Environmental Impact Assessment

July 2017

PAK: Jalalpur Irrigation Project

Project No. 46528-002

Part 3 of 9 of the Main Report

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

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Irrigation Department
Government of Punjab

DETAILED DESIGN OF JALALPUR IRRIGATION PROJECT

ENVIRONMENTAL IMPACT ASSESSMENT (EIA)

MAY 2017

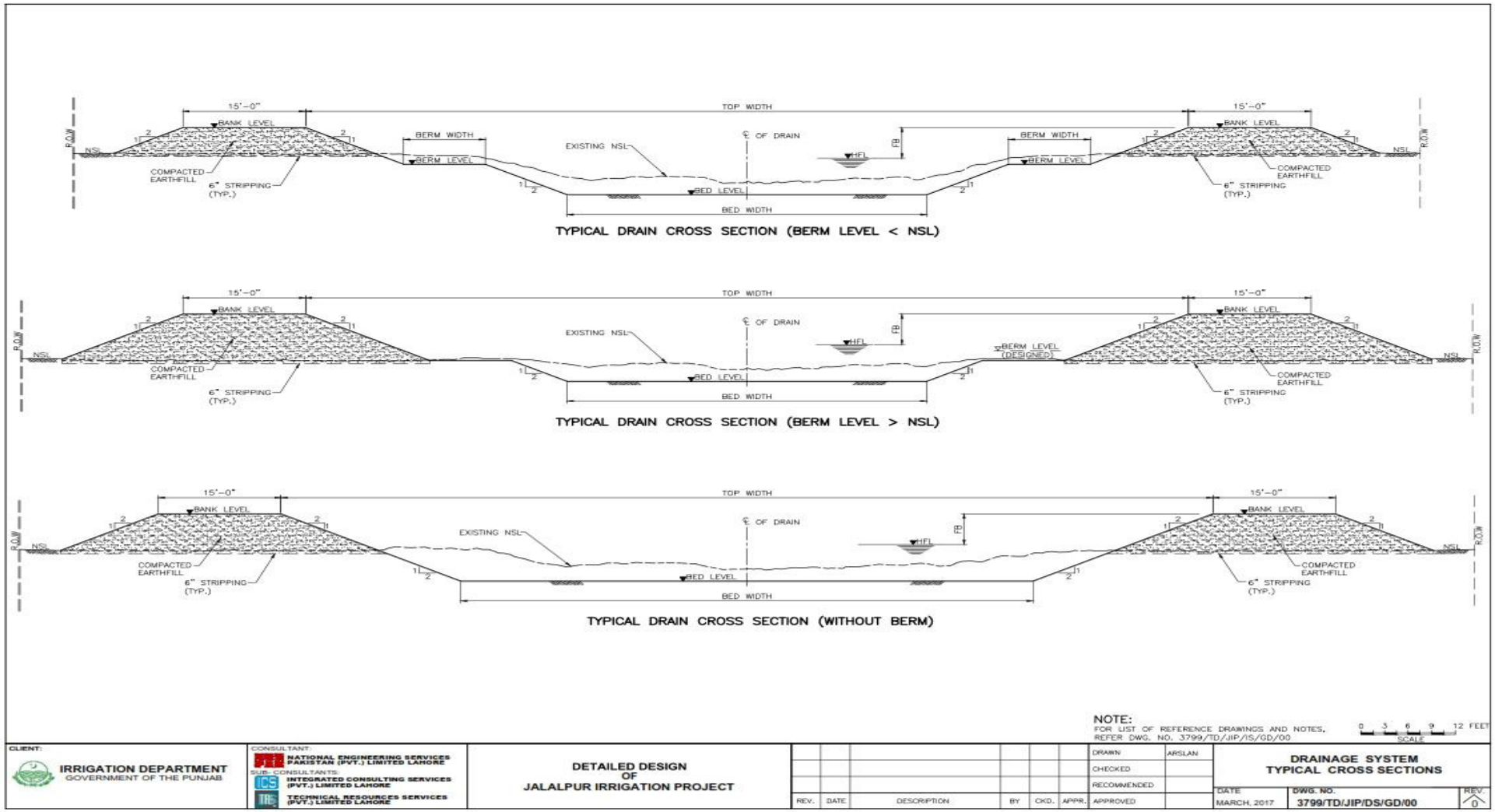

Figure 4.6: Typical Cross-section of Drain

4.5. Salient Features and Land Requirements of the Project

4.5.1. Salient Features

130. Salient features of JIP project are shown in below **Table 4.3**:

Table 4.3: Salient Features

Element	Details / feature	Description
Capacity	Design Discharge	1,350 cusecs (38.15 m^3/s)
Main canal	Location	72^0-20' north to 73^0-31' east and latitude from 32^o-25' east to 32^o-43' north
	Length	110 km
	Width including Right of Way	300 ft (91 m) to 125 ft (38 m)
	Type	lined
Distributaries and Minors	Length	176 km
	Width including Right of Way	130 to 40 ft (40 to 12 m)
	Type	lined
	Number of Distributaries	18
	Number of Minors	3
Command area	Culturable Command area	170,000 acre (68,797 ha)
	Gross area	215,000 acre (87,007 ha)
Structures	Main canal	195
	Distributaries	592

Source: Design Team NESPAK, Detailed Design Stage JIP

4.5.2. Land Requirements and Acquisition[2]

131. 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 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) for both main canal 1700 acres and distributaries 1300 acres.

132. 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.

133. A total of about 408 structures/ assets were found within the limit of RoW both for main canal and distributaries, however, this would be further investigated at the time of implementation of the project. Out of these 408 structures, 159 are residential/ farm houses (deras), 30 are cattle sheds, 22 hand pumps, 104 tube wells/bores, 13 commercial, 77 electric poles and three mosques. Most of these structures are permanent (concrete) and semi-permanent.

[2] *Source: Land Acquisition and Resettlement Plan Report May 2015*

4.6. Construction Stage Interventions

4.6.1. Excavation Works

134. All excavated material will be used in filling and compaction along the banks of main canal, irrigation channels and drainage channels. Approximately 17, 951,500 cubic feet of concrete will be needed for canal lining, piling work and for construction of allied structures. Approximately, total 3,159,464 number of cement bags (20 kg each) will be used for construction works. The approximate total earth work quantities are shown in **Table 4.4**.

Table 4.4: Total Earth Work Quantities

Sr. #	Description	Quantities (ft^3)
1	Excavation	347,907,000
2	Filling	402,141,000
3	Borrow	54,234,000

4.6.2. Construction of Cofferdam[5]

135. A cofferdam is a temporary enclosure built within, or in pairs across, a body of water and constructed to allow the enclosed area to be pumped out, creating a dry work environment for the major work to proceed. In the proposed JIP the cofferdam will be built to start construction works of "intake structure" at Rasul Barrage. Cofferdam will be 5 feet (1.5 meters) above barrage pond level of 719 feet (219 meters); it will increase the barrage pond level to 724 feet (220.6 meters).

4.6.3. Construction Camps, Storage Area and other Allied Utilities

136. Three construction camps and storage sites have been proposed along new proposed alignment. The construction camps and allied utilities will include main site installations, labor camps, excavation stock piles, work yards, staff camps, transfer areas, dumping areas, quarry areas, solid waste disposal, wastewater management, water supply in construction facilities and camps, electricity and fuel etc. Each construction camp would have around 300 number of personnel in it. The proposed location map for three construction camps i.e. near Misri More, Khewra and Dudhi thal are shown in Figures 4.7, 4.8 and 4.9 respectively. However, the exact location of the construction camp will be finalized by the Contractor in consultation with Supervisory Consultants and PID before start of the construction.

[5]Source: Feasibility Report Jalalpur Irrigation project (NESPAK-ICS Joint Venture)

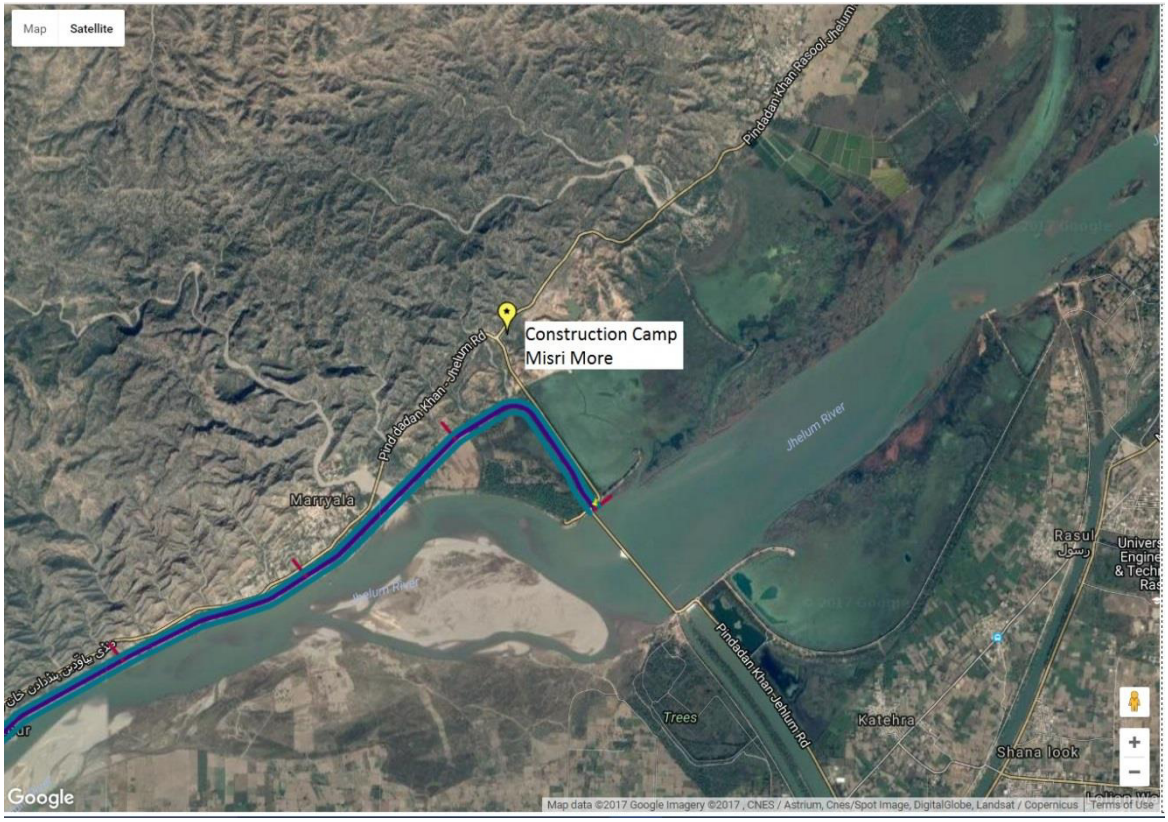

Figure 4.7: Construction Camp near Misri More

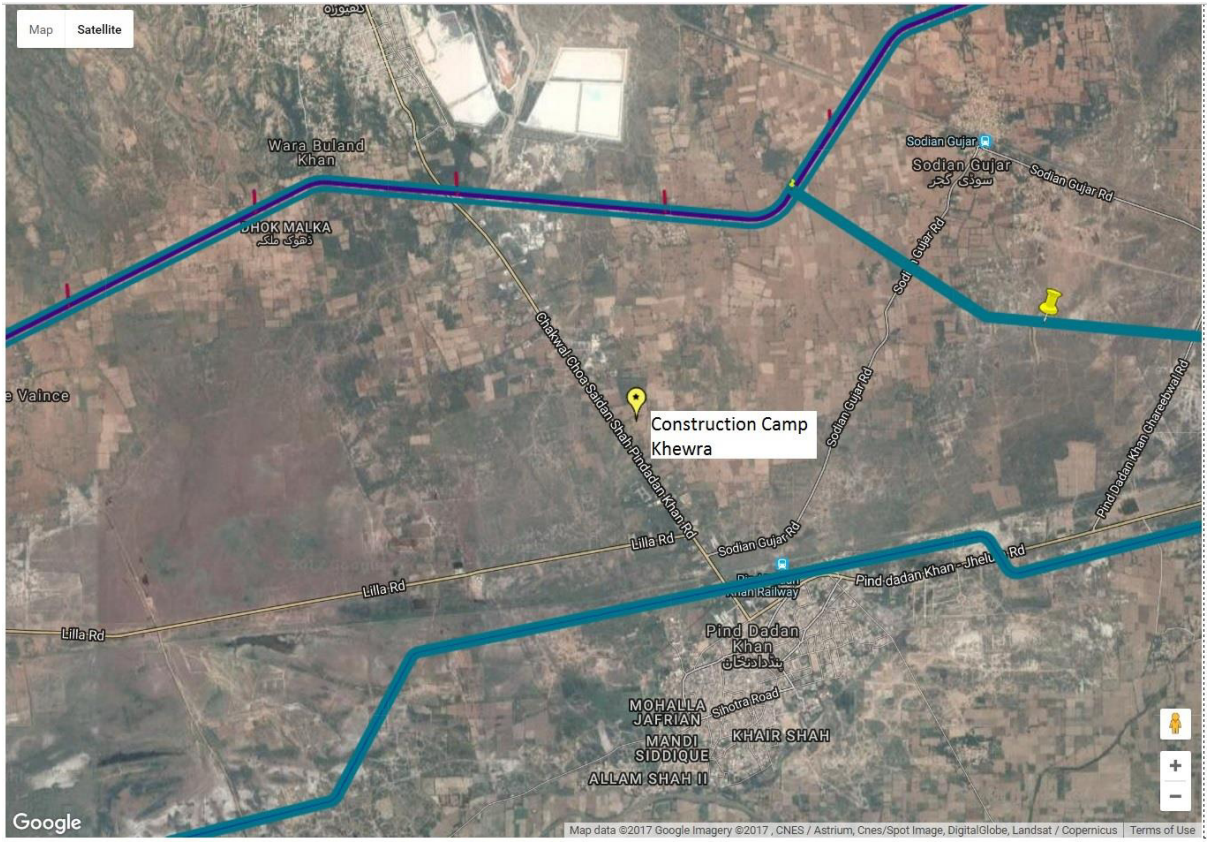

Figure 4.8: Construction Camp near Khewra

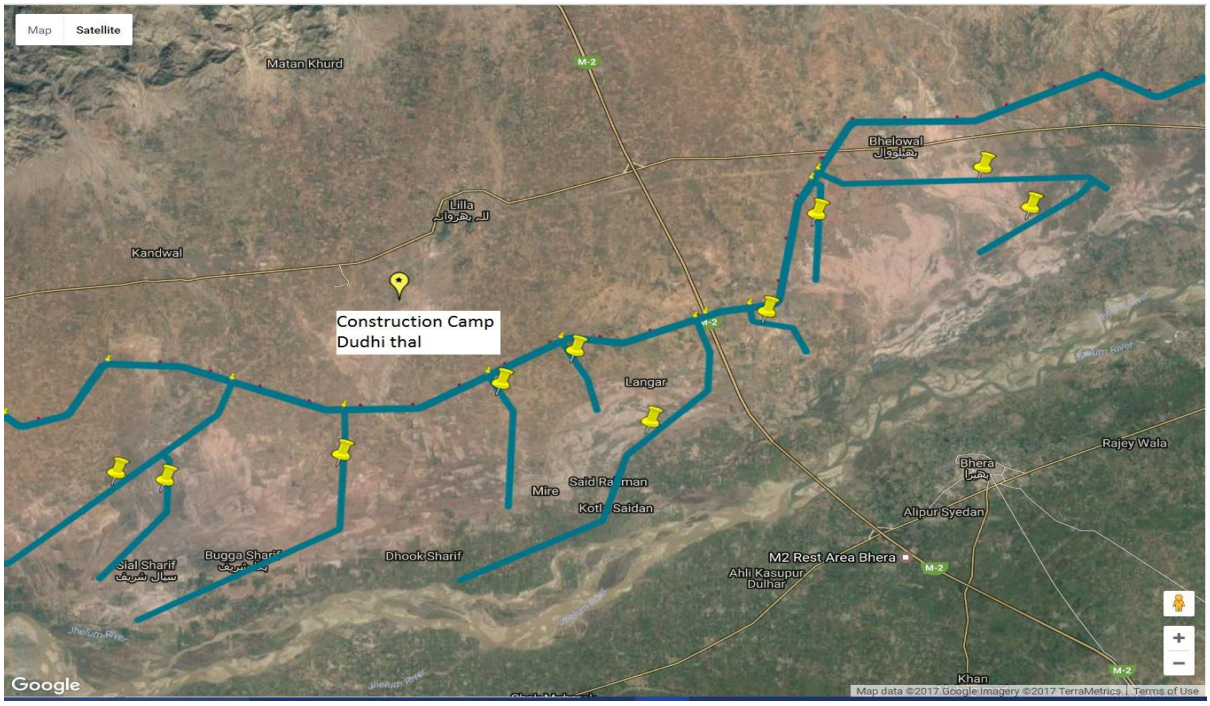

Figure 4.9: Construction Camp near Dudhi Thal

4.7. Operation of Irrigation System

137. As for other canal systems, the operation of JIP will be as per the general practice of irrigation department which mainly consists of following steps:

4.7.1. Indenting

138. It is a method of estimating the water needs at various control points e.g. a watercourse, a distributary/minor head regulator and finally at the head regulator of the main canal and its off-take at the barrage. The SOP for indenting is as follows:

139. A canal patwari estimates the water required at the head of each watercourse on the basis of crops grown on the area served by each watercourse. These statements, one for each watercourse, are entered on a standard form known as 'Water Indent Form' or simply an Indent. Indents for all watercourses are passed on by patwaris to their incharge who is known as Zilladar. Zilladar summarizes these individual indents on a new indent for the whole minor or distributary as the case may be. The Zilladar hands it over to Sub-Engineer (incharge of the distributary) who checks it and passes it on to another Sub-Engineer (incharge of the upper distributary). The incharge of the upper distributary similarly gets and sums up his own indent. After calculating the discharge at the head of his distributary, he passes it on to the next sub-engineer incharge of the next upper distributary. This process goes on until the head of the main canal. In this way the discharge to be released through the head regulator of the main canal is calculated. Usually the indents are prepared daily. Communication of the indents is generally done by means of telegraphic System or in its absence by couriers (mates/mistries or baildars) like a relay race. Arrangements of telecommunication system on JIP have been proposed.

4.7.2. Regulation or Releasing of the Indented Discharge

140. Regulation is done by electrically operated mechanical gates. This is generally adopted on main and branch canals where gates are too heavy to be operated by manual means. On distributaries manually operated or mechanical gates are used. However in order to deal with failure of electrically operated gates 'Jharis' or slots are also provided in the piers through which rectangular (or circular) logs slided one by one until the waterway required is achieved. These logs are known as KARI's. Slots may be made for sliding the Kari's horizontally or vertically. Regulation is generally carried out by Gauge Readers who work under sub-engineers. Sub-Engineer work under the Sub-Divisional Officers who in turn work under an Executive Engineer. In case of new canal as in case of Jalalpur canal Operation, will be started once the first cross regulator and distributaries upstream of it are constructed.

141. Outlets are self-regulated structures. However, for distribution of water to farmers proportional to their land holdings, 'WARABANDI' is approved by Executive Engineer (Distribution) and is enforced by the Ziladars.

4.7.3. Operation on Rotation

142. In times of minimum flows in the main canal, distributaries are operated in rotation. In this method, a group of four or five distributaries are operated while the other are kept closed. Then the next group is operated and the rest are kept closed and so on.

4.7.4. Maintenance of Canal System

143. Maintenance involves keeping the canal system in order by constant monitoring, repairing or replacements of parts of the channels, structures and machinery fitted on these. Detail is given below:

4.7.5. Operation of Drainage System

144. The main objectives of maintenance of drainage system are:

- To keep the system in top operating condition throughout the year;
- To obtain the greatest use of the system facilities and long life through proper maintenance and replacement; and
- The aforementioned objective to be achieved at minimum possible cost.

145. A regular maintenance and upkeep of all the components of the system makes the drainage system efficient and successful.

146. The control of weeds and pests, storm erosion of contiguous lands, banks and bottoms, aggradations, degradation and embayment are the problems that require proper attention.

147. A smooth working system means uninterrupted flow in the drains and removal of the unwanted growth and obstructions.

4.8. Project Time Frame

148. The major components of the implementation schedule are as follows:

- Land Acquisition;

- Additional Survey and Investigations;
- Preparation of Detailed Design and Tender Documents;
- Prequalification of Contractors and Invitation of Tenders, Evaluation and Award;
- Construction of Camps; and
- Construction of Railway Bridges.

Project implementation schedule is provided as **Figure 4.10**.

ID	Task Name	Start	Finish
0	**JIP IMPLEMENTATION SHEDULE**	**Fri 4/1/16**	**Tue 4/2/24**
1	**Phase - 1 Detail Design and Tendering**	**Fri 4/1/16**	**Thu 9/28/17**
2	**Detail Engineering Design and Bidding Documents**	**Fri 4/1/16**	**Tue 1/2/18**
3	Detail Design, LARP, EIA, Bidding Documents	Fri 4/1/16	Thu 9/28/17
4	PC-I Approval, Bidding Process, Evaluation and Award	Fri 7/28/17	Tue 1/2/18
5	Recruitment of Supervision Consultant	Mon 1/2/17	Tue 1/2/18
6	**Land Acquisition and Resettlement (by Government)**	**Fri 11/18/16**	**Tue 3/6/18**
7	Land Acquisition and Resettlement (by Government)	Fri 11/18/16	Tue 3/6/18
8	**PHASE-II Construction Stage**	**Thu 1/4/18**	**Tue 4/4/23**
9	Award of Construction Contract	Mon 4/2/18	Mon 4/2/18
10	Contractor Mobilization and Employers Facilities	Mon 4/2/18	Wed 7/25/18
11	**Irrigation System**	**Thu 1/4/18**	**Tue 4/4/23**
12	**Main Canal**	**Thu 1/4/18**	**Tue 9/29/20**
13	Earthwork and Lining	Wed 7/25/18	Wed 7/27/22
14	In line Structures	Wed 1/15/20	Wed 3/15/23
15	**Distribution System**	**Wed 5/29/19**	**Tue 4/4/23**
16	Earthwork and Lining	Wed 5/29/19	Wed 7/27/22
17	In Line Structures	Tue 9/22/20	Tue 4/4/23
18	**Infrastructure for Operation Staff Facilities**	**Wed 7/25/18**	**Wed 1/15/20**
19	**Command Area Development**	**Tue 7/27/21**	**Tue 4/4/23**
20	**PHASE-III Defect Liability (Operation & Maintenance)**	**Tue 4/4/23**	**Tue 4/2/24**

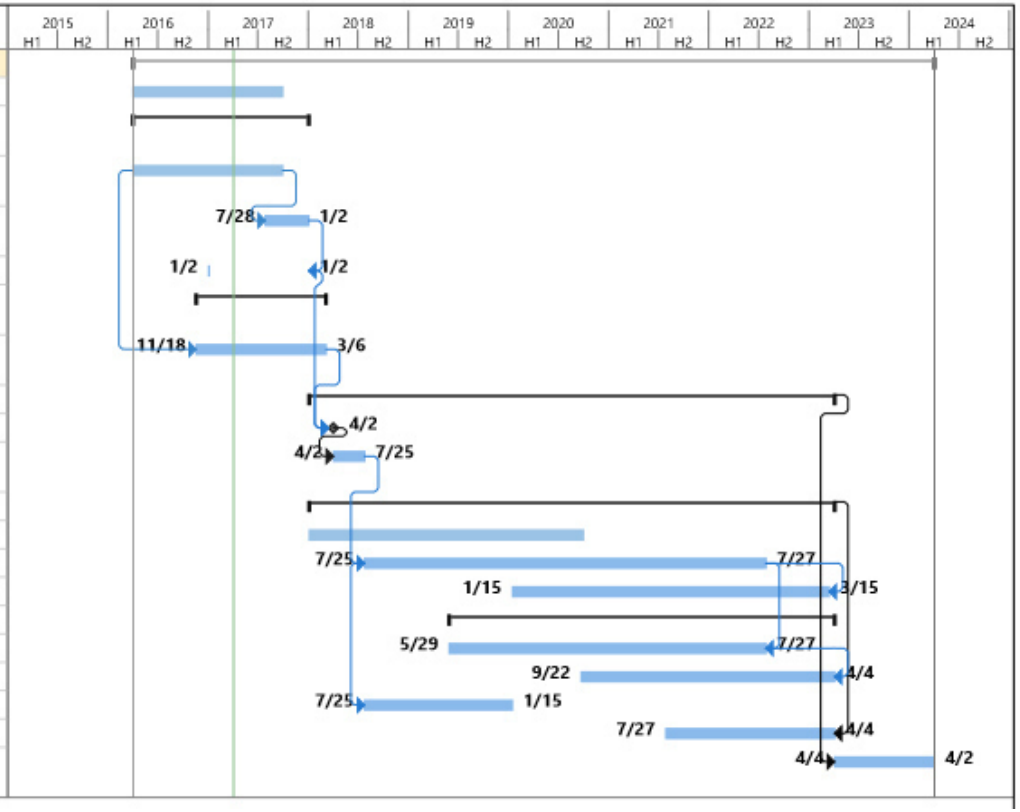

Figure 4.10: Project Implementation Schedule

4.9. Project Cost

149. The estimated total capital cost of the proposed JIP with complete lining of main canal and distributaries is 255 US million dollars[6] whereas; it's annual Operation and Maintenance (O&M) cost will be around Three US million dollars.

[6] 1 US Dollar = 104.83 Pakistani rupees , conversion date 18 May 2017

5. PROJECT NEED AND ALTERNATIVES

5.1. Introduction

150. The following description, as abstracted from the various studies[1], provides a synopsis of the problems, issues in the area and the consideration of alternate options for JIP. The existence of flood, water and agricultural issues necessitates appropriate interventions for better management and harvesting of the available natural resources, to alleviate the abject poverty currently found in the human settlements of the area.

151. In upcoming sections of this Chapter, following different alternatives for this project have been discussed:

- No project Alternative
- Irrigation Options Considered Historically for JIP
- Design Options for Non-Perennial canal
- Canal Alignment Alternatives Considered at different Stages of JIP
- Alternate Institutional Models

5.2. No Project Alternative

152. The project area is situated in two districts, i.e. Pind Dadan Khan Tehsil (District Jhelum) and Tehsil Khushab (District Khushab). The area falling in Pind Dadan Khan Tehsil (District Jhelum) is utilizing tube well water on limited scale for agriculture. Farming is practiced under rain fed and tube well irrigated conditions. The annual cropping intensities of the area are 42.6% including Kharif 13.1% and Rabi 29.5%. For the area located in Tehsil Khushab (District Khushab), farming is being practiced under rain fed conditions. The annual cropping intensities are estimated as 25.3 percent with Kharif as 9.2 percent and Rabi at 16.1 percent. There is no likelihood of increase in cropping intensity due to rain fed cultivation. During Rabi 1990-91 and Kharif 2007 a total area of 124,616 acres was sown. Out of this area, 48,216 acres was irrigated whereas 76,400 acres was un-irrigated (barani). Due to scarcity of rainfall in the area, the crop yield was too low. The average yearly rainfall is 23.1 inches (588 mm) while the pan evaporation is more than 64.4 inches (1637 mm) which makes irrigation essential for crop production. The poor drainage and salinity in the area, limited surface irrigation supply and encouraged insufficient and costly tube well irrigation supplies are the limiting factors. The inhabitants of the project area have irrigated 47,610 acres through wells and tube wells along the river edge where the ground water is sweet. This irrigation is concentrated in the area near Jalalpur Sharif. Another 600 acres area was irrigated by other means e.g. lift from nearby creeks. However, this system does not play any role in the improvement of economic conditions of farmers due to low agricultural production and low farm incomes as a result of frequent crop failure, low crop yields, low farm profitability and secondary salinization.

153. The farm population will continue to make plan for changing profession and seeking employment in the non-agricultural sector or allied professions in the country or overseas. The trend of adopting overseas jobs is increasing ever year. Presently local farming community is not totally depending upon agriculture income for their livelihood. Generally, one or more than one person from each family is employed in the armed forces or working overseas and providing financial assistance to their families and acting as an alternative source of income.

[1] Agriculture study report Jalalpur Irrigation project October 2014, Initial Poverty and Social Assessment (IPSA) report Jalalpur Irrigation project October 2014, Soli & water quality studies Jalalpur Irrigation project November 2014 and ICS-NESPAK design report

154. As per agriculture report future crop yield under '"without" project conditions have been estimated from 1st to 8th year of development for the crops irrigated through tube well irrigation supplies. Without project, there would be no increase in existing crop yields or production.

155. 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. Projection of crop yield and production have been made keeping in view existing crop yields in the irrigated area, availability of irrigation supplies, maximum yield potential reported by agriculture officials and presently attained in the adjacent canal irrigated areas. The ultimate level of yield and production for crops in the project area are summarized in Table 5.1:

Table 5.1: Proposed Crop Production "with Project"

Crops	Crop Production (000tons) for three years after Construction		
	Existing	With Project	Incremental Production
Cotton	0.35	22.84	22.49
Rice	0.59	11.99	11.41
Bajra	1.18	1.57	0.40
Sorghum	0.92	1.04	0.12
Maize	6.24	184.81	178.57
Kh. Oilseeds	0.08	0.45	0.37
Kh. Pulses	0.02	0.58	0.56
Kh. Vegetables	0.40	63.16	62.73
Kh. Fodder	9.38	74.46	65.08
Gowara	0.14	0.00	0.00
Wheat	24.93	41.28	16.36

156. In the light of above discussion and the above tables the increase in crop yield cannot be met without the implementation 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 take opportunities of improved livelihood from the locals. Therefore, this option is not a viable option.

5.3. Irrigation Options Considered Historically for JIP

157. 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. 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. In 2008, a feasibility report was prepared.

158. As per the NDC feasibility report, following four alternative irrigation schemes were considered. These schemes were established from year 1900 to date. The below mentioned alternatives are still valid as the geological and soil conditions of the area are same and the concerns of the population for the availability of water are still valid:

i) **Inundation Canals**

159. As early as 1900 A.D., an inundation canal was proposed to be taken off at Jalalpur from the Jhelum River. The scheme was, however, dropped in 1903.

160. In 1919, Mr. Bedford submitted a project for a canal of 1,066 cusecs capacity taking off at Rasul to irrigate 233,470 acres of Culturable Command area (CCA). It was proposed that Rabi irrigation on the new canal should consist of first and last watering. Commenting on this project Mr. Woods, the then Chief Engineer summed up as follows:

161. "The lie of the country, narrow strips sloping transversely from the hills on one side and from the river on the other side, with a longitudinal depression in which water lodges and stagnates between those two narrow strips of land, the nature of the soil, a hard kallar clay, subject to impregnation by salt wash from the hills and the whole irrigated area liable to inundation by river floods, to say nothing of the prospect of incalculable future expenditure on the control of the floods of hill torrents passing across the canal, make up a combination of unfavourable conditions that inspires anything but confidence in the Irrigation Engineer."

162. The command would be poor and much of the area could not be helped. The present state of affairs of the Pind Dadan Khan canal clearly proves this assumption.

ii) **Pumping Project**

163. In 1926, a pumping project for irrigating a gross commanded area of 167,624 acres at an estimated cost of Rs. 61.22 lakhs was submitted to Government of India for sanction. It was proposed to generate hydro-electric power at Rasul and to have five (5) sets of pumping plants so as to avoid crossing of big torrents.

164. Commenting on this project, Mr. H.W. Nicholson, the then Superintending Engineer, and new projects noted:

- Why pumps when irrigation could be done by flow from above Rasul Weir?
- The pumping project was definitely unsound;
- Cost of a gravity canal in view of the large number of cross drainages would make the project unproductive; and
- Irrigation, which must necessarily be heavy, would cause a rise in spring level and cause further deterioration.

165. The Government of India ordered preparation of detailed estimates without which the work could not be started.

166. In 1928 an Engineer was placed on special duty to examine the drainages. His findings were:

- Cost of suitably leading the drainages past the channels and of controlling their water in such a manner as to prevent their spreading over the tract would cost an indefinite sum;
- Even when the cross drainage works were completed, one could never be certain that the drainages will always find their way to them without the aid of large and expensive training measures; and
- Greater part of the area to be served by the project was inundated by the big flood of September, 1928.

167. The Chief Engineer, therefore, was of the opinion that any irrigation project in this locality was devoid of any prospect or success as an engineering venture. The project was consequently abandoned.

iii) **Storage Reservoirs in the Salt Range**

168. Storage in the Salt Range raises the question of suitability of the water for irrigation purposes. The Director Irrigation Research, carried out some investigations on Makrach Kas and other Kasses in the Salt Range. Samples of water were taken from flood discharges and analyzed. The analysis indicated that the salt content of the waters of the main stream was very high and unsuitable for irrigation. Other samples were taken from the run-off water from the outer-hills. The salt content of such samples was lower but in excess of the limit considered suitable for irrigation water. Also only small storage capacities were available in the Salt Range. This water during its passage through the area to be irrigated would be subject to contamination.

iv) **Non-Perennial Canal from Rasul Barrage**

169. After considering the various alternatives, Mr. F.F.Haigh, Chief Engineer, noted (30.04.1943):

170. "I consider that the only practical way of irrigating the Jalalpur area is a Kharif Channel from Rasul. I would like Mr. Bedford's project reviewed and brought upto date to see what the extra cost would be. The area which is subject to regular flooding and that which is flooded only occasionally, as in 1929, should also be determined. A soil survey is required also to determine, what areas are good, what are the affected and could reasonably be reclaimed".

171. Among many irrigation schemes, Jalalpur canal was considered as most suitable one. Project Preparatory Technical Assistance (PPTA) Consultants reviewed and studied the area characteristics and alternate design options for JIP.

5.4. Canal Alignment Alternatives

172. The canal alignment was optimized by considering different alternatives during the PPTA studies and detailed design stage.

173. The feasibility study prepared during PPTA delineated the initial layout as per previous feasibility studies (NDC-2008). However, some discrepancies were found in the previous survey and the canal alignment was interpreted based on physical features and information contained in the NDC-report. The alignment so demarked was thoroughly reviewed so that resettlement could be minimized and that most of the canal crossings are made perpendicular in order to minimize canal structural cost. Where possible, graveyards were also avoided by realigning the canal so that minimum social problems arise during canal construction. The main criteria adopted to lay the canal is provided below:

- Best hydraulic setting;
- Less resettlement requirements;
- Cultural; and
- Avoidance of cross drainage structures which reduced project cost.

174. Two alternate canal alignments were studied as marked together in **Figure 5.1 (Sheet 1 & Sheet 2)**. The alternative A is the canal alignment marked in the previous studies for the project while alternative B is the proposed alignment by the PPTA Consultants. **Table 5.2** provides a comparative analysis of both options (A&B) whereas; option B has been opted for JIP by considering its merits and demerits.

Table 5.2: Comparative Analysis of Alternatives A & B

Parameters	Alternative A	Alternative B
Settlements and land use	Through the thickly populated area of Jalalpur town, Nathial, Thill Sharif, Sadhowal towns (more than 100 houses)	Less than 20 houses at the mentioned locations
Number of Cross Drainage Structures	7 number cross drainage structures near Kahana village	2 number cross structure
Cultural	Major Issues due to resettlement	Less issues

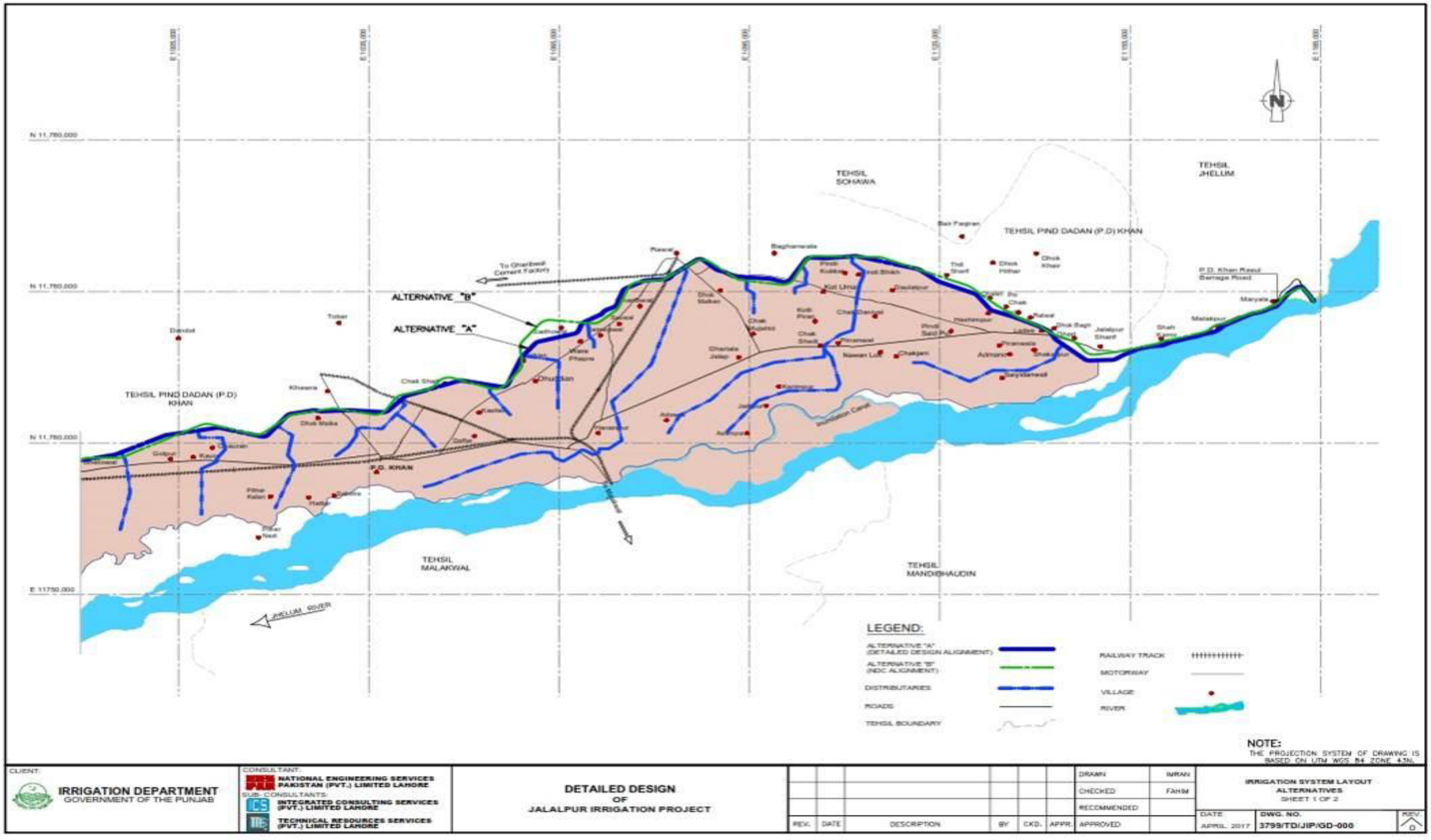

Figure 5.1: Irrigation System Layout Alternatives A & B – Sheet 1

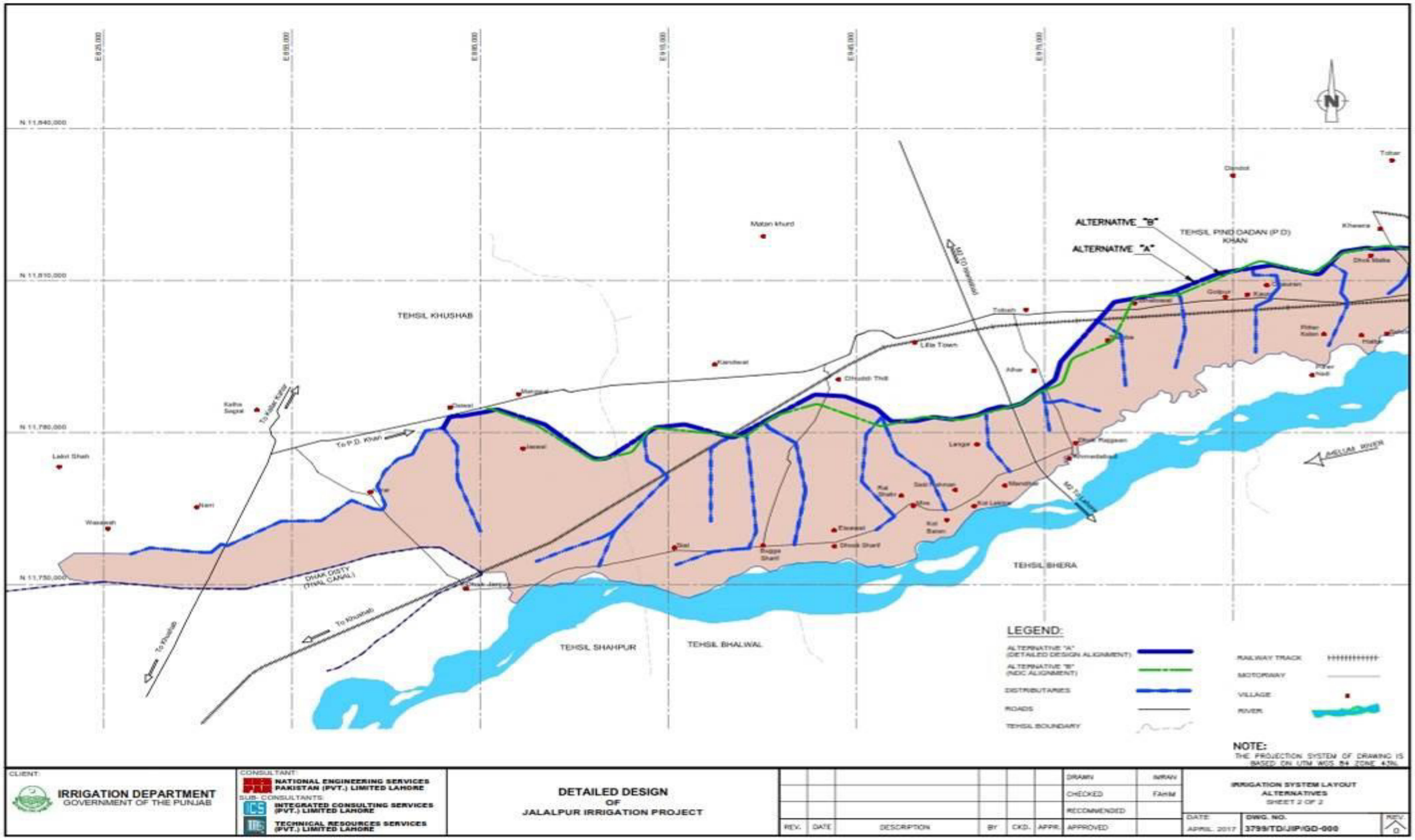

Figure 5.1: Irrigation System Layout Alternatives A & B – Sheet 2