# Environmental Impact Assessment

February 2018

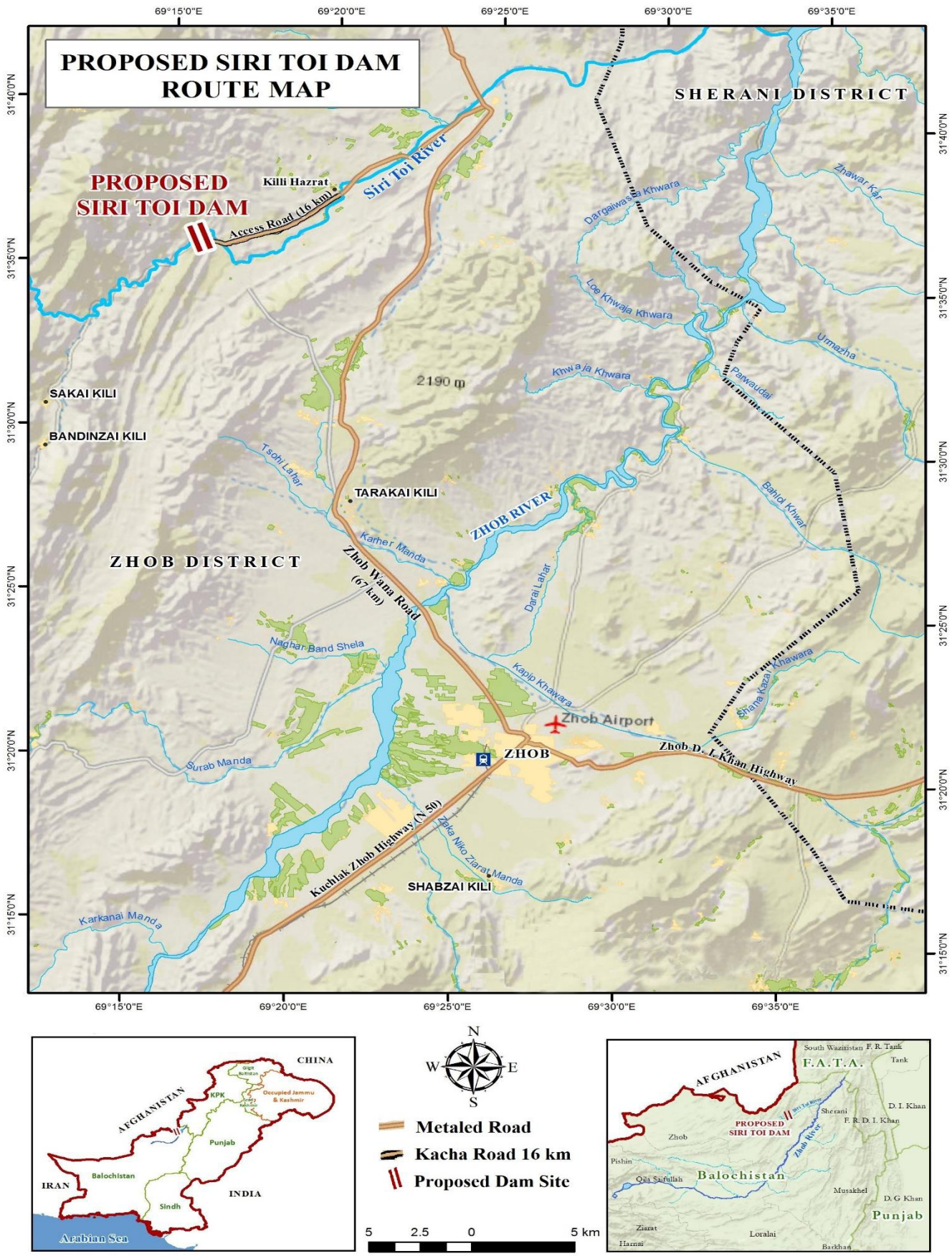
# PAK: Balochistan Water Resources Development Sector Project

Project No. 48098-002

Part 2 of 5

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

**Figure 4: Access Road to the Project Site**



## 3.7 Construction Stage Interventions

### 3.7.1 Earth Works

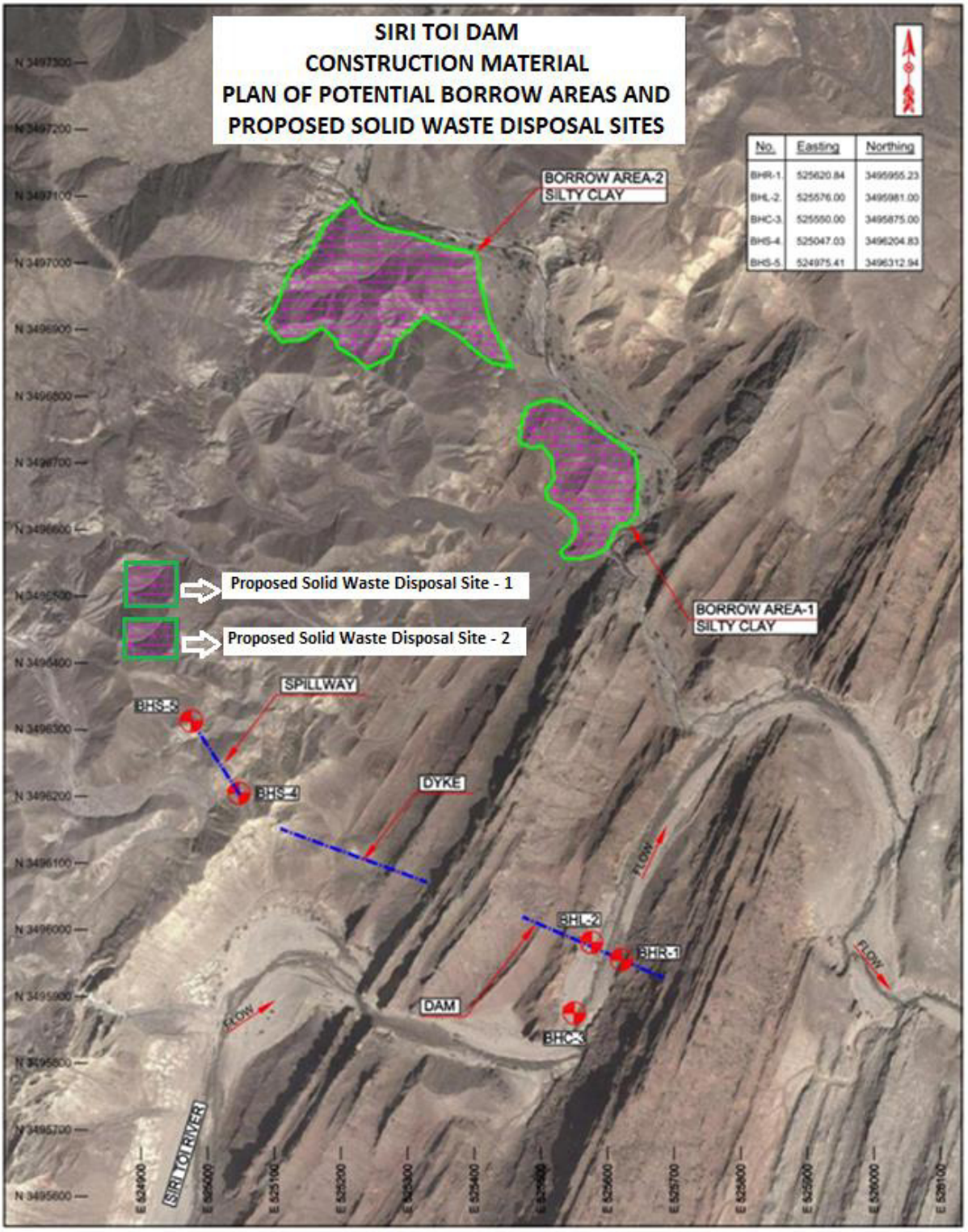
187. Huge amount of earth works will be done. The approximate total earth work quantities are shown in **Table 10**.

**Table 3: Total Earth Work Quantities**

| S. No. | Description | Quantities ($m^3$) |
|---|---|---|
| 1 | Spillway Cut Volume | 600,000 |
| 2 | Total intake excavation | 12,000 |
| 3 | Total Dam, Dyke 1 and Dyke 2 fill quantity | 2,050,000 |
| | **Total Earth Work** | **2,662,000** |

188. After the execution of geotechnical investigation two burrow pit locations are identified which is shown below as **Figure 7**.

**Figure 5: Burrow Pit and Solid Waste Disposal Sites Locations**



### 3.7.2 Construction Camps, Storage Area and other Allied Utilities

189. Construction camp office has been finalized by the design team and given as **Annexure 10**. However, recommendations and specifications for selection of those areas and need of allied utilities which 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, Supply and Handling of Electricity and Fuel etc. is given in the EMP of this EIA report. The existing source of drinking water for the nearby villages is karaiz. The same will be used for drinking at campsite. However, any additional water to be used during construction would need special arrangements. **Table 11** below shows the estimated labor force and resource usage by contractor. The generated solid waste from campsite is also evaluated in the **Table 11** and proposed solid waste disposal sites are mentioned in **Figure 7** above. It should be noted that proposed sites for solid waste will be finalized during the construction phase of the project by the Consultant's Resident Engineer as per the performa attached in **Annexure 19** of this report:

**Table 4: Estimated Labor Force and Resource Usage by Contractor**

| # | Description | Unit | Quantity |
|---|---|---|---|
| **Construction Works at Sri Toi Storage Dam Irrigation Sub-Project** | | | |
| 1 | Labor force deployed for a period of 36 months | No. | 750 |
| 2 | Water requirement for construction works for a period of 36 months | $m^3$ | 20,000 |
| 3 | Water requirement for labor force for a period of 36 months | $m^3$ | 81,000 |
| 4 | Wastewater generated from campsite for a period of 36 months | $m^3$ | 64,800 |
| 5 | Genertion of soild waste[1] @ 0.4 kg/capita/day | tons/day | 0.3 |
| 6 | Following machine will be utilized at site:<br>1. Concrete Batching Plant<br>2. Concrete Pump Mobile<br>3. Concrete Static Pump<br>4. Transit Mixture<br>5. Loader<br>6. Excavator (Type) | No. | Various depending upon contractor progress |

[1] Generation of solid waste is estimated only for domestic waste generated from the campsite as per established criteria of domestic solid waste generation (i.e. 0.4 kg/capita/day). It is not possible at present to calculate the hazardous and construction waste as it changes with respect to construction site activities. Moreover Proper mitigation meausures related with handling and disposal of hazardous wastes generated during construction phase have been provided in Impact Asssessment and Mitigation as well as in the EMP sections.

| # | Description | Unit | Quantity |
|---|---|---|---|
| | 7. Excavator (Chain)<br>8. Dumper<br>9. Mobile Crain<br>10. Truck Crain<br>11. Tractor<br>12. Tractor Trolley<br>13. Electric Vibrator (Petrol)<br>14. Steel Cutting Machine<br>15. Steel Bending Machine<br>16. Water Bowser<br>17. Fuel Pump<br>18. Power Generator<br>19. Welding Plant (Diesel)<br>20. Dewatering Pump (Diesel) | | |
| 7 | Cement | tons | 31,000 |
| 8 | Sand | tons | 46,500 |
| 9 | Crush | tons | 139,500 |

***Source: Design Report***

### 3.8 Operations of Water Storage Dam

190. The provision of Sri Toi Dam is to store water for irrigation purposes only. The operation of the proposed water storage dam at Sri Toi will be according to the general practice of dam management and as follows:

#### 3.8.1 Estimation of Water discharges and Sediment Deposition

191. As the primary purpose of the dam is to supply irrigation water, the dam releases will be based on the water requirement of the crops grown in the command area. The crop water requirement for the design command area of 4,027 ha has been computed. The gross irrigation requirement based on the system efficiency is listed below in **Table 12.**

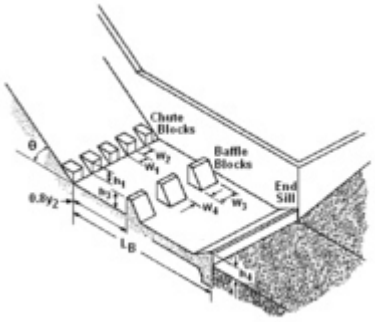
192. The rate of sedimentation in Balochistan is relatively high as compared to other parts of the country. Sedimentation Analysis has been carried out by the design team. The sediment analysis and calculations are given as **Table-19**.

193. It has been estimated that the dead storage capacity that will deplete in the **early 10 years** which is computed as **6.49 MCM (5,216 acre-ft)**. The annual sediment load has been computed as **0.901 Million Short Tons (MST)**. The life of the dam has been estimated as approximately **80 years.**

194. In the post-BWRDP scenario, estimated surface water availability in the basin will be around 457 MCM. With the proposed Sri Toi water storage dam and irrigation system the net withdrawal will be around 179 MCM[2]; therefore, balance water available will be around 278 MCM. As per hydrology study this is sufficient for maintaining environmental flows and continue to contribute inflows to the Gomal Zam Dam without causing any ecological problems.

### 3.8.2 Energy dissipation

195. As water passes over a spillway and down the chute, potential energy converts into increasing kinetic energy. Failure to dissipate the water's energy can lead to scouring and erosion at the dam's toe (base). This can cause spillway damage and undermine the dam's stability[3]. The provision of energy dissipation is provided through and is evident in the typical cross-sections given in **Annexure 9**.




### 3.8.3 Releasing of estimated discharge

196. Varying discharges will be released from the dam outlet based on the above mentioned monthly volumes of irrigation water. To assure the adequacy of the dam reservoir storage for the proposed design command area, reservoir operation study has been carried out. The results of the operation study show that the reservoir is capable of releasing water with a shortage of only 9 % over a period of 8 years which is in the acceptable range.

[2] The net withdrawl consist of irrigation as well as other requirements

[3] *Irrigation and Water Power Engineering. Firewall Media. 1992. pp. 500–501. ISBN 81-7008-084-3.*

## 3.9 Operations of Irrigation System

197. The operation of Canal System will be as per the general practice of irrigation mainly comprising of the following:

### 3.9.1 Indenting

198. It is a means of estimating the water needs at various control parts e.g. a watercourse, a distributary/minor head regulator and final at the head regulator of the main canal and its off-take at the barrage. 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-Engr. incharge of the distributary who checks it and passes it on to the Sub. Engr. Incharge of the upper distributary. The next sub-engineer incharge of the upper distributary similarly gets and checks his own indent. He sums up the indents of his own and the lower distributary to calculate the discharge at the head of his distributary and passes it on to the sub-engineer incharge of the 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 known. Usually the indents are prepared daily. Communication of the indents is generally by means of Telegraphic System or in its absence by couriers (mates/mistries or baildars) like a relay race.

### 3.9.2 Regulation or Releasing of the Indented Discharge

199. This 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.

200. 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.

### 3.9.3 Operation on Rotation

201. In times of short supply in the main canal, distributaries are operated in rotation. In this method, a group of 4 or 5 distributaries are operated while the other is kept closed. Then the next group is operated and the rest are kept closed and so on.

### 3.9.4 Maintenance of Canal System

202. Maintenance means 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.

## 3.10 Project Time Frame

203. 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 Irrigation Canal System

204. Project implementation schedule is provided as **Figure 8**. The construction activity of the proposed Sri Toi Irrigation Project will start from January 01, 2020 with the anticipated date of completion as December 31, 2022. The start-up of operation will depend upon following scenarios:

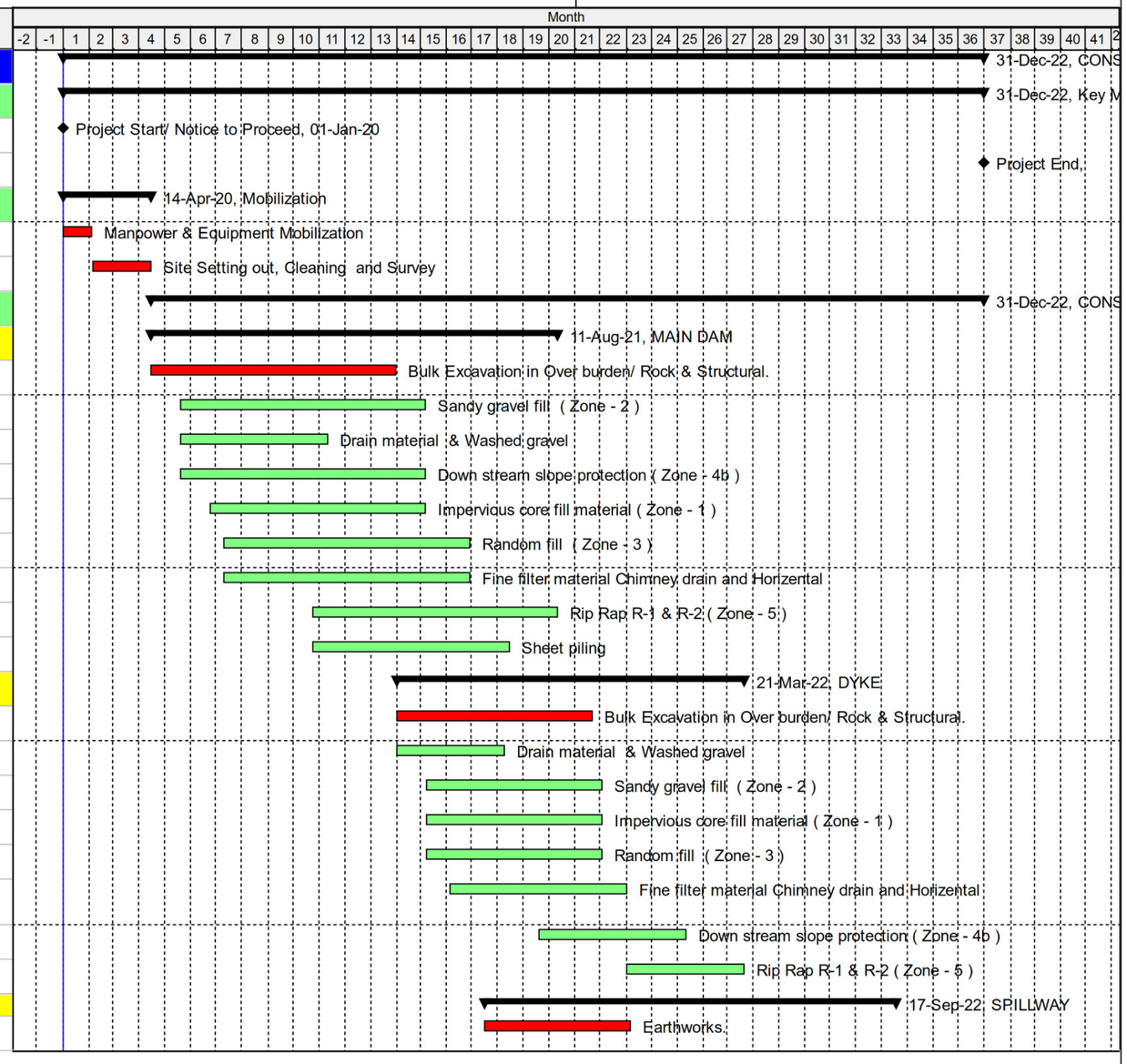
- Wet year 6 to 8 months i.e. operation will start from September 01 2023
- Average year 12 to 15 months i.e. operation will start from April 01 2024
- Dry year 24 to 30 months operation will start from July 01, 2025

**Figure 6: Project Implementation Schedule**

Techno-Consult International
WATER DIVISION

**CONSTRUCTION OF SIRI TOI DAM ZHOB RIVER BASIN**

| # | Activity ID | Activity Name | Original Duration | Start | Finish |
|---|---|---|---|---|---|
| 1 | | CONSTRUCTION OF SIRI TOI DAM ZHOB RIVER BASIN | 940d | 01-Jan-20 | 31-Dec-22 |
| 2 | | Key Milestone | 940d | 01-Jan-20 | 31-Dec-22 |
| 3 | | Project Start/ Notice to Proceed | 0d | 01-Jan-20 | |
| 4 | | Project End | 0d | | 31-Dec-22 |
| 5 | | Mobilization | 90d | 01-Jan-20 | 14-Apr-20 |
| 6 | | Manpower & Equipment Mobilization | 30d | 01-Jan-20 | 04-Feb-20 |
| 7 | | Site Setting out, Cleaning and Survey | 60d | 05-Feb-20 | 14-Apr-20 |
| 8 | | CONSTRUCTION WORK | 850d | 15-Apr-20 | 31-Dec-22 |
| 9 | | MAIN DAM | 415d | 15-Apr-20 | 11-Aug-21 |
| 10 | | Bulk Excavation in Over burden/ Rock & Structural. | 250d | 15-Apr-20 | 30-Jan-21 |
| 11 | | Sandy gravel fill ( Zone - 2 ) | 250d | 20-May-20 | 06-Mar-21 |
| 12 | | Drain material & Washed gravel | 150d | 20-May-20 | 10-Nov-20 |
| 13 | | Down stream slope protection ( Zone - 4b ) | 250d | 20-May-20 | 06-Mar-21 |
| 14 | | Impervious core fill material ( Zone - 1 ) | 220d | 24-Jun-20 | 06-Mar-21 |
| 15 | | Random fill ( Zone - 3 ) | 250d | 11-Jul-20 | 28-Apr-21 |
| 16 | | Fine filter material Chimney drain and Horizental | 250d | 11-Jul-20 | 28-Apr-21 |
| 17 | | Rip Rap R-1 & R-2 ( Zone - 5 ) | 250d | 24-Oct-20 | 11-Aug-21 |
| 18 | | Sheet piling | 200d | 24-Oct-20 | 14-Jun-21 |
| 19 | | DYKE | 355d | 01-Feb-21 | 21-Mar-22 |
| 20 | | Bulk Excavation in Over burden/ Rock & Structural. | 200d | 01-Feb-21 | 21-Sep-21 |
| 21 | | Drain material & Washed gravel | 110d | 01-Feb-21 | 08-Jun-21 |
| 22 | | Sandy gravel fill ( Zone - 2 ) | 180d | 08-Mar-21 | 02-Oct-21 |
| 23 | | Impervious core fill material ( Zone - 1 ) | 180d | 08-Mar-21 | 02-Oct-21 |
| 24 | | Random fill ( Zone - 3 ) | 180d | 08-Mar-21 | 02-Oct-21 |
| 25 | | Fine filter material Chimney drain and Horizental | 180d | 06-Apr-21 | 01-Nov-21 |
| 26 | | Down stream slope protection ( Zone - 4b ) | 150d | 20-Jul-21 | 10-Jan-22 |
| 27 | | Rip Rap R-1 & R-2 ( Zone - 5 ) | 120d | 02-Nov-21 | 21-Mar-22 |
| 28 | | SPILLWAY | 420d | 17-May-21 | 17-Sep-22 |
| 29 | | Earthworks. | 150d | 17-May-21 | 06-Nov-21 |




Remaining Level of Effort | Actual Work | Critical Remaining ...
Actual Level of Effort | Remaining Work | Milestone

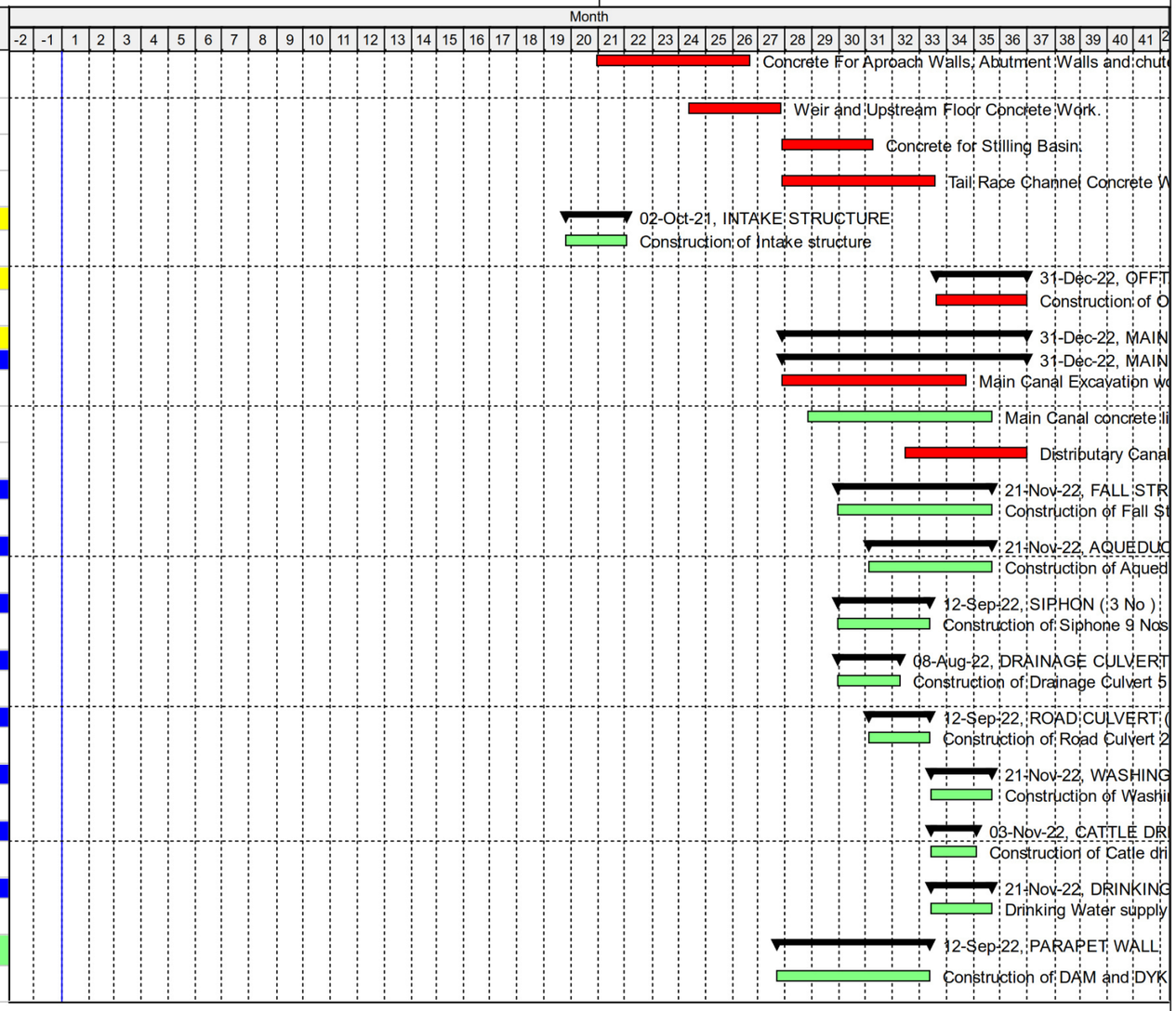
Page 1 of 2

TASK filter: All Activities

Techno-Consult International
WATER DIVISION

## CONSTRUCTION OF SIRI TOI DAM ZHOB RIVER BASIN

| # | Activity ID | Activity Name | Original Duration | Start | Finish |
|---|---|---|---|---|---|
| 30 | | Concrete For Aproach Walls, Abutment Walls and chute walls. | 150d | 30-Aug-21 | 19-Feb-22 |
| 31 | | Weir and Upstream Floor Concrete Work. | 90d | 13-Dec-21 | 26-Mar-22 |
| 32 | | Concrete for Stilling Basin. | 90d | 28-Mar-22 | 09-Jul-22 |
| 33 | | Tail Race Channel Concrete Work | 150d | 28-Mar-22 | 17-Sep-22 |
| 34 | | **INTAKE STRUCTURE** | 60d | 26-Jul-21 | 02-Oct-21 |
| 35 | | Construction of Intake structure | 60d | 26-Jul-21 | 02-Oct-21 |
| 36 | | **OFFTAKE STRUCTURE** | 90d | 19-Sep-22 | 31-Dec-22 |
| 37 | | Construction of Offtake structure 31 No. | 90d | 19-Sep-22 | 31-Dec-22 |
| 38 | | **MAIN CANAL** | 240d | 28-Mar-22 | 31-Dec-22 |
| 39 | | **MAIN CANAL WORKS** | 240d | 28-Mar-22 | 31-Dec-22 |
| 40 | | Main Canal Excavation works | 180d | 28-Mar-22 | 22-Oct-22 |
| 41 | | Main Canal concrete lining works | 180d | 26-Apr-22 | 21-Nov-22 |
| 42 | | Distributary Canal work | 120d | 15-Aug-22 | 31-Dec-22 |
| 43 | | **FALL STRUCTURE** | 150d | 31-May-22 | 21-Nov-22 |
| 44 | | Construction of Fall Structure 98 Nos | 150d | 31-May-22 | 21-Nov-22 |
| 45 | | **AQUEDUCT ( 9 No )** | 120d | 05-Jul-22 | 21-Nov-22 |
| 46 | | Construction of Aqueduct 9 Nos. | 120d | 05-Jul-22 | 21-Nov-22 |
| 47 | | **SIPHON ( 3 No )** | 90d | 31-May-22 | 12-Sep-22 |
| 48 | | Construction of Siphone 9 Nos. | 90d | 31-May-22 | 12-Sep-22 |
| 49 | | **DRAINAGE CULVERT ( 5 No )** | 60d | 31-May-22 | 08-Aug-22 |
| 50 | | Construction of Drainage Culvert 5 Nos. | 60d | 31-May-22 | 08-Aug-22 |
| 51 | | **ROAD CULVERT ( 2 No )** | 60d | 05-Jul-22 | 12-Sep-22 |
| 52 | | Construction of Road Culvert 2 Nos. | 60d | 05-Jul-22 | 12-Sep-22 |
| 53 | | **WASHING STRUCTURE ( 5 No )** | 60d | 13-Sep-22 | 21-Nov-22 |
| 54 | | Construction of Washing Structure ( 5 No. ) | 60d | 13-Sep-22 | 21-Nov-22 |
| 55 | | **CATTLE DRINKING TROUGH ( 5 No )** | 45d | 13-Sep-22 | 03-Nov-22 |
| 56 | | Construction of Catle drinking trough ( 5 No. ) | 45d | 13-Sep-22 | 03-Nov-22 |
| 57 | | **DRINKING WATER SUPPLY SYSTEM** | 60d | 13-Sep-22 | 21-Nov-22 |
| 58 | | Drinking Water supply system | 60d | 13-Sep-22 | 21-Nov-22 |
| 59 | | **PARAPET WALL** | 150d | 22-Mar-22 | 12-Sep-22 |
| 60 | | Construction of DAM and DYKES parapet wall | 150d | 22-Mar-22 | 12-Sep-22 |




Remaining Level of Effort | Actual Work | Critical Remaining ...
Actual Level of Effort | Remaining Work | Milestone

Page 2 of 2

TASK filter: All Activities

## 3.11 Project Cost

205. Infrastructure cost of Sri Toi Dam with all other interventions is PKR. 5,445 Million and O&M cost is PKR. 91 Million per annum. Since, the feasibility of Sri Toi Dam is in progress, the quantities of earth work and cost may subject to change till the finalization of geotechnical investigations.