for managing pests are often grouped in the following categories:

a) Biological control

615. Biological control with pathogens, parasites and predators, such as insects or spiders should be encouraged.

b) Environmental management measures:

616. This approach must be in mind of local growers through training sessions by Agriculture and Irrigation departments such as removing standing water where malaria mosquitoes can breed.

c) Cultural controls

617. In JIP area Cultural controls are recommended to be adopted which may reduce pest establishment, reproduction, dispersal, and survival. Changing the irrigation practices can reduce pest problems, since too much water can increase root disease and weeds. The most important is crop rotation or using plant varieties resistant to disease according to site and climate of the project area. Another aim of crop rotation is to increase soil fertility, e.g with Trifolium, a source of nitrogen in the soil that is widely used as fodder in the area. The farmers in the area would need some guidance on how crop rotation can be used against pests and pesticide use. Moreover, early harvesting is an effective measure for local area to discourage unwanted herbs and herbicides. If herbs increase and dominate over a crop, farmers will cut the crop before maturity. This way the seedlings of unwanted herbs do not spread in the soil. Premature cutting is a practice for wheat, maize, crops in the study area.

d) Mechanical and physical controls

618. Mechanical and physical controls are recommended to kill a pest directly, block pests out, or make the environment unsuitable for it. Physical controls must include mulches for weed management, steam sterilization of the soil for disease management, or barriers.

e) Chemical control

619. Chemical control or use of pesticides is the last resort/option of IPM. Pesticides should be used only when needed. Chemical control must be applied in combination with other approaches for more effective, long term control. The farmers must use the most selective pesticide that will do the job and be the safest for other organisms, air, soil, and water quality; use pesticides in bait stations rather than sprays; or spot-spray a few weeds instead of an entire area.

8.9.11. Increase of Agricultural Lands

Potential Impacts

620. The cultivated area currently is very low. The reason for this low level of cultivation is poorly distributed rainfall, saline ground water and absence of perennial water streams (either natural or man-made). In the Project area, the cropping intensity is around 13% for Kharif crop that goes up to 29% during the Rabi season. One of the key factors is that the area lacks a dependable irrigation system despite having the potential for one.

621. It is safe to assume that the proposed Project will increase the area under cultivation. It is difficult to exactly quantify the extent of this increase, but due to the fact that the current land utilization for agriculture is very low, despite agriculture being the social norm, it is deduced that the increase will be substantial. It can be assumed that up to 70% proposed command area may come under agriculture i.e. 119,000 acres (48157 ha) of 170,000 acres (68796 ha). There

may be tendency that farmers may cultivate crops at their own decisions that may also affect efficient use of water. The impact should be of moderate nature.

Mitigation Measures

622. By adopting the following measures the impact would be finally of low significance:

- One thing that will need to be monitored is that additional area under cultivation should be used for crops suitable to the overall climatic conditions of the area and farmers should follow the recommended pattern of agriculture; and
- Increase in the cultivated area will also cause reduction in pastoral lands. However, the livestock would still get benefits by use of farm residue and mostly by availability of fodder crops. The project should work with the Agriculture department to ensure that stall feeding practices take root for livestock, so that the remaining pastoral lands are available for the wild animals.

8.9.12. Periodic Cleaning and Maintenance of the System

Potential Impacts

623. The blessing of any available resource might be wiped out by poor governance. Non-functional KPs, leakages, improper maintenance of structures, broken outlets, and poorly maintained field channels may result in unequal utilization of water. This impact would be a high significant impact.

Mitigation Measures

624. By adopting the following measures the impact would be finally of low significance:

- Proposed Project is an integrated irrigation program. The proponent should also facilitate it to become an integrated community development program through formal structure of Supervisory Consultant and through the community engagement cell. Timely and correct sharing of information will enable other line departments to implement their own development schemes in the area;
- Irrigation Department, Punjab should develop and implement a proactive maintenance plan for the proposed Project, with predefined periodicity;
- Monitoring the results and performance of cleaning activities;
- Ensure proper disposal of waste at designated disposal sites; and
- Efficiency of the system will be at its best by adopting proper maintenance activities such as silt removal and bed scratching at periodic intervals.

8.9.13. Community Participation for Management and Operation of the Irrigation System

Potential Impacts

625. Community participation is very imperative at this stage in order to implement the Project successfully and to get the desired objectives of the Project. The community engagement through FOs will ensure the smooth running of the Canal and the system sustainability. The impact may lead to social and system sustainability issues and would be of moderate significance.

Mitigation Measures

626. By adopting the following measures the impact would be finally of low significance:

- Ensure community participation in management and operation of the irrigation system by implementing O&M manual for Farmers' management of Irrigation System prepared as a separate document for JIP;
- Training of related communities; and

- Interaction of FAO with the rest of community is recommended throughout the Project implementation. Moreover any change in the design or structure or operation if incurred, it must be done through consultation with the local people.

8.9.14. Impacts on JIP due to Global Climate Change

627. Changes in the climate can have significant impact on infrastructure viability and operation, as well as on the surrounding communities. For JIP, impacts of climate change on temperature, precipitation, and storm frequency and intensity has been analyzed in Climate Change Impact Report.

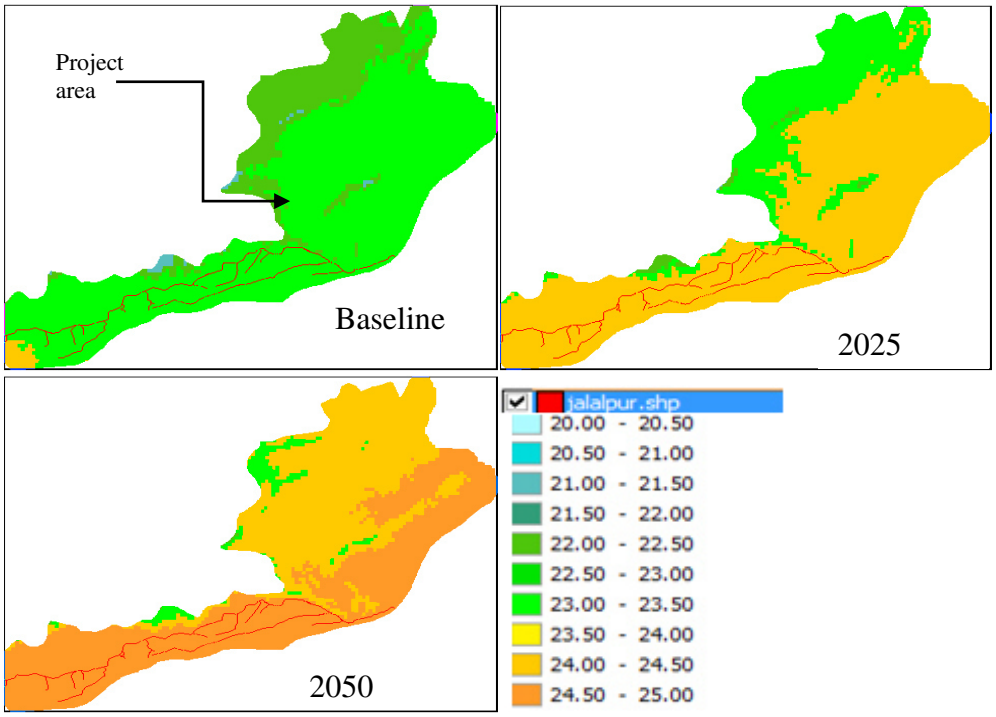
628. Climate change projections are an estimate of the response of the climate system to possible greenhouse gas and aerosol emissions over the next century. Such projections are typically based on climate model simulations.

629. Following projections for the climate change impact have been carried out by making use of simulation model, Simulation Climate (SimCLIM, 2013). It uses pattern downscaling methodology, where outputs are generated by adjusting local climate variables.

Potential Impacts of climate change on JIP

Temperature

630. Higher annual mean temperatures are anticipated within the project area. Figure 8.7 shows the mean annual temperature within the project area for the current climate (1960-1995) along with mean annual temperatures for the project area for the 2025 and 2050 timeframes using ensemble of 40 Global Circulation Models (GCM) for Representative Concentration Pathways (RCP) 6.0, which stabilizes by 2100 at 850 PPM CO_2 equivalent to 2100 without overshoot. The percentage change in temperature for the project site is illustrated in the Figures underneath.



(Source: WMO included in the SimCLIM Model)

Figure 8.7: Distribution of annual mean temperatures for the project area, Year 2025 and Year 2050

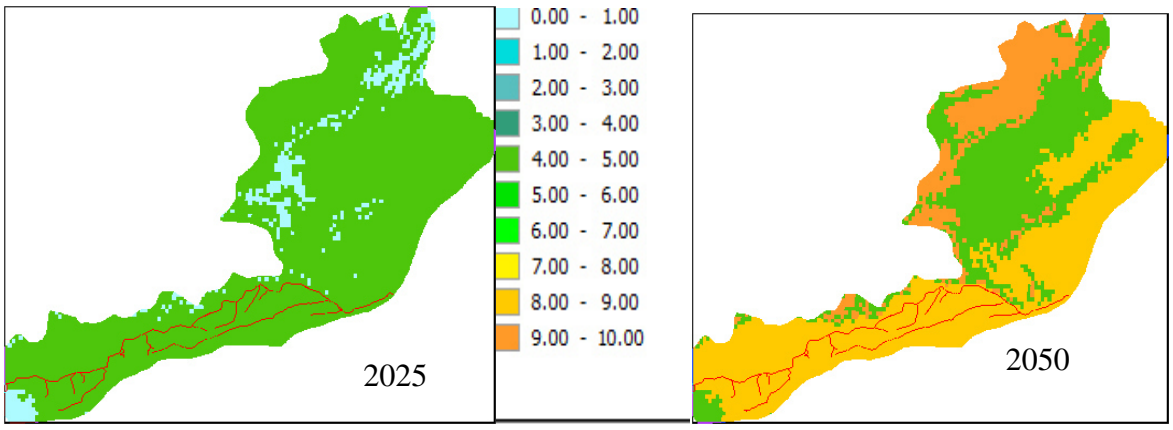


Figure 8.8: Projected mean annual %age temperature change for the project site

631. The results indicate that there will be an increase of 0.84ºC in the year 2025 and 1.50ºC for the maximum and minimum mean annual temperature in the year 2050 from the baseline period (1980-2013) as shown in the Figure 8.9.

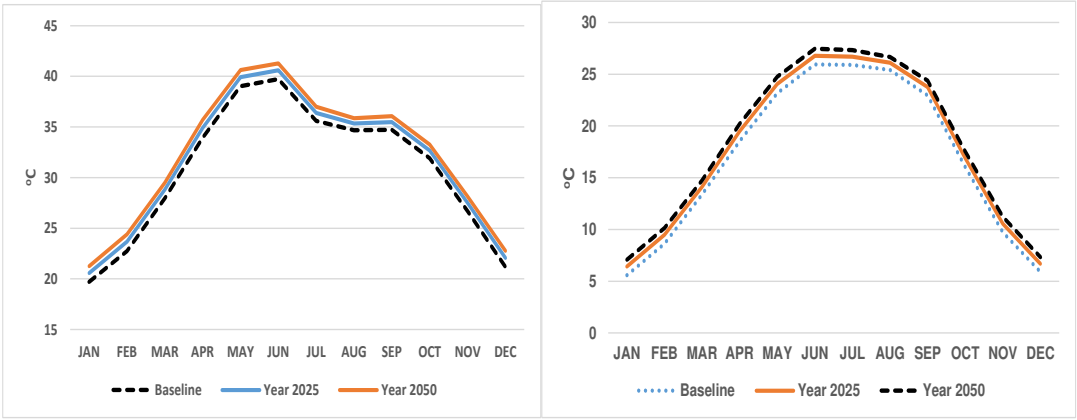


Figure 8.9: Projected monthly temperature for the year 2025 and year 2050 for the project site (Jhelum station)

Rainfall

632. Based upon the analysis of the Jhelum station data, there is no clear trend for the decrease or increase in the rainfall pattern. There is about 11% increase in annual rainfall in the decade (1990-2000) from the previous decade (1980-1990) while decrease (10%) in the annual rainfall was recorded in the next decade (2001-2010).

633. Rainfall is projected to increase in the future for the project area. However, there is considerable variability between the projected range of rainfall changes for the different Global Circulation Models (GCMs). The results indicate that there will be about 4% increase in annual rainfall for the year 2025 and 6.5% for the year 2050 using ensemble of 40 GCMs under Intergovernmental Panel on Climate Change (IPCC) emission scenario of Representative Concentration Pathways (RCP) 6.0.

634.

635. Figure shows the annual spatial variability of rainfall for the baseline and future periods and the percentage change in annual rainfall in the region for the year 2025 and year 2050.

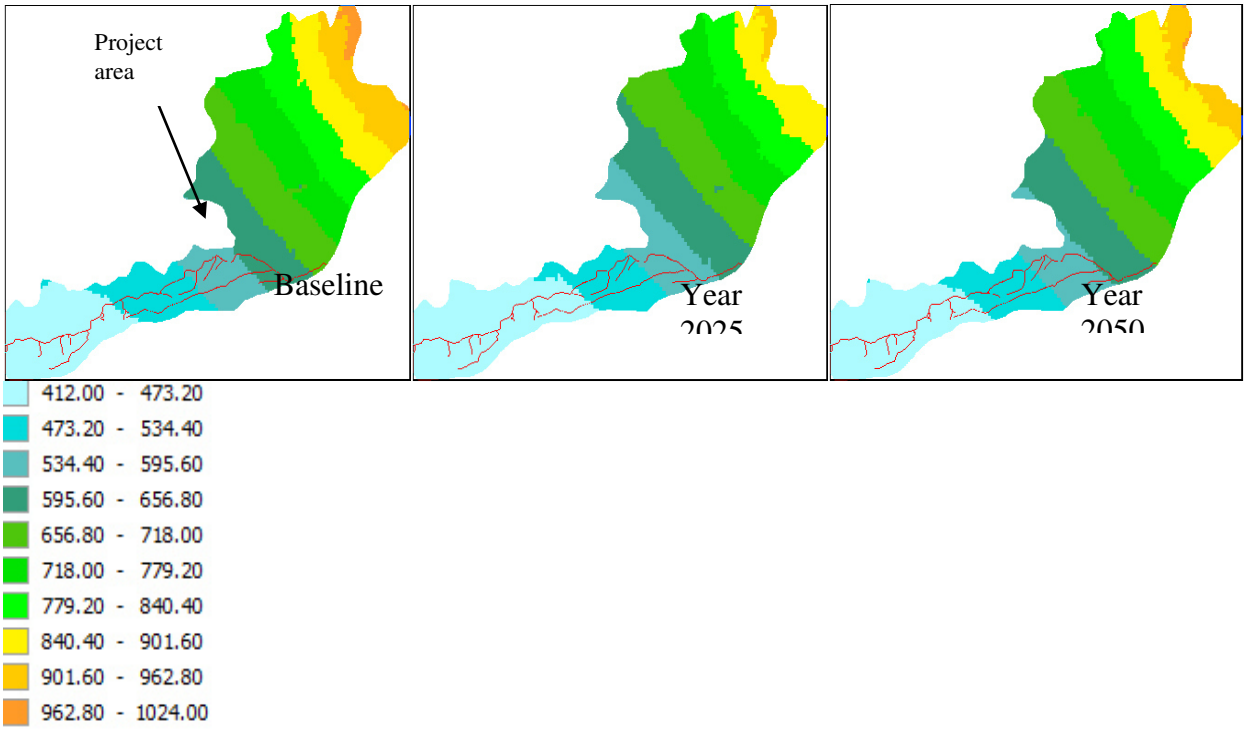


Figure 8.10: Projected annual rainfall (mm) for the baseline period, year 2025 & year 2050

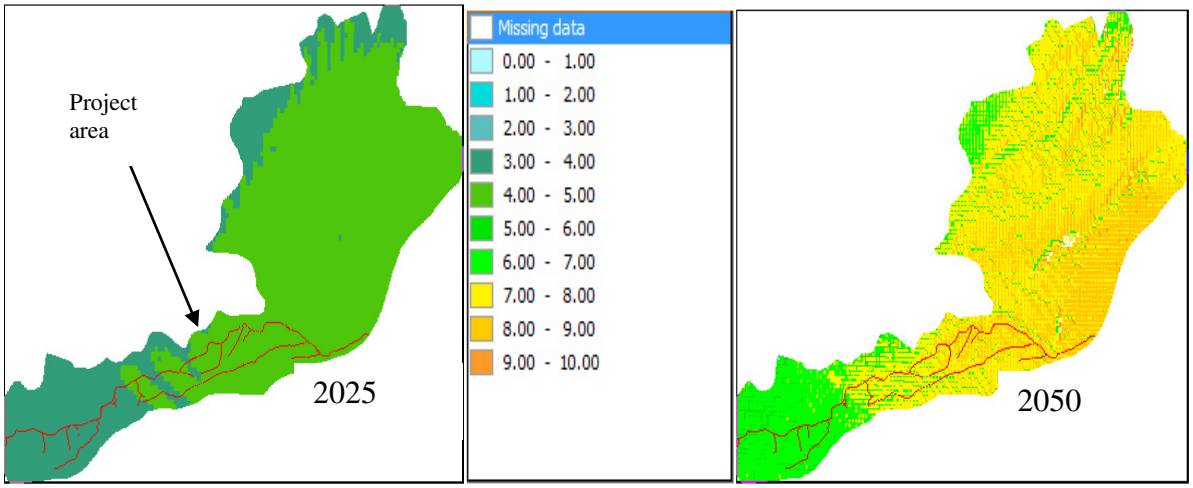


Figure 8.11: %age annual rainfall for the baseline period, year 2025 and year 2050

636. The mean monthly analysis was also carried out for the Jhelum station to determine the spatial variability of rainfall. The results show that maximum increase in the rainfall is likely to occur in the monsoon season (July to September) while there will be decrease in the rainfall in the months from December to April as shown in Figure

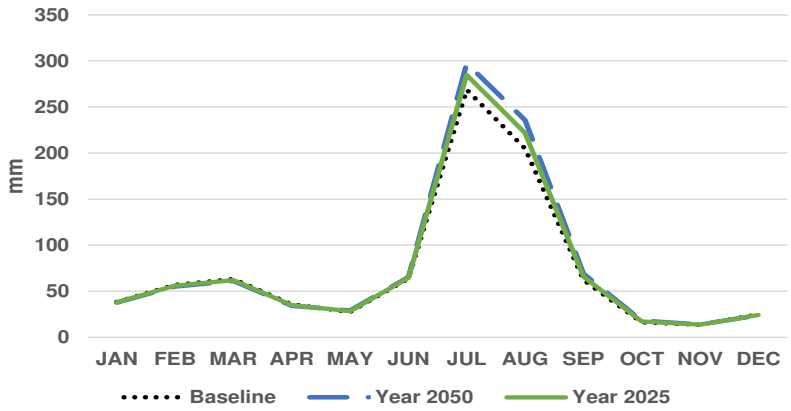


Figure 8.12: Projected monthly rainfall for the year 2025 and year 2050 for the project site (Jhelum station)

Rainfall Intensity and Flooding

637. It is projected that the impact on JIP due to frequency and intensity of extreme rainfall events (fewer but larger) would occur (IPCC, 2007). To provide an indication of this change, the SimCLIM model has been used to undertake a statistical analysis of historical daily rainfall data from the weather stations at Jhelum.

638. The change in the intensity of rainfall events is provided using estimated recurrence periods for historic and projected rainfall events. The recurrence period is an estimate of the probability that a given rainfall event would be equaled or exceeded in any given year. The results demonstrate that little extreme rainfall change is projected for the future. The maximum increase in extreme event for year 2025 is about 6% for 100 year return period whereas 10% increase in extreme event is predicted for 100 year return period for the year 2050 as shown in Figure 8.13.

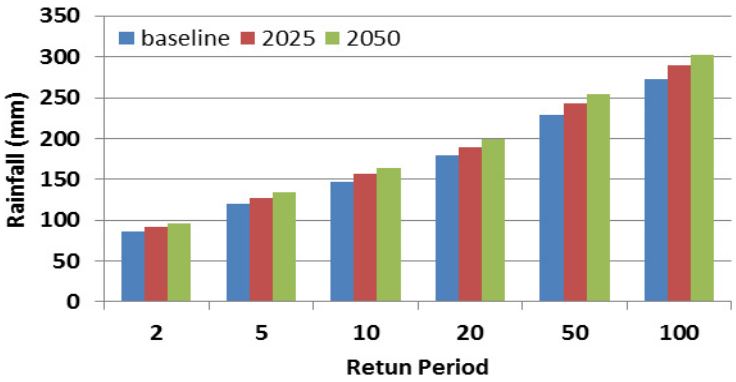


Figure 8.13: Extreme Event analysis for the various return periods

639. As there is likely to be increase in the temperature and rainfall in the project area with more extreme events will be the characteristics of the future weather.

640. Higher temperatures could increase evaporation leading to drier soils. Moreover, due to shift in rainfall patterns, water availability will reduce in the winter season. As a result of climate change, rainfall events which are the same size as the historic 1-in-100 year rainfall event are expected to occur more frequently in the future. In addition to the potential for more frequent flooding, this shift in the characteristics of rainfall events is also likely to:

- Increase runoff and associated pollutants;

- Increase soil erosion;
- Impact on vegetation cover which provides soil stability; and
- These shifts in environmental flows and water quality are expected to impact on waterways and biodiversity.

Mitigation Measures

641. By adopting following measures, impact would be finally of low significance:

- 7-10% enhanced discharges have been proposed with monitoring during operation stage;
- PMU is required to involve climate change expert during O&M stage;
- Promotion of measures such as rainwater harvesting along the reaches;
- Gradual increase in plantation and vegetation cover; and
- Watershed management to control runoff and flooding.

8.9.15. Reforestation in the Vicinity of the Proposed Interventions

Potential Impacts

642. During the baseline surveys, it has been observed that there is very little canopy cover in the surrounding area. After the completion of the proposed Project, this may launch efforts to plant trees and other greenery throughout the area. This reforestation can substantially improve the local environmental condition.

643. The Forest department also showed keen interest in plantation alongside water channels, once the water flow regime is regulated, so that the plants can have the required amount of water and also not blown away by the floods. The total channel length including distributaries length will be around 286 km. Based on the general standard of 33 trees per km, a total of only 18,876 trees could be planted along the water channels. However, more number of tree rows along banks or block plantation in 17 hectares land would.be required. The overall development of rangeland will be in addition to that. This gives an excellent opportunity to develop a carbon sink in the area.

644. However, availability of water may lead to false perceptions of abundance, resulting in introduction of water intensive species. As stated elsewhere in this report, in some portions of Project area where tube wells are used for irrigation, water intensive crops are grown. This is not a sustainable practice. The impact would be of moderate significance.

Mitigation Measures

645. By adopting the following measures the impact would be finally of low significance:

- It needs to be ensured that the planted species are suitable for the local environmental conditions, in all respects. Therefore, it is vital to take the forest department onboard from the very outset. All plantation activities under the Project should be spearheaded by the Forest department, through its representation in the tree plantation plan. It will ensure that no unwanted species are introduced into the area.